



WAMBO COAL PTY LTD

NORTH WAMBO UNDERGROUND MINE

EXTRACTION PLAN
LONGWALLS 8 TO 10A

APPENDIX A
WATER MANAGEMENT PLAN

WAMBO COAL PTY LTD
NORTH WAMBO UNDERGROUND MINE

WATER MANAGEMENT PLAN
LONGWALLS 8 - 10A



PREPARED BY
WAMBO COAL PTY LTD

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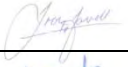


DOCUMENT CONTROL

Document No.	WMP LW8-10A
Title	Water Management Plan for North Wambo Underground Mine Longwalls 8 to 10A
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 8 to 10A at the North Wambo Underground Mine
Key Support Documents	Wambo Coal Surface Water Monitoring Program Wambo Coal Groundwater Monitoring Program Wambo Coal Surface and Groundwater Response Plan Wambo Coal North Wambo Creek Subsidence Response Strategy

Revisions

Rev No	Date	Description	By	Checked
A	October 2012	Original Draft	WCPL and Resource Strategies	-
B	November 2012	Draft for Consultation	WCPL and Resource Strategies	T. Favell
C	December 2012	Final for Submission	WCPL and Resource Strategies	T. Favell
D	January 2014	Revised to include Longwalls 9 and 10	WCPL and Resource Strategies	T. Favell
E	February 2014	Final for Submission	WCPL and Resource Strategies	T. Favell
F	April 2015	Revised to include Longwall 10A	WCPL and Resource Strategies	P. Jaeger

Approvals

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The nominated Coordinator for this document is	Environment and Community Manager
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Attachment 1	Water Management Plan Trigger Action Response Plan
Attachment 2	Wambo Coal Pty Limited Surface Water Monitoring Program
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Attachment 4	Wambo Coal Pty Limited Surface and Groundwater Response Plan
Attachment 5	Wambo Coal Pty Limited North Wambo Creek Subsidence Response Strategy

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 (Peabody).

The North Wambo Underground Mine is a component of the approved Wambo Coal Mine. The North Wambo Underground Mine commenced in 2005 and involves extraction of coal by longwall mining methods from the Wambo Seam within Mining Lease (ML) 1402, ML 1594, Coal Lease 397 and Consolidated Coal Lease 743 (**Figure 2**).

The potential environmental impacts of the existing Wambo Coal 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*.

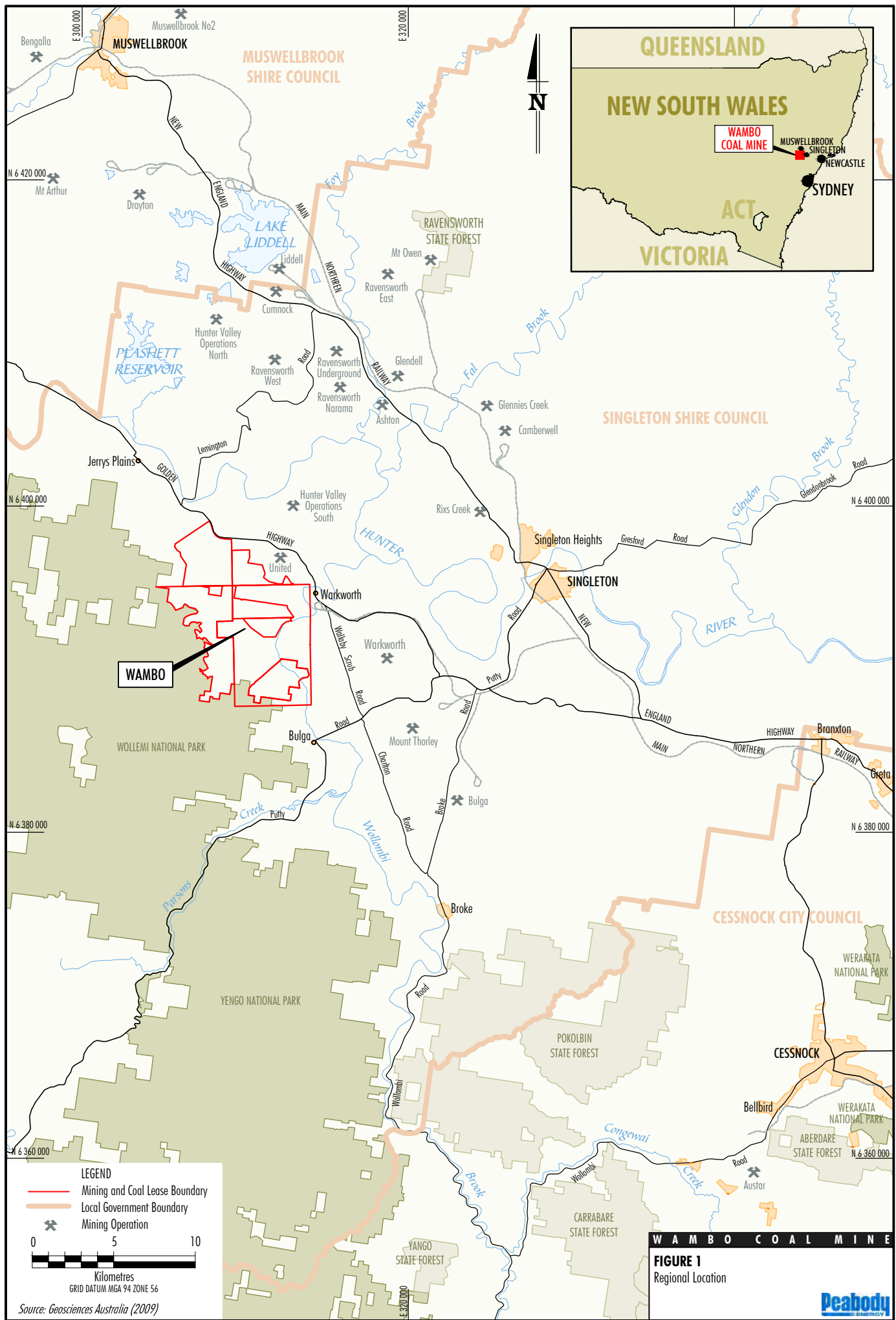
An application to modify the Development Consent (DA 305-7-2003 MOD 2) was lodged in January 2005 to facilitate the re-orientation of the North Wambo Underground Mine longwall panels and allow access to the Wambo Seam via the open cut highwall and was approved on 4 May 2005. The application was accompanied by the *Wambo Development Project – Wambo Seam Underground Mine Modification Statement of Environmental Effects* (North Wambo SEE) (WCPL, 2005).

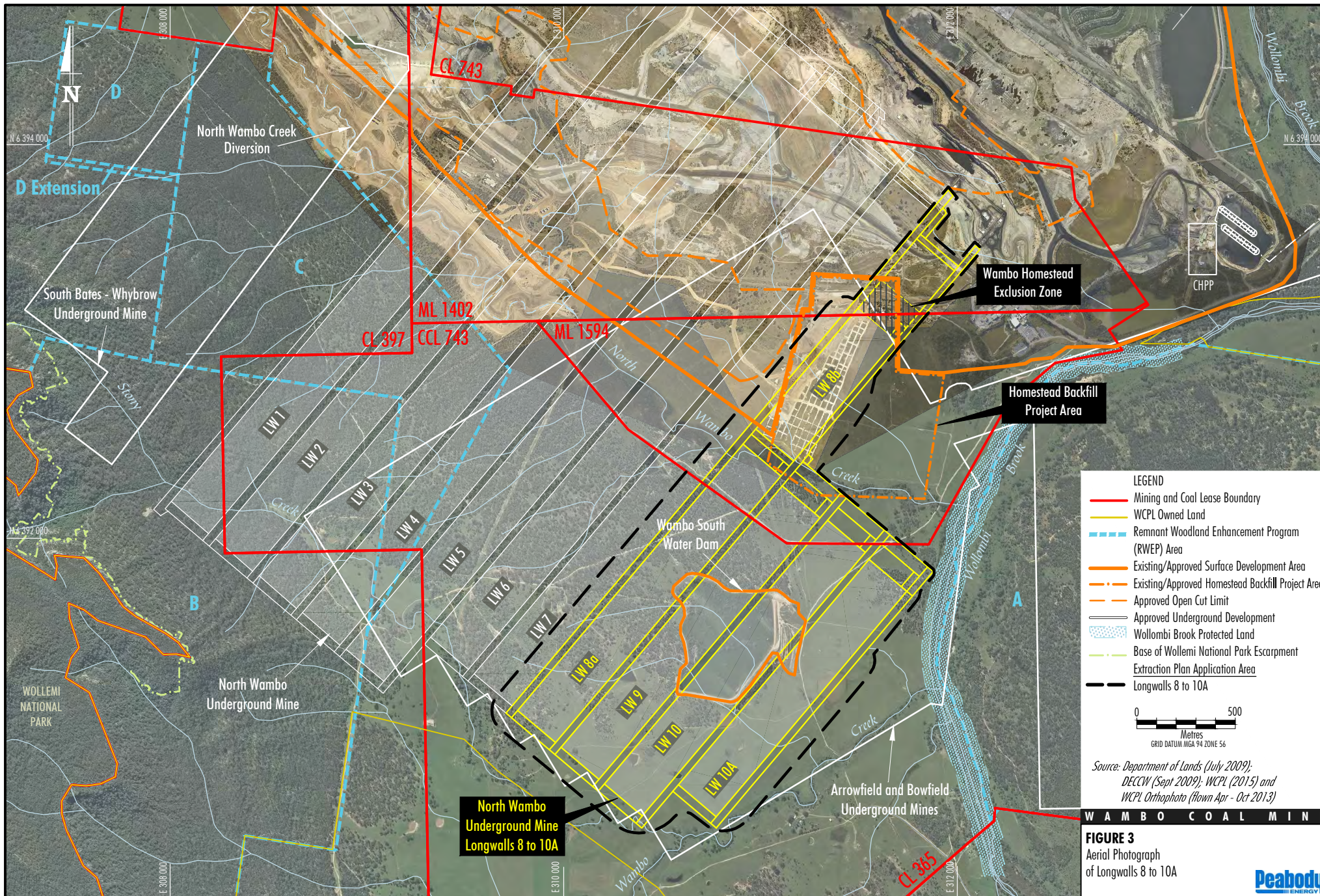
A subsequent application to modify the Development Consent (DA 305-7-2003 MOD 13) was lodged in December 2012 to allow an extension to the approved North Wambo Underground Mine to include two additional longwalls (Longwalls 9 and 10) and was approved on 8 July 2013. The application was accompanied by the *North Wambo Underground Mine Modification Environmental Assessment* (the North Wambo Modification EA) (WCPL, 2012).

An application to modify the Development Consent (DA 305-7-2003 MOD 14) was lodged in September 2014 to allow a minor extension to the approved North Wambo Underground Mine to include an additional longwall (Longwall 10A). The application was accompanied by the *North Wambo Underground Mine Longwall 10A Modification Environmental Assessment* (North Wambo Longwall 10A Modification EA) (WCPL, 2014).

A Subsidence Management Plan for Longwalls 1 to 6 at the North Wambo Underground Mine (WCPL, 2006) was approved by the NSW Department of Primary Industries – Mineral Resources on 11 December 2006. An Extraction Plan for Longwalls 7 and 8 was approved by the NSW Department of Planning and Infrastructure (DP&I) for Longwall 7 on 16 May 2013 and for Longwall 8 on 24 September 2013. Subsequently, a revised Extraction Plan for Longwalls 7 to 10 was approved by the Department of Planning and Environment (DP&E) on 4 July 2014.

The approved Extraction Plan for Longwalls 7 to 10 has been revised to include the remaining longwall within the North Wambo Underground Mine extent (Longwall 10A) for a consolidated Extraction Plan for Longwalls 8 to 10A (**Figure 3**).





1.1 PURPOSE AND SCOPE

Purpose: This Water Management Plan for Longwalls 8 to 10A (WMP) 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 8 to 10A 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 North Wambo Underground Mine Longwalls 8 to 10A 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 HydroSimulations, Advisian and Resource Strategies. WCPL would request endorsement of the team of suitably qualified and experienced experts by the Secretary of the DP&E upon approval of the North Wambo Underground Mine Longwall 10A Modification.

Table 1
Water Management Plan Requirements

Development Consent (DA 305-7-2003) Condition	WMP Section
<p>Condition 22C(h) of Schedule 4</p> <p>22C. The Applicant shall 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:</p> <p>...</p> <p>(h) include a:</p> <ul style="list-style-type: none"> Water Management Plan, which has been prepared in consultation with EPA and NOW, 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: <ul style="list-style-type: none"> surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or water quality; a program to monitor and report groundwater inflows to underground workings; and a program to manage and monitor impacts on groundwater bores on privately-owned land; <p>...</p>	<p>Management of potential impacts and/or environmental consequences on water are addressed in Table 2.</p> <p>Performance measures and performance indicators relevant to water are presented in Section 2 and Section 6 respectively.</p> <p>Addressed in Table 2.</p> <p>Addressed in Table 2.</p> <p>Addressed in Table 2.</p>

Table 1 (Continued)
Water Management Plan Requirements

Development Consent (DA 305-7-2003) Condition	WMP Section
<p>Condition 22D of Schedule 4</p> <p>22D. The Applicant shall ensure that the management plans required under condition 22C(h) above include:</p> <p>(a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this consent;</p> <p>(b) a detailed description of the measures that would be implemented to remediate predicted impacts; and</p> <p>(c) a contingency plan that expressly provides for adaptive management.</p>	<p>Addressed in Section 3.</p> <p>Addressed in Table 2.</p> <p>Addressed in Section 7.</p>

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 4**.

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

- Surface Water Monitoring Program (SWMP);
- Groundwater Monitoring Program (GWMP);
- Surface and Groundwater Response Plan (SGWRP); and
- North Wambo Creek Subsidence Response Strategy (NWCSRS) (the NWCSRS is a component of the SGWRP).

The sections of the SWMP, GWMP, SGWRP and NWCSRS relevant to the WMP are summarised in **Table 2**, with the monitoring site locations shown in **Figure 5**. The SWMP, GWMP, SGWRP and NWCSRS are included as **Attachments 2 to 5** respectively.

The NWCSRS has been revised as part of the preparation of the Extraction Plan for Longwalls 8 to 10A. If the SWMP, GWMP, SGWRP or NWCSRS 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 5** of this WMP will be updated accordingly.

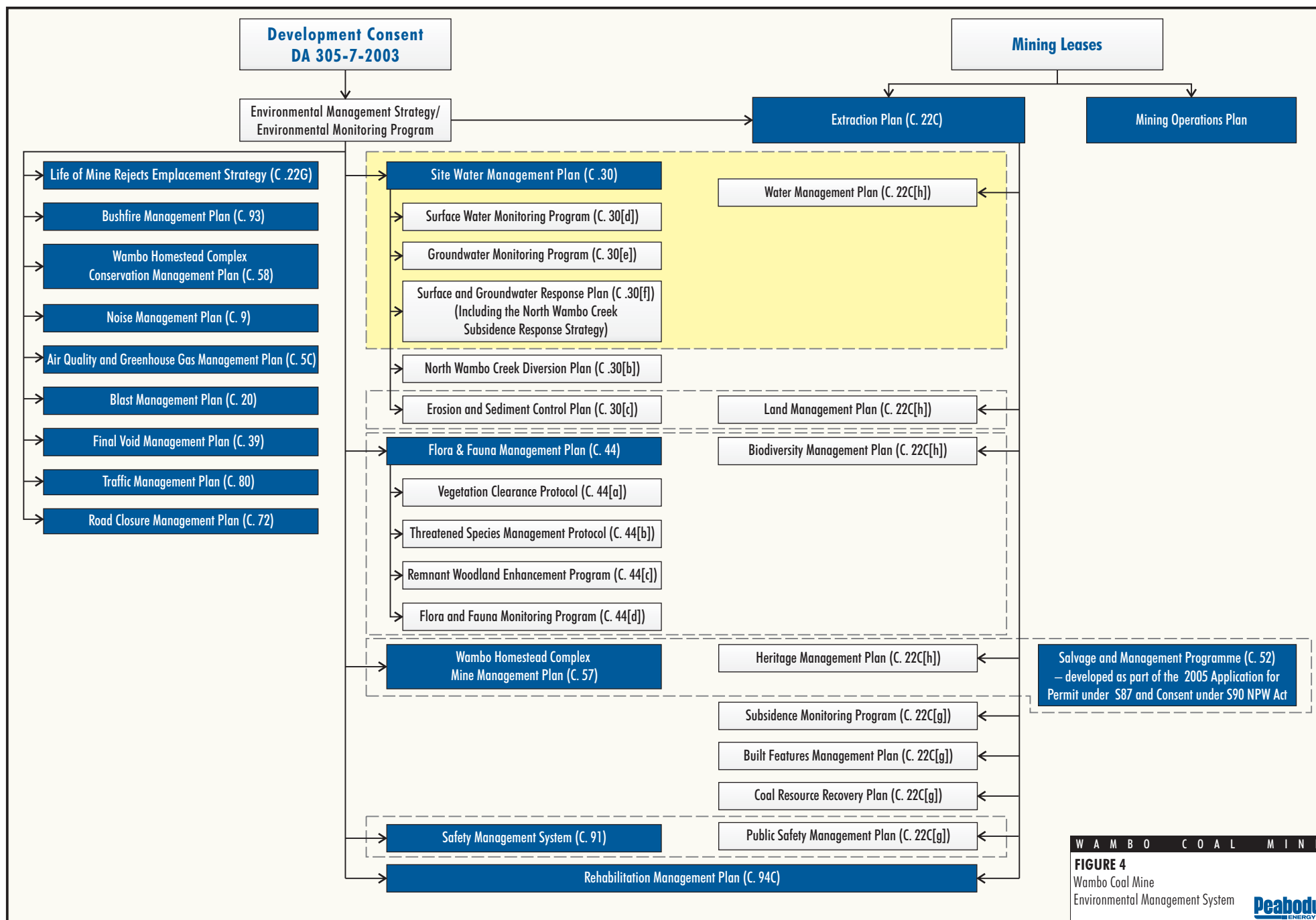




Table 2
Supporting Documents - Reference Summary

WMP Component	Existing Program/Plan Reference	Section Description
Description of the existing environment ¹	GWMP Section 3 – Description of Groundwaters	Section 3 of the GWMP includes an overview of the hydrogeology in proximity to the Wambo Coal Mine.
	SWMP Section 3 – Description of Surface Waters	Section 3 of the SWMP includes an overview of the hydrological features in proximity to the Wambo Coal Mine.
Management measures	NWCSRS Section 3.2 – Subsidence Management Responses	Section 3.2 of the NWCSRS outlines management measures that will be employed if connective cracking to North Wambo Creek is identified.
Surface water monitoring	SWMP Section 4.2 – Stream Flow	WCPL operates nine flow gauging stations including four along North Wambo Creek, three along Wambo Creek (also known as South Wambo Creek) and two along Stony Creek. In addition WCPL sources data for Wollombi Brook from two gauging stations operated by the NSW Government. The location of these sites is presented in Figure 5 .
	SWMP Section 6 – Surface Water Monitoring Program	Surface water quality sampling and analysis is conducted in accordance with <i>Approved Methods for Sampling and Analysis of Water Pollutants in New South Wales</i> (NSW Department of Environment and Conservation, 2004), Australian/New Zealand Standard (AS/NZS) 5667:1998 Parts 1, 4 and 6 and the requirements of the Hunter River Salinity Trading Scheme.
	SWMP Section 6.1 – Surface Water Quality	Water quality monitoring is undertaken at 17 sites including five along North Wambo Creek, two along Wambo Creek, one on Stony Creek, four along Wollombi Brook. Parameters monitored include pH, electrical conductivity (EC) and total suspended solids (TSS). The location of these sites is presented in Figure 5 .
	SWMP Section 6.2 – Mine Water Quality	Mine water storage dams including Eagles Nest Dam, Wambo South Water Dam (referred to as South Wambo Dam in the SWMP) and Chitter Dam are sampled monthly for pH, EC and TSS (sites MW15, MW16 and MW17 shown on Figure 5). Hales Crossing sediment pond is also sampled monthly, as it is situated downstream of the rail load out facility.
	SWMP Section 6.4 – Riparian Vegetation & Creekbed Stability Monitoring	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, Wambo Creek and Stony Creek and annual transect monitoring of riparian vegetation.

Table 2 (Continued)
Supporting Documents - Reference Summary

WMP Component	Existing Program/Plan Reference	Section Description
Groundwater monitoring	GWMP Section 5 – Groundwater Monitoring	Section 5 of the GWMP summarises the Wambo groundwater monitoring program including the monitoring network, measured parameters and monitoring frequency.
	GWMP Section 5.2 – Monitoring Network, Parameters and Frequency	The Wambo groundwater monitoring network is presented on Figure 5 . Groundwater monitoring sites are regularly monitored for water level, pH and EC. A comprehensive initial analysis of groundwater quality is also undertaken following development of a groundwater monitoring well or piezometer.
	GWMP Section 5.2.5 – Inflows to Underground Workings	Dewatering volumes and underground water levels are recorded on a monthly basis. These data are 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. Frequent visual inspections of water inflow at the working face are also undertaken.
	NWCSRS Section 3.1 - Subsidence Monitoring	Section 3.1 of the NWCSRS outlines groundwater monitoring undertaken to monitor subsidence impacts due to the North Wambo Underground Mine. This monitoring is additional to the monitoring described in the GWMP.
Surface water impact assessment criteria	SWMP Section 5 - Surface Water Impact Assessment Criteria	Section 5 of the SWMP summarises the surface water impact assessment criteria adopted for Wollombi Brook, North Wambo Creek, Wambo Creek and Stony Creek. If monitoring data exceed these criteria an investigation is undertaken to identify any adverse impacts on water resources or water quality.
	SWMP Section 7 - Review Procedure	Section 7 of the SWMP outlines the procedure for managing and review of data collected as part of the SWMP.
	SWMP Section 7.2 - Data Review & Investigation	Outlines the investigation and response protocol implemented if water quality monitoring data are found to exceed the water quality criteria.

Table 2 (Continued)
Supporting Documents - Reference Summary

WMP Component	Existing Program/Plan Reference	Section Description
Groundwater impact assessment criteria	GWMP Section 5.4 – Trigger Values	Trigger levels have been developed for groundwater quantity and quality. Alluvial bore trigger levels are listed in Table 11 of Section 5.4 of the GWMP.
	GWMP Section 6.5 - Data Review and Investigation Process	This section outlines the investigation process undertaken if monitoring data indicate a potential groundwater impact (i.e. if the trigger levels are exceeded) with reference to the SGWRP.
	NWCSRS Section 3.1 - Subsidence Monitoring	Section 3.1 of the NWCSRS outlines the process for investigating potential connective cracking between the North Wambo Underground Mine and North Wambo Creek and includes trigger levels for groundwater monitoring site MG08 and site GW08. If these levels are exceeded, an investigation is undertaken to identify if the event is a result of connective cracking.
Program to manage and monitor impacts on groundwater bores on privately-owned land	SGWRP Section 3.1 - Groundwater Impacts	This section 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 3.5 - Unforeseen Impacts	This section details the general response procedure initiated in the event that an unforeseen surface or groundwater impact is detected.
Responsibilities ¹	SWMP Section 9 – Responsibilities	This section summarises the SWMP responsibilities and timing of SWMP tasks.
	GWMP Section 6.3 – Roles and Responsibilities	This section summarises the GWMP responsibilities and timing of GWMP tasks.
	SGWRP Section 4 - Responsibilities	This section summarises the SGWRP responsibilities and timing of SGWRP tasks.
	NWCSRS Section 6 – Responsibilities	This section summarises the NWCSRS responsibilities and timing of NWCSRS 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 8 to 10A.
- Section 4** Describes the management measures that will be implemented.
- Section 5** Provides a summary of the monitoring that will be undertaken of Wambo Creek and Stony Creek (and associated alluvium) in relation to Longwalls 8 to 10A.

- Section 6** Describes how monitoring data will be used to assess the extraction of Longwalls 8 to 10A 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 existing SWMP.
- Attachment 3** Provides a copy of the existing GWMP.
- Attachment 4** Provides a copy of the existing SGWRP.
- Attachment 5** Provides a copy of the NWCSRS.

2 PERFORMANCE MEASURES

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 impact. ¹ Controlled release of excess site water only in accordance with Environment Protection Licence 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*”.

Section 6 provides a summary of the analysis of monitoring data that will be undertaken to assess the impact of Longwalls 8 to 10A 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 are described in the Wambo Development Project EIS, the North Wambo SEE, the North Wambo Modification EA and the North Wambo Longwall 10A Modification EA. As part of the Wambo Development Project EIS, Gilbert & Associates prepared a surface water assessment for the Wambo Coal Mine in 2003 (Gilbert & Associates, 2003).

North Wambo Creek

In regard to subsidence induced lowering of the ground surface, Section 4.2.3 of the Wambo Development Project EIS stated:

Some additional areas of the North Wambo Creek catchment would likely be inundated during floods either from its own catchment or backwater flooding from Wollombi Brook due to subsidence (Appendix O).

In addition, in relation to potential environmental consequences on North Wambo Creek, Section 3.2.1 of the North Wambo SEE stated:

The reorientation of the Wambo Seam longwall panels would be expected to result in the formation of two elongated on-stream ponds in the lower reaches of North Wambo Creek. As described in the Wambo Development Project EIS, smaller on-stream ponds would also potentially form further upstream as a result of subsidence. On-stream ponds would likely become depositional zones for sediment carried in flows in North Wambo Creek. The shallower off-stream depressions would likely become wetlands over time with periodic connection to North Wambo Creek as has been observed in existing subsidence areas.

Section 4.2.2 of the North Wambo Modification EA (WCPL, 2012) stated:

North Wambo Creek and Wambo Creek (also known as South Wambo Creek) are located outside the extent of the Modification longwall panels. These creeks are not expected to experience any measurable tilts, curvatures or strains resulting from the extraction of the Modification longwall panels (Appendix A).

Section 4.2.2 of the North Wambo Longwall 10A Modification EA (WCPL, 2014) stated:

North Wambo Creek is located outside the angle of draw, with the banks of the creek located at a distance of 270 m north of the finishing end of the proposed Longwall 10A. It is expected that any subsidence effects caused by the Modification would be negligible (Appendix A).

Longwall 8b is the only remaining longwall at the North Wambo Underground Mine that will be extracted beneath the North Wambo Creek alluvium.

Wollombi Brook

In regard to subsidence induced cracking, Section 4.7.1 of the Wambo Development Project EIS stated:

The coal seams that would be mined in the vicinity of Wollombi Brook are deep and cracking would not extend to the surface from the underground workings (Appendix F). Further, as stated in Appendix O there would be no subsidence, or associated cracking, of Wollombi Brook. Consequently, groundwater levels and/or surface flow would generally remain unchanged due to underground mining (Appendix F).

Section 4.2.3 of the Wambo Development Project EIS also stated:

Mining of the longwall panels in the vicinity of Wollombi Brook would be constrained to an angle of 26.5 degrees from the vertical to “Protected Land” (i.e. within 40 m of Wollombi Brook as defined by the Rivers and Foreshore Improvement Act, 1948).

The Longwalls 8 to 10A Application Area is consistent with this commitment.

Further, in regard to potential environmental consequences on Wollombi Brook, Section 4.2.3 of the Wambo Development Project EIS stated:

Underground longwall mining subsidence would not impact on Wollombi Brook.

Section 4.2.2 of the North Wambo Modification EA (WCPL, 2012) stated:

Wollombi Brook is located 450 m east of Longwall 10, at its closest point to the Modification longwall panel. At this distance, Wollombi Brook is not expected to experience any measurable tilts, curvatures or strains.

Section 4.2.2 of the North Wambo Longwall 10A Modification EA (WCPL, 2014) stated:

Wollombi Brook is located 125 m east of the finishing end of the proposed Longwall 10A. At this distance, the brook is predicted to experience less than 20 mm of vertical subsidence (Appendix A). While it is possible that Wollombi Brook could experience very low levels of subsidence, it would not be expected to experience any measurable tilts, curvatures or ground strains.

The extent of the proposed Longwall 10A is outside of the subsidence exclusion zone related to Wollombi Brook (as defined above). It is expected, therefore, that the potential subsidence impacts on the Wollombi Brook due to the extraction of the proposed Longwall 10A would be negligible.

Stony Creek

In regard to potential environmental consequences on Stony Creek, Section 4.2.3 of the Wambo Development Project EIS stated:

The lower reaches of Stony Creek that would undergo episodes of subsidence (i.e. above the Wambo, Arrowfield and Bowfield Seam workings) could potentially be impacted by subsidence induced erosion as well as some ponding.

A small amount of cracking would most likely occur along Stony Creek over the north-westernmost ends of Wambo Seam longwall panels because of the steep surface topography and nature of the overlying strata (i.e. sandstone outcrops). The creek bed is located in rock in the steeper terrain therefore cracking depths would be limited and would be expected to in-fill with loose stream wash material when there is water flow (Appendix O).

In addition, in relation to potential subsidence impacts on Stony Creek, Section 3.2.1 of the North Wambo SEE stated:

The section of Stony Creek described in the Wambo Development Project Environmental Impact Statement (WCPL, 2004) that would be affected by the Wambo Seam workings would remain substantially unchanged. There would be a minor increase in the extent of subsidence to the northwest along Stony Creek from approximately 2.2 km to 2.4 km due to the re-oriented Wambo Seam longwall panels.

Section 4.7.1 of the Wambo Development Project Environmental Impact Statement (WCPL, 2003) recognised and assessed the potential for connectivity to Stony Creek and Wambo Creek and outlined a proposed management approach:

Although connectivity between the underground workings and Stony and Wambo Creeks is considered to be unlikely (Appendix O), careful monitoring of alluvial groundwater levels via a network of piezometers and stream flows along Wambo Creek would be conducted. Should connectivity of the creek(s) to the workings be detected, a mitigation option would be to grout and seal any crack in the creek bed similar to the remediation undertaken of cracking above existing underground workings at the Wambo Coal Mine.

Section 4.2.2 of the North Wambo Modification EA (WCPL, 2012) stated:

Stony Creek is also located outside the extents of the Modification longwall panels, but it is situated immediately adjacent to the southern corner of the proposed Longwall 10. Stony Creek could experience small additional subsidence in the vicinity of the proposed longwalls, however, this is negligible when compared with the total subsidence where the creek is located directly above the longwalls in the Wambo, Arrowfield and Bowfield Seams further upstream (Appendix A).

Wambo Creek

In regard to potential environmental consequences on Wambo Creek, Section 4.2.3 of the Wambo Development Project EIS stated:

A minor increase in ponding is expected along sections of Wambo Creek which have been previously subsided. There would also be a slight increase in areas of flooding during high flow events in the lower portions of Wambo Creek due to subsidence within the creeks flood plain.

Section 4.7.1 of the Wambo Development Project Environmental Impact Statement (WCPL, 2003) recognised and assessed the potential for connectivity to Stony Creek and Wambo Creek and outlined a proposed management approach:

Although connectivity between the underground workings and Stony and Wambo Creeks is considered to be unlikely (Appendix O), careful monitoring of alluvial groundwater levels via a network of piezometers and stream flows along Wambo Creek would be conducted. Should connectivity of the creek(s) to the workings be detected, a mitigation option would be to grout and seal any crack in the creek bed similar to the remediation undertaken of cracking above existing underground workings at the Wambo Coal Mine.

Overview of Revised Subsidence Impacts

As described in Section 2.1 of the Extraction Plan, the magnitude of the revised tilt and strain predictions for Longwalls 8 to 10A are generally consistent with those presented in the Wambo Development Project EIS, the North Wambo SEE, the North Wambo Modification EA and the North Wambo Longwall 10A Modification EA.

The commencing end of Longwall 10A is to be shortened compared to the longwall layout presented in the North Wambo Longwall 10A Modification EA. MSEC (2015) has revised the predicted subsidence effects and subsidence impacts to incorporate the change to the commencing end of Longwall 10A.

Potential subsidence impacts to the creeks and watercourses directly above the Longwalls 8 to 10A Application Area include (Ditton Geotechnical Services [DgS], 2012; Mine Subsidence Engineering Consultants [MSEC], 2014a; MSEC, 2014b):

- transient surface cracking along and across creek beds or watercourses;
- in-channel ponding and changes in stream alignment;
- cracking and low angle shearing and uplift;
- potential sub-surface re-routing of surface flows resulting from high flow events due to cracks occurring within the drainage gullies or creek beds (this is expected to be self-healing in most cases due to the high sediment accumulation in cracks following high rainfall events);
- surface cracking in alluvial soils along creek beds;
- a short-term increase of existing erosion rates and head cuts along the creeks inside the upstream ribs of Longwall 8 (after a number of high flow events the erosion rates would be expected to reach an equilibrium);
- potential for insignificant surface cracking along the alignments of Wambo Creek and Stony Creek near the ends of Longwalls 10 and 10A; and
- instability of steep creek banks where cracking or undercutting occurs and soils are exposed to erosion.

North Wambo Creek

DgS (2012) predicts the extraction of Longwall 8 to result in subsidence to North Wambo Creek of up to 1.74 metres (m), with creek bed gradients estimated to increase by 2 percent (%) (approximately 1.14 degrees [°]) and decrease by 1.5% (approximately 0.86°). MSEC (2014a, 2014b) predict the extraction of Longwalls 9 to 10A will result in a maximum additional subsidence of less than 20 millimetres (mm) at North Wambo Creek.

Longwalls 9 to 10A would not result in any additional measurable tilts, curvatures or strains of North Wambo Creek (MSEC, 2014a; MSEC, 2014b).

Wollombi Brook

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

An empirical model for the Newcastle Coalfield indicates that measurable far-field displacement movements (i.e. greater than 20 mm) may occur for distance up to 3 to 4 times the cover depth (i.e. for a distance up to 150 to 720 m), however far-field displacement movements outside a distance equal to one cover depth are unlikely to generate significant strains or movements to cause cracking or damage to the surface (DgS, 2012). MSEC (2014a) predicts that far-field horizontal movements resulting from the extraction of Longwalls 9 and 10 would be very small and could only be detected by precise surveys. Similarly, MSEC (2014b) predicts that far-field horizontal movements resulting from the extraction of Longwall 10A would be very small and could only be detected by precise surveys.

Wollombi Brook lies 125 m east of the extent of Longwalls 8 to 10A at the closest point and is outside of Wollombi Brook “Protected Land”¹. While it is possible that Wollombi Brook could experience very low levels of vertical subsidence, it would not be expected to experience any measurable tilts, curvatures or strains (MSEC, 2014b; MSEC, 2015).

Performance indicators have been developed for Wollombi Brook and are detailed in **Section 6**.

Stony Creek

In the mine layout presented in the North Wambo Longwall 10A Modification EA, Stony Creek was situated immediately above the southern corner of Longwall 10A. As a result of the revised commencing end, Longwall 10A will no longer extract directly beneath Stony Creek.

The revised maximum predicted total subsidence on Stony Creek due to the extraction of Longwalls 8 to 10A, is 50 mm (MSEC, 2014a; MSEC, 2015). Approximately 110 m of Stony Creek would be subject to subsidence between 20 mm and 50 mm as a result of Longwall 10 (MSEC, 2014a; MSEC, 2015).

Stony Creek is not expected to experience any significant tilts, curvatures or strains due to the extraction of Longwalls 8 to 10A (MSEC, 2015). The predicted changes in grade are very small (i.e. 0.1 % or less) and it is unlikely that any significant surface cracking, bed erosion or bank instability would occur along Stony Creek due to the Longwalls 8 to 10A (MSEC, 2015; Advisian, 2015).

Wambo Creek

In the mine layout presented in the North Wambo Longwall 10A Modification EA, Wambo Creek was situated immediately above the southern corner of Longwall 10A. As a result of the revised commencing end, Longwall 10A will no longer extract directly beneath Wambo Creek.

The revised maximum predicted total subsidence on Wambo Creek due to the extraction of Longwalls 8 to 10A, is 50 mm (MSEC, 2015). Approximately 130 m of Wambo Creek would be subject to subsidence between 20 mm and 50 mm as a result of Longwall 10A (MSEC, 2015).

Wambo Creek is not expected to experience any significant tilts, curvatures or strains due to the extraction of Longwalls 8 to 10A (MSEC, 2015). The predicted changes in grade are very small (i.e. 0.1 % or less) and it is unlikely that any significant surface cracking, bed erosion or bank instability would occur along Wambo Creek due to the Longwalls 8 to 10A (MSEC, 2015; Advisian, 2015).

¹ Wollombi Brook “Protected Land” is defined as land within 40 m of Wollombi Brook in accordance with the now repealed *Rivers and Foreshore Improvement Act, 1948* (replaced by provisions relating to “controlled activity approvals” within the *NSW Water Management Act, 2000*).

Overview of Revised Environmental Consequences

An assessment of potential subsidence impacts on Wambo and Stony Creeks was prepared by Evans & Peck (now Advisian) (2014) as part of the North Wambo Longwall 10A Modification EA. Advisian (2015) has prepared a Surface Water Impact Assessment Review in consideration of the revised commencing end of Longwall 10A and the review of predicted subsidence effects and subsidence impacts prepared by MSEC (2015).

Based on the above, Advisian (2015) concluded it is unlikely Wambo Creek and Stony Creek would experience adverse impacts, and mitigation measures are unlikely to be required.

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 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.

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 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 are described in the Wambo Development Project EIS, the North Wambo SEE, the North Wambo Modification EA and the North Wambo Longwall 10A Modification EA. As part of the Wambo Development Project EIS, AGE prepared a groundwater assessment for Wambo in 2003 (AGE, 2003). The study included numerical modelling to assess the potential cumulative impacts of Wambo and surrounding mining operations on groundwater resources.

Alluvial Aquifers

In relation to subsidence impacts to the alluvium, Holt (2003) stated:

Connection between the underground mine workings and the alluvials is not expected although there is some potential for connection in areas where geological structures exist. This would require monitoring if such structures are noted and remediation if necessary as discussed in Section O6.

As part of the Wambo Development Project EIS, G.E Holt & Associates (Holt) prepared a subsidence assessment for Wambo in 2003. In regard to fracturing heights, Holt (2003) stated:

The interburden thickness between Whybrow and Wambo Seam workings in the vicinity of North Wambo Creek is in the range 50 m – 55 m. Whilst the old Whybrow Seam workings did not impact North Wambo Creek, there is potential for a combination of geological structures, Wambo Seam goaf and Whybrow Seam goaf to result in a connection to the surface. The potential for this to occur would require monitoring (particularly if geological structures are observed) and remediation works undertaken if necessary.

Interburden thickness between the Whybrow and Wambo Seams in the south-east part of workings closest to Wambo Creek are in the range 70 m to 90 m. Geological structures are known in this area, and extend through the interburden. There is potential that this area could also provide a pathway for inter-connection. As discussed above, this would require monitoring and remediation if necessary.

In regard to potential environmental consequences on alluvial aquifers, Section 4.2.3 of the Wambo Development Project EIS stated:

With mining of the Wambo Seam, cracking in the alluvials along North Wambo Creek would potentially occur along the sides of the panels, and in curvilinear fashion across the panels. Cracking in the underlying rocks may result in short-term drainage of groundwater out of the alluvials. These cracks would however be expected to in-fill quickly with sediment or close (Appendix O). The minimum depth of cover between North Wambo Creek and the Wambo Seam longwall panels is not expected to cause connection from the surface to the underground workings (Appendix O). Cracking is not expected to cause connection from the alluvials to the underground workings although there is some potential for connection in areas where geological structures exist (Appendix O).

In addition, Section 4.7.1 of the Wambo Development Project EIS stated:

The subsidence would result in a lowering of the base of the North Wambo Creek alluvium which may also affect the groundwater leakage rates. Bores set in the alluvium between the southern extent of the open cut and the confluence of Wollombi Brook may be impacted by a declining water level and yield. These bores are owned by WCPL. It is expected that with the implementation of appropriate mitigation measures (see below) there would be no impacts on groundwater bores or wells along Wollombi Brook (Appendix F).

Project underground mine areas are distant to the Hunter River and the Project open cut, although expanding to the north-west towards the Hunter River, would not intersect the alluvium. The Project would therefore not impact groundwater users along the Hunter River (Appendix F).

Impact on groundwater quality due to the Project would be limited to the coal seams and Permian aquifers. As a result no water quality impact is expected on the local alluvial groundwater system (Appendix F).

A review of subsidence impacts associated with the North Wambo Underground Mine was undertaken by Holt (2005) as part of the North Wambo SEE. The outcomes of the review were consistent with those of the subsidence assessment undertaken as part of the Wambo Development Project EIS. In regard to subsidence impacts on alluvium, Holt (2005) stated:

The potential for connection between alluvial aquifers associated with the creeks remain unchanged when compared to that assessed in the Wambo Development Project Subsidence Assessment (Holt, 2003).

As part of the North Wambo Modification EA, MSEC (2012) prepared a subsidence assessment. In regard to fracturing above the longwalls, MSEC (2012) stated:

The interburden thickness between the Wambo and Whybrow Seams, directly above the proposed WMLW9 and WMLW10, varies between 55 metres and 95 metres. Also, the depth of cover to the Wambo Seam, directly above the proposed longwalls, varies between a minimum of 120 metres and 230 metres. It is expected, therefore, that the fractured zone resulting from the extraction of the proposed WMLW9 and WMLW10 would extend up to the existing workings in the Whybrow Seam, reactivate the existing goaf, with the fracturing extending up to the surface where the depths of cover are the shallowest.

This does not necessarily imply that there will be hydraulic connectivity between the surface and the seam, as the vertical fractures can be discontinuous near to the surface where the depths of cover are higher. It is not expected that there would be a hydraulic connection between the surface and seam, as none was observed after the extraction of the first four longwalls at the NWUM, which extracted directly beneath North Wambo Creek at a depth of cover of around 100 metres. This was anticipated by Holt (2003), who stated that “This depth of cover is not expected to cause connection from the surface to the workings as it has not caused connection to single seam workings in the WCPL lease area before”.

Heritage Computing (2012) concluded the following as part of the North Wambo Modification EA:

The Modification would cause less than 0.5 m additional drawdown in the alluvium overlying the proposed Longwalls 9 and 10 and the additional drawdown extent would be confined to the modified North Wambo Underground Mine footprint.

MSEC (2014b) concluded the following as part of the North Wambo Longwall 10A Modification EA:

As described in Section 4.8, it is expected that the fractured zone above the proposed WMLW10A would extend up to the existing workings in the overlying Whybrow Seam. It is not expected, however, that there would be a hydraulic connection between the surface and seam, as none was observed after the extraction of the first seven longwalls at the NWUM, which extracted directly beneath North Wambo Creek at a depth of cover of around 100 metres. This was anticipated by Holt (2003), who stated that “This depth of cover is not expected to cause connection from the surface to the workings as it has not caused connection to single seam workings in the WCPL lease area before”.

HydroSimulations (2014b) concluded the following as part of the North Wambo Longwall 10A Modification EA:

The Longwall 10A Modification would cause less than 1 m additional drawdown in the alluvium overlying the Longwalls 9 to 10A compared with the Approved mine plan. Much of that predicted drawdown is simulated as being generated by the dewatering system operated in the Whybrow Seam.

Permian Aquifers

In regard to potential environmental consequences on Permian aquifers, Section 4.7.2 of the Wambo Development Project EIS stated:

The available data indicates that substantial dewatering of the coal seams in the Wambo Coal Mine area has already taken place and that the Project would result in further dewatering of the Permian aquifers and lowering of groundwater levels, particularly in the Permian strata around the Project underground workings.

...

The assessment undertaken for the Project has shown that the potential impacts of the mining on water quality would be limited to the coal seams and Permian strata (Appendix F). Due to the poor quality of the water, it is considered that the resource is of limited benefit and as a result, any loss through mining activities would not be detrimental to the area.

Section 4.4.2 of the North Wambo Modification EA (WCPL, 2012) stated:

The impacts of the Modification on the North Wambo Creek alluvium are predicted to be limited to the area where alluvium is present overlying the Modification longwall panels (Appendix B). Heritage Computing (Appendix B) predicts a maximum additional localised drawdown of less than 0.5 m in the alluvium.

Section 4.4.2 of the North Wambo Longwall 10A Modification EA (WCPL, 2014) stated:

The Modification would result in additional dewatering of the Permian coal measures, however the impact on water levels due to the Modification is negligible regionally (Appendix B).

Overview of Revised Subsidence Impacts

As described in Section 2.1 of the Extraction Plan, the magnitude of the revised tilt and strain predictions for Longwalls 8 to 10A are generally consistent with those presented in the Wambo Development Project EIS, the North Wambo SEE, the North Wambo Modification EA and the North Wambo Longwall 10A Modification EA.

The commencing end of Longwall 10A is to be shortened compared to the longwall layout presented in the North Wambo Longwall 10A Modification EA. MSEC (2015) has revised the predicted subsidence effects and subsidence impacts to incorporate the change to the commencing end of Longwall 10A.

The potential for fracturing between the surface and seam is considered by MSEC (2015) to be the same as the potential described in the North Wambo Modification EA and the North Wambo Longwall 10A Modification EA.

Overview of Revised Environmental Consequences

A groundwater assessment, supported by numerical modelling, was prepared by HydroSimulations (2014b) as part of the North Wambo Longwall 10A Modification EA. An independent peer review of the groundwater assessment by Hydrogeologic (Hugh Middlemis) was commissioned by the DP&E. The review determined “that the Wambo model is a good example of best practice in design and execution, and is fit for mining project impact prediction purposes” (Hydrogeologic, 2015).

HydroSimulations (2015) has prepared a Groundwater Impact Assessment Review in consideration of the revised commencing end of Longwall 10A and the review of predicted subsidence effects and subsidence impacts prepared by MSEC (2015).

Based on the above, HydroSimulations (2015) has concluded that the revised commencing end of Longwall 10A would have no material impact on the predictions in the Wambo Longwall 10A Modification EA (HydroSimulations, 2014b).

4 MANAGEMENT MEASURES

Management measures to remediate impacts on water resources resulting from the extraction of Longwalls 8 to 10A will be undertaken in accordance with the NWCSRS (as described in **Table 2**), the SGWRP and the measures proposed in **Section 6**. In addition, bulk filling of the historical workings of the Homestead Mine is being undertaken in order to minimise potential for flooding of the Longwall 8 workings (**Section 4.1**).

4.1 GROUTING OF HOMESTEAD MINE WORKINGS

Sections of the historical workings of the Homestead Mine in the Whybrow Seam are being bulk filled with low strength grout primarily as a mitigation measure to minimise the potential for flooding due to chimney failure and pot hole development resulting from failure of remnant pillars within the Homestead Mine workings. The bulk filling/grouting is being undertaken within portions of the historical workings of the Homestead Mine which underlie alluvium above Longwalls 7 and 8.

Further detail regarding the bulk filling/grouting is provided in the main report of the Extraction Plan.

5 MONITORING OF WAMBO CREEK AND STONY CREEK

Surface water and groundwater monitoring will be undertaken in accordance with the programs outlined in the SWMP and GWMP (**Section 1.2**).

Of note to Wambo Creek and Stony Creek, WCPL will undertake the following monitoring:

- monitoring of subsidence in accordance with the Subsidence Monitoring Program (Appendix H of the Extraction Plan), including confirmation of the spatial extent of subsidence from Longwall 8 to 10A;
- monitoring of bores in the alluvium associated with Wambo Creek and comparison to the groundwater trigger values in the GWMP (P106, P109, P114, P116, P202 and P206 as shown on **Figure 5**);
- surface water quality and flow monitoring on Wambo Creek downstream of Longwalls 8 to 10A and comparison to the surface water trigger values in the SWMP (SW07 and FM5 as shown on **Figure 5**); and
- bed and bank stability monitoring of Wambo Creek and Stony Creek in accordance with the SWMP (with a “pre-mining” survey occurring of these creeks in December 2014).

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 4**.

Monitoring conducted to inform the assessment of the extraction of Longwalls 8 to 10A against the performance indicators for the performance measure relating to Wollombi Brook includes:

- monitoring of subsidence in accordance with the Subsidence Monitoring Program (Appendix H of the Extraction Plan);
- monitoring in accordance with the SWMP;
- monitoring in accordance with the GWMP; and
- monitoring in accordance with the NWCSRS.

Table 4
Water Performance Measure and Performance Indicators

Performance Measure	Performance Indicator(s)
Negligible impact ¹ to Wollombi Brook.	<ul style="list-style-type: none"> • 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 12 of the SWMP. • The performance indicators will be considered to have been exceeded if pumping of water from the North Wambo Underground Mine roadways requires continuous pumping². • 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 11 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 11 of 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 Continuous pumping from the North Wambo Underground Mine roadways would be considered higher than normal operations and may indicate an additional source of water to the workings.

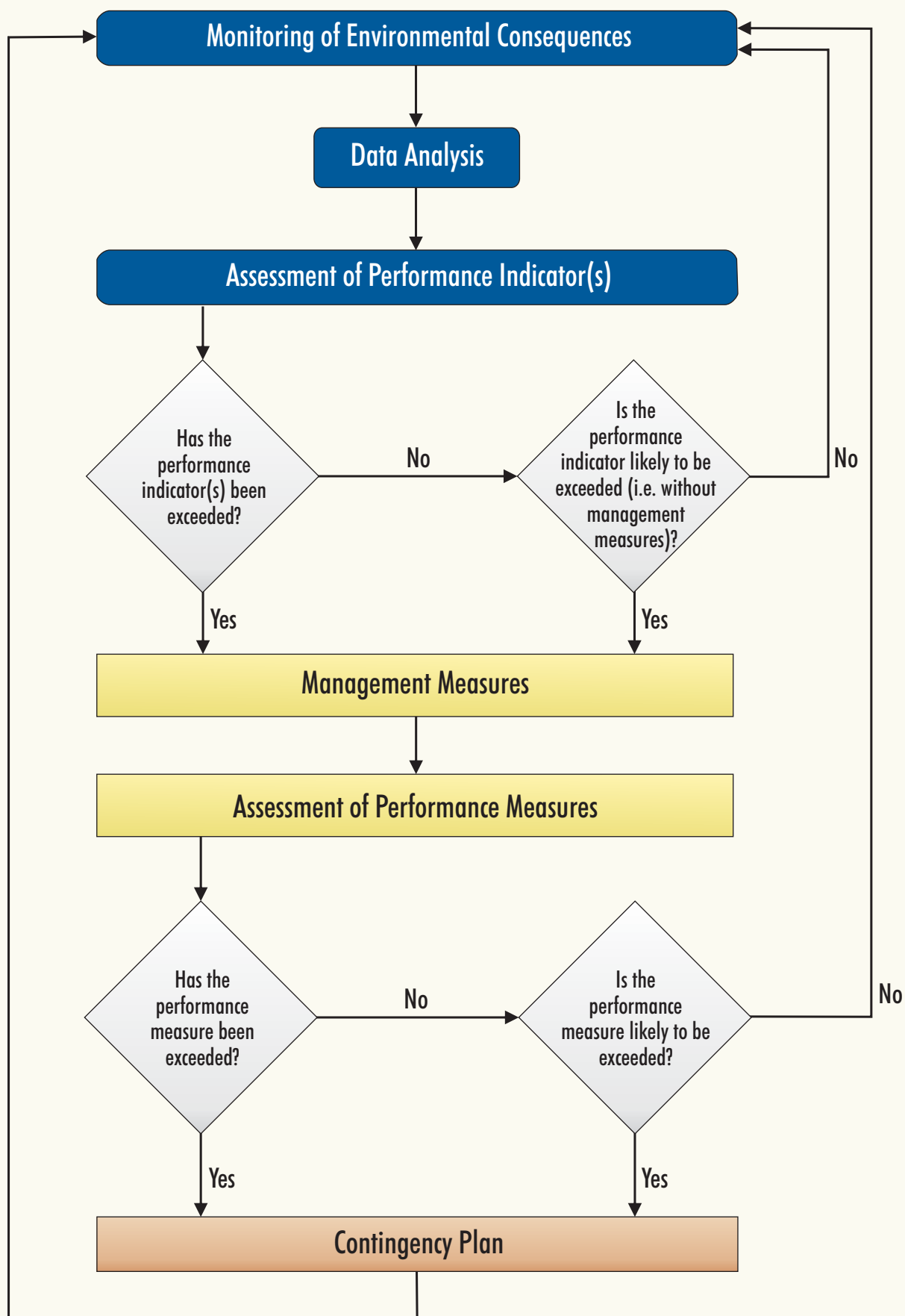
The monitoring results will be used to assess the extraction of Longwalls 8 to 10A against the performance indicators and performance measure as detailed in **Table 5**. The monitoring process and subsequent assessment of performance indicators and measures is outlined in **Figure 6**.

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 5
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 impact to Wollombi Brook.	<ul style="list-style-type: none"> Surface water quality monitoring sites listed in Table 13 of the SWMP. FM10. FM11. 	<ul style="list-style-type: none"> pH. EC. Surface water flow. 	<ul style="list-style-type: none"> Monthly/Rainfall event. Continuous. 	<ul style="list-style-type: none"> Analysis of surface water quality monitoring data in accordance with the SWMP. 	<ul style="list-style-type: none"> The surface water quality in the Wollombi Brook does not exceed the surface water quality criteria listed in Table 12 of the SWMP. 	<ul style="list-style-type: none"> 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 12 of the SWMP. If data analysis indicates the performance indicators have been exceeded, an assessment will be made against the performance measure (Figure 6). 	<ul style="list-style-type: none"> The performance measure is exceeded if subsidence, groundwater and surface water monitoring data and hydrogeological and/or hydrogeological analysis indicate subsidence from development of Longwalls 8 to 10A has resulted in: <ul style="list-style-type: none"> 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. the NSW Office of Water [NOW] 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 NOW. If the performance measure has been exceeded, the Contingency Plan will be implemented (Section 7). 	<ul style="list-style-type: none"> 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.
	<ul style="list-style-type: none"> North Wambo Underground Mine roadway pumps and Homestead workings dewatering bores. FM10. FM11. 	<ul style="list-style-type: none"> Rate of water pumped from North Wambo Underground Mine roadways and Homestead workings. Surface water flow. 	<ul style="list-style-type: none"> When pumping is required. Continuous. 	<ul style="list-style-type: none"> Analysis of pumping data to identify a regular increase in pumping rates. 	<ul style="list-style-type: none"> Water pumping rates are not regularly higher than normal rates. 	<ul style="list-style-type: none"> The performance indicators will be considered to have been exceeded if dewatering requires regular pumping at rates higher than normal. If data analysis indicates the performance indicators have been exceeded, an assessment will be made against the performance measure (Figure 6). 		
	<ul style="list-style-type: none"> Groundwater monitoring sites listed in Table 9 of the GWMP. FM10. FM11. 	<ul style="list-style-type: none"> Water level. Surface water flow. 	<ul style="list-style-type: none"> Every two months or as specified in Table 9 of the GWMP. Continuous. 	<ul style="list-style-type: none"> Analysis of groundwater level monitoring data in accordance with the GWMP. 	<ul style="list-style-type: none"> The groundwater levels in alluvial bores do not exceed the groundwater level criteria listed in Table 11 of the GWMP. 	<ul style="list-style-type: none"> 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 11 of the GWMP. If data analysis indicates the performance indicators have been exceeded, an assessment will be made against the performance measure (Figure 6). 		
	<ul style="list-style-type: none"> Groundwater monitoring sites listed in Table 9 of the GWMP. FM10. FM11. 	<ul style="list-style-type: none"> pH. EC. Surface water flow. 	<ul style="list-style-type: none"> Every two months (or else as specified in Table 9 of the GWMP). Continuous. 	<ul style="list-style-type: none"> Analysis of groundwater quality monitoring data in accordance with the GWMP. 	<ul style="list-style-type: none"> The groundwater quality in alluvial bores does not exceed the groundwater quality criteria listed in Table 11 of the GWMP. 	<ul style="list-style-type: none"> 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 11 of the GWMP. If data analysis indicates the performance indicators have been exceeded, an assessment will be made against the performance measure (Figure 6). 		

CONTINGENCY MANAGEMENT



W A M B O C O A L M I N E

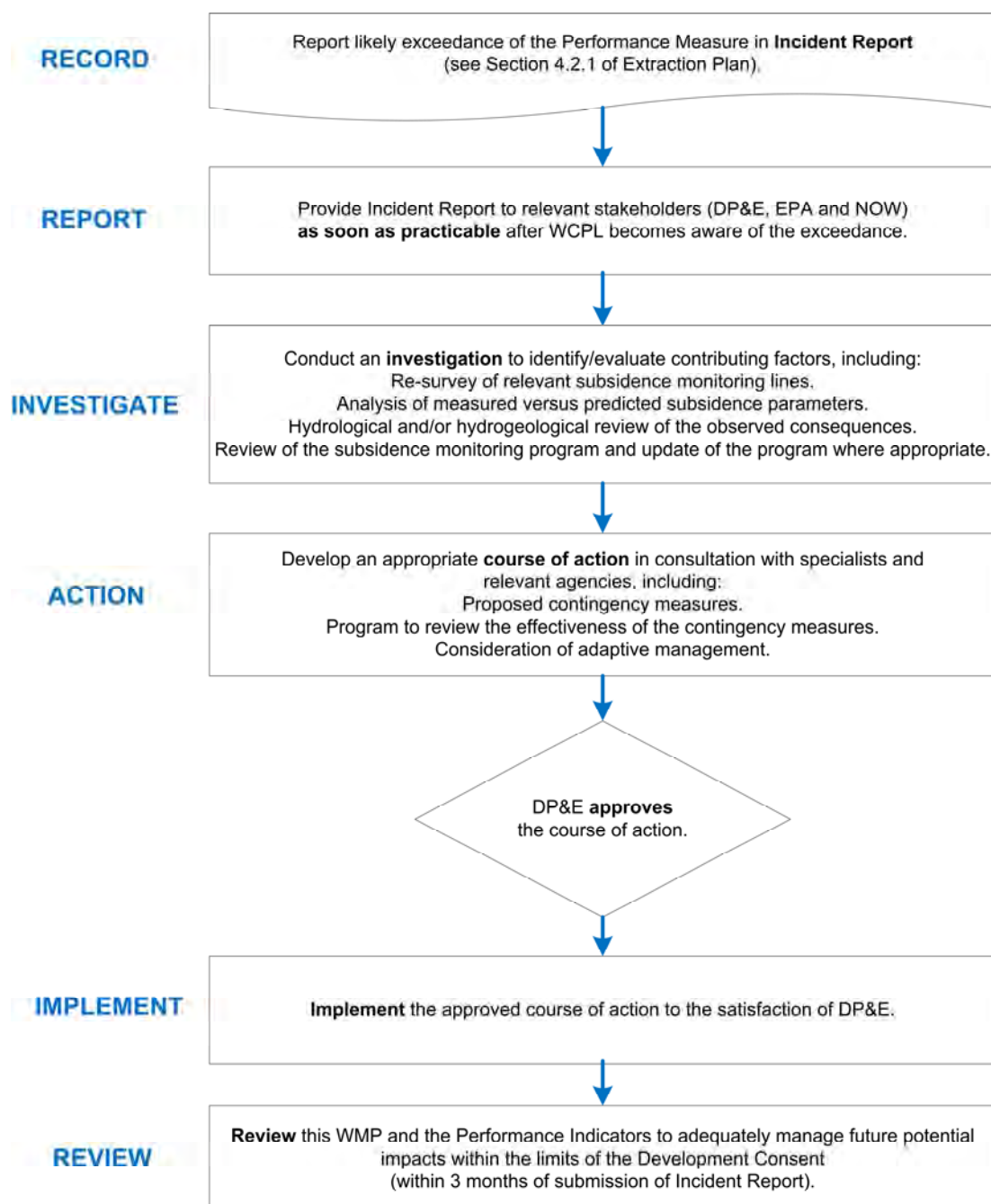
FIGURE 6

Monitoring of Environmental Consequences
against Performance Indicators
and Measures

Peabody
ENERGY

7 CONTINGENCY PLAN

In the event the Wollombi Brook performance measure and actions summarised in **Table 5** are considered to have been exceeded or are 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

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Wambo Coal Pty Limited (2014) *North Wambo Underground Mine Longwall 10A 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
	Predicted Impacts	Management Measures	Restoration/Contingency Phase
Trigger	<ul style="list-style-type: none"> Predicted impacts on surface water and groundwater, described in Section 3. 	<ul style="list-style-type: none"> Management measures implemented (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 Section 6, the SGWRP and the NWCSRS). 	<ul style="list-style-type: none"> If the Wollombi Brook performance measure has been exceeded, or is likely to be exceeded.
Action	<ul style="list-style-type: none"> Conduct monitoring, consistent with Table 5, the GWMP, SWMP, NWCSRS and the Subsidence Monitoring Program (Appendix H of the Extraction Plan). Assess the environmental consequences of the subsidence in accordance with Section 6, the SGWRP and the NWCSRS. Assess the need for management measures in accordance with Table 5, the SGWRP and the NWCSRS. 	<ul style="list-style-type: none"> Implement management measures, as required, in accordance with Table 5, the SGWRP and the NWCSRS. 	<ul style="list-style-type: none"> Implement Contingency Plan described in Section 7.
Frequency	<ul style="list-style-type: none"> Frequency consistent with Table 5, the GWMP, SWMP, SGWRP, and NWCSRS. 	<ul style="list-style-type: none"> As required, in accordance with Section 6, the SGWRP and the NWCSRS. 	<ul style="list-style-type: none"> As required, in accordance with Section 7.
Position of Decision Making	<ul style="list-style-type: none"> Environment and Community Manager. 	<ul style="list-style-type: none"> Environment and Community Manager. Implementation of management measures for North Wambo Creek, Wambo Creek or Stony Creek will be undertaken in consultation with DRE and NOW. 	<ul style="list-style-type: none"> General Manager.

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.
NWCSRS refers to the Wambo Coal North Wambo Creek Subsidence Response Strategy.
DRE refers to the Division of Resources and Energy (Department of Trade and Investment, Regional Infrastructure and Services).
NOW refers to the New South Wales Office of Water.

ATTACHMENT 2

WAMBO COAL PTY LIMITED
SURFACE WATER MONITORING PROGRAM



SURFACE WATER MONITORING PROGRAM

(Water Management Plan)

**PREPARED BY
WAMBO COAL PTY
LIMITED**

September 2014

WCPL Coal Pty Limited Environmental Management System

Surface Water Monitoring Program

Document Control

Document No.	EMP009(a)
Title	Surface Water Monitoring Program
General Description	Monitoring of surface water
Key Support Documents	Wambo Coal Site Water Management Program – (WMP-EMP009) DA 305 – 7 -2003, DA 177-8-2004, EIS 2003, EPL 529

Revisions

Rev No.	Date	Description	By	Checked
0	August 05	Original Draft	Resource Strategies	JT/TS
1	August 05	Revised Draft	Resource Strategies	JT/TS
2	August 07	Management Plan Consolidation	Hansen Bailey	SW
3	October 08	Management Plan Consolidation	WCPL	SB
4	November 09	Consent Modification	WCPL	SB
5	March 2012	Audit Findings/ Rail Loop DA Mod	WCPL	LC
6	Sept 2014	Revision	WCPL	TF

The nominated document coordinator	Environmental Advisor
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Approver:	Manager: Environment and Community
Date:	September 2014
Name:	Troy Favell
Signature:	

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1 INTRODUCTION

WCPL Coal Pty Limited (WCPL) is situated approximately 15 kilometres west of Singleton, near the village of Warkworth, New South Wales (see **Figure 1**), 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.

An aerial photograph of WCPL, illustrating the approved extent of the open cut and underground mine operations and key infrastructure is provided on **Figure 2**. A summary of the approved WCPL Coal Mine (the mine) is provided in **Table 1**.

Table 1: Summary of the Approved Wambo Coal Mine

Component	Approved WCPL ¹
Life of Mine	<ul style="list-style-type: none"> 21 years (from the date of the commencement of Development Consent [DA 305-7-2003]).
Open Cut Mining	<ul style="list-style-type: none"> Open cut mining at a rate of up to 8 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal from the Whybrow, Redbank Creek, WCPL and Whynot Seams. An estimated total open cut ROM coal reserve of 98 Mt. Open cut mining operations until 2017.
Underground Mining	<ul style="list-style-type: none"> Underground mining of up to 7.5 Mtpa of ROM coal from the Whybrow, WCPL, Arrowfield and Bowfield Seams. Underground ROM coal reserves are estimated at 104 Mt.
Subsidence commitments and management.	<ul style="list-style-type: none"> The subsidence performance measures listed in Conditions 22 and 22A of the Development Consent (DA 305-7-2003).
ROM Coal Production Rate	<ul style="list-style-type: none"> Up to 14.7 Mtpa of ROM coal.
Total ROM Coal Mined	<ul style="list-style-type: none"> 202 Mt.
Waste Rock Management	<ul style="list-style-type: none"> Waste rock deposited in open cut voids and in waste rock emplacements adjacent open cut operations.
Total Waste Rock	<ul style="list-style-type: none"> 640 million bank cubic metres (Mbcm).
Coal Washing	<ul style="list-style-type: none"> Coal handling and preparation plant (CHPP) capable of processing approximately 1,800 tonnes per hour (tph).
Product Coal	<ul style="list-style-type: none"> Production of up to 11.3 Mtpa of thermal coal predominantly for export.
CHPP Reject Management	<ul style="list-style-type: none"> Coarse rejects and tailings would be incorporated, encapsulated and/or capped within open cut voids in accordance with existing WCPL management practices.
Total CHPP Rejects	<ul style="list-style-type: none"> Approximately 27 Mt of coarse rejects and approximately 18 Mt of tailings.
Water Supply	<ul style="list-style-type: none"> 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.

1.1 SCOPE & OBJECTIVES

This Surface Water Monitoring Program (SWMP) has been developed to address the relevant consent conditions, regulatory requirements and 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. The SWMP also address the relevant conditions of WCPL mining leases, Environmental Protection Licence (EPL) and groundwater licenses. In accordance with Condition 33, Schedule 4 of DA305-7-2003, 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; and
- a program to monitor the effectiveness of the Erosion and Sediment Control Plan.

Notwithstanding this, the SWMP has also been prepared in accordance with:

- Development consent DA 305-7-2003, Schedule 6, Consent Condition 4
- Development Consent DA 177-8-2004, Schedule 4, Consent Condition 32,33 and 34; and
- Relevant approved Mining and Exploration leases associated with Wambo Coal Pty Ltd.

The applicable consent conditions and where they are address within the corresponding sections of this SWMP are outlined in **Table 2**. All regulatory correspondence related to the SWMP is included in **Appendix A**.

1.2 CONSULTATION

In accordance with Consent Condition 30, Schedule 4, DA 305-7-2003, the SWMP revision of this document is undertaken in consultation with the Division of Resources and Energy within the Department of Trade and Investment, Regional Infrastructure and Services (DRE) and NSW Office of Water (NOW). Please refer to **Appendix A** for all regulatory correspondence relating to this SWMP.

The SWMP was initially approved by the Department of Planning & Environment (DP&E), formally the Department of Planning (DoP) in October 2005 (**Appendix 1**). It is a component of WCPL Site Water Management Plan and was approved by the Department of Planning (DoP) (now Department of Planning and Infrastructure) in September 2005.

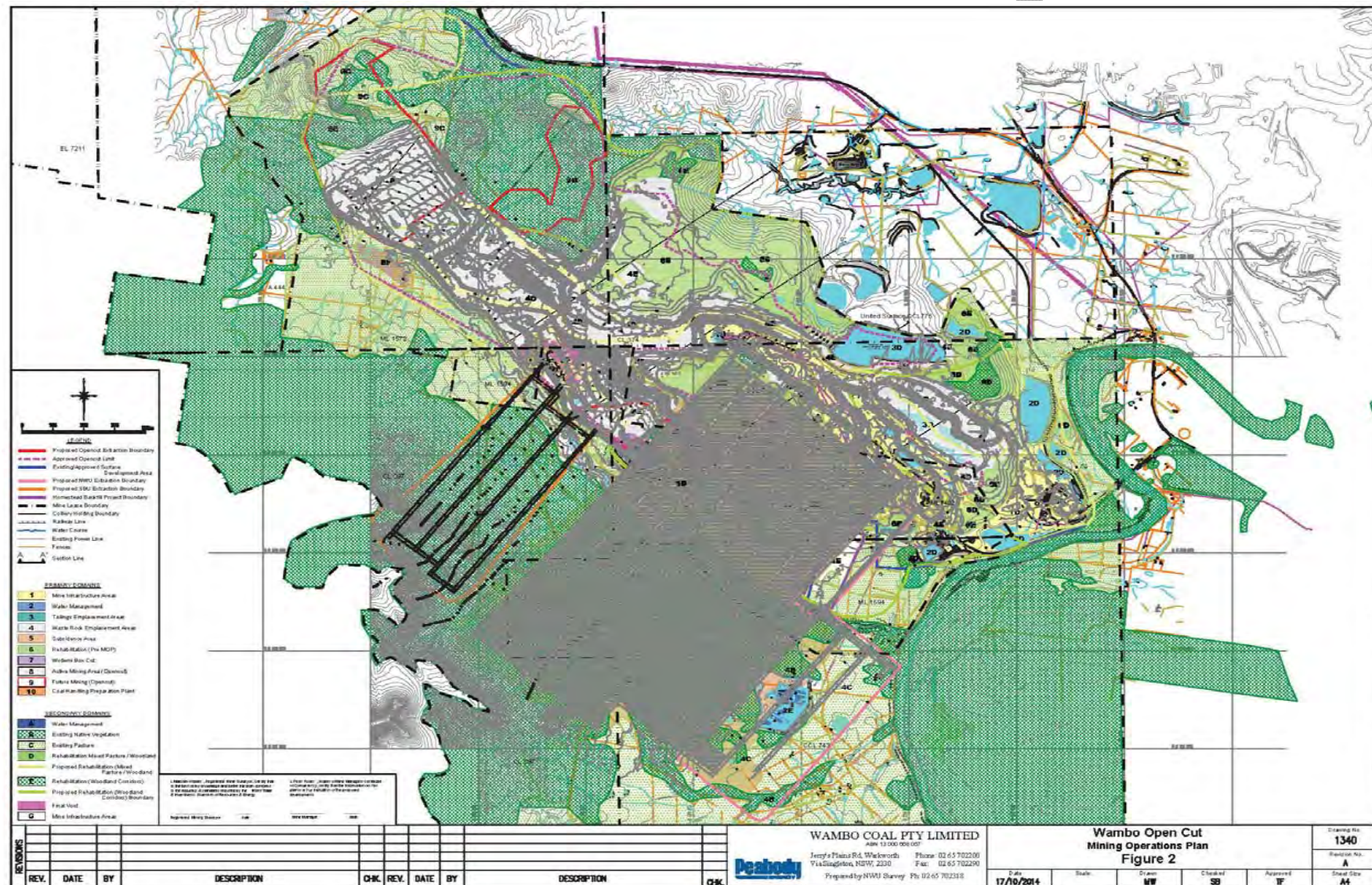
1.3 WATER MANAGMENT

This SWMP is a component of the Site Water Management Plan (see **Figure 3**) which forms part of WCPL's Environmental Management System for the Wambo Coal Mine.

Figure 1: Locality Map



Figure 2: Wambo Mining Operations



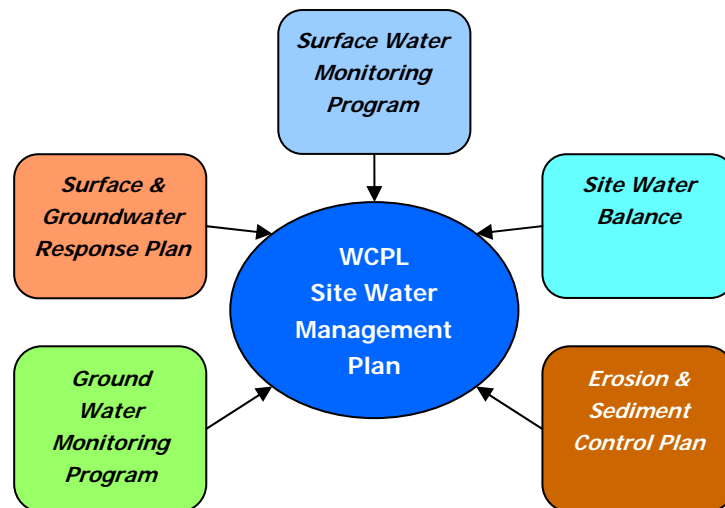


Figure 3: WCPL - Water Management Plan

2 STATUTORY REQUIREMENTS

2.1 DEVELOPMENT APPROVAL CONDITIONS

This SWMP has been prepared to address the relevant Development Approval (DA) consent conditions within DA305-7-2003 and DA177-8-2004. **Table 2** displays the relevant DA regulatory requirements and where they are addressed in the document. Additional monitoring requirements are discussed in **Table 3**.

Table 2: Surface Water Monitoring Program Requirements

Consent Requirement	Condition	Where Addressed in this SWMP
Wambo Mine Development Consent (DA 305-7-2003)	<p>"30. Before carrying out any development, the Applicant shall prepare a Site Water Management Plan for the development in consultation with <i>DII</i> and <i>NOW</i>, and to the satisfaction of the Director-General. This plan must include:</p> <p>...</p> <p>(d) a Surface Water Monitoring Program;</p> <p>By the end of October 2009, the Applicant shall revise the Site Water Management Plan in consultation with <i>DII</i>, <i>DECCW</i>, and <i>NOW</i>, and to the satisfaction of the Director-General.</p> <p>...</p>	This SWMP
Schedule 4, Conditions 30 and 33	<p>33. The Surface Water Monitoring Program shall include:</p> <p>(a) detailed baseline data on surface water flows and quality in the Wollombi Brook, and North Wambo, South Wambo, and Stony Creeks;</p> <p>(b) surface water impact assessment criteria;</p> <p>(c) a program to monitor surface water flows and quality in the Wollombi Brook; and North Wambo, South Wambo, and Stony Creeks;</p> <p>(d) a program to monitor bank and bed stability in North Wambo, South Wambo, and Stony Creeks;</p>	<p>Sections 4.1 & 4.2</p> <p>Section 5.0</p> <p>Sections 6.1 & 6.2</p> <p>Section 6.4</p>

Consent Requirement	Condition	Where Addressed in this SWMP
	(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 (f) a program to monitor the effectiveness of the Erosion and Sediment Control Plan."	Section 6.4 Section 6.3
Wambo Rail Spur Development Consent (DA 177-8-2004) Schedule 4, Condition 17	"17. Before carrying out any development, the Applicant shall 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 6.6 Section 6.0 Section 6.7

NOTE: Brown represents June 2009 Modification
Lime represents August 2009 Modification
Blue with yellow highlight represents 2011 Modification
* In September 2009, DoP granted WCPL an extension to the submission date to 30/4/2010 to allow for DII and DECCW review and comment.

2.2 ENVIRONMENTAL PROTECTION LICENCE

Under EPL 529 and the Hunter River Salinity Trading Scheme (HRSTS), WCPL are required to monitor discharges from a designated licenced discharge point. **Section 5.1** provides further information on discharge requirements under the HRSTS.

2.3 ADDITIONAL PROGRAM REQUIREMENTS

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

Table 3: Additional Surface Water Monitoring Program Requirements

Government Department	Water Monitoring Requirement	Relevant Section of SWMP
Department of Planning	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 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	Section 6.1
Department of Water & Energy	DWE grants approval to the detailed design plans for the constructed diversion channel, subject to the following; <ul style="list-style-type: none"> 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; 	Section 6.5

Government Department	Water Monitoring Requirement	Relevant Section of SWMP
	<ul style="list-style-type: none"> 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). 	<p><i>Section 5.0</i></p> <p><i>Noted. Section 8.2</i></p>

3 DESCRIPTION OF SURFACE WATERS

3.1 LOCAL SURFACE WATER HYDROLOGY

The mine site is within the lower Wollombi Brook catchment near its confluence with the Hunter River. 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. Wollombi Brook drains an area of approximately 1,950 km² (Gilbert and Associates, 2003) and joins the Hunter River some 5 km north-east of Wambo.

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. North Wambo Creek, which also has its headwaters in the Wollemi escarpment, drains the central parts of the mining lease. 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 4**).

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. 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, 2007b).

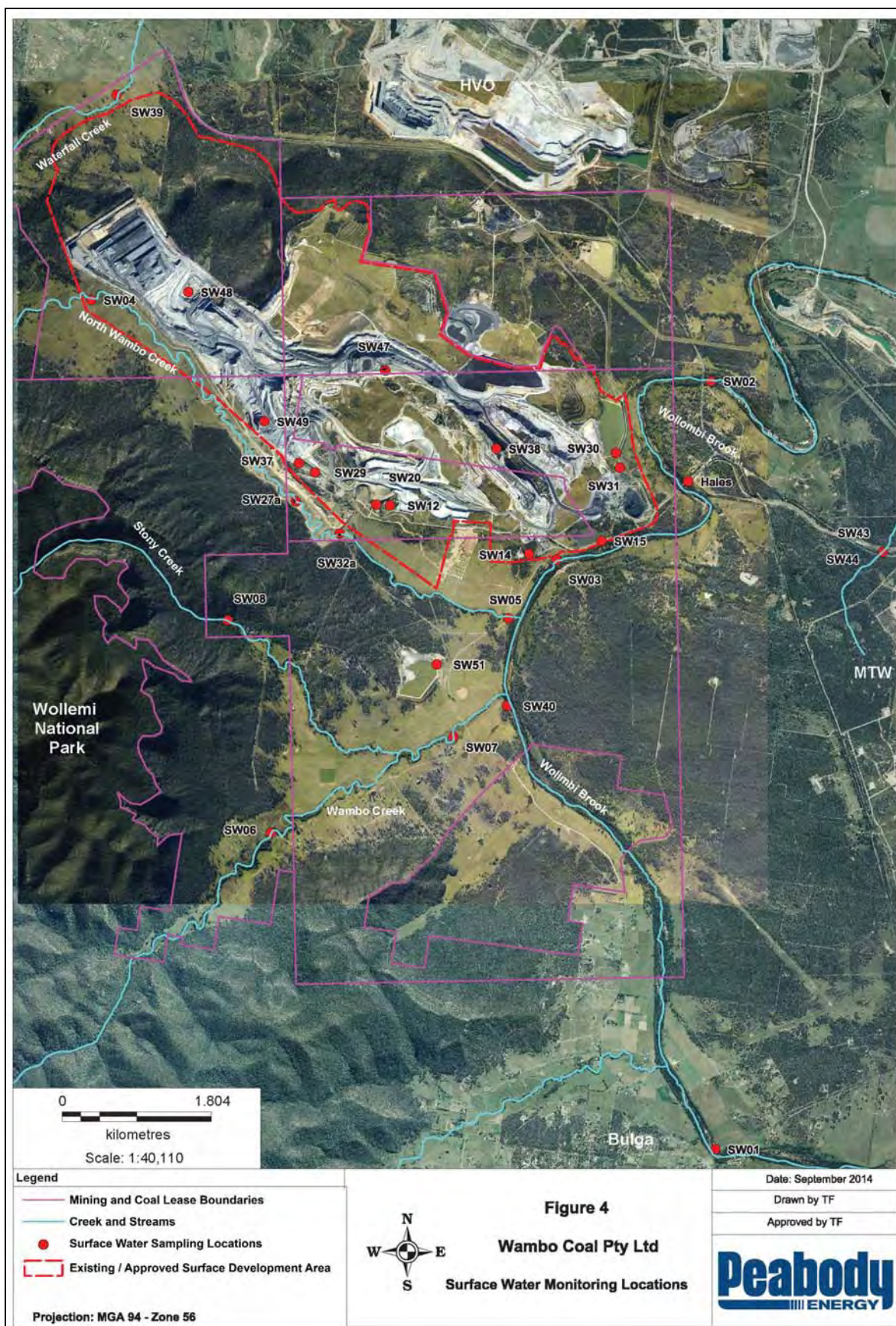
Table 4: Catchment Areas of Local Creeks

Creek Name	Catchment Area (km ²)
North Wambo Creek	48.5
South Wambo Creek	43.2
Stony Creek	11.2
Redbank Creek	12.3
Waterfall Creek	6.6
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.

Figure 4: Surface Water Monitoring Locations



4 BASELINE SURFACE WATER DATA

4.1 SURFACE WATER QUALITY

A summary of surface water quality monitoring results for July 2003 to June 2014 is presented in Table 5.

Table 5: Surface Water Quality Ranges – Local Watercourses

SW Sites	Parameter	Min	20%	Mean	80%	Max	Count
SW01 - Wollombi Brook Upstream	pH	6.45	7.1	7.5	8	8.6	102
	EC (µS/cm)	160	504.4	720	880	1,969	102
	TSS (mg/L)	0	4	7	13	125	101
	TDS (mg/L)	60	258	390	470	1,175	101
SW02 - Wollombi Brook – Downstream	pH	6.8	7.4	7.7	8.1	9	103
	EC (µS/cm)	217	544	825	1,254	5,290	103
	TSS (mg/L)	0.5	3	6	18	308	103
	TDS (mg/L)	25	279	436	656	3,238	103
SW03 - Wollombi Brook – Pump-out	pH	6.7	7.4	7.6	7.9	9.1	109
	EC (µS/cm)	197	538	797	2,414	5,240	109
	TSS (mg/L)	0.5	5	10	20	220	109
	TDS (mg/L)	130	277	406	1,290	2,924	109
SW40 - Wollombi Brook – Upstream of Wambo Creek	pH	6.4	7.3	7.6	8	8.8	91
	EC (µS/cm)	66	455	643	796	1,147	91
	TSS (mg/L)	0.5	4	7	18	179	88
	TDS (mg/L)	18	232	348	455	1,090	87
SW04 - North Wambo Creek – Upstream	pH	7.3	ID	8.1	ID	8.4	4
	EC (µS/cm)	256	ID	315	ID	393	4
	TSS (mg/L)	2.5	ID	37.5	ID	2,712	4
	TDS (mg/L)	154	ID	165	ID	214	4
SW27 - North Wambo Creek – Middle-lower	pH	7	7.4	7.9	8.4	8.8	29
	EC (µS/cm)	52	209	341	738	2,700	30
	TSS (mg/L)	18	58.4	339	1138	5,440	30
	TDS (mg/L)	252	432	673	947	2,000	30
SW32 - North Wambo Creek – Pump	pH	7.4	ID	8.1	ID	9.2	21
	EC (µS/cm)	220	ID	786	ID	6,970	21
	TSS (mg/L)	0.5	ID	136	ID	4,190	21
	TDS (mg/L)	378	ID	601	ID	4,400	21
SW05 - North Wambo Creek	pH	7	7.3	7.6	7.9	9	104
	EC (µS/cm)	113	1,118	2,025	2,294	3,200	104
	TSS (mg/L)	1	6	14.5	70.4	1,110	104
	TDS (mg/L)	172	636	1,110	1,286	2,162	104
SW06 - Wambo Creek	pH	6.3	7	7.4	7.7	9.1	71
	EC (µS/cm)	156	431	511	644	970	71
	TSS (mg/L)	0.5	2.5	5	12	193	71
	TDS (mg/L)	130	224	269	332	3,692	71
SW07 – Wambo / Stony Creek	pH	6.6	7.4	7.6	7.9	9.1	37
	EC (µS/cm)	159	355	596	700	971	37
	TSS (mg/L)	0.5	2.1	3	27.2	331	37
	TDS (mg/L)	145	236	306	388	520	37
SW08 - Stony Creek	pH	6.2	6.8	7.2	7.4	8.4	22
	EC (µS/cm)	190	295	360	423.2	479	22
	TSS (mg/L)	0.5	1	2.5	3.4	24	23
	TDS (mg/L)	58	155	203	238	276	23

SW Sites	Parameter	Min	20%	Mean	80%	Max	Count
SW39 - Waterfall Creek	pH	6.9	7.3	7.6	7.9	8.6	36
	EC ($\mu\text{S}/\text{cm}$)	92	163	230	426	1,268	36
	TSS (mg/L)	8	70	187	581	1,922	36
	TDS (mg/L)	182	276	468	630	958	36

The available data indicates that the surface water quality of **Wollombi Brook** near the mine site can be characterised as being:

- near neutral to slightly alkaline (median pH range from 7.5 to 7.8);
- having moderate salinity (median EC values ranging from 643 to 825 $\mu\text{S}/\text{cm}$); and
- having generally low TSS concentrations (median concentrations of 6 to 10 mg/L).

The surface water quality data available for **North Wambo Creek** indicate that:

- pH levels have been typically slightly alkaline (median values 7.6 to 8.1);
- salinity (EC) has been variable, being moderate in the more upstream sampling sites (median values of 315 $\mu\text{S}/\text{cm}$ at the upstream site [SW4]) and high in the downstream sampling sites (median values of 2,025 $\mu\text{S}/\text{cm}$); and
- TSS concentrations are highly variable ranging from low (median concentration of 14.5 mg/L at SW5 downstream) to high (median concentration 339 mg/L at SW27 in the mid reaches of the Creek). Recorded concentrations have been highly variable ranging from a minimum of 0.5 mg/L at SW32 to a maximum of 5,440 mg/L at SW27.

The surface water quality data available for **Stony Creek** indicate that:

- pH levels have been near neutral (median value of 7.2 and range of 6.2 to 8.4);
- salinity (EC) has been moderate (median value of 360 $\mu\text{S}/\text{cm}$ and range of 190 to 479 $\mu\text{S}/\text{cm}$); and
- TSS concentrations have been low ranging from 0.5 to 24 mg/L.

The surface water quality data available for **Wambo Creek** indicate that:

- pH levels have been near neutral (median values 7.4 to 7.6);
- salinity (EC) has been moderate (median values of 511 $\mu\text{S}/\text{cm}$ at SW6 upstream and 596 $\mu\text{S}/\text{cm}$ at SW7 downstream); and
- TSS concentrations have been generally low (median concentration at SW6 of 5 mg/L and 3 mg/L at SW7). Some high concentrations have however been recorded with the maximum of 193 mg/L at SW6 and 331 mg/L at SW7.

The surface water quality data available for **Waterfall Creek** indicate that:

- pH levels have been near neutral (median value of 7.6 and range of 6.9 to 8.6);
- salinity (EC) has been low to moderate (median value of 230 $\mu\text{S}/\text{cm}$ and range of 92 $\mu\text{S}/\text{cm}$ to 1,268 $\mu\text{S}/\text{cm}$); and
- TSS concentrations have been moderate to high (median value of 187 mg/L and range of 8 mg/L to 1,922 mg/L).

4.2 STREAM FLOW

WCPL operate nine flow gauging stations located along North Wambo Creek, Stony Creek and South Wambo Creek (see

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Figure 5 and **Table 6**). 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 NOW operated flow gauging stations, located at Warkworth (FM10) and Bulga (FM11). A summary of the stream flow data is provided in **Table 7**.

Table 6: Surface Water Flow Monitoring Locations

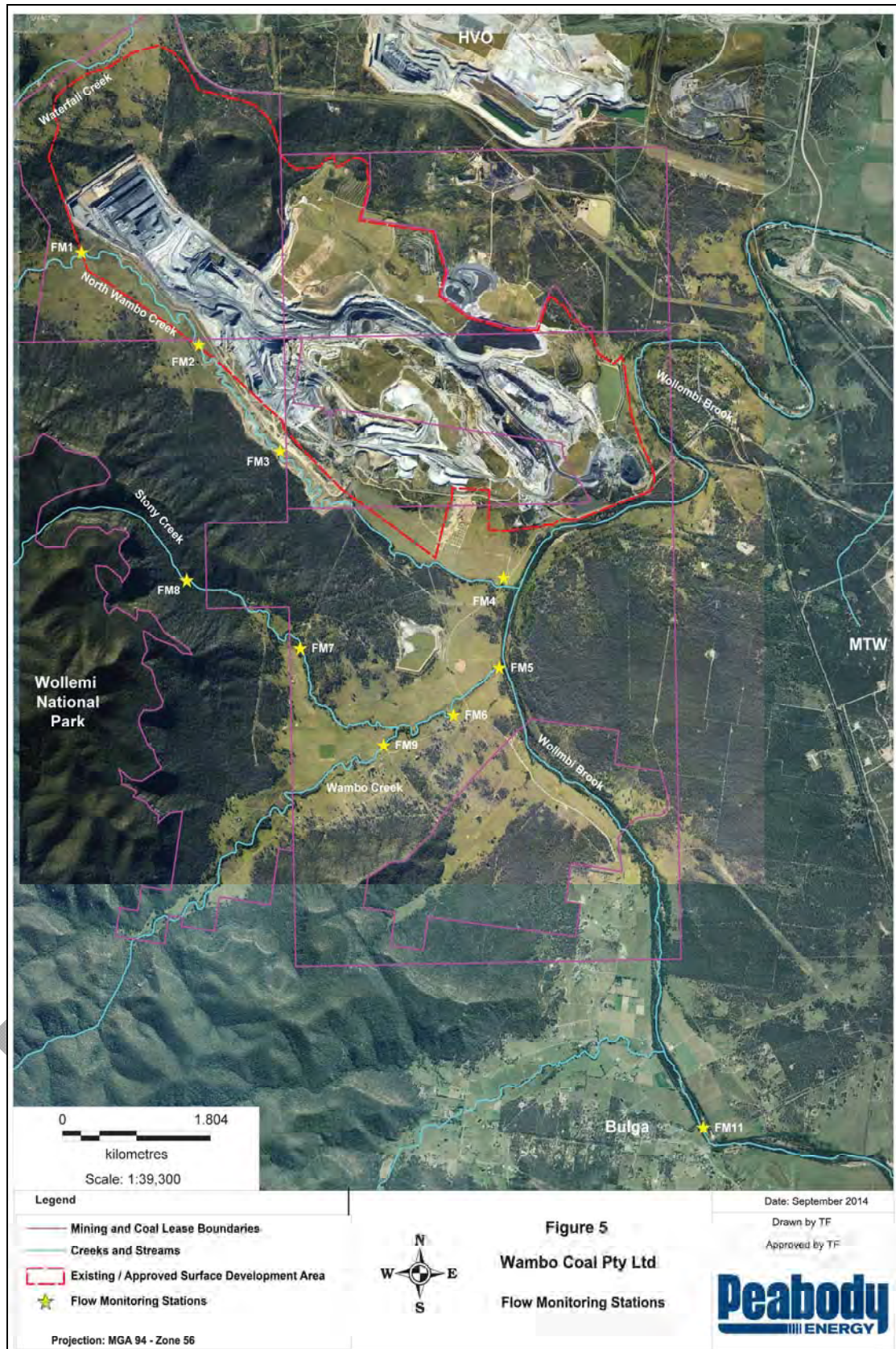
Site Ref	Frequency	Approximate Co-ordinates (MGA 94, zone 56)		Purpose
		Easting	Northing	
FM1	Continuous	306752	6396115	Monitoring of flow in North Wambo Creek upstream of diversion
FM2	Continuous	308181	6395028	Monitoring of midstream flow of North Wambo Creek Diversion
FM3	Continuous	309646	6394331	Monitoring of flow at the end of North Wambo Creek Diversion
FM4	Continuous	311890	6392288	Monitoring of flow in North Wambo Creek downstream near confluence of the Wollombi Brook
FM5	Continuous	311838	6391231	Monitoring of flow in South Wambo Creek downstream near confluence of the Wollombi Brook
FM6	Continuous	311281	6390674	Monitoring of flow in South Wambo Creek downstream
FM7	Continuous	309416	6391459	Monitoring of flow in Stony Creek downstream
FM8	Continuous	308033	6392258	Monitoring of flow in Stony Creek upstream
FM9	Continuous			Monitoring of flow in South Wambo Creek upstream
FM10	Continuous	314228	6395064	¹ Monitoring of flow in Wollombi Brook downstream from WCPL at the Golden Highway
FM11	Continuous	314323	6385825	¹ Monitoring of flow in Wollombi Brook upstream from Wambo Coal at the Bulga Village

Notes: ¹ Data sourced from DWE Gauging Stations on Wollombi Brook at Bulga [GS21004] and Warkworth [GS210028]

The flow monitoring data 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 – refer **Table 7**.

Figure 6 shows the flow duration curves for **Wollombi Brook** at the NOW 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 5: Flow Monitoring Stations



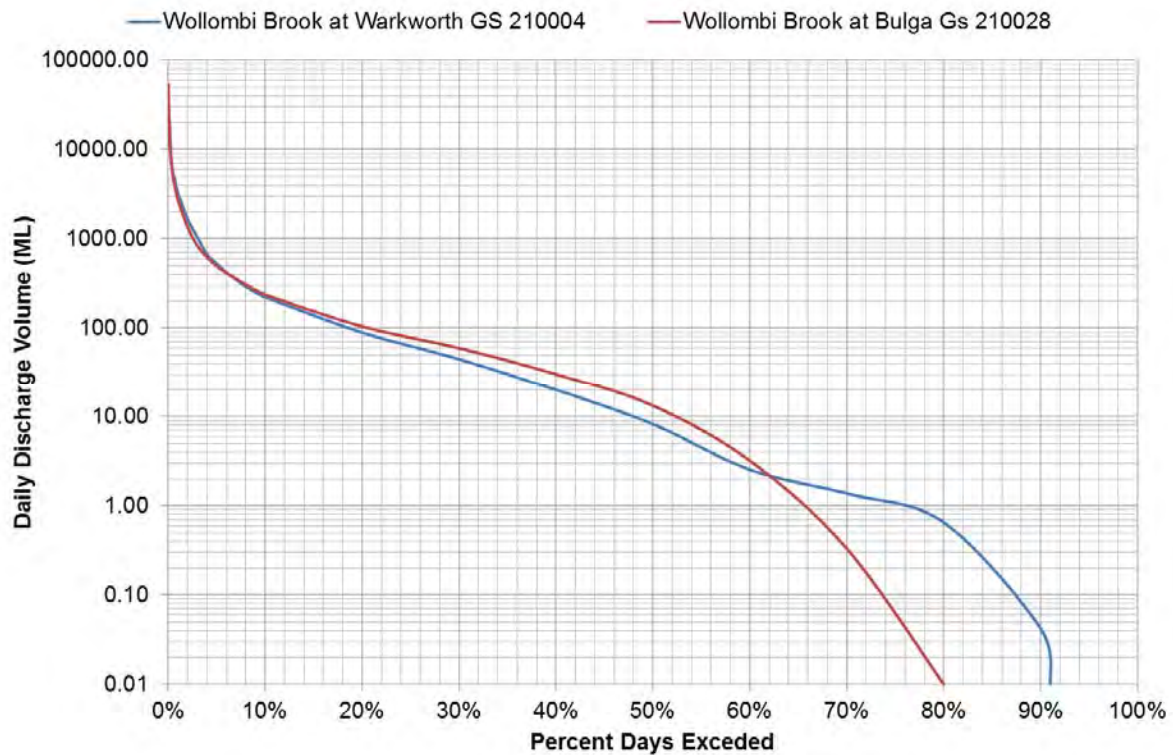


Figure 6: Flow Duration Curves Wollombi Brook Upstream and Downstream of Wambo Coal Mine

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 the following plots showing monitored (non-zero) daily flow data and concurrent daily rainfall measured at the WCM climate station – refer **Figure 7** to **Figure 9**.

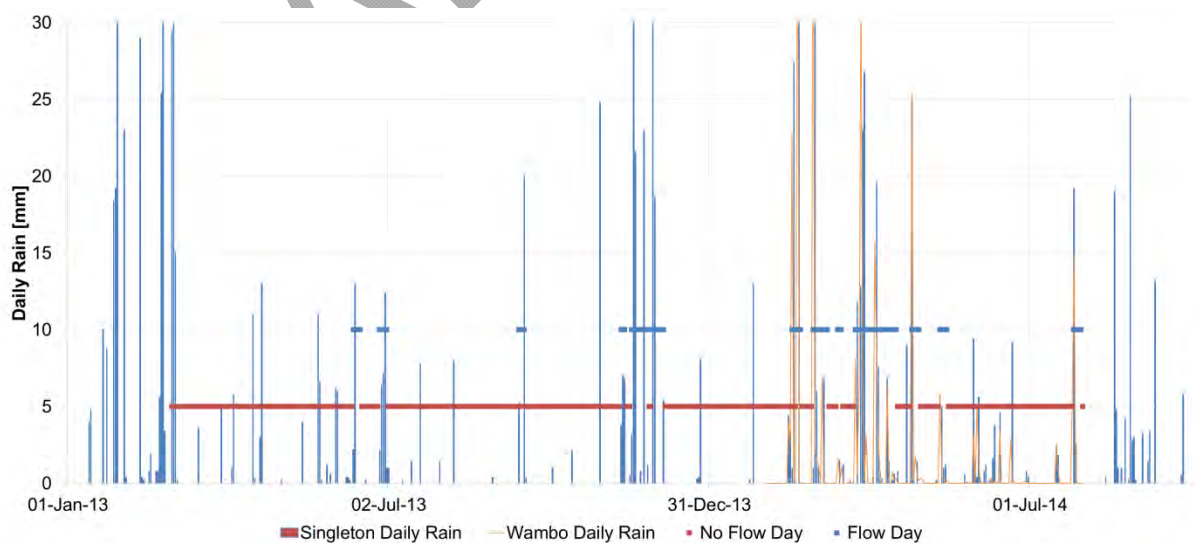


Figure 7: Recorded Daily Rainfall and Flow and No Flow Days – North Wambo Creek at FM2

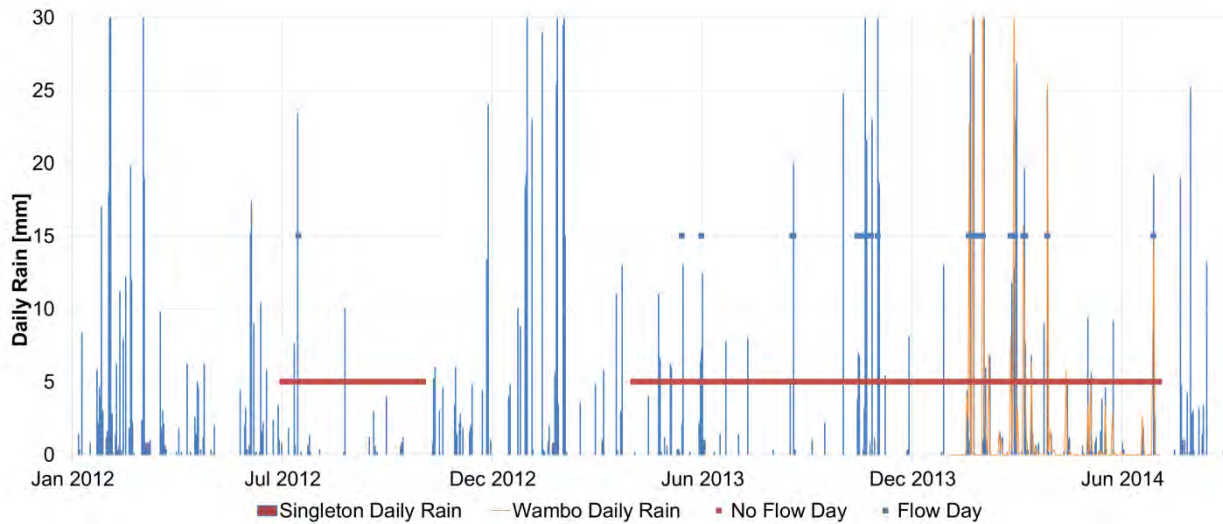


Figure 8: Recorded Daily Rainfall and Flow and No Flow Days – North Wambo Creek at FM3

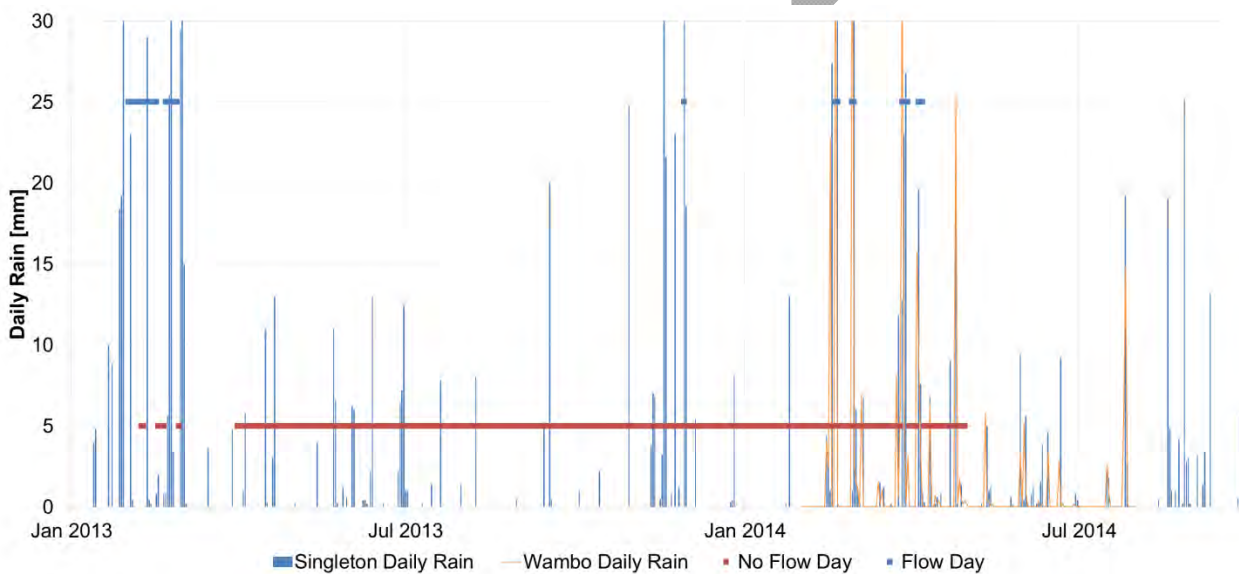


Figure 9: Recorded Daily Rainfall and Flow and No Flow Days – North Wambo Creek at FM4

Table 7: Stream Flow Summary

Site	Period of Record	Flow Days	Max (M/L Day)	Mean per Flow Day (ML/Day)	% of results with no Data Available
FM1	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			
FM2	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
FM3	12/04/2009 to 01/12/2009	6	0.08	NA	NA
	02/12/2009 to 30/06/2012	No flow data available			
	01/07/2012 to 30/06/2013	2	320	69.1	50.0%
	01/07/2013 to 31/01/2014	NA	20.4	0.04	0.0%
	01/02/2014 to 19/08/2014	2	19.65	5.34	Negligible
FM4	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
FM5	21/10/2008 to 01/12/2009	36	361.91	1.34	NA
	02/12/2009 to 30/06/2012	No flow data available			
	01/07/2012 to 30/06/2013	No flow data available			
	01/07/2013 to 31/01/2014	No flow data available			
	01/02/2014 to 19/08/2014	No flow data available			
FM6	21/10/2008 to 01/12/2009	113	252.59	0.78	NA
	02/12/2009 to 30/06/2012	No flow data available			
	01/07/2012 to 30/06/2013	NA	7536	906	50.0%
	01/07/2013 to 31/01/2014	No flow data available			
	01/02/2014 to 19/08/2014	No flow data available			
FM7	21/10/2008 to 01/12/2009	100	56.81	0.33	NA
	02/12/2009 to 30/06/2012	No flow data available			
	01/07/2012 to 30/06/2013	NA	0	0	33.3%
	01/07/2013 to 31/01/2014	No flow data available			
	01/02/2014 to 19/08/2014	No flow data available			
FM8	21/10/2008 to 01/12/2009	108	46.04	0.31	NA
	02/12/2009 to 30/06/2012	No flow data available			
	01/07/2012 to 30/06/2013	NA	11.8	8.94	33.3%
	01/07/2013 to 31/01/2014	No flow data available			
	01/02/2014 to 19/08/2014	No flow data available			
FM9	Installed on 01/12/2009	NA	NA	NA	NA
	02/12/2009 to 30/06/2012	No flow data available			
	01/07/2012 to 30/06/2013	NA	6.05	3.46	25.0%
	01/07/2013 to 31/01/2014	No flow data available			
	01/02/2014 to 19/08/2014	No flow data available			

4.2.1 Historical Flow Data

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 **Table 8**.

Table 8: Creek Flow Summary (Former Site V8)

Site	Period of Record	Number of Flow Days	Maximum (L/s)	Minimum (L/s)	Mean (L/s)
V8	29 Jun 2005 - 10 Aug 2005	43	216.1	0.0	17.7

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 **Table 9**.

Table 9: Creek Flow Summary (United Weirs)

Weir	Period of Record	Maximum (L/s)	Minimum (L/s)	Mean (L/s)
Weir 1	14 Jun 2002 – 1 Oct 2003	9.3	0.0	1.5
Weir 2	14 Jun 2002 – 1 Oct 2003	120.0	0.0	0.9

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).

5 SURFACE WATER IMPACT ASSESSMENT CRITERIA

5.1 DISCHARGE CRITERIA

Mine water at WCPL is discharged through the EPL 529 licensed discharge point located at Eagles Nest Dam, shown as in **Figure 4**. Water quality discharge limits are drawn from Development Consent 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, Consent 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: <ul style="list-style-type: none"> 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	

	Conditions	Source
	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 to be measured continuously in $\mu\text{S}/\text{cm}$ throughout the discharge with an instrument designed to measure between 0 and 10,000 $\mu\text{S}/\text{cm}$.	
	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

5.2 STREAMFLOW IMPACT ASSESSMENT CRITERIA

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

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

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 after¹ 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 - FM7	20mm
South Wambo Creek - FM5	20mm
North Wambo Creek - FM4	25mm

5.3 SURFACE WATER QUALITY IMPACT ASSESSMENT CRITERIA

The surface water impact assessment criteria for water quality are summarised in **Table 12**. The criteria have been set based on applicable ANZECC² default guidelines values for

¹ To overcome the possible issue of lagged flow response which could arise if rainfall occurred late in the day and runoff did not commence until the next day.

² Australian and New Zealand Environment Conservation Council/ Agriculture and Resource Management Council of Australia and New Zealand "Australian and New Zealand Guidelines for Fresh and Marine Water Quality" 2000

slightly to moderately disturbed ecosystems; water quality objectives for the Hunter River³ and results of site specific water quality monitoring as summarised above.

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	6.5 ²	8.5 ²
	EC (µS/cm)	-	1,254 ³
	TSS (mg/L)	18 (low flow) – 308 (high flow) ⁴	
SW05 - North Wambo Creek	pH	6.5 ²	8.5 ²
	EC (µS/cm)	-	2,294 ³
	TSS (mg/L)	70.4 (low flow) – 1,110 (high flow) ⁴	
SW07 - Wambo Creek	pH	6.5 ²	8.5 ²
	EC (µS/cm)	-	1,000 ¹
	TSS (mg/L)	27.2 (low flow) – 331 (high flow) ⁴	
SW08 - Stony Creek ⁵	pH	6.5 ²	8.5 ²
	EC (µS/cm)	-	1,000 ¹
	TSS (mg/L)	27.2 (low flow) – 331 (high flow) ⁴	
SW39 - Waterfall Creek	pH	6.5 ²	8.5 ²
	EC (µS/cm)	-	1,000 ¹
	TSS (mg/L)	581 (low flow) – 1,922 (high flow) ⁴	

¹ Based on ANZECC/ARMCANZ Water Quality Guidelines, 2000

² Based on Water Quality Objectives for the Hunter River

³ Based on 20th percentile and 80th percentile of monitored data.

⁴ Low flow conditions based on 80th percentile of recorded concentrations and high flow criteria on maximum recorded concentrations.

⁵ There is currently insufficient data for Stony Creek to set site specific impact assessment criteria and values derived for South Wambo Creek downstream have been used

6 SURFACE WATER MONITORING PROGRAM

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.

6.1 SURFACE WATER QUALITY

Sampling is undertaken at 28 sites, including Wollombi Brook, North Wambo, South Wambo, and Stony Creeks. Monitoring site locations are shown in **Figure 4** and provided in **Table 13**. 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 2**) commenced in July 2007 to enable the collection of sufficient baseline data prior to the commencement of any potential mining within that catchment. Monitoring sites SW04, SW27 and SW32 have been replaced with sites SW41, SW47 and SW48, within the NWC Diversion. Monitoring at sites SW43 and SW44 is to cease as of December 2014 – Monitoring sites are directly impacted by neighbouring mine water source flow (Mount Thorley Warkworth (MTW)). As such results are not indicative of WCPL operations and therefore should be removed from WCPL monitoring obligations.

6.2 MINE WATER QUALITY

Three mine water storage dams (Eagles Nest Dam, South Dam and Chitter Dam) are sampled monthly for water pH, EC and TSS, as presented in **Table 13**. Hales crossing sediment pond is also sampled monthly, as it is situated downstream of the rail load out facility and proposed Locomotive Provisioning Site. Eagles Nest (MW15) and Hales Crossing (HC) are tested for Total Oil & Grease.

6.3 EROSION & 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.

6.4 RIPARIAN VEGETATION & CREEKBED STABILITY MONITORING

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 Flora and Fauna Management Plan (FFMP).

6.5 MONITORING OF DISCHARGE FLOWS

Monitoring and reporting of discharge flows in the North Wambo Creek Diversion (NWCD) will be undertaken in accordance with the NOW 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 the NOW;
- Assessment of diversion stability performance, compared with selected stable reaches of North Wambo Creek and other control catchments, as approved by NOW; and
- Reporting of NWCD monitoring data in the AEMR/Annual Review.

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WCPL - Surface Water Monitoring Program

Table 13: Surface Water Quality Monitoring Program

Site Ref	Parameter ¹	Frequency ²	Approximate Co-ordinates (MGA 94, z56)		Purpose
			Easting	Northing	
SW01	pH, EC, TSS	Monthly / Rainfall event	314410	6385705	Monitoring water quality of Wollombi Brook, upstream of Wambo Coal Operations
SW02	pH, EC, TSS	Monthly / Rainfall event	314356	6395037	Monitoring water quality of Wollombi Brook, downstream of Wambo Coal Operations
SW03	pH, EC, TSS	Monthly / Rainfall event	312513	6392868	Monitoring water quality of Wollombi Brook, downstream of junction with North Wambo Creek and at Wambo Coal intake pump.
SW40	pH, EC, TSS	Monthly / Rainfall event	311914	6391104	Monitoring water quality of Wollombi Brook, upstream of junction with South Wambo Creek
SW41	pH, EC, TSS	Monthly / Rainfall event	306752	6391115	Monitoring water quality of North Wambo Creek upstream of North Wambo Creek Diversion
SW05	pH, EC, TSS	Monthly / Rainfall event	311900	6392162	Monitoring water quality of North Wambo Creek downstream of Wambo Coal Operations
SW47	pH, EC, TSS	Monthly / Rainfall event	308181	6395028	Monitoring water quality of North Wambo Creek Diversion
SW48	pH, EC, TSS	Monthly / Rainfall event	309646	6394331	Monitoring water quality of North Wambo Creek Diversion
SW39	pH, EC, TSS	Monthly / Rainfall event	307354	6398647	Monitoring water quality of Waterfall Creek
SW06	pH, EC, TSS	Monthly / Rainfall event	309061	6389554	Monitoring water quality of South Wambo Creek upstream of Wambo Coal former operations
SW07	pH, EC, TSS	Monthly / Rainfall event	311283	6390674	Monitoring water quality of South Wambo Creek downstream of Wambo Coal former operations and junction with Stony Creek
SW08	pH, EC, TSS	Monthly / Rainfall event	308483	6392149	Monitoring water quality of Stony Creek
SW32	pH, EC, TSS	Monthly / Rainfall event	309958	6393665	Monitoring water quality at North Wambo Creek Pump
MW15	pH, EC, TSS, TOG	Monthly	313055	6393110	Monitoring water quality of Eagles Nest Dam – licensed discharge dam licensed under HRSTS
MW16	pH, EC, TSS	Monthly	313085	6394781	Monitoring water quality of Chitter Dam
MW17	pH, EC, TSS	Monthly	311050	6391688	Monitoring water quality of South Wambo Dam
Hales Crossing	pH, EC, TSS, TOG	Monthly	314102	6393813	Monitoring water quality at Hales Crossing Sump, downstream of rail loop facility

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
SW47 & SW48 replace SW27 & SW32 as a result of the North Wambo Creek Diversion

6.6 MANAGEMENT OF LOCOMOTIVE PROVISIONING FACILITY

The 2012 modification to the Wambo Rail Spur Consent (DA 177-8-2004) allows for the construction of a Locomotive Provisioning Facility adjacent to the WCPL rail loop. It is proposed that construction of the facility be completed in 2012. The facility will include 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 construction and operation of the facility to minimise the potential for contamination of land, or water in Wollombi Brook:

Hydrocarbon Storage and Handling

The diesel storage tank will be 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.

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 will be kept within a lockable onsite storage container.

All pumps and external equipment will be locked, and a two metre high chain wire perimeter fence with lockable gate will be 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 will be connected to a SPEL Puraceptor™ oily water management system.

Water Treatment system

The SPEL Puraceptor™ oily water management system is a full retention separator that will treat 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 30m²), the system is capable of treating the equivalent of over 2,000mm of rainfall per hour.

The unit will have an alarm signal that will notify (via SMS or similar) 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

Management Procedures

All personnel involved in the use of hydrocarbons on the site will be 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, will be undertaken.

During the first six months, monthly total petroleum hydrocarbons (TPH) sampling (or during outflow) of the outlet will be undertaken. TPH testing will only be discontinued once nil hydrocarbon discharge is demonstrated. Monthly Total Oil & Grease testing will be undertaken in a downstream sediment sump.

Absorbent spill control matting located between the tracks in the refuel area (absorbs approximately 12L/m²) will be replaced every 18 months or as required.

6.7 DECOMMISSIONING OF WATER MANAGEMENT STRUCTURES

It is anticipated that the post-mining area would consist of safe and stable landform features, re-vegetated to a mixture of woodland and pasture areas, consistent with the open cut MOP. It is expected that the majority of internal and external mine water management dams will be decommissioned and completely rehabilitated in accordance with the MCP. However a number of key sediment control structures are likely to remain.

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 match the landuse in the immediate surrounding area.

7 REVIEW PROCEDURE

The following section outlines the procedure for managing and reviewing data collected as part of the SWMP.

7.1 DATA MANAGEMENT

Surface water quality data is entered into the environmental monitoring database, in accordance with WCPL's Environmental Monitoring and Reporting Manual.

Monthly surface water quality monitoring data is compiled in monthly environmental monitoring reports to confirm that (a) all required monitoring has been completed, and (b) monitoring results are reviewed and validated against surface water quality criteria on a regular basis. Any results not complying with the surface water quality criteria will trigger an investigation, as outlined in **Section 7.2**.

7.2 DATA REVIEW & INVESTIGATION

If water quality monitoring results are found not to comply with the surface water quality criteria discussed in **Section 5.1** or listed in **Table 10**, an investigation will be undertaken, in accordance with the protocol outlined in **Table 14**.

Table 14: Investigation Protocol

Stage	Protocol
1	Assess the monitoring results for any anomalies or causes
2	Confirm the timing and general location of the result(s)
3	Confirm the meteorological conditions at the time of the result(s), if relevant
4	Resample, or request re-analysis, to validate initial exceedance result (if possible)
5	Identify any potential natural, or non-mining, contributing factors
6	Determine if Wambo Coal operations contributed to the exceedance
7	Ensure the immediate cause of the exceedance is rectified, if possible
8	Develop and implement appropriate mitigation and preventative management strategies
9	Follow up subsequent results to assess the effectiveness of mitigation and preventative management strategies
10	Report relevant exceedances in the AEMR/Annual Review, and describe the implemented mitigation and management strategies and their effectiveness.

7.3 AMELIORATIVE MEASURES

If investigations indicate WPCL's operations did contribute to an exceedance of the surface water quality criteria, appropriate ameliorative measures will be implemented where necessary. Ameliorative measures will be developed by Environmental Personnel in consultation with the relevant Operational Manager, within the framework of the Investigation Protocol outlined in **Section 7.2**. Consideration should be given to the hierarchy of hazard control when selecting an appropriate ameliorative strategy, with preference given to hard or engineering controls over soft or administrative controls.

Additional monitoring may be implemented to assess the effectiveness of the ameliorative measures, where required. Effectiveness of the ameliorative measures will be reported in the Annual Environmental Management Report (AEMR/Annual Review).

8 REPORTING & REVIEW

8.1 MONTHLY REPORTING

Surface water quality monitoring results will be reported on a monthly basis, and published on the Peabody Energy Australia website (<http://www.peabodyenergy.com/content/398/Australia-Mining>) following validation of results from WCPL's Environmental Personnel.

8.2 ANNUAL ENVIRONMENTAL MANAGEMENT REPORT

In accordance with Consent Condition 5, Schedule 6 of DA305-7-2003, WCPL will report outcomes of the SWMP in the AEMR/Annual Review. These outcomes will include a summary of:

- surface water quality and flow monitoring undertaken;
- evidence of existing erosion and sediment control effectiveness;
- additional management and mitigation measures implemented to minimise surface water impacts; and
- performance of those additional mitigation and management measures.
- published on the Peabody Energy Australia website (<http://www.peabodyenergy.com/content/398/Australia-Mining>)

8.3 MANAGEMENT PLAN REVIEW

This SWMP will be reviewed by the Manager, Environment and Community (or appointed delegate) based on the following triggers:

- Changes to consent or licence conditions relating to this SWMP;
- Recommendations provided during an Environmental Audit;
- Significant surface water incident(s);
- Changes in technology or operations; and/or
- A maximum interval of three years.

9 RESPONSIBILITIES

Table 15 summarises SWMP responsibilities.

Table 15: SWMP Responsibilities

Task	Responsibility	Timing
Conduct surface water quality monitoring in accordance with the Section 6.1 .	Senior Environmental & Community Advisor	Monthly / Significant rainfall events
Assess surface water monitoring data against relevant criteria listed in Table 9 in accordance with protocol in Section 7 .	Senior Environmental & Community Advisor	As required
Facilitate the surface water flow monitoring in accordance with Section 6.4 .	Senior Environmental & Community Advisor	Continuous
Conduct erosion and sediment control monitoring in accordance with Section 6.1 .	Senior Environmental & Community Advisor	Monthly / Significant rainfall events
Conduct internal monthly surface water reporting.	Senior Environmental & Community Advisor	Monthly / Quarterly
Report in the AEMR details of SWMP in accordance with Section 8.2 .	Senior Environmental & Community Advisor	Annually
Internal review of SWMP in accordance with Section 8.3 .	Senior Environmental & Community Advisor	Every three years
Submit updated SWMP to DoP, DEWHA and SSC in accordance with Section 8.3 .	Environment and Community Manager	Every three years

10 REFERENCES

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*

Wells Environmental Services (2011) *Modification of DA 177-8-2004, Environmental Assessment, Locomotive Refuelling Station - Wambo Coal Rail Loop*

Appendix A

REGULATORY CORRESPONDENCE

DRAFT - 2014



13 April 2010

File Ref: L93/0257

General Manager
Wambo Mine
PMB 1
SINGLETON NSW 2330

ATTENTION: Sarah Bailey – Environment & Community Manager

Dear Sir,

Sarah

**WAMBO COAL
REVISED SITE WATER MANAGEMENT PLAN DOCUMENTS**

I refer to your letter of 1 March 2010 providing to I&I NSW for review the Site Water Management Plan (SWMP) according to Wambo Consent Condition 33. I refer also to your related letter of 9 April 2010 providing tables summarising changes to each of the plans.

I&I NSW acknowledges consultation by Wambo and accepts the SWMP documentation:

Erosion and Sediment Control Plan;

Surface Water Monitoring Program;

Groundwater Monitoring Program;

Site Water Balance

Surface and Groundwater Response Plan.

For clarification or further information please contact me at the Maitland Office on (02)49316705.

Yours faithfully,

**Greg Summerhayes
Principal Environmental Officer
Environmental Sustainability Unit**

1 March 2010

Mr Greg Summerhayes
Department of Industry and Investment
PO Box 344
Hunter Region Mail Centre
NSW 2310

Dear Greg

**WAMBO COAL
REVISED SITE WATER MANAGEMENT PLAN DOCUMENTS**

In accordance with Consent Condition 33, Schedule 4, DA 305-7-2003, Wambo Coal's Site Water Management Plan (SWMP) must be revised in consultation with Department of Industry and Investment (DII) and Department of Environment, Climate Change and Water (DECCW), prior to submission to the Department of Planning (DoP) by the 30 April 2010.

The SWMP has been revised three times since 2005 in response to consent modifications. The latest revision of the SWMP was triggered by consent modifications relating to the approval of the Chitter Dam and South Dam in June and August 2009, respectively.

Wambo Coal's SWMP is comprised of the following documents which are enclosed for your review:

- The predicted site water balance;
- An Erosion and Sediment Control Plan;
- A Surface Water Monitoring Program;
- A Groundwater Monitoring Program; and
- A Surface and Groundwater Response Plan.

Please review and provide comment by Friday 9 April 2010 to allow changes to be made prior to the DoP submission date.

Please contact me on (02) 6570 2217 if you would like to arrange a meeting to discuss these documents.

Yours sincerely



Sarah Bailey

Environment and Community Manager

1 March 2010

Mr Fergus Hancock
DECCW – Office of Water
Honeysuckle Drive
Newcastle NSW 2330

Dear Fergus

**WAMBO COAL
REVISED SITE WATER MANAGEMENT PLAN DOCUMENTS**

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- A Surface and Groundwater Response Plan.

Please review and provide comment by Friday 9 April 2010 to allow changes to be made prior to the DoP submission date.

Please contact me on (02) 6570 2217 if you would like to arrange a meeting to discuss these documents.

Yours sincerely



Sarah Bailey
Environment and Community Manager

Sarah Bailey

From: Sarah Bailey
Sent: Friday, 9 April 2010 10:38 AM
To: Fergus Hancock
Subject: Wambo Coal SWMP - table of changes to assist DECCW in the review
Attachments: 100409 let to DECCW OoW re revised SWMPs table of changes.pdf

Hi Fergus

I hope all is well and I hope you had a good Easter.

As per my phone message yesterday, we have put together tables summarizing the changes to the revised Site Water Management Plan documents.

In accordance with Consent Condition 33, Schedule 4, DA 305-7-2003, Wambo Coal's Site Water Management Plan (SWMP) must be revised in consultation with Department of Industry and Investment (DII) and Department of Environment, Climate Change and Water (DECCW), prior to submission to the Department of Planning (DoP) by the 30 April 2010.

Please let me know if you did not receive the SWMP which was posted to you on 1st March 2010.

Please let me know if you will be unable to review the SWMP documents in time to allow us to make any requested changes before submitting the SWMP to DoP before 30th April. I will need to talk to DoP re an extension to the submission date if this is the case.

Regards

Sarah Bailey

Manager Environment & Community
Wambo Coal Pty Ltd
Peabody Energy Australia
PMB 1, Singleton, NSW, 2330
Phone: +61 (0)2 6570 2217
Fax: +61 (0)2 6570 2290
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22/04/2010



Planning

Major Projects Assessment

Mining

Phone: (02) 9228 6306

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Room 305

23-33 Bridge Street

GPO Box 39

SYDNEY NSW 2001

Ms Sarah Bailey
Environment and Community Manager
Wambo Coal Pty Limited
PMB 1
SINGLETON NSW 2330

Our Ref: S02/02197

Dear Ms Bailey

Wambo Coal Mine (DA 305-7-2003) Environmental Management Plans

I refer to your letter dated 21 October 2009, requesting an extension to the date for submission of the revised Flora and Fauna Management Plan (Condition 44, Schedule 3) and revised Site Water Management Plan (Condition 30, Schedule 3), for approval by the Director-General, as required under the Minister's consent for the mine (DA 305-7-2003).

The Department has reviewed the information supplied and Wambo's Independent Offset Strategy Audit Report dated 16 October 2009, and is satisfied that the proposed extension would enable:

- the audit recommendations to be included in Wambo's Flora & Fauna Management Plan; and
- a comprehensive review of the Site Water Management Plan, incorporating comments from relevant government agencies.

Consequently, I wish to advise you that the Department accepts your request to delay submission of the Flora and Fauna Management Plan and the Site Water Management Plan. The revised Plans are now required to be submitted to the Department by 30 April 2010.

If you have any queries, please contact Belinda Parker on 9228 6306.

Yours sincerely

dkitto 4/11/09

David Kitto
Director
Major Development Assessment
as delegate for the Director-General



NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Now incorporating Department of Mineral Resources
ABN 51 73 412 4190-003

8 August 2008

File Ref: L93/0257

General Manager
Wambo Mine
PMB 1
SINGLETON NSW 2330

ATTENTION: Sarah Bailey – Environmental Specialist

Dear Sir,

WAMBO - GROUND WATER MANAGEMENT PROGRAM

I refer to your letter of 31 July 2008 providing the subject GWMP. The DPI acknowledges and accepts the GWMP documentation.

I also confirm the referenced components of the Wambo Site Water Management Plan have been provided to DPI for review. DPI have been consulted and have provided comment in March 2008.

For clarification or further information please contact me at the DPI Maitland Office on (02)49316705.

Yours faithfully,

Greg Summerhayes
Principal Environmental Officer
Environmental Sustainability Division



NSW GOVERNMENT
Department of Planning

Contact: Colin Phillips
Phone: (02) 9228 6483
Fax: (02) 9228 6466
Email: colin.phillips@planning.nsw.gov.au

Our ref: S02/02197

Mr Chris Millard
General Manager
Wambo Coal Pty Limited
PMB 1
SINGLETON NSW 2330

Dear Mr Millard

**Wambo Coal Mine
Site Water Management Plan**

I refer to your letter, dated 18 December 2007, requesting an extension of time to finalise the preparation of the revised Wambo Site Water Management Plan required by condition 30 of schedule 4 of Wambo coal mine's development consent (DA 305-7-2003).

The Department has considered the importance of gaining input from DPI and DWE to this plan and accordingly extends the submission date of this plan until 31 March 2008 to allow consultation with these agencies to be finalised.

Yours sincerely,

Howard Reed 20.12.07
A/Manager
Mining and Extractive Industries
as Delegate for the Director-General



NSW GOVERNMENT
Department of Planning

Contact: Colin Phillips
Phone: (02) 9228 6483
Fax: (02) 9228 6466
Email: colin.phillips@planning.nsw.gov.au

Ms Sarah Bailey
Environmental Officer
Wambo Coal Pty Limited
PMB 1
SINGLETON NSW 2330

Our ref: S02/02197

Dear Sarah

**Wambo Coal Mine
Site Water Management Plan**

I refer to a letter from Ms Sarah Withell, dated 30 October 2007, requesting an extension of time to finalise the preparation of the revised Wambo Site Water Management Plan required by condition 30 of schedule 4 of Wambo coal mine's development consent (DA 305-7-2003).

The Department has considered the importance of gaining input from DPI and DWE to this plan and accordingly extends the submission date of this plan until 31 December 2007 to allow consultation with these agencies to be finalised.

Yours sincerely,

Howard Reed
A/Manager
Mining and Extractive Industries
as Delegate for the Director-General

12-11-07



NSW GOVERNMENT
Department of Planning

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Mr Tony Sutherland
Wambo Coal Pty Ltd
PMB 1
SINGLETON NSW 2330

24.10.05
D → J.T.
WD
RH
GH

Dear Mr Sutherland

**Wambo Development Project
Management Plans and Monitoring Programs**

Thank you for forwarding the following documents required under the Wambo development consent (DA 305-7-2003) for the Department's consideration:

- ~~Noise Monitoring Program (condition 9, Schedule 4);~~
- Site Water Balance (condition 25, Schedule 4);
- Erosion and Sediment Control Plan (condition 32, Schedule 4);
- Surface Water Monitoring Program (condition 33, Schedule 4);
- Groundwater Monitoring Program (condition 34, Schedule 4); and
- Environmental Management Strategy (condition 1, Schedule 6).

The Department has reviewed these documents and is generally satisfied they address the requirements of the relevant conditions in the development consent. ~~Consequently, I would like to advise you that the Director-General has approved these documents.~~ However, the Surface Water Monitoring Programme has been approved on the proviso that it is revised following the approval of the North Wambo Creek Diversion Plan.

The Director-General has previously approved the Air Quality Monitoring Program, Flora and Fauna Management Plan, and Landowner Notification Strategy for the development, but notes there are several other matters which must be satisfied prior to commencing certain operations under the new consent. These matters include:

- Blast Monitoring Program (condition 19, Schedule 4);
- Blast Management Plan (condition 20, Schedule 4);
- Site Water Management Plan (condition 30, Schedule 4);
- Surface and Groundwater Response Plan (condition 35, Schedule 4);
- Surface and Sub-Surface Investigation Program (condition 36, Schedule 4);
- Archival Record of the Wambo Homestead Complex (condition 62, Schedule 4);
- Assessment of options for reducing the greenhouse gas emissions of the development (condition 87, Schedule 4);
- Environmental Monitoring Program (condition 2, Schedule 6).

The Department also notes that under condition 5 of Schedule 4, the development consent will only commence after all previous development consents for the Wambo coal mine have been surrendered, excluding DA No. 108/91 issued by Singleton Shire Council, to the satisfaction of the Director-General.

I would appreciate it if you would advise the Department of when you expect to commence open cut and underground operations under DA 305-7-2003, and when you are likely to submit the various outstanding documents required under the consent.

If you have any enquiries about this matter, please contact Mike Young on 9228 6481.

Yours sincerely

per David Kitto
Manager
Mining & Extractive Industries
as delegate for the Director-General

10/10/05



Department of
Environment and Conservation (NSW)

Your reference :
Our reference : 270075A12; NEF17395; 17455; 17093; 17579
Contact : Karen Marler; ph: 49086803

Wambo Coal Pty Limited
PMB 1
SINGLETON NSW 2330

- 7 SEP 2005

Attention: Mr Tony Sutherland

Dear Mr Sutherland

WAMBO DEVELOPMENT PROJECT:

1. SURFACE WATER MONITORING PROGRAM (31 August 2005)
2. GROUNDWATER MONITORING PROGRAM (31 August 2005)
3. AIR QUALITY MONITORING PROGRAM (ORIGINAL (7 June 2005) AND REVISIONS 16 June 2005 AND 31 August 2005)
4. ~~EROSION AND SEDIMENT CONTROL PLAN (29 July 2005)~~
5. LANDOWNER NOTIFICATION PROCEDURE – AIR QUALITY (9 August 2005)

I refer to the above documents sent to the Department of Environment and Conservation (DEC) on the dates indicated. With regard to these documents the DEC provides the following advice:

1. SURFACE WATER MONITORING PROGRAM
2. GROUNDWATER MONITORING PROGRAM
3. AIR QUALITY MONITORING PROGRAM
4. EROSION AND SEDIMENT CONTROL PLAN

The DEC encourages the preparation of strategies, programs and plans as useful tools for industry to ensure that it meets the environmental objectives specified in conditions of Environment Protection Licences. As a regulatory authority, the DEC does not review or comment on these plans.

5. LANDOWNER NOTIFICATION PROCEDURE – AIR QUALITY

The fact sheet contains comprehensive advice regarding what particulate emissions are. You should contact NSW Health for comment on the adequacy of the information provided about the potential health impacts that may result from exposure to particulate matter.

The DEC understands that the primary aim of this procedure is to provide tenants and prospective tenants with information on likely health-related impacts associated with air quality at the place they are leasing or considering leasing. It will be important to ensure that landowners, tenants or prospective tenants are provided with site specific information regarding the predicted future particulate matter levels for each residence (particularly those Warkworth Mining Limited owned dwellings on Wallaby Scrub Road). The fact sheet should be provided to assist tenants to interpret this information and understand the likely future impacts of mining on air quality and potentially their health and amenity when making a decision to live in these residences.

If you have any questions regarding this matter, please contact Karen Marler on 4908 6803.

Yours sincerely



MITCHELL BENNETT
Head – Regional Operations Unit - Hunter
North East Branch
Environment Protection and Regulation Division

ATTACHMENT 3

WAMBO COAL PTY LIMITED
GROUNDWATER MONITORING PROGRAM



Groundwater Monitoring Program
(Water Management Plan)

PREPARED BY

WAMBO COAL PTY LIMITED

June 2015

**WAMBO COAL PTY
LIMITED
ENVIRONMENTAL
MANAGEMENT
SYSTEM**

**GROUNDWATER
MONITORING PROGRAM**

Document Control

Document No.	EMP009(b)
Title	Groundwater Monitoring Program
General Description	Monitoring of Groundwater
Key Support Documents	Wambo Coal Site Water Management Plan – (WMP-EMP009) DA 305-7-2003, DA177-8-2004, EPL529, EIS-2003

Revisions

Rev No	Date	Description	By	Checked
0	August 05	Original Draft	AGE	JT/TS
1	August 05	Revision 1	AGE	JT/TS
2	March 06	Revision 2	WCPL	JT
3	June 07	Revision 3	WCPL	SW
4	July 08	Revision 4	WCPL	RP
5	January 10	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

	Environmental Advisor
--	------------------------------

Approver	Director: Technical Services and Projects
Date	June 2015
Name	M. Alexander
Signature	

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APPENDIX

Appendix 1	Regulatory Correspondence
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1.0 INTRODUCTION

Wambo Coal Mine (Wambo) is an existing open cut and underground coal mine located in the Singleton Local Government Area (LGA) approximately 15 km west of Singleton NSW **Figure 2**.

A range of open cut and underground mine operations have been conducted at Wambo 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 Wambo by rail.

Figure 3 illustrates the approved extent of the open cut and underground mine operations and key infrastructure. A summary of the approvals for Wambo is provided in **Table 1**.

Table 1 Summary of the Approved Wambo Coal Mine

Component	Approved Wambo Coal Mine ¹
Life of Mine	<ul style="list-style-type: none"> 21 years (from the date of the commencement of Development Consent [DA 305-7-2003]).
Open Cut Mining	<ul style="list-style-type: none"> 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 until 2017.
Underground Mining	<ul style="list-style-type: none"> Underground mining of up to 7.5 Mtpa of ROM coal from the Whybrow, Wambo, Arrowfield and Bowfield Seams. Underground ROM coal reserves are estimated at 109.6 Mt.
Subsidence commitments and management.	<ul style="list-style-type: none"> The subsidence performance measures listed in Conditions 22 and 22A of the Development Consent (DA 305-7-2003).
ROM Coal Production Rate	<ul style="list-style-type: none"> Up to 14.7 Mtpa of ROM coal.
Total ROM Coal Mined	<ul style="list-style-type: none"> 207.6 Mt.
Waste Rock Management	<ul style="list-style-type: none"> Waste rock deposited in open cut voids and in waste rock emplacements adjacent to open cut operations.
Total Waste Rock	<ul style="list-style-type: none"> 640 million bank cubic metres (Mbcm).
Coal Washing	<ul style="list-style-type: none"> Coal handling and preparation plant (CHPP) capable of processing approximately 1,800 tonnes per hour (tph).
Product Coal	<ul style="list-style-type: none"> Production of up to 11.3 Mtpa of thermal coal predominantly for export.
CHPP Reject Management	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Approximately 28.2 Mt of coarse rejects and approximately 18.6 Mt of tailings.
Water Supply	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Coal Lease (CL) 365, CL374, CL397, Consolidated Coal Lease (CCL) 743, Mining Lease (ML) 1402, ML1572, ML1594, Authorisation (A) 444, Exploration Licence (EL) 7211.

This Groundwater Monitoring Program (GWMP) is a component of the Wambo Coal Pty Limited (WCPL) Site Water Management Plan. **Figure 1** 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 Groundwater Response Plan.

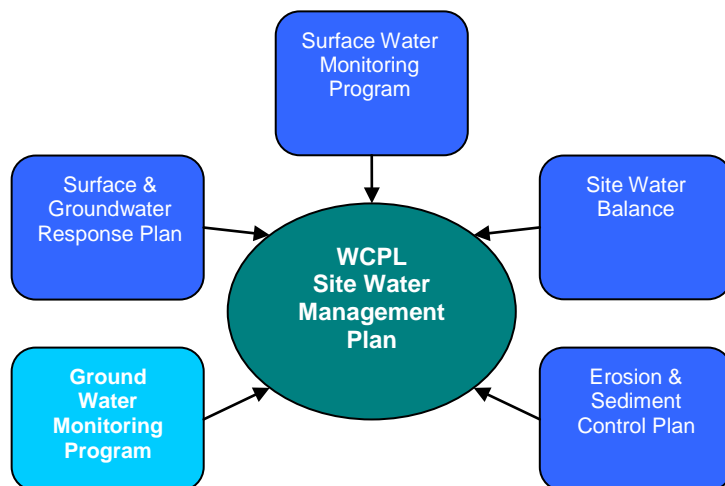


Figure 1 Wambo Coal Site Water Management Plan

1.1 OBJECTIVES OF THE GWMP

This GWMP has been developed to address the relevant requirements of Development Consent DA 305-7-2003 and DA 177-8-2004. In addition this GWMP addresses the relevant requirements of bore licences 20BL173032, 20BL173033, 20BL173034 and 20BL173035 issued under the *Water Act 1912*.

In accordance with Condition 34, Schedule 4 of DA305-7-2003, WCPL have prepared this GWMP to provide:

- 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;
- ground water impact assessment criteria;
- a program to monitor the volume and quality of ground water seeping into the open cut and underground mining workings;
- a program to monitor regional ground water 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.

In addition, the GWMP has also been prepared in accordance with Development Consent DA 305-7-2003, Schedule 6, Condition 4.

Other components of the Site Water Management Plan have been prepared to address the requirements of Development Consent DA 177-8-2004. There are no conditions relevant to groundwater monitoring or management in Development Consent DA 177-8-2004.

1.2 CONSULTATION

Several applications to modify DA 305-7-2003 were sought and approved by the Department of Planning (now Department of Planning and Environment (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 January 2010.

In accordance with Consent Condition 30, Schedule 4, DA 305-7-2003, the revised GWMP has been undertaken in consultation with Department of Industry and Investment (formerly DPI), Environment Protection Authority (formerly DECCW) and NSW Office of Water (NoW) (formerly DWE), prior to submitting to the Secretary of the DP&E for approval. Please refer to Appendix A for regulatory correspondence.

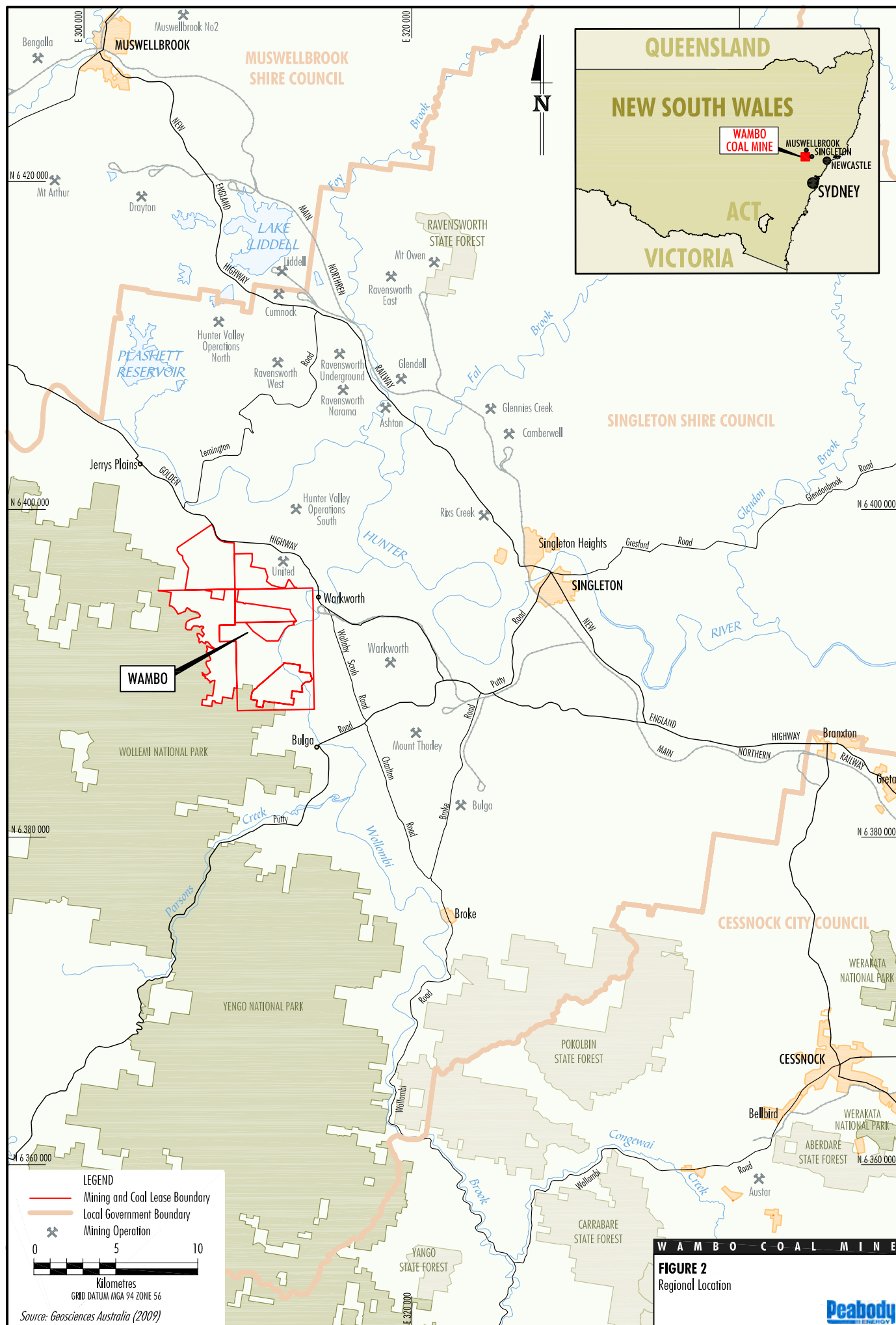
1.3 EXISTING OPERATIONS

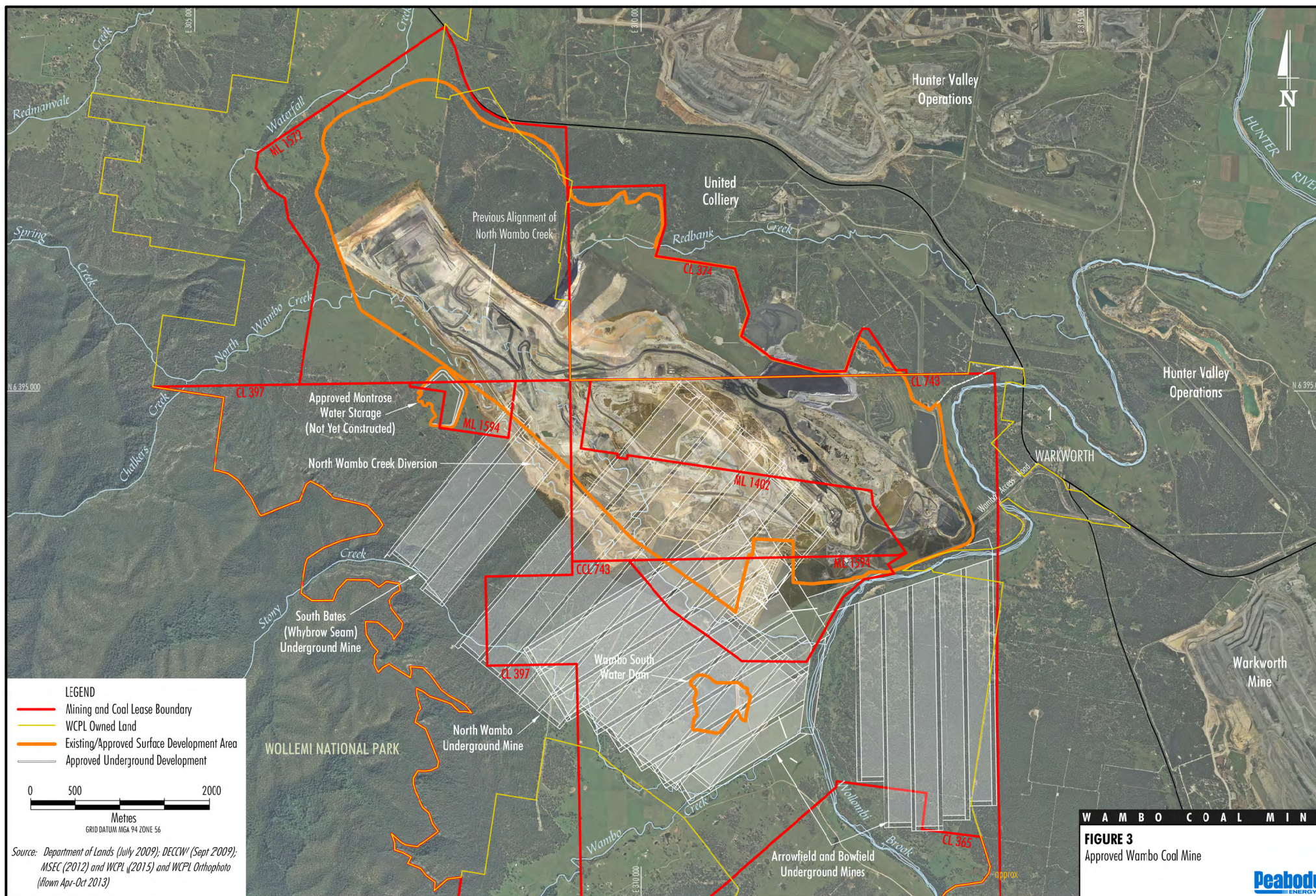
Since mining commenced at Wambo in 1969, coal has been recovered primarily from the Whybrow, Redbank Creek, Wambo and Whynot Seams through open cut and underground operations. Wambo has active open cut and underground mining operations. Open cut pits include the Montrose Pit, Bates Pit and Bates South Pit. Homestead (Decant) doubles as Open Cut Pit/Portal Access/Tailings Decant (Worley Parsons, 2014). The current extent of the open cut operations is located at the northern end of the Wambo lease boundary as shown in **Figure 3**.

Underground mining operations are currently occurring in the Wambo Seam in the North Wambo Underground Mine. WCPL has approval under DA 305-7-2003 to undertake mining in the Whybrow Seam at the South Bates Underground Mine, as well as within the Arrowfield and Bowfield Seams. There are historical workings in the Whybrow Seam at the Homestead Underground Mine, which were completed in 1999. Following completion of mining, the Homestead workings naturally flooded with water as groundwater re-pressurised. The Homestead workings were de-watered by WCPL before mining commenced in the underlying North Wambo Underground Mine in 2009.

1.4 SURROUNDING OPERATIONS

Several other coal mines operate in close proximity to WCPL, including United Colliery to the north, Coal and Allied's Hunter Valley Operations to the north and east, and Coal and Allied's Mt Thorley Warkworth operation to the east. The United Colliery's underground operations extend under the Wambo open cut operations. The United Colliery actively mined the Arrowfield Seam (referred to as the Woodlands Hill Seam by United Colliery) between 1992 and 2010.





2.0 STATUTORY REQUIREMENTS

The following section provides a brief overview of the legislation, policy and guidelines relevant to this GWMP.

2.1 DEVELOPMENT APPROVAL CONDITIONS

This GWMP has been prepared to address the relevant Development Approval (DA) consent conditions within DA305-7-2003. **Table 2** displays the relevant DA regulatory requirements and where they are addressed in the document. There are no conditions relevant to groundwater monitoring or management in Development Consent DA 177-8-2004.

Table 2 DA 305-7-2003 Groundwater Monitoring Requirements

Consent Requirement	Condition	Where Addressed in this GWMP
WCPL Mine Development Consent (DA 305-7-2003)	<p>“30. Before carrying out any development, the Applicant shall prepare a Site Water Management Plan for the development in consultation with DRE and NOW, and to the satisfaction of the Secretary. This plan must include::</p> <p>...</p> <p>(f) a Groundwater Water Monitoring Program;</p> <p>The Ground Water Monitoring Program shall include:</p> <p>(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;</p> <p>(b) ground water impact assessment criteria;</p> <p>(c) a comprehensive and detailed program to monitor the volume and quality of ground water seeping into the open cut and underground mining workings;</p> <p>(d) a detailed program to monitor regional ground water levels and quality in the alluvial and overburden aquifers; and</p> <p>(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.</p>	<p>This GWMP</p> <p>Section 4.0</p> <p>Section 5.0</p> <p>Section 5.2</p> <p>Section 5.0</p> <p>Section 5.4</p>

NOTE:

Brown represents June 2009 Modification

Lime represents August 2009 Modification

Blue with grey background represents April 2015 Modification

2.2 LEGISLATION

2.2.1 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.

At this point in time, the *Water Act 1912* applies to groundwater interference, bore installation and extraction of groundwater within the Permian formations within the GWMP area. WCPL currently has a number of licences under the *Water Act 1912* shown in **Table 3**.

2.2.2 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.

A WSP for the North Coast Fractured and Porous Rock Groundwater Sources (NFPR WSP) is currently under development by the NoW and due to commence in 2015. Once the WSP commences, existing licences under the *Water Act 1912* will be converted to WALs and water supply works and use approvals under the WM Act.

2.2.3 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 WAL within the Lower Wollombi Brook water source of the HUA WSP as shown in **Table 3**.

WCPL - Groundwater Monitoring Program

Table 3 Entitlement and Licences

Licence No.	Description	Facility	Valid to	Extraction Limit
Licences under the Water Management Act 2000				
WAL 23897	Well No. 2	Well	Perpetuity	70 ML/year
WAL 718	Hunter River Pump	Pump	Perpetuity	1,000 ML/year
Licences under the Water Act 1912				
20BL132753	Old Well No. 1	Well	29/07/2018	243ML/year
20BL166910	Dewatering (Bore No. 1)	Bore	21/05/2017	450ML/year
20BL168017	Dewatering (Bore No. 2)	Bore	21/05/2017	750ML/year
20BL167738	Dewatering Bore	Bore	11/09/2015	57ML/year
20BL168643	Dewatering Bore	Bore	7/08/2018	40ML/year
20BL172061	Dewatering (BoreNo.2a)	Bore	22/03/2014	750ML/year
20BL172156	Dewatering	Excavation	3/05/2019	98ML/year
20BL173032	Dewatering Bore	Bore	30/11/2016	450ML/year
20BL173033	Dewatering Bore	Bore	30/11/2016	450ML/year
20BL173034	Dewatering Bore	Bore	30/11/2016	450ML/year
20BL173035	Dewatering Bore	Bore	30/11/2016	450ML/year
20BL173040	Dewatering Bore	Bore	21/05/2017	750 ML/year
20BL173844	Dewatering Bore	Bore	04/09/2019	9 ML/year
20BL166438	Well - Stock	Bore	Perpetuity	5ML/year
20BL168997	Piezometer	Test Bore	Perpetuity	Groundwater monitoring
20BL168998	Piezometer	Test Bore	Perpetuity	Groundwater monitoring
20BL168999	Piezometer	Test Bore	Perpetuity	Groundwater monitoring
20BL169000	Piezometer	Test Bore	Perpetuity	Groundwater monitoring
20BL170638	Piezometer	Test Bore	Perpetuity	Groundwater monitoring
20BL166906	Spearpoints	Irrigation	Perpetuity	19ML/year
20BL172237	GW14, GW18, GW21	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172238	GW12	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172240	GW15	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172242	GW16, GW17	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172244	GW20	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172255	GW22	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172256	GW13	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172257	GW19	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL172332	Piezometer	Test Bore	Perpetuity	Groundwater monitoring
20BL173290	Bore	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL173291	Bore	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL173292	Bore	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL173293	Bore	Monitoring Bore	Perpetuity	Groundwater monitoring
20BL009818	Bore	Stock	Perpetuity	Stock
20BL009819	Bore	Stock	Perpetuity	Stock
20BL009820	Bore	Stock	Perpetuity	Stock
20BL009821	Bore	Stock	Perpetuity	Stock
20BL143779	Bore	Stock/Domestic	Perpetuity	Stock/Domestic

Note: Application for renewal of 20BL172061 has been submitted

2.2.4 Draft North Coast Fractured and Porous Rock Groundwater Sources

The NFPR WSP is currently under development and is due to commence in 2015. The water extraction entitlement for each groundwater source has not yet been determined, however it is expected to be based on existing groundwater extraction licences under the *Water Act 1912* and the Long Term Average Annual Extraction Limit (LTAAEL).

It is expected that the NFPR WSP will provide rules for each groundwater source, which may include:

- access rules;
- rules for managing water allocation accounts;
- rules for granting and amending water supply works approvals;
- rules for the use of water supply works approvals;
- limits to the availability of water; and
- trading rules.

2.3 POLICIES

2.3.1 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.

2.3.2 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.

2.3.3 NSW Groundwater Quantity Protection Policy

The principles of this 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.

2.3.4 NSW Groundwater Quality Protection Policy

The objective of this 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.

2.3.5 NSW Groundwater Dependent Ecosystem Policy

This 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.

2.4 GUIDELINES

2.4.1 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 the NoW as the benchmark for groundwater monitoring programs at mine sites within the Hunter Region.

3.0 DESCRIPTION OF GROUNDWATERS - EXISTING ENVIRONMENT

The existing geological, hydrogeological and surface water environment at Wambo is outlined in this section.

3.1 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, Wollombi Brook, 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 (DA 305-7-2003 MOD 5). The locations of these watercourses are shown in **Figure 5**.

3.2 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 Jerrys 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.

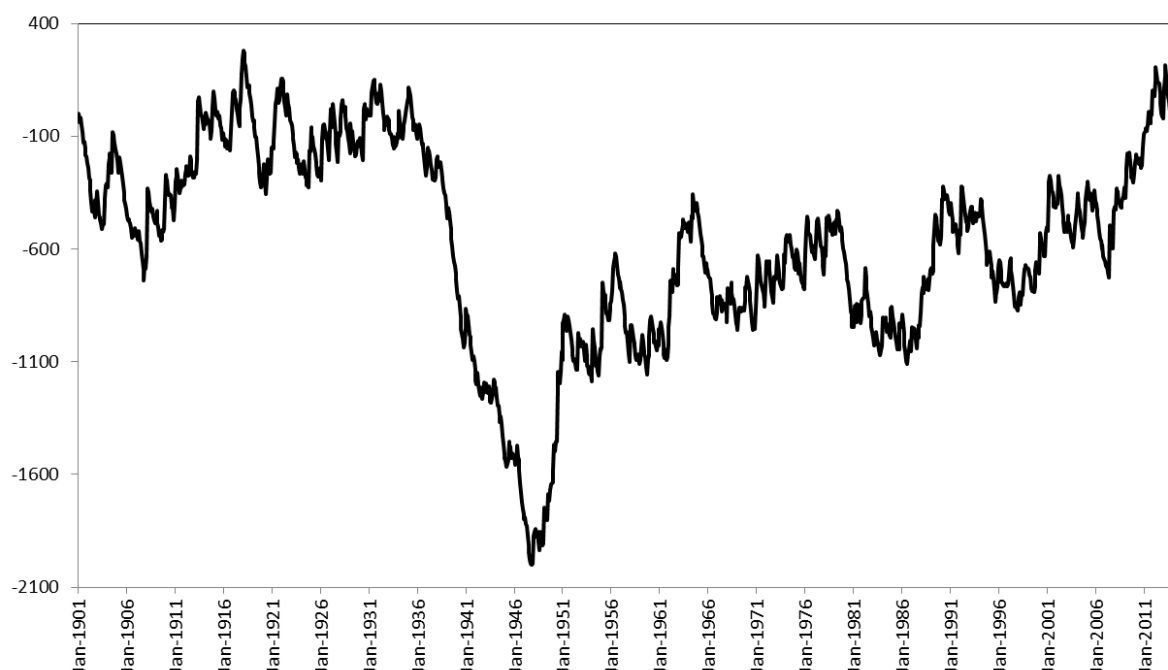


Figure 4 CRD Curve for Jerrys Plains Post Office (1901-2014)

3.3 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 Newcastle Coalfields Regional Geology 1:100,000 map (NSW Department of Mineral Resources, Edition 2 1993). The target coal seams at Wambo are all within the Jerrys Plains Subgroup of the Wittingham Coal Measures.

Table 4 Stratigraphic Sequence

Period	Supergroup	Group	Subgroup	Lithology
Quaternary				Alluvium
Permian	Singleton Supergroup	Newcastle Coal Measures (Wollombi Coal Measures)	Glen Gallic Subgroup	
			Doyles Creek Subgroups	
			Horseshoe Creek Subgroup	
			Apple Tree Flat Subgroup	
			Watts Sandstone	Medium to coarse-grained sandstone

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Period	Supergroup	Group	Subgroup	Lithology
		Wittingham Coal Measures	Denman Formation	Sandstone siltstone laminite
			Jerrys 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

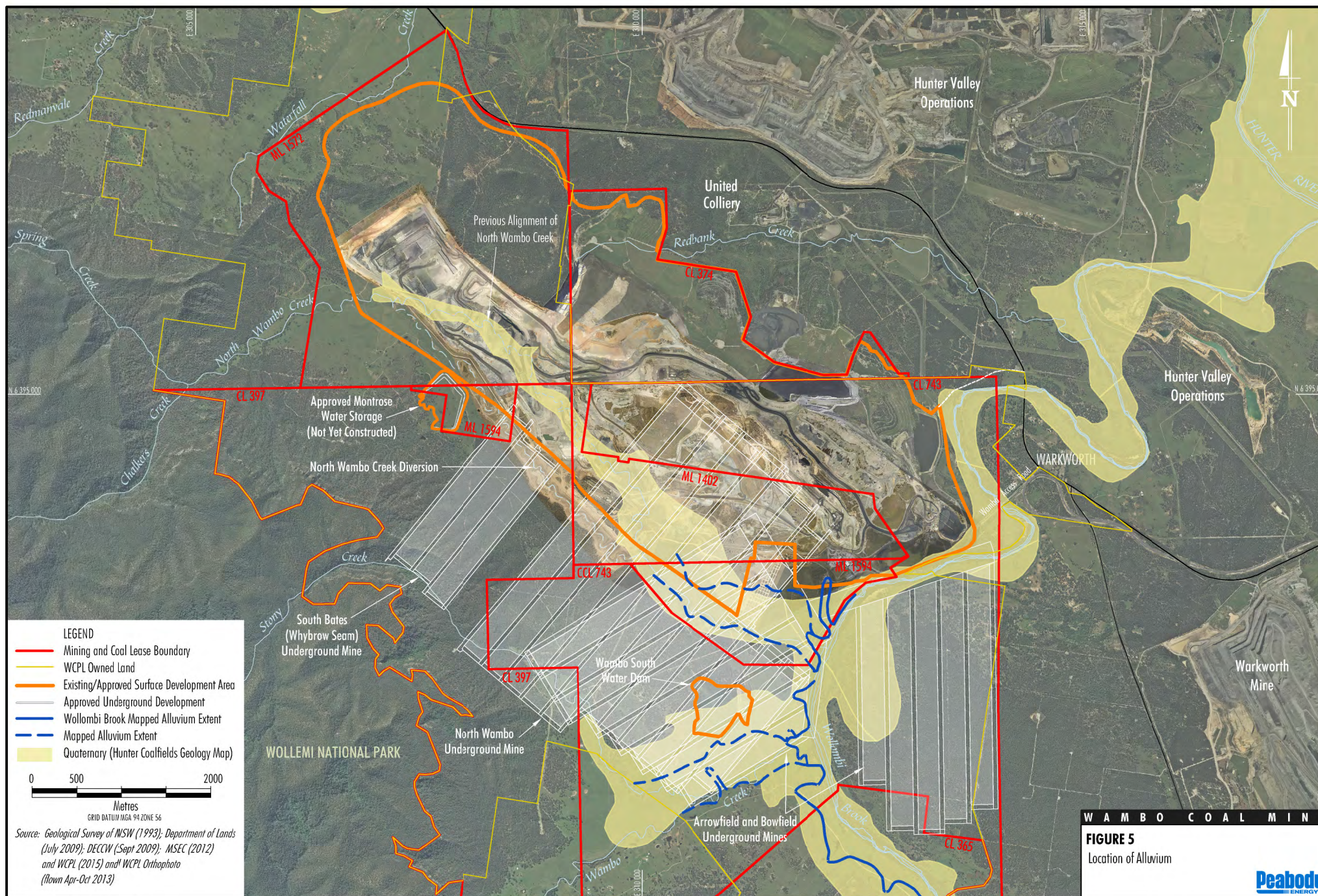
Approximate boundaries of quaternary alluvial sediments in the vicinity of Wambo are shown in **Figure 5** and have been derived from the Hunter Coalfields Regional Geology 1:100,000 map (NSW Department of Mineral Resources, Edition 2 1993). The coal measures are overlain by the Triassic Narrabeen Group. The Narrabeen Group 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 and North Wambo Creek. The extent of alluvial sediments determined from that study is also presented on **Figure 5**.

3.4 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.



3.4.1 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 thinner (laterally) alluvial body along both the lower reaches of (South) Wambo and North Wambo Creeks than is mapped in the publicly available mapping (HydroSimulations, 2014).

A section of North Wambo Creek has been diverted to avoid 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 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 shown in **Table 5** 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.

3.4.2 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 predicted that pre-mining piezometric head in the Permian groundwater sources 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.

3.5 GROUNDWATER RECEPTORS

3.5.1 NSW Bore Database Search

A search of the NSW Bore Database was undertaken to identify registered bores within a 5 km radius of Wambo. The search identified 74 bores, with the majority (45) 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 4 bores were of unknown use. The remainder (15) are registered for irrigation, domestic and/or stock use.

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

Table 5 Results of NSW Bore Database Search

Bore No	Licence No	Location		Use	Depth (m)	SWL (bgl)	Salinity (ppm)	Yield (L/s)	Aquifer
		mE	mN						
GW017462	20BL008224	315339.2	6391460	Stock	0				
GW060327	-	314180.8	6393442	Mining	9.8	6.7	0-500		
GW060328	-	314205.2	6393534	Mining	10	7			
GW060329	-	311903.5	6392474	Mining	6.4				
GW060330	-	311726.7	6392163	Mining	6.2	3.8	0-500		
GW060363	20BL132753	311697.8	6392317	Mining	6.3				
GW060364	-	311636.3	6392808	Mining	5.1				
GW060365	-	311690.8	6392686	Irrigation	6.6				
GW060366	-	311195.9	6392646	Irrigation	5.2				
GW060750	20BL132130	314309.8	6394923	Domestic	24.4	7.8		1.25	
GW043673	-	311486.3	6392467	Test Bore	9.4				
GW043674	-	311302.6	6392525	Test Bore	8.2				
GW043675	-	311432.9	6392527	Test Bore	8.5				
GW065117	-	311153.9	6390735	Irrigation	6				
GW066606	-	311207.2	6390674	Domestic Stock	2.5				
GW037184	-	309685	6393911	Test Bore	21				
GW038579	-	309737.7	6393882	Test Bore	20.9				
GW005327	20BL009540	314682.9	6394498	Stock	10.4	6.1	Excellent	0.13	
GW037998	-	311589.4	6392530	Irrigation	10.9				
GW037999	-	311481.6	6392713	Irrigation	13.7				
GW038000	-	311457.3	6392620	Irrigation	9.4				
GW079780	-	309588.9	6393932	Unknown	0				
GW078574	20BL167170	309174.3	6390605	Farming Stock	12				
GW078575	20BL167171	309504.8	6389687	Farming Stock	12				
GW078577	20WA208559	309968.7	6389973	Domestic Stock	10				
GW080502	20BL168017	308897	6390160	Mining	250	105			Coarse Sand
GW080514	20BL168881	310973	6394353	Test/Monitoring Bore	55	42.7	6300		Coarse Sand
GW080515	20BL168882	313418	6394794	Test/Monitoring Bore	8.1	5.7	8690		
GW080516	20BL168883	312898.8	6394954	Test Bore	15	7.11	950		Sandy Clay
GW080517	20BL168884	313572.7	6394742	Test/Monitoring Bore	15	7.24	3600		
GW080519	20BL168885	313622.4	6394161	Test Bore	10.5	7.42	6490		
GW079060	-	314595.5	6394852	Unknown	14.6				
GW047240	20CA209896	316826.7	6397095	Irrigation	12.7				

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Bore No	Licence No	Location		Use	Depth (m)	SWL (bgl)	Salinity (ppm)	Yield (L/s)	Aquifer
		mE	mN						
GW078576	20BL167172	309763.7	6389784	Farming Stock	7				Gravel, Shale Grey Siltstone, Sandstone Conglomerate
GW079059	20BL153300	314595.5	6394852	Monitoring Bore	0		5147		
GW060326	-	314104.3	6393348	Mining	9.8	6.7			
GW043676	-	311479.9	6392805	Test Bore	10.6				
GW080518	20BL168885	313585.8	6394232	Test/Monitoring Bore	10.8	6.95	53000		
GW080951	-	314619	6394878	Unknown	3.1	3.14			
GW080952	-	314643	6394905	Unknown	1.6	1.59			Sandy Clay / Gravel / Clay
GW078055	-	310104.9	6390490	Test Bore	198.5		1660	3-5	
GW080963	20BL170103	315994	6397210	Monitoring Bore	84	60		5	Gravel Clay
GW200615	20BL168886	313434	6394246	Test/Monitoring Bore	11.5	7.49	7160		
GW200616	20BL168886	313473.4	6394446	Test/Monitoring Bore	8.5	5.68	8360		
GW200617	20BL168888	309987.4	6393974	Test/Monitoring Bore	9	4.75	710		
GW200618	20BL168888	310100.4	6393820	Test/Monitoring Bore	11.5	5.26	2690		
GW200619	20BL168888	310182.4	6393656	Test/Monitoring Bore	11.5	5.39	1080		
GW200620	20BL168888	310489.4	6394097	Test/Monitoring Bore	49	39.09	4700		
GW200621	20BL168887	312857	6395909	Test/Monitoring Bore	37	24.89	5695		
GW200622	20BL168887	312901	6395806	Monitoring Bore	30	29.95	4050		
GW200623	20BL168887	312982.1	6395319	Test/Monitoring Bore	31	13.84	11500		
GW200624	20BL168939	310165.9	6392650	Dewatering	260	6			
GW200625	20BL168940	310901	6393375	Mining	270				
GW200634	20BL168999	311470	6391252	Test/Monitoring Bore	20		13000		
GW200635	20BL168999	311659	6391236	Test/Monitoring Bore	20		23300		
GW200636	20BL168999	311749	6391078	Test/Monitoring Bore	20		4790		
GW200637	20BL168999	311662	6391094	Test/Monitoring Bore	15	8.45	17900		
GW200638	20BL168999	311452	6391103	Test/Monitoring Bore	20	5.18			
GW200639	20BL168999	311455	6390889	Test/Monitoring Bore	20				
GW200640	20BL168999	311638	6390920	Test/Monitoring Bore	50		1210		Coarse Sand
GW200641	20BL168999	311761	6390921	Test/Monitoring Bore	20	7.01	1210		
GW200642	20BL168999	311696	6390688	Test/Monitoring Bore	20	15.12	6230		
GW200643	20BL168999	311454	6390685	Test/Monitoring Bore	15				
GW200361	20BL170638	311832.9	6392209	Test Bore	0	3.12			
GW200833	20BL172255	311340	6389530	Monitoring Bore	54				Fractured Shale, Coal

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Bore No	Licence No	Location		Use	Depth (m)	SWL (bgl)	Salinity (ppm)	Yield (L/s)	Aquifer
		mE	mN						
GW200834	20BL172257	313695	6389546	Monitoring Bore	15				Shale, coal, fractured, with fragments of quartz
GW200827	20BL172237	312505	6391469	Monitoring Bore	9				
GW200830	20BL172240	313335	6392745	Monitoring Bore	16.8				
GW080513	20BL168880	312345	6394818	Test Bore	10	7.53			
GW200942	20BL167947	312325	6395750	Test Bore	37	32			
GW200943	20BL167947	312332	6395760	Test Bore	30	27			
GW200828	20BL172237	310061	6393206	Monitoring Bore	11.5				
GW200829	20BL172237	308641	6393376	Monitoring Bore	36				
GW200835	20BL172256	308424	6394517	Monitoring Bore	11				

3.5.2 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 include:

- 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 GDEs. It is considered that all or parts of these 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 (RWEPP) areas.



4.0 EXISTING MONITORING AND MANAGEMENT

4.1 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 see **Figure 2**.

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 commencing in October 2007. Underground mining has occurred both above and below the Wambo Seam currently being mined by WCPL at North Wambo Underground Mine. The North Wambo Underground Mine is due for completion in 2016. The adjacent United Colliery mined the lower Arrowfield Seam until 2010 (United Underground Mine).

4.2 GROUNDWATER MONITORING NETWORK

Groundwater monitoring data has been collected at Wambo since 1994. The groundwater monitoring network currently consists 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.

The groundwater monitoring network includes a number of bores that are part of the United Colliery's monitoring network.

Details of the groundwater bores at Wambo are summarised in **Table 6** and locations are shown in **Figure 7**.

Table 6 Groundwater Monitoring Bore Details

Bore	Lithology
Wambo Monitoring Network	
P106	Wambo Creek Alluvium
P109	Wambo Creek Alluvium & Underlying Interburden
P114	Wambo Creek Alluvium
P116	Wambo Creek Alluvium
P202	Whybrow Interburden
P206	Whybrow Interburden
P301	Whybrow Interburden
P315	Stony Creek Alluvium/Regolith
GW02	Wambo Creek Alluvium
GW08	North Wambo Creek Alluvium
GW09	North Wambo Creek Alluvium
GW11	Wambo Creek Alluvium
GW12	Stony Creek Alluvium / Whybrow Interburden
GW13	Wollombi Brook Alluvium
GW14	Regolith
GW15	Wollombi Brook Alluvium
GW16	North Wambo Creek Alluvium
GW17	North Wambo Creek Alluvium
GW18	North Wambo Creek Alluvium
GW19	Alluvium/Whybrow Interburden
GW20	North Wambo Creek Alluvium, Whybrow Seam, Redbank Seam, Wambo Seam
GW21	Whybrow Coal Interburden
GW22	Whybrow Coal Interburden
MG08	North Wambo Creek Alluvium, Whybrow Seam, Redbank Seam, Wambo Seam
United Colliery Monitoring Network	
P1	Coal Measure Overburden
P3	Blakefield Seam
P5*	North Wambo Creek Alluvium
P6*	North Wambo Creek Alluvium
P11	Blakefield Seam
P16	Wollombi Brook Alluvium
P20	Wollombi Brook Alluvium

Note:

1. GW14 has been dry since December 2011; GW18 dry since October 2010 and GW19 dry since monitoring began in 2009.
2. GW20 and MG08 contain Vibrating Wire Piezometers (VWPs).
3. A number of alluvial bores are also screened within the underlying interburden.
4. *No longer active – Removed by Open Cut Operations.

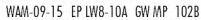


FIGURE 7
Wambo Coal Mine
Groundwater Monitoring Bore Locations

4.3 REVIEW OF EXISTING DATA

4.3.1 Alluvial Water Sources

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

A HARTT (Hydrograph Analysis: Rainfall and Time Trends) analysis has been undertaken for each alluvial dataset (up to June 2014) to establish the relationship between groundwater levels and rainfall and detect underlying trends in groundwater level that are independent of rainfall. The HARTT statistical output for each alluvial hydrograph is given in **Table 7**. The analysis also includes the bores that are screened across alluvium and interburden.

Table 7 HARTT Analysis Results for Shallow Monitoring Bores

Bore	R ²	Rainfall Coeff. <i>a</i> (m/mm)	P rain	Time Coeff. <i>b</i> (m/month)	P time	<i>c</i> (m)
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
P202	0.254	0.001	0.273	0.010	0.001	52.021
P206	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
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
P5	0.756	0.005	0.000	-0.078	0.000	75.849
P6	0.191	0.006	0.012	-0.061	0.004	75.893
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

The R^2 value 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 P206) are all located near the confluence of Wambo Creek and Wollombi Brook. Bores P202 and P206 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 Wambo South Water Dam may be attributable to these increasing trends.

The decreasing trends in groundwater levels at a number of the alluvial bores may be attributable to mining related activities. The decreasing trend in groundwater levels in North Wambo Creek alluvium at P5 (now decommissioned), P6 (now decommissioned) and GW18 is most likely due to the approved impacts associated with the Wambo open cut operations and the diversion of North Wambo Creek. The decreasing trends in groundwater levels within North Wambo Creek alluvium at bores GW16 and GW17 are most likely attributable to the open cut operations at Wambo. Decreasing trends in lower North Wambo Creek alluvium at GW08 and GW09 may be attributable to upstream impacts as well as underlying secondary extraction within the United Colliery mine, recent dewatering operations in the historic Wambo No.1 bord and pillar workings and/or North Wambo Underground Mine. An investigation has commenced and is outlined in **Section 6.1**.

Minor decreasing downward trends in groundwater at bores P16, P20 and GW13 within Wollombi Brook alluvium are 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 be responsible for the slight decreasing trend in groundwater levels within Wambo Creek alluvium at GW02. It is noted however that there is no statistically significant trend at adjacent bore GW11.

Significant decreasing trends in groundwater levels at GW12 and P301 (screened in Whybrow seam interburden) are likely related to mining within the North Wambo Underground Mine and/or dewatering of the old Homestead workings. HydroSimulations (2014) predicted cumulative drawdowns greater than 40 m in the Whybrow Seam overburden in the vicinity of these bores.

Time series plots of groundwater pH and EC reported at alluvial monitoring bores at Wambo have been prepared and are shown in GHD (2014). Based on a visual assessment of the time series plots, EC appears to be increasing at many bores for the period prior to June 2007 while there appears to be a falling trend in EC at most monitoring locations post 2007. This may be attributable to increased rainfall from 2007.

There are a number of bores where EC has recently increased and this is potentially attributable to reduced rainfall and/or interaction with mine water from the Homestead workings or seepage from Wambo South Water Dam. Between February 2011 and June 2014 at monitoring bore P114, EC has increased from below 1,000 microSiemens per centimetre ($\mu\text{S}/\text{cm}$) to almost 7,000 $\mu\text{S}/\text{cm}$. This bore is located to the west of Wambo South Water Dam. Between July 2011 and October 2013 average EC in the Wambo South Water Dam was 7350 $\mu\text{S}/\text{cm}$ (Worley Parsons 2014). This indicates the increase in EC may be due to seepage from this water storage, which has now been drained. An investigation has commenced and is outlined in **Section 6.1**.

The variation in EC over the same time period at neighbouring alluvial bore P116 indicates a much smaller increase in EC that is within the range reported prior to construction of the Wambo South Water Dam, while EC at alluvial bore P106 and Whybrow Seam interburden bore P206 has been steady over the same time period. At Whybrow Seam interburden bore P202 groundwater EC has increased from 3,490 $\mu\text{S}/\text{cm}$ in October 2011 to 6,610 $\mu\text{S}/\text{cm}$ in June 2014.

pH is consistently between 6 and 8 at the majority of alluvial monitoring locations.

A statistical summary of alluvial groundwater levels and quality is shown in **Table 8**, including the maximum, minimum, median and 20th and 80th percentiles. This table includes the bores screened within both alluvium and underlying interburden.

4.3.2 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. Therefore, a visual assessment of hydrographs from deeper bores was undertaken to identify existing responses of Permian groundwater sources to mining at Wambo. Hydrographs for deeper monitoring bores at Wambo are shown in GHD (2014).

The Permian strata monitored are the Blakefield Seam and the Whybrow Interburden. The monitoring data for these aquifers indicate that generally there is a decreasing trend in groundwater levels in the deeper strata.

Groundwater bore P3 in the Blakefield Seam experienced a steady drop in groundwater level from the commencement of monitoring in December 2005 to August 2009. Groundwater bore P11 also in the Blakefield Seam appears to have experienced a gradual decline in groundwater levels. Groundwater levels have stabilised since September 2010 and any variation since this time is possibly attributable to natural variation in groundwater levels.

Groundwater levels at bore GW21 in the Whybrow Seam have been slightly decreasing since August 2011. Groundwater levels at bore GW22 in the Whybrow seam interburden have been relatively stable since monitoring commenced with no clear depressurisation evident.

Available Permian data indicates that post 2007, EC has been very stable with little variation. pH is reasonably constant with minimum and maximum recorded values ranging between 5.9 and 8 at all locations.

WCPL - Groundwater Monitoring Program

Table 8 Bore Groundwater Level and Quantity

Bore	pH					Conductivity (µS/cm)					Depth to Groundwater (m)				
	Min	Max	Median	20 th	80 th	Min	Max	Median	20 th	80 th	Min	Max	Median	20 th	80 th
P106	6.2	8.62	6.96	6.81	7.25	391	5,350	555	462	835	4.69	15.08	9.31	7.85	10.36
P109	6.21	8.7	6.83	6.61	7.36	272	1,164	594	522	654	4.28	8.96	6.11	5.15	6.51
P114	6.33	8.71	7.07	6.72	7.4	355	6,970	596	551	917	5.22	8.11	6.67	5.79	7.05
P116	6.14	7.96	7.0	6.79	7.3	514	6,570	3,595	753	5,580	4.16	8.28	6.67	5.20	7.14
P202	6.35	7.9	7.3	6.9	7.5	2,650	10,280	5,035	4,171.2	6,162	3.26	10.08	9.10	8.30	9.57
P206	6.78	8.6	7.75	7.31	8.1	481	3,070	2,460	2,280	2,630	14.69	22.77	20.51	17.73	21.36
P301	5.78	7.7	6.6	6.29	7.0	1,086	9,580	8,880	3,146	9,164	10.13	19.90	12.92	11.73	13.70
P315	3.7	7.5	6.4	6.16	6.9	257	758	402	351	461	3.77	9.37	7.58	5.14	8.61
GW02	6.01	8.37	6.79	6.6	7.0	190	908	537	468.8	624.4	4.69	9.49	6.89	6.14	8.17
GW08	5.69	7.94	7.04	6.86	7.25	1,371	3,260	1,900	1,830	1,974	1.77	5.11	3.28	2.79	3.42
GW09	6.48	8.81	7.56	7.11	8.11	287	1,937	1,490	487	1,710	2.22	6.19	3.56	2.48	3.82
GW11	6.54	8.19	7.10	6.9	7.3	336	691	518	440.4	574.6	3.73	7.55	5.62	4.20	6.42
GW12	6.6	6.9	6.8	6.6	6.8	19,200	22,300	21,300	19,580	22,200	9.82	12.77	10.24	10.06	11.98
GW13	6.7	7.3	6.9	6.9	7	3,210	9,320	3,920	3,490	4,456	4.76	12.88	5.07	4.88	5.24
GW15	6.3	7.5	6.9	6.7	7.12	521	879	635	599	707.4	10.03	11.39	10.77	10.46	11.02
GW16	7.1	8.1	7.5	7.3	7.7	359	870	677	504	768.8	4.28	8.69	7.43	6.35	7.94
GW17	6.8	7.6	7.1	7.0	7.2	4,610	5,610	5,160	4,868	5,322	6.90	11.54	10.77	9.23	11.34
GW18	6.8	7.0	6.9	6.82	6.98	8,360	10,430	9,730	8,546	10,318	6.99	10.59	8.90	8.22	9.36
P5	6.67	8.01	7.41	7.25	7.65	684	5,540	2,133.5	888	3,785	4.87	10.97	8.21	6.98	9.50
P6	6.67	7.96	7.4	7.18	7.61	355	5,040	937	648.8	2,726	1.37	9.45	5.86	4.93	7.37
P16	5.1	8.11	7.36	7.12	7.62	6,700	12,100	9,740	7,922	10,588	6.83	8.23	7.46	7.17	7.66
P20	5.47	8.14	7.3	7.14	7.5	6,500	11,400	9,300	8,672	9,910	5.37	8.40	7.79	7.34	8.14

4.4 SITE WATER BALANCE

A site water balance is undertaken annually to document the management of water at Wambo in accordance with DA 305-7-2003, Schedule 4, Condition 25. Summary results are reported in the Annual Environmental Management Report (AEMR) which is available on the Peabody Energy Australia website (<http://www.peabodyenergy.com/content/398/Australia-Mining>).

4.5 HYDROGEOLOGICAL MODEL

A hydrogeological model has been developed for Wambo and is detailed in HydroSimulations (2014).

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.

5.0 GROUNDWATER MONITORING PROGRAM

5.1 MONITORING PROGRAM OBJECTIVE

The purpose of this GWMP is to monitor and manage groundwater quality and levels to detect potential impacts on surrounding groundwater 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:

- enable verification and refinement (where necessary) of the hydrogeological model developed for Wambo;
- be used in the continued development of groundwater investigation triggers (**Section 5.4**); and
- provide input to annual reviews of groundwater monitoring data (**Section 6.2**).

5.2 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 groundwater inflows to underground and open cut mining operations.
- Monitor for potential water loss from the Chitter Dam and Wambo South Water Dam, including potential migration of sub-surface water toward Wollombi Brook.

5.2.1 Groundwater Monitoring Bores

The proposed groundwater monitoring network comprises 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 9** provides a summary of WCPL's proposed groundwater monitoring program.

Table 9 Groundwater Monitoring Program

Monitoring Locations	Parameters Monitored	Lithology Monitored	Monitoring Frequency
P1, P3, P11	<ul style="list-style-type: none"> • Depth to water. • Electrical Conductivity (EC). • pH. • Temperature. 	Alluvium	Bi-monthly [from December 2005]
P16, P20	<ul style="list-style-type: none"> • Depth to water. • EC. • pH. • Temperature. 	Alluvium	Bi-monthly [from December 2005]
	<ul style="list-style-type: none"> • TDS, Na, K, Mg, Ca, Cl, HCO₃, CaCO₃, SO₄ and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se). 		Annually [from July 2015]

WCPL - Groundwater Monitoring Program

Monitoring Locations	Parameters Monitored	Lithology Monitored	Monitoring Frequency
P106, P109, P114, P116	<ul style="list-style-type: none"> Depth to water. EC. pH. Temperature. 	Alluvium	Bi-monthly [from July 2003]
	<ul style="list-style-type: none"> TDS, Na, K, Mg, Ca, Cl, HCO₃, CaCO₃, SO₄ and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se). 		Annually [from July 2015]
P202, P206	<ul style="list-style-type: none"> Depth to water. EC. pH. Temperature. 	Shallow Permian, Overburden	Bi-monthly [from July 2003]
	<ul style="list-style-type: none"> TDS, Na, K, Mg, Ca, Cl, HCO₃, CaCO₃, SO₄ and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se). 		Annually [from July 2015]
P301, P315	<ul style="list-style-type: none"> Depth to water. EC. pH. Temperature. 	Alluvium, Shallow Permian. Overburden	Bi-monthly [from March 2004]
GW02, GW08, GW09, GW11	<ul style="list-style-type: none"> Depth to water. EC. pH. Temperature. 	Alluvium	Bi-monthly [from July 2005]
	<ul style="list-style-type: none"> TDS, Na, K, Mg, Ca, Cl, HCO₃, CaCO₃, SO₄ and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se). 		Annually [from July 2015]
GW12, GW13, GW15, GW16, GW17, GW21, GW22	<ul style="list-style-type: none"> Depth to water. EC. pH. Temperature. 	Alluvium, Shallow Permian. Overburden	Bi-monthly [from December 2009]
	<ul style="list-style-type: none"> TDS, Na, K, Mg, Ca, Cl, HCO₃, CaCO₃, SO₄ and metals (Cu, Zn, Fe, Al, Ni, Mn, Ba, Pb, As, Se). 		Annually [from July 2015]
GW20, MG08	<ul style="list-style-type: none"> Groundwater Pressure. 	Alluvium, Permian Overburden, Whybrow Seam, Redbank Seam, Wambo Seam	Continuous

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.

WCPL - Groundwater Monitoring Program

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 the proposed underground mining areas and it is possible that depressurisation in such areas may extend 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 North WCPL Creek.

The existing groundwater monitoring bore network is shown in **Table 10** and **Figure 7**. Bi-monthly monitoring of groundwater levels, pH and EC will be undertaken at all standpipe monitoring bores.

Table 10 Locations of Groundwater Monitoring Network

Monitoring Name	Aquifer/s	Location	
		Easting	Northing
P106	Wambo Creek Alluvium	311518	6391084
P109	Wambo Creek Alluvium & Underlying Interburden	311215	6390768
P114	Wambo Creek Alluvium	311205	6391288
P116	Wambo Creek Alluvium	311057	6391293
P202	Whybrow Interburden	311852	6391288
P206	Whybrow Interburden	311772	6391293
P301	Whybrow Interburden	309360	6391467
P315	Stony Creek Alluvium/Regolith	309091	6391852
GW02	Wambo Creek Alluvium	309109	6389680
GW08	North Wambo Creek Alluvium	311793	6392268
GW09	North Wambo Creek Alluvium	311644	6392565
GW11	Wambo Creek Alluvium	309228	6389699
GW12	Stony Creek Alluvium	309841	6391056
GW13	Wollombi Brook Alluvium	313810	6388990
GW14	Regolith	312478	6391358
GW15	Wollombi Brook Alluvium	313164	6392807
GW16	North Wambo Creek Alluvium	306641	6396034
GW17	North Wambo Creek Alluvium	306895	6396048
GW18	North Wambo Creek Alluvium	310061	6393206
GW19	North Wambo Creek Alluvium	308550	6394648
GW20	North Wambo Creek Alluvium Whybrow Seam Redbank Seam Wambo Seam	305762	6397717
MG08	North Wambo Creek Alluvium Permian Overburden	311054.43	6392670.11
GW21	Whybrow Coal Interburden	308454	6393439
GW22	Whybrow Coal Interburden	310548	6389505
P1	Coal Measure Overburden	312198.64	6395839.7

WCPL - Groundwater Monitoring Program

Monitoring Name	Aquifer/s	Location	
		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

Groundwater bores that have been consistently dry (GW14, GW18 and GW19) are proposed to be removed from the monitoring program. These bores will be decommissioned in accordance with the Minimum Construction Requirements for Water Bores in Australia (NUDLC, 2011).

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 is 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).

5.2.2 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.

5.2.3 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.

5.2.4 Inflows to Open Cut Pits

As reported in the Site Water Balance (Worley Parsons, 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.

5.2.5 Inflows to Underground Workings

The active North Wambo Underground Mine, the Wollemi Drift and the old Homestead underground workings are currently 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 North Wambo Underground Mine exceeds the peak estimate predicted by HydroSimulations (2014) (375 ML/year) by 50% or more (that is more than 563 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; and
- submit a report summarising the assessment to the NoW.

WCPL must notify the NoW as soon as practicable on becoming aware of any take of water in excess of its licensed entitlement

5.2.6 Chitter Dam and Wambo South 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 Wambo South Water Dam, including potential migration of sub-surface water toward Wollombi Brook.

To detect potential sub-surface water loss from the two dams, WCPL will monitor existing groundwater monitoring bores P16 and P20 and P114, P116 and P202 and surface water quality of both dams. 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.

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

5.3 MONITORING METHODOLOGY

5.3.1 Groundwater Monitoring Bores

As specified in DIPNR (2003), groundwater monitoring will be undertaken in general accordance with 'A Practical Guide for Groundwater Sampling' (Jiwan & Gates, 1992), although it is recommended that low flow sampling techniques be used for purging and sampling (rather than bailers or submersible pumps) to minimise aquifer disturbance and reduce the volume of groundwater extracted during sampling.

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

- Gauging of groundwater levels prior to purging.
- Purging of monitoring bores using a low flow peristaltic pump. To limit the disturbance of possible sediments in the base of each bore, the sample tubing at each bore should be lowered to approximately the middle of the screened interval for purging and sample collection.
- Measurement of groundwater field parameters (pH, EC) using a calibrated water quality meter and a flow cell during purging. pH and EC readings should be recorded in the field once they have stabilised.
- 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.
- Decontamination of all non-dedicated sampling equipment between monitoring locations.

5.3.2 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.

5.4 TRIGGER VALUES

This section outlines the development of trigger values for groundwater levels and quality. The exceedance of these trigger values initiates the response process as outlined in EMP017 Surface and Groundwater Response Plan.

5.4.1 Groundwater Levels

5.4.1.1 Alluvial Monitoring Locations

Statistical analysis of groundwater levels in shallow bores has been undertaken in **Section 4.3.1**. 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 range in recorded depths to groundwater in the historical dataset.

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.

Groundwater level trigger values are shown in **Table 11**.

Table 11 Shallow Bores Water Level Trigger Values

Bore	Minimum		Maximum	
	Depth to Groundwater (m)	Level (m AHD)	Depth to Groundwater (m)	Level (m AHD)
P106	4.69 ^a	56.38	14.00	47.07
P109	4.28 ^a	58.16	8.96 ^a	53.48
P114	5.22 ^a	56.22	8.11 ^a	53.33
P116	4.16 ^b	54.88	8.28 ^b	50.76
P315	3.77 ^a	90.97	9.37 ^a	85.37
GW02	4.69 ^a	78.92 ^d	9.49 ^a	74.12 ^d
GW11	3.73 ^a	77.17 ^d	7.55 ^a	73.35 ^d
GW13	4.76 ^a	57.80	5.22 ^e	57.34
GW15	10.03 ^a	52.33	11.39 ^a	50.97
P16	6.83 ^a	50.65	8.23 ^a	49.25
P20	5.37 ^a	52.03	8.40 ^a	49.00
GW08	To be developed as part of response procedure in Section 6.1			
GW09	To be developed as part of response procedure in Section 6.1			
Whybrow Interburden Bores				
P202	3.26 ^b	57.01	10.08 ^b	50.19
P206	15.83 ^b	44.40	22.77 ^b	37.46
P301	N/A (bore predicted to go dry by HydroSimulations [2014])			

Note:

- Established from reviewing records for entire monitoring period.
- Established from pre Wambo South Water Dam construction data set (pre August 2009).
- Established from pre mining data set.
- Elevation estimated.
- Anomalous results excluded.

5.4.1.2 Chitter Dam and Wambo South Water Dam Monitoring Locations

As outlined in **Section 5.2.6**, WCPL is required to monitor impacts from the Chitter Dam and Wambo South Water Dam.

WCPL will monitor groundwater levels in bores P16 and P20 (Chitter Dam) and P114, P116 and P202 (South Wambo Water Dam) against the trigger levels in **Table 11**. Trigger values for groundwater levels for P114, P116 and P202 have been determined to be minimum and maximum groundwater levels prior to construction of Wambo South Water Dam (pre August 2009) as shown in **Table 11**. It is noted that the Wambo South Water Dam is currently not in use (**Section 5.2.6**).

5.4.1.3 Permian Monitoring Locations

Groundwater level trigger values have not been established for Permian groundwater bores, since it is predicted by HydroSimulations (2014) that levels will fall below pre-mining 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 (**Sections 5.2.4 and 5.2.5**).

5.4.2 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 and Wambo Creek is limited due to the high EC.

A water quality trigger for EC has been proposed based on the 80th percentile value observed in these bores (refer to statistical summary in **Table 8**). 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 will not be triggered unless the 80th percentile value is exceeded on three consecutive bi-monthly monitoring events (**Table 12**).

As described in **Section 4.3.1**, pH is consistently between 6 and 8 at the majority of alluvial monitoring locations. Therefore these values are proposed 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 (with the exception of P206 where the 80th percentile has been adopted) (**Table 12**).

Bores P16 and P20 provide suitable indicators near the Chitter Dam. Bores P116, P202 and P206 provide suitable indicators near the South Wambo Water Dam.

Table 12 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	835	6.0	8.0
P114	917	6.0	8.0
P116	5,580	6.0	8.0
P315	461	6.0	8.0
GW02	624	6.0	8.0
GW11	575	6.0	8.0
GW13	4,456	6.0	8.0
GW15	708	6.0	8.0
P16	10,588	6.0	8.0
P20	9,910	6.0	8.0
Whybrow Interburden Bores			
P202	6,162	6.0	8.0
P206	2,630	6.0	8.1
P301	N/A (bore predicted to go dry by HydroSimulations [2014])		

6.0 REPORTING OF MONITORING AND ASSESSMENTS

6.1 DATA REVIEW

6.1.1 Data Review

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

- Data will be compared to the specific trigger values where applicable.
- If result(s) do not meet specified trigger values the response procedure will be initiated in accordance with the EMP017 Surface and Groundwater Response Plan.

WCPL will undertake an annual review of monitoring data to compare groundwater levels to rainfall and 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 Wambo South Water Dam towards Wollombi Brook.

6.1.2 Investigation

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 EMP017 Surface and Groundwater Response Plan.

6.1.3 Investigation of Levels in GW08 and GW09

An investigation into the declining water levels in bores GW08 and GW09 has been initiated to further investigate potential impacts on the North Wambo Creek alluvium in the vicinity of these bores and potential licensing implications.

The recent trend observed in GW08 and GW09 may be attributable to open cut operations at Wambo, upstream impacts associated with the North Wambo Creek Diversion, underlying secondary extraction at the United Colliery, recent dewatering operations in the historic Wambo No.1 bord and pillar workings and/or North Wambo Underground Mine.

A preliminary investigation report will be provided to the DP&E and NoW by **30 September 2015** outlining the following:

- Detailed statistical review of monitoring data collected prior to and during the investigation period.
- Preliminary conclusions regarding the cause(s) of the declining water levels in GW08 and GW09 and the potential risks to downstream receptors.
- Preliminary conclusions regarding the potential licensing implications.
- Options for contingency and remedial measures.
- Process and timetable for any further investigation work (including potential additional numerical hydrogeological modelling work).

Where the investigation 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.

6.1.4 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 Wambo South Water Dam and potential remediation/mitigation measures.

As described in **Section 5.2.6**, 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.

WCPL will undertake quarterly water quality major ion analysis in P114 and P202 during the period of the investigation.

A preliminary investigation report will be provided to the DP&E and NoW by **30 November 2015** outlining the following:

- Detailed statistical review of monitoring data collected prior to and during the investigation period, including the results of water quality major ion analysis.
- Preliminary conclusions regarding the cause(s) of the observed increase in salinity and the potential risks to downstream receptors.
- Options for contingency and remedial measures.
- Process and timetable for any further investigation work.

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

6.2 REPORTING

6.2.1 Annual Environmental Monitoring Report

The site currently develops an Annual Environmental Management Report (AEMR). The annual data review, results of the site water balance and assessment of the hydrogeological model will be reported in the AEMR.

Groundwater inflows to mine workings will be calculated annually using the site water balance and hydrogeological model to determine whether WCPL holds sufficient groundwater licence entitlements for the inflow volume.

6.2.2 Bore 20BL132753 Annual Compliance Report

It is a requirement of the licence for bore 20BL132753 that an Annual Compliance Report be submitted to the NoW. As specified by the bore licence the Annual Compliance Report must:

- assess compliance with the licence;
- provide a summary of new bores or pits constructed during that year;
- provide statistics for the monitoring data collated for each bore for the past water year;
- summarise contingency events that impacted on groundwater during the last water year, including actions taken to remedy the situation and extra monitoring results; and
- any recommendations for improvements for the new water year.

6.3 ROLES AND RESPONSIBILITIES

Table 13 below summarises responsibilities documented in this GWMP. Responsibilities may be delegated as required.

Table 13 Groundwater Monitoring Program Responsibilities

Task	Responsibility	Timing
Regional groundwater quality/level monitoring in accordance with the Section 5.2 .	Environmental Advisor	Bimonthly.
Assess groundwater monitoring data against relevant criteria listed in Tables 11 and 12 .	Environmental Advisor	As required
Review procedure in accordance with Section 6.0 .	Environmental Advisor	Annually
Internal bi-monthly groundwater reporting.	Environmental Advisor	Bimonthly
Report in the AEMR details of GWMP in accordance with Section 6.2 .	Environment and Community Manager	Annually
Internally review GWMP in accordance with Section 6.4 .	Environmental Advisor	Every 2 years
Notify government departments if incident occurs.	Environment and Community Manager	As required
Submit updated GWMP to DP&E.	Environment and Community Manager	As required

6.4 MANAGEMENT PLAN REVIEW

This GWMP will be reviewed and revised every 3 years or as a result of:

- Any significant change to water management practices.
- New underground mining areas being developed.
- Changes to consent or licence conditions or other regulatory requirements relevant to this GWMP.
- The recommendations of an Independent Environmental Audit.
- Continual exceedance of trigger values.
- Change in technology or mining methodology.

A review of this GWMP will be undertaken by a suitably qualified person and also should consider consultation with the appropriate local and state government authorities.

7.0 REFERENCES

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.

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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.

Jiwan, J. & Gates, G. (1992) A Practical Guide to Groundwater Sampling, 1st Edition, NSW Department of Water Resources Technical Services Division TS92 080.

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Worley Parsons (2014) OPSIM Water Balance Model Initial Investigations – January 2014.

APPENDIX 1
REGULATORY CORRESPONDENCE



13 April 2010

File Ref: L93/0257

General Manager
Wambo Mine
PMB 1
SINGLETON NSW 2330

ATTENTION: Sarah Bailey – Environment & Community Manager

Dear Sir,

Sarah

**WAMBO COAL
REVISED SITE WATER MANAGEMENT PLAN DOCUMENTS**

I refer to your letter of 1 March 2010 providing to I&I NSW for review the Site Water Management Plan (SWMP) according to Wambo Consent Condition 33. I refer also to your related letter of 9 April 2010 providing tables summarising changes to each of the plans.

I&I NSW acknowledges consultation by Wambo and accepts the SWMP documentation:

Erosion and Sediment Control Plan;

Surface Water Monitoring Program;

Groundwater Monitoring Program;

Site Water Balance

Surface and Groundwater Response Plan.

For clarification or further information please contact me at the Maitland Office on (02)49316705.

Yours faithfully,

**Greg Summerhayes
Principal Environmental Officer
Environmental Sustainability Unit**

1 March 2010

Mr Greg Summerhayes
Department of Industry and Investment
PO Box 344
Hunter Region Mail Centre
NSW 2310

Dear Greg

**WAMBO COAL
REVISED SITE WATER MANAGEMENT PLAN DOCUMENTS**

In accordance with Consent Condition 33, Schedule 4, DA 305-7-2003, Wambo Coal's Site Water Management Plan (SWMP) must be revised in consultation with Department of Industry and Investment (DII) and Department of Environment, Climate Change and Water (DECCW), prior to submission to the Department of Planning (DoP) by the 30 April 2010.

The SWMP has been revised three times since 2005 in response to consent modifications. The latest revision of the SWMP was triggered by consent modifications relating to the approval of the Chitter Dam and South Dam in June and August 2009, respectively.

Wambo Coal's SWMP is comprised of the following documents which are enclosed for your review:

- The predicted site water balance;
- An Erosion and Sediment Control Plan;
- A Surface Water Monitoring Program;
- A Groundwater Monitoring Program; and
- A Surface and Groundwater Response Plan.

Please review and provide comment by Friday 9 April 2010 to allow changes to be made prior to the DoP submission date.

Please contact me on (02) 6570 2217 if you would like to arrange a meeting to discuss these documents.

Yours sincerely



Sarah Bailey

Environment and Community Manager

1 March 2010

Mr Fergus Hancock
DECCW – Office of Water
Honeysuckle Drive
Newcastle NSW 2330

Dear Fergus

WAMBO COAL
REVISED SITE WATER MANAGEMENT PLAN DOCUMENTS

In accordance with Consent Condition 33, Schedule 4, DA 305-7-2003, Wambo Coal's Site Water Management Plan (SWMP) must be revised in consultation with Department of Industry and Investment (DII) and Department of Environment, Climate Change and Water (DECCW), prior to submission to the Department of Planning (DoP) by the 30 April 2010.

The SWMP has been revised three times since 2005 in response to consent modifications. The latest revision of the SWMP was triggered by consent modifications relating to the approval of the Chitter Dam and South Dam in June and August 2009, respectively.

Wambo Coal's SWMP is comprised of the following documents which are enclosed for your review:

- The predicted site water balance;
- An Erosion and Sediment Control Plan;
- A Surface Water Monitoring Program;
- A Groundwater Monitoring Program; and
- A Surface and Groundwater Response Plan.

Please review and provide comment by Friday 9 April 2010 to allow changes to be made prior to the DoP submission date.

Please contact me on (02) 6570 2217 if you would like to arrange a meeting to discuss these documents.

Yours sincerely



Sarah Bailey
Environment and Community Manager

Sarah Bailey

From: Sarah Bailey
Sent: Friday, 9 April 2010 10:38 AM
To: Fergus Hancock
Subject: Wambo Coal SWMP - table of changes to assist DECCW in the review
Attachments: 100409 let to DECCW OoW re revised SWMPs table of changes.pdf

Hi Fergus

I hope all is well and I hope you had a good Easter.

As per my phone message yesterday, we have put together tables summarizing the changes to the revised Site Water Management Plan documents.

In accordance with Consent Condition 33, Schedule 4, DA 305-7-2003, Wambo Coal's Site Water Management Plan (SWMP) must be revised in consultation with Department of Industry and Investment (DII) and Department of Environment, Climate Change and Water (DECCW), prior to submission to the Department of Planning (DoP) by the 30 April 2010.

Please let me know if you did not receive the SWMP which was posted to you on 1st March 2010.

Please let me know if you will be unable to review the SWMP documents in time to allow us to make any requested changes before submitting the SWMP to DoP before 30th April. I will need to talk to DoP re an extension to the submission date if this is the case.

Regards

Sarah Bailey

Manager Environment & Community
Wambo Coal Pty Ltd
Peabody Energy Australia
PMB 1, Singleton, NSW, 2330
Phone: +61 (0)2 6570 2217
Fax: +61 (0)2 6570 2290
Mobile: +61 (0)429 452 194
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Planning

Major Projects Assessment

Mining

Phone: (02) 9228 6306

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Email: belinda.parker@planning.nsw.gov.au

Room 305

23-33 Bridge Street

GPO Box 39

SYDNEY NSW 2001

Ms Sarah Bailey
Environment and Community Manager
Wambo Coal Pty Limited
PMB 1
SINGLETON NSW 2330

Our Ref: S02/02197

Dear Ms Bailey

Wambo Coal Mine (DA 305-7-2003) Environmental Management Plans

I refer to your letter dated 21 October 2009, requesting an extension to the date for submission of the revised Flora and Fauna Management Plan (Condition 44, Schedule 3) and revised Site Water Management Plan (Condition 30, Schedule 3), for approval by the Director-General, as required under the Minister's consent for the mine (DA 305-7-2003).

The Department has reviewed the information supplied and Wambo's Independent Offset Strategy Audit Report dated 16 October 2009, and is satisfied that the proposed extension would enable:

- the audit recommendations to be included in Wambo's Flora & Fauna Management Plan; and
- a comprehensive review of the Site Water Management Plan, incorporating comments from relevant government agencies.

Consequently, I wish to advise you that the Department accepts your request to delay submission of the Flora and Fauna Management Plan and the Site Water Management Plan. The revised Plans are now required to be submitted to the Department by 30 April 2010.

If you have any queries, please contact Belinda Parker on 9228 6306.

Yours sincerely

dkitto 4/11/09

David Kitto
Director
Major Development Assessment
as delegate for the Director-General



NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Now incorporating Department of Mineral Resources
ABN 51 73 412 4190-003

8 August 2008

File Ref: L93/0257

General Manager
Wambo Mine
PMB 1
SINGLETON NSW 2330

ATTENTION: Sarah Bailey – Environmental Specialist

Dear Sir,

WAMBO - GROUND WATER MANAGEMENT PROGRAM

I refer to your letter of 31 July 2008 providing the subject GWMP. The DPI acknowledges and accepts the GWMP documentation.

I also confirm the referenced components of the Wambo Site Water Management Plan have been provided to DPI for review. DPI have been consulted and have provided comment in March 2008.

For clarification or further information please contact me at the DPI Maitland Office on (02)49316705.

Yours faithfully,

Greg Summerhayes
Principal Environmental Officer
Environmental Sustainability Division



NSW GOVERNMENT
Department of Planning

Contact: Colin Phillips
Phone: (02) 9228 6483
Fax: (02) 9228 6466
Email: colin.phillips@planning.nsw.gov.au

Our ref: S02/02197

Mr Chris Millard
General Manager
Wambo Coal Pty Limited
PMB 1
SINGLETON NSW 2330

Dear Mr Millard

**Wambo Coal Mine
Site Water Management Plan**

I refer to your letter, dated 18 December 2007, requesting an extension of time to finalise the preparation of the revised Wambo Site Water Management Plan required by condition 30 of schedule 4 of Wambo coal mine's development consent (DA 305-7-2003).

The Department has considered the importance of gaining input from DPI and DWE to this plan and accordingly extends the submission date of this plan until 31 March 2008 to allow consultation with these agencies to be finalised.

Yours sincerely,

Howard Reed 20.12.07
A/Manager
Mining and Extractive Industries
as Delegate for the Director-General



NSW GOVERNMENT
Department of Planning

Contact: Colin Phillips
Phone: (02) 9228 6483
Fax: (02) 9228 6466
Email: colin.phillips@planning.nsw.gov.au

Ms Sarah Bailey
Environmental Officer
Wambo Coal Pty Limited
PMB 1
SINGLETON NSW 2330

Our ref: S02/02197

Dear Sarah

**Wambo Coal Mine
Site Water Management Plan**

I refer to a letter from Ms Sarah Withell, dated 30 October 2007, requesting an extension of time to finalise the preparation of the revised Wambo Site Water Management Plan required by condition 30 of schedule 4 of Wambo coal mine's development consent (DA 305-7-2003).

The Department has considered the importance of gaining input from DPI and DWE to this plan and accordingly extends the submission date of this plan until 31 December 2007 to allow consultation with these agencies to be finalised.

Yours sincerely,

Howard Reed
A/Manager
Mining and Extractive Industries
as Delegate for the Director-General

12-11-07



NSW GOVERNMENT
Department of Planning

Mining & Extractive Industries
Major Development Assessment
Phone: (02) 9228 6487
Fax: (02) 9228 6466
Email: david.kitto@dpnr.nsw.gov.au
Level 4 Western Gallery
23-33 Bridge Street
GPO Box 39
SYDNEY NSW 2001

Mr Tony Sutherland
Wambo Coal Pty Ltd
PMB 1
SINGLETON NSW 2330

24.10.05
D → J.T.
WD
RH
GH

Dear Mr Sutherland

**Wambo Development Project
Management Plans and Monitoring Programs**

Thank you for forwarding the following documents required under the Wambo development consent (DA 305-7-2003) for the Department's consideration:

- ~~Noise Monitoring Program (condition 9, Schedule 4);~~
- Site Water Balance (condition 25, Schedule 4);
- Erosion and Sediment Control Plan (condition 32, Schedule 4);
- Surface Water Monitoring Program (condition 33, Schedule 4);
- Groundwater Monitoring Program (condition 34, Schedule 4); and
- Environmental Management Strategy (condition 1, Schedule 6).

The Department has reviewed these documents and is generally satisfied they address the requirements of the relevant conditions in the development consent. ~~Consequently, I would like to advise you that the Director-General has approved these documents.~~ However, the Surface Water Monitoring Programme has been approved on the proviso that it is revised following the approval of the North Wambo Creek Diversion Plan.

The Director-General has previously approved the Air Quality Monitoring Program, Flora and Fauna Management Plan, and Landowner Notification Strategy for the development, but notes there are several other matters which must be satisfied prior to commencing certain operations under the new consent. These matters include:

- Blast Monitoring Program (condition 19, Schedule 4);
- Blast Management Plan (condition 20, Schedule 4);
- Site Water Management Plan (condition 30, Schedule 4);
- Surface and Groundwater Response Plan (condition 35, Schedule 4);
- Surface and Sub-Surface Investigation Program (condition 36, Schedule 4);
- Archival Record of the Wambo Homestead Complex (condition 62, Schedule 4);
- Assessment of options for reducing the greenhouse gas emissions of the development (condition 87, Schedule 4);
- Environmental Monitoring Program (condition 2, Schedule 6).

The Department also notes that under condition 5 of Schedule 4, the development consent will only commence after all previous development consents for the Wambo coal mine have been surrendered, excluding DA No. 108/91 issued by Singleton Shire Council, to the satisfaction of the Director-General.

I would appreciate it if you would advise the Department of when you expect to commence open cut and underground operations under DA 305-7-2003, and when you are likely to submit the various outstanding documents required under the consent.

If you have any enquiries about this matter, please contact Mike Young on 9228 6481.

Yours sincerely

per David Kitto
Manager
Mining & Extractive Industries
as delegate for the Director-General

10/10/05



Department of
Environment and Conservation (NSW)

Your reference :
Our reference : 270075A12; NEF17395; 17455; 17093; 17579
Contact : Karen Marler; ph: 49086803

Wambo Coal Pty Limited
PMB 1
SINGLETON NSW 2330

- 7 SEP 2005

Attention: Mr Tony Sutherland

Dear Mr Sutherland

WAMBO DEVELOPMENT PROJECT:

1. SURFACE WATER MONITORING PROGRAM (31 August 2005)
2. GROUNDWATER MONITORING PROGRAM (31 August 2005)
3. AIR QUALITY MONITORING PROGRAM (ORIGINAL (7 June 2005) AND REVISIONS 16 June 2005 AND 31 August 2005)
4. ~~EROSION AND SEDIMENT CONTROL PLAN (29 July 2005)~~
5. LANDOWNER NOTIFICATION PROCEDURE – AIR QUALITY (9 August 2005)

I refer to the above documents sent to the Department of Environment and Conservation (DEC) on the dates indicated. With regard to these documents the DEC provides the following advice:

1. SURFACE WATER MONITORING PROGRAM
2. GROUNDWATER MONITORING PROGRAM
3. AIR QUALITY MONITORING PROGRAM
4. EROSION AND SEDIMENT CONTROL PLAN

The DEC encourages the preparation of strategies, programs and plans as useful tools for industry to ensure that it meets the environmental objectives specified in conditions of Environment Protection Licences. As a regulatory authority, the DEC does not review or comment on these plans.

5. LANDOWNER NOTIFICATION PROCEDURE – AIR QUALITY

The fact sheet contains comprehensive advice regarding what particulate emissions are. You should contact NSW Health for comment on the adequacy of the information provided about the potential health impacts that may result from exposure to particulate matter.

The DEC understands that the primary aim of this procedure is to provide tenants and prospective tenants with information on likely health-related impacts associated with air quality at the place they are leasing or considering leasing. It will be important to ensure that landowners, tenants or prospective tenants are provided with site specific information regarding the predicted future particulate matter levels for each residence (particularly those Warkworth Mining Limited owned dwellings on Wallaby Scrub Road). The fact sheet should be provided to assist tenants to interpret this information and understand the likely future impacts of mining on air quality and potentially their health and amenity when making a decision to live in these residences.

If you have any questions regarding this matter, please contact Karen Marler on 4908 6803.

Yours sincerely



MITCHELL BENNETT
Head – Regional Operations Unit - Hunter
North East Branch
Environment Protection and Regulation Division

ATTACHMENT 4

WAMBO COAL PTY LIMITED SURFACE AND GROUNDWATER RESPONSE PLAN



Surface and Groundwater
Response Plan

(Water Management Plan)

***PREPARED BY
WAMBO COAL PTY LIMITED***

September 2014

Wambo Coal Environmental Management System

Surface and Groundwater Response Plan

Document Control

Document No.	EMP017
Title	Surface and Groundwater Response Plan
General Description	Responses to potential surface and groundwater impacts
Key Support Documents	Wambo Coal Environmental Management System Wambo Coal Surface Water Monitoring Programme Wambo Coal Groundwater Monitoring Programme Wambo Coal Erosion and Sediment Control Plan Wambo Coal Site Water Balance DA 305-7-2003, DA 177-8-2004, EPL529, EIS 2003

Revisions

Rev No.	Date	Description	By	Approved
0	October 05	Original Draft	RS	JT
1	October 05	Revision 1	RS	JT
2	November 05	Revision 2	RS	JT
3	March 06	Revision 3	WCPL	JT
4	October 07	Revision 4	RS	SW
5	February 2010	Revision 5	WCPL	SB
6	September 2014	Revision 6	GHD / WCPL	TF

The nominated document coordinator	Environmental Advisor
---	-----------------------

Approvals

Originator	Name: Lachlan Crawford Wambo Coal	Position: Senior Environmental Coordinator	Date: 26/2/10
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Approver:	Manager: Environment and Community
Date:	
Name:	
Signature:	

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1 INTRODUCTION

Wambo Coal Pty Limited (Wambo Coal) operates the Wambo Coal Mine, which consists of open cut and underground mining operations, a coal handling and preparation plant (CHPP), rail loop, and associated rail load-out facilities. The operations are located approximately 15 kilometres (km) west of Singleton. The location of Wambo's operations is shown in **Figure 2**.

Wambo Coal's activities are undertaken in accordance with the Development Consents and Environmental Protection Licence (EPL) listed in **Table 1**.

Table 1: Wambo Coal Development Consents

Consent	Activity	Date	Issuing Authority
DA 305-7-2003	Wambo Mine - Open Cut & Underground Mining	February 2004	Department of Planning
DA 177-8-2004	Wambo Rail Spur & Coal Loading Facility	December 2004	Department of Planning
DA 235/97.3	Wambo Rail Line	July 1998	Singleton Shire Council
EPL 529	Mining for coal Coal works	Review date 6/08/2014	Department of Environment, Climate Change and Water

Figure 1 below illustrates the Wambo Coal Site Water Management Plan and constituent components, including the Surface & Groundwater Response Plan.

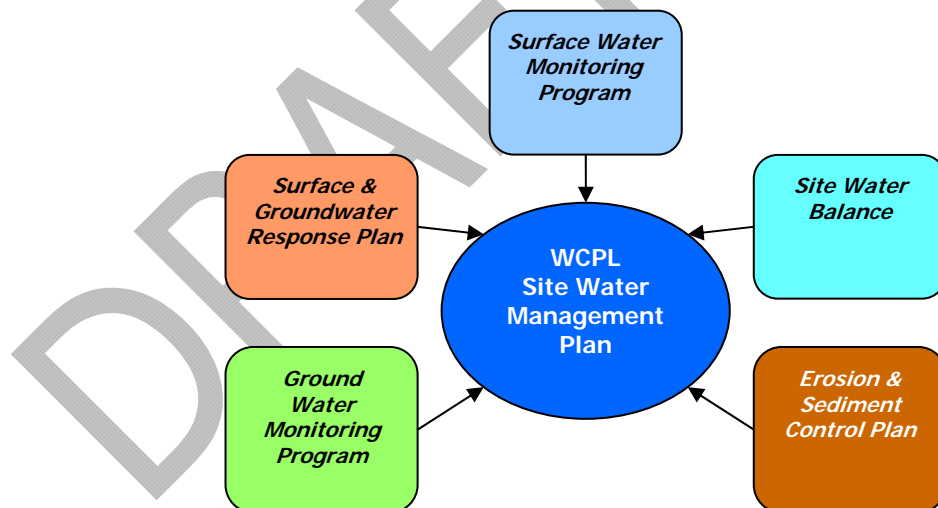


Figure 1: WCPL - Water Management Plan

Figure 2: Locality Plan



2 SCOPE AND OBJECTIVES

This Surface and Groundwater Response Plan (SGWRP) outlines the response procedure that will be initiated if surface or groundwater monitoring results exceed designated trigger levels. This management plan has been prepared in accordance with Consent Condition 35, Schedule 4 of the Development Consent (DA 305-7-2003). Consent condition 35 and the corresponding sections of this SGWRP that address the conditions are outlined in **Table 2** below.

Table 2: Condition 35, Schedule 4 of Development Consent DA-305-7-2003

Development Consent (DA 305-7-2003) Condition	Section Addressed in this Document
35. <i>The Surface and Ground Water Response Plan shall include:</i>	
(a) <i>measures to mitigate any adverse impacts on existing water supply bores or wells;</i>	Section 3.1
(b) <i>measures to mitigate the loss of surface water flows in the surface water streams or channel on the site;</i>	Section 3.2
(c) <i>measures to remediate any connective cracking between the underground mine workings and the surface water streams, channel or alluvials;</i>	Section 3.2
(d) <i>measures to mitigate the long term direct hydraulic connection between the backfilled open cut and the North Wambo Creek alluvium if the potential for an downstream adverse impact is detected;</i>	Section 3.3
(e) <i>measures to address the decrease in throughflow rates caused by the development within the Wollombi Brook alluvium downstream of the open cut;</i>	Section 3.4
(f) <i>measures to address any reduction in the stability or ecological quality of the North Wambo Creek Diversion below the established performance criteria;</i>	Section 3.4
(g) <i>trigger levels for the relinquishment of water extraction rights to compensate for surface and groundwater losses from streams, channels or alluvials to open cut and underground mining workings;</i>	Section 3.5
(h) <i>the procedures that would be followed if any unforeseen impacts are detected during the development; and</i>	Section 3.6
(i) <i>response times for undertaking the above measures</i>	Section 3.6

The SGWRP is a component of the Wambo Coal Site Water Management Plan, which is made up of several related management plans. Of particular relevance to this SGWRP are the:

- Surface Water Monitoring Plan (SWMP); and
- Groundwater Management Plan (GWMP).

The relationship between the SGWRP and these documents is shown in **Figure 1**. Also of relevance is the Erosion and Sediment Control Plan (ESCP), which details erosion and sediment control measures implemented at Wambo Coal.

Figure 3: Groundwater Monitoring Locations

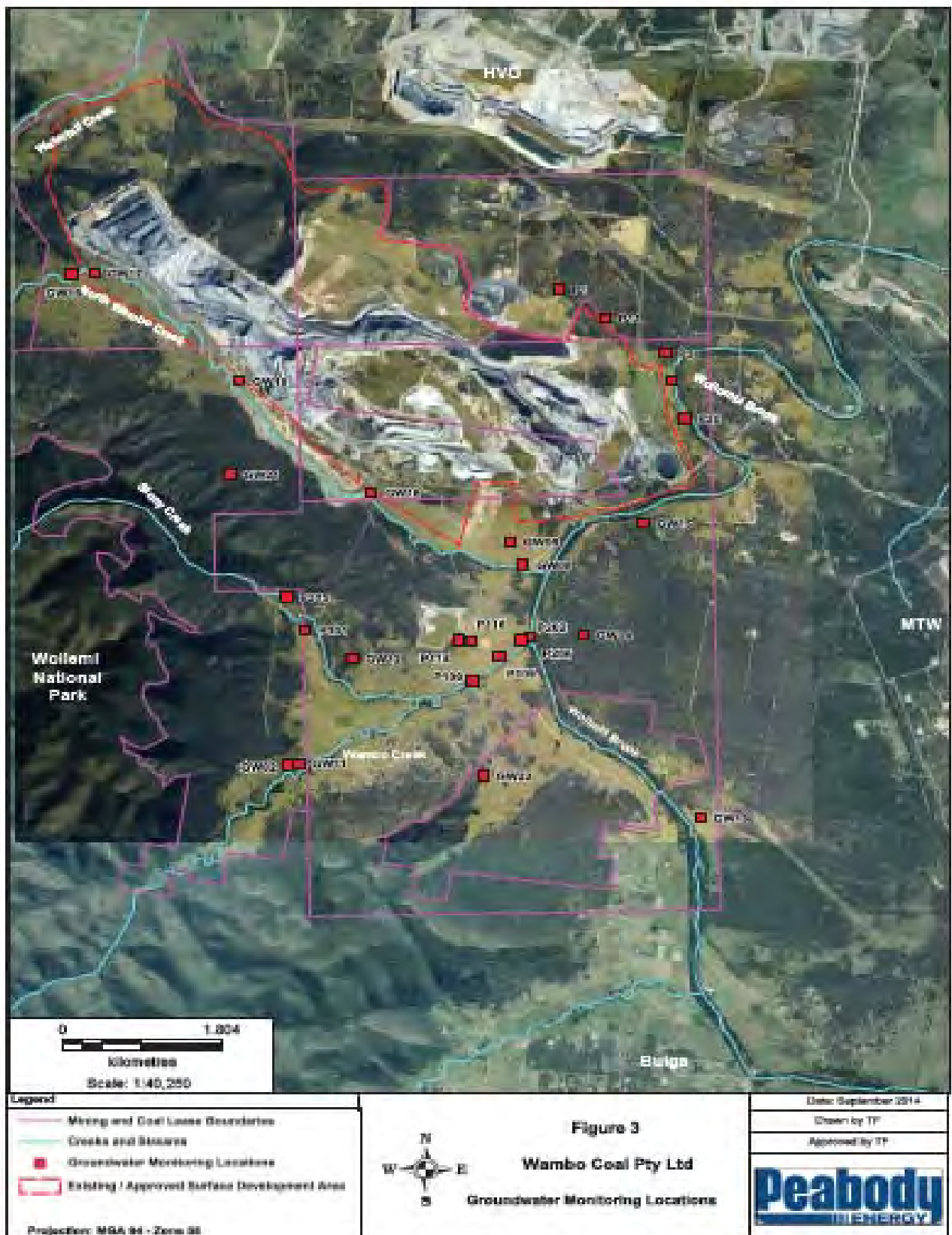


Figure 4: Surface Water Monitoring Locations



3 SURFACE AND GROUNDWATER RESPONSE PLAN

Potential surface water 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).

3.1 GROUNDWATER IMPACTS

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 the GWMP).

Trigger Response Plan

Groundwater depth trigger levels are specified in **Section 5.4** of the GWMP. Following the receipt of bi-monthly 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. The investigation will involve the following steps.

1. Review of monitoring data trends and climatic information along with operational activities and surrounding land uses will be reviewed to determine if the impact on groundwater are a result of Wambo Coal's activities.
2. If the investigation identifies actual groundwater impacts and attributes those impacts to Wambo Coal's activities, appropriate measures will be developed and implemented in consultation with DECCW, DoP and any affected adjacent landowners.
3. Existing management measures will be modified, if required, to minimise the potential for a recurrence. Any modifications will be made in consultation with DoP and other relevant authorities.

Ameliorative Measures

Ameliorative measures will be implemented, where deemed necessary from the Data Review and Investigation Process. Ameliorative 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.

Ameliorative measures will be developed by the Environment and Community Manager in consultation with the relevant mining operations manager (e.g. underground Manager) based on the results of the above investigations.

The outcomes of this process will be reported in the AEMR. Should any significant impact to groundwater become evident, or noncompliance with consent or EPL conditions identified, WCPL will notify relevant government departments.

3.2 SURFACE WATER IMPACTS

Surface water is monitored at over twenty locations across Wambo, including flow monitoring and water quality. Monitoring of mine water storage dams is also undertaken on a monthly basis.

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 (NWCSRS) was prepared in consultation with DII, DECCW and DoP. Wambo will continue to monitor in accordance with the NWCSRS (**Appendix A**).

If routine monitoring (in accordance with SWMP) identifies evidence of potential surface water impacts, the following investigation process will be undertaken.

1. Relevant monitoring data trends and climatic information along with operational activities will be reviewed to determine whether a more detailed investigation is required.
2. If the investigation identifies actual surface water impacts and attributes those impacts to Wambo Coal's activities, appropriate measures will be developed and implemented in consultation with DECCW, DoP and any affected adjacent landowners.
3. Existing management measures will be modified, if required, to minimise the potential for a recurrence. Any modifications will be made in consultation with DoP and other relevant authorities.

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.

3.3 DIRECT HYDRAULIC CONNECTION BETWEEN BACKFILLED OPEN CUT AND CREEK 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 the investigation procedure (**Section 3.1**) would be initiated in accordance with Condition 35(d), Schedule 4 of Development Consent DA 305-7-2003.

If the investigation determines that mitigation measures are necessary, they will be consistent with those described in the EIS and GWMP. The implementation of any mitigation measures will be undertaken in consultation with DoP and other relevant authorities.

3.4 WATER MANAGEMENT ACT

As part of annual reporting and data review Wambo Coal is required to compare annual extractions from alluvium water sources to Wambo's licenced extraction volume under the Water Management Act 2000 (WM Act). If extraction from alluvial water sources exceeds the licenced volume consultation should be entered into with the relevant government authorities to develop ameliorative measures.

Additional information regarding the WM Act is available in Section 2.1.2 of the GWMP. Wambo Coal must ensure they have sufficient licenced volumes under the WM Act to account for the predicted extraction of water from alluvial water sources for the upcoming water year.

3.5 UNFORSEEN IMPACTS

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

- Review of relevant monitoring data, mining activities and land management practices in the relevant catchment.
- Engage a consulting hydrologist/hydrogeologist to investigate the causes of the impact.
- Develop appropriate mitigation and management measures, based on investigation results, and in consultation with the relevant authorities.
- Modify relevant monitoring program(s) to assess the effectiveness of introduced mitigation and management measures, where necessary.

3.6 RESPONSE TIMELINE

It is proposed that any investigation into exceedance of trigger values or unforeseen impacts commence as soon as possible following the receipt of monitoring data and subsequent identification of impacts. The results of all investigations should be reported in the AEMR. If the findings of any investigation identify that the impacts are a result of Wambo Mine's activities then the relevant government authorities and any impacted surrounding landholders should be notified. Consultation regarding any response plan or ameliorative measures including its timeline should be entered into with the relevant authorities and impacted surrounding landholders.

4 RESPONSIBILITIES

Table 3 below summarises responsibilities documented in the SGWRP. Responsibilities may be delegated as required.

Table 3: Surface and Groundwater Response Plan Responsibilities

No	Task	Responsibility	Timing
1	Identify triggers and initiate appropriate response in accordance with the SGWRP	Environment & community Manager (or delegate)	As required.
2	Implementation of mitigation measures in accordance with the relevant response process.	Environment & community Manager (or delegate)	As required.
3	Review of SGWRP in accordance with requirements of Section 5.	Environment & community Manager (or delegate)	As specified in Section 5.
4	Ensure appropriate reporting requirements are met, in accordance with Section 5 of SGWRP.	Environment & community Manager (or delegate)	As specified in Section 5.

5 REPORTING AND REVIEW

Wambo Coal will prepare an Annual Environmental Management Report (AEMR) which will report on the following related to this SGWRP:

- details of any surface or groundwater responses undertaken during the reporting period, including:
 - a summary of the impact triggering the response;
 - a description of the measures implemented in response;
 - details of consultation with relevant authorities; and
 - any relevant monitoring results.

Review of the SGWRP will occur:

- prior to additional longwall mining operations (other than the North Wambo Underground Mine);
- following changes to consent and licence conditions or other regulatory requirements relevant to this SGWRP;
- in response to an Independent Environmental Audit;
- following significant incidents at Wambo in relation to water; or
- in response to a relevant change in technology or mining methodology.

6 REFERENCES

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*.

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*.

ATTACHMENT 5

WAMBO COAL PTY LIMITED
NORTH WAMBO CREEK SUBSIDENCE RESPONSE STRATEGY



WAMBO COAL

**North Wambo Creek
Subsidence
Response Strategy**



Document Control

Document No.	NWCSRS – R4
Title	North Wambo Creek Subsidence Response Strategy
General Description	Responses to potential surface and groundwater impacts on North Wambo Creek
Key Support Documents	Wambo Coal Environmental Management System Wambo Coal Surface Water Monitoring Program Wambo Coal Groundwater Monitoring Program Wambo Coal Erosion and Sediment Control Plan Wambo Coal Site Water Balance North Wambo Creek Diversion Detailed Design 080707 Wambo DPI and DWE minutes NWC Pipeline Detailed Design

Revisions

Rev No.	Date	Description	By	Checked	Approved
					Signed
0	September 2008	Final	Sarah Bailey	AB	
1	September 2008	Final - Amended	Sarah Bailey	SS	
2	December 2012	Final Amended – Longwalls 7 & 8	Resource Strategies	TF	
3	January 2014	Revised to include Longwalls 9 and 10	Resource Strategies	TF	
4	March 2015	Revised to include Longwall10A	Resource Strategies		

The nominated Coordinator for this document is	Environment and Community Manager
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1 INTRODUCTION

Wambo Coal Pty Limited (WCPL) owns and operates the Wambo Coal Mine which consists of open cut and underground mining operations, coal handling and preparation plant (CHPP), the Wambo Rail Spur with associated rail load-out facilities and the Wambo Rail Line. The operations are located approximately 15 kilometres (km) west of Singleton, New South Wales (NSW) (**Figure 1**).

WCPL's operations are undertaken in accordance with the Development Consents listed in **Table 1**.

Table 1
WCPL Development Consents

Consent ¹	Activity	Date	Issuing Authority
DA 305-7-2003	Wambo Mine - Open Cut & Underground Mining	February 2004	Department of Planning (now Department of Planning and Environment [DP&E])
DA 177-8-2004	Wambo Rail Spur & Coal Loading Facility	December 2004	Department of Planning (now DP&E)
DA 235/97.3	Wambo Rail Line	July 1998	Singleton Shire Council

North Wambo Underground Mine commenced extraction of Longwall 1 in the Wambo Seam in October 2007.

2 SUBSIDENCE RESPONSE STRATEGY REQUIREMENT

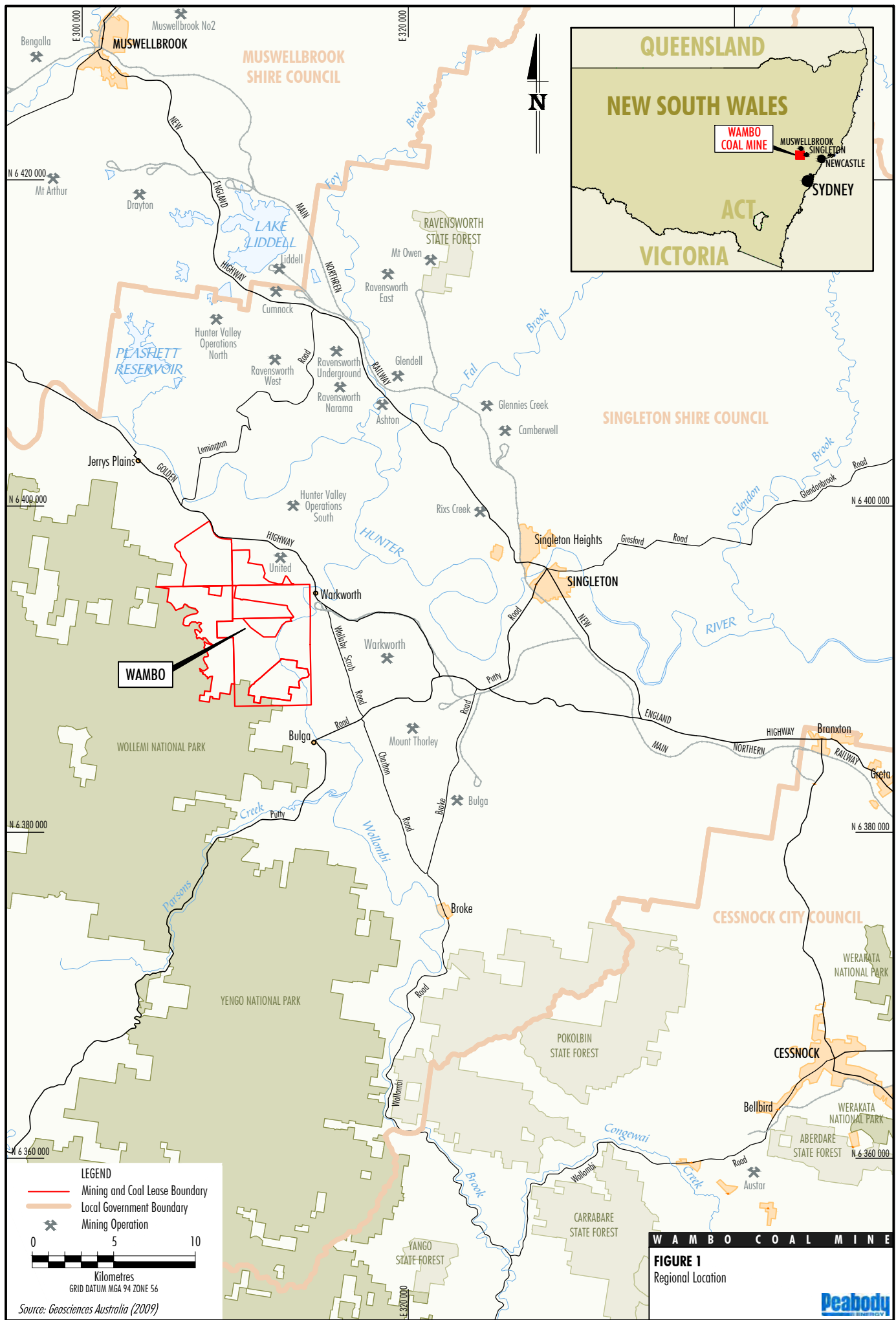
Connective cracking between the North Wambo Underground Mine and North Wambo Creek was identified as a potential impact in the *Wambo Development Project Environmental Impact Statement* (WCPL, 2003), *Wambo Development Project – Wambo Seam Underground Mine Modification Statement of Environmental Effects* (WCPL, 2005), the Subsidence Management Plan for North Wambo Underground Mine Longwalls 1 to 6 (the *Wambo Development Project – North Wambo Underground Mine Subsidence Management Plan* [WCPL, 2006]), the Extraction Plan for Longwalls 7 and 8 (the *North Wambo Underground Mine Extraction Plan for Longwalls 7 and 8* [WCPL, 2013]), the Extraction Plan for Longwalls 7 to 10 (the *North Wambo Underground Mine Extraction Plan for Longwalls 7 to 10* [WCPL, 2014]) and by the relevant regulatory authorities.

A temporary pipeline was previously proposed as a primary hard control for the prevention of surface water loss from North Wambo Creek to North Wambo Underground Mine, by conveying low flows around sections of North Wambo Creek with a depth of cover above the North Wambo Underground Mine of less than 100 metres (m).

WCPL, the NSW Department of Water and Energy (DWE) (now NSW Office of Water [NOW]) and the NSW Department of Primary Industries (now Division of Resources and Energy [DRE]) agreed in July 2008 that rather than constructing North Wambo Creek Temporary Pipeline (NWCTP), the preferred approach was to develop a program (Response Strategy) to monitor and manage the subsidence of each longwall as it passes under North Wambo Creek (**Appendix A**).

As such, this North Wambo Creek Subsidence Response Strategy (NWCSRS) was prepared and implemented for the North Wambo Underground Mine.

¹ In addition, DA 108/91 has been retained in accordance with Schedule 3, Condition 5 of DA 305-7-2003.



The NWCSRS has been revised as part of the preparation of the Extraction Plan for North Wambo Underground Mine Longwalls 8 to 10A.

Longwall 8b is the only remaining longwall at the North Wambo Underground Mine planned for extraction under the North Wambo Creek alluvium. Extraction is scheduled for November 2015 to January 2016.

WCPL has an approved Surface and Groundwater Response Strategy as part of WCPL's overall Site Water Management Plan (SWMP). This NWCSRS has been developed specifically for North Wambo Creek. If there are any inconsistencies between the SWMP and this document, this document will prevail. Regulatory correspondence relevant to this NWCSRS is included in **Appendix B**.

The remainder of this NWCSRS is structured as follows:

- Section 3:** Subsidence monitoring and management responses.
- Section 4:** Unexpected impacts to North Wambo Creek.
- Section 5:** Reporting and review.
- Section 6:** Responsibilities.
- Section 7:** References.

3 SUBSIDENCE MONITORING AND MANAGEMENT RESPONSES

3.1 SUBSIDENCE MONITORING

The process for investigating connective cracking between North Wambo Underground Mine and North Wambo Creek or other subsidence impacts to North Wambo Creek is as follows:

1. Review recent monitoring data to identify potential depressurisation of alluvial aquifers. An investigation will be conducted where the trigger level is exceeded and does not recover after a significant rainfall event.

Relevant groundwater monitoring sites in the vicinity of North Wambo Creek are multi-level piezometer MG08 and piezometer GW08 as shown in **Figure 2**. MG08 has a continuous data logger that will be downloaded on a weekly basis while the North Wambo Underground Mine is within 100 m of the floodplain; monitoring will then be undertaken on a monthly basis unless a change is detected. Monitoring at MG08 commenced in December 2012. GW08 is monitored bi-monthly and water level, field pH and EC recorded when water is present. "Trigger Levels" for MG08 and GW08 are presented in **Table 2**.

Table 2
MG08 and GW08 Trigger Levels

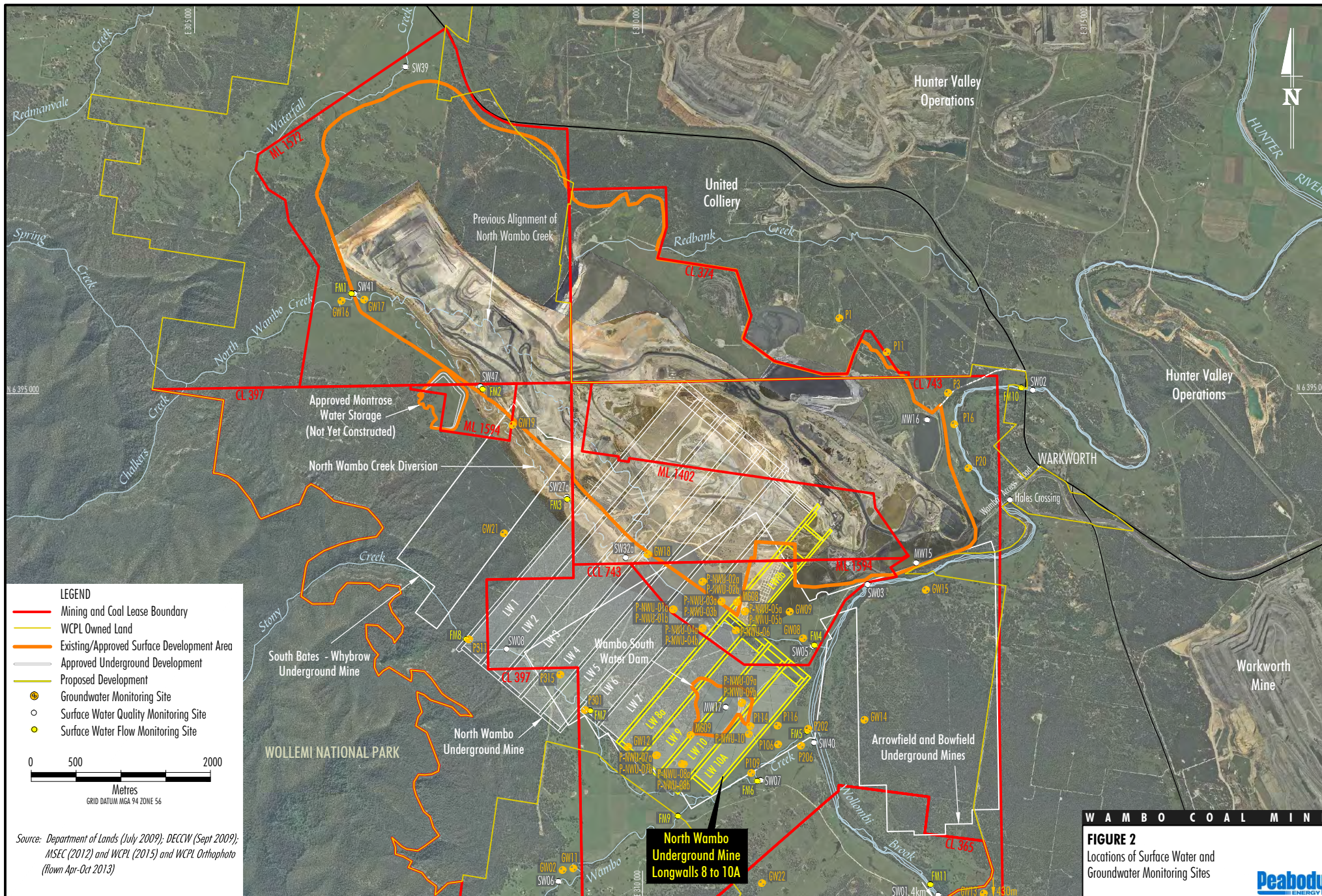
Groundwater Monitoring Site	Depth to Groundwater Level Trigger Level (m)	pH Trigger Level		Electrical Conductivity (EC) Trigger Level (µS/cm)	
	Max	Min	Max	Min	Max
GW08*	- [‡]	6.0	9.5	80	5,900
MG08 [^]	9.0	-	-	-	-

µS/cm = microSiemens per centimetre.

* Where a valid sample can be obtained. The trigger level adopted for GW08 is consistent with the triggers determined for bore P6 (monitoring site no longer active).

[‡] A depth to groundwater trigger level has not been included as this monitoring bore can be dry.

[^] EC and pH cannot be measured at vibrating wire piezometers as they are installed in a grouted hole. The methodology for developing the trigger level is described in Appendix C.



2. Environmental personnel will consult North Wambo Underground Mine personnel weekly to determine if there has been an increase in the quantity of excess water reporting to the underground mine sump(s). Monitoring of pumping volumes (inflow) from the North Wambo Underground Mine is undertaken and is reviewed weekly. An increase in water make at the end of the goaf to above 3 litres per second (pumping rate averaged over the week) will trigger an investigation.
3. Monitoring of pumping rates from North Wambo Underground Mine roadways and the Homestead workings is undertaken weekly. If monitoring indicates regular pumping is required at rates higher than normal, an investigation will be triggered.
4. Undertake visual inspections of North Wambo Creek during and post subsidence to identify erosion and/or surface cracking. Visual inspections will be triggered by: more than 20 millimetres of rain recorded (in a 24 hour period) at WCPL's weather station; and by any flow recorded at the hydrographic flow monitoring station located upstream of Longwall 8. If erosion and/or surface cracking are identified, remediation would be undertaken in accordance with **Section 3.2** and the Land Management Plan for Longwalls 8 to 10A.
5. Review and comparison of annual bed and bank stability survey monitoring results to identify erosion, ponding and/or surface cracking. Bed and bank stability monitoring is currently undertaken as part of WCPL's annual riparian vegetation monitoring as identified in the Flora and Fauna Management Plan. If erosion and/or surface cracking are identified remediation would be undertaken in accordance with **Section 3.2** and the Land Management Plan for Longwalls 8 to 10A.
6. Review of survey results from subsidence monitoring lines in accordance with the Extraction Plan for Longwalls 8 to 10A. Exceedance of predicted subsidence effects would trigger further investigation for signs of subsidence impacts/environmental consequences to North Wambo Creek.

Where one of points 1 to 6 is triggered:

7. If considered necessary to validate whether or not a hydraulic connection has developed between the North Wambo Underground Mine and North Wambo Creek, tests will be undertaken using isotopic tracers or helium. This is consistent with the outcomes of the North Wambo Subsidence Management Plan risk assessment for Longwalls 1 to 6 (G. Holt, pers. comm. in SP Solutions [2006]).
8. If it is likely that connective cracking has occurred, a water quality sample would be obtained and the Water Quality Signature (cation/anion) plotted and analysed by a specialist hydrologist (if an adequate water sample can be obtained).
9. To further assist in the detection of connective cracking, where required, WCPL will apply the response trigger that was prepared by Gilbert & Associates (specialist hydrologists) for the NWCTP. The response trigger requires the measurement of the difference in flow upstream and downstream of the area to be subsided via the flow monitoring sites (FM1, FM2, FM3 and FM4) installed along North Wambo Creek. **Figure 2** shows the locations of these flow monitoring sites and WCPL's surface and groundwater monitoring network.

If connective cracking has been identified, WCPL would implement subsidence management responses outlined in **Section 3.2**.

3.2 SUBSIDENCE MANAGEMENT RESPONSES

Subsidence management of North Wambo Creek will be consistent with measures described in the Extraction Plan for Longwalls 8 to 10A (WCPL, 2015).

Potential management measures are available to mitigate/remediate subsidence impacts. The requirement and methodology for any subsidence remediation techniques will be determined in consideration of:

- potential impacts of the unmitigated impact, including potential risks to public safety and the potential for self-healing or long-term degradation; and
- potential impacts of the remediation technique, including site accessibility.

Remediation of surface cracks would be undertaken 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.

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

If surface crack remediation works are required in remnant vegetation areas, compact mobile equipment will be utilised, where practicable, to minimise damage to surrounding vegetation. If the remediation work requires clearing of remnant vegetation to an extent that would exceed the benefit of the remediation, the requirement for remediation will be reviewed. Vegetation that requires clearance will be subject to the Vegetation Clearance Protocol (refer to the Biodiversity Management Plan for Longwalls 8 to 10A).

There are supplementary management measures that can be utilised should connective cracking be identified including, but not limited to:

- Re-contouring surface cracks.
- Injection grouting.
- *Geomembrane* - should the monitoring process discussed in **Section 3.1** identify a direct hydraulic connection between North Wambo Underground Mine and North Wambo Creek, a geomembrane² (or similar low permeability layer) will be installed in the creek where connective cracking is identified. The geomembrane will be installed by excavating and stockpiling the creek alluvium to a depth of up to 1.5 m, installing the geomembrane (or similar low permeability layer), and then backfilling the excavation with the stockpiled alluvium.

The implementation of any remedial measures will be undertaken in consultation with NOW, DRE and other relevant authorities and reported in the Annual Review.

² A geosynthetic clay liner is envisaged for the purpose, comprising twin geotextile layers encapsulating a layer of sodium bentonite (Gilbert & Associates, 2006).

4 UNEXPECTED IMPACTS TO NORTH WAMBO CREEK

In the event that any unforeseen surface or groundwater impacts to North Wambo Creek (i.e. impacts greater than or different to those described in the Extraction Plan for Longwalls 8 to 10A) are detected, the following general response procedure will be initiated:

- review relevant monitoring data, mining activities and land management practices in the relevant catchment;
- engage a consulting hydrologist/hydrogeologist to investigate the causes of the impact;
- develop appropriate mitigation and management measures, based on investigation results, and in consultation with the relevant authorities; and
- modify relevant monitoring program(s) to assess the effectiveness of introduced mitigation and management measures, where necessary.

5 REPORTING AND REVIEW

WCPL will report on the following items in the Annual Review:

- details of surface or groundwater responses undertaken in accordance with the NWCSRS, including:
 - a summary of the impact triggering the response;
 - a description of the measures implemented in response;
 - details of consultation with relevant authorities; and
 - any relevant monitoring results.

The NWCSRS will be reviewed by the Environmental and Community Manager:

- on an annual basis;
- when there are any modifications to the conditions of Development Consent (DA 305-7-2003) 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 Development Consent (DA 305-7-2003); and/or
- following significant incidents at WCPL in relation to North Wambo Creek; or in response to a relevant change in technology or legislation.

6 RESPONSIBILITIES

Table 3 below summarises responsibilities documented in the NWCSRS. The following responsibilities may be delegated as required.

Table 3
North Wambo Creek Subsidence Response Strategy Responsibilities

No.	Task	Responsibility	Timing
1	Monitoring as identified in Section 3.1 of this document.	Senior Environmental Advisor	As required.
2	Implementation of mitigation measures in accordance with this strategy and in consultation with relevant agencies.	Environment and Community Manager and Underground Manager of Mining Engineering	As required.

7 REFERENCES

Gilbert & Associates (2006) *Wambo Coal Mine Hydrological Assessment of Staged Diversion and Temporary pipeline – North Wambo Creek.*

SP Solutions (2006) *Review of North Wambo Underground SMP Proposed Controls - North Wambo Creek.*

Wambo Coal Pty Limited (2003) *Wambo Development Project Environmental Impact Statement.*

Wambo Coal Pty Limited (2005) *Wambo Development Project – Wambo Seam Underground Mine Modification Statement of Environmental Effects.*

Wambo Coal Pty Limited (2006) *Wambo Development Project – North Wambo Underground Mine Subsidence Management Plan.*

Wambo Coal Pty Limited (2013) *North Wambo Underground Mine Extraction Plan for Longwalls 7 and 8.*

Wambo Coal Pty Limited (2014) *North Wambo Underground Mine Extraction Plan for Longwalls 7 to 10.*

Wambo Coal Pty Limited (2015) *North Wambo Underground Mine Extraction Plan for Longwalls 8 to 10A.*

APPENDIX A
DWE AND DPI MEETING MINUTES 7 JULY 2008
AND
15 SEPTEMBER 2008

MEETING NOTES
NORTH WAMBO CREEK SUBSIDENCE RESPONSE STRATEGY
DWE OFFICES NEWCASTLE
2.00 PM ON 15 SEPTEMBER 2008

ATTENDEES

Greg Summerhayes	Department of Primary Industries
Fergus Hancock	Department of Water and Energy
Janelle Pierson	Department of Water and Energy
Micheal Alexander	Wambo Coal
Jeff Hanlon	Wambo Coal
Sarah Bailey	Wambo Coal

PURPOSE

To discuss the North Wambo Creek Subsidence Response Strategy (NWCSRS) that was sent to DWE and DPI on the 11 September 2008, following the outcome of the meeting held on the 7 July 2008 with DPI and DWE.

Note: The NWCSRS has been developed in accordance with Consent Condition 26, Schedule 4 of Development Consent DA 305-7-2003. Consultation with DPI and DWE commenced 16th June 2008. The proposed NWCSRS was discussed with DoP on the 24th July 2008.

OUTCOME

The following items are to be added to the North Wambo Creek Subsidence Response Strategy:

- Trigger levels for piezometer P5 and P6 which are currently detailed in Wambo's Groundwater Monitoring Program. (Section 3.1)
- Monitoring of pumping volumes from Wollemi Box Cut, including a trigger level. (Section 3.1)
- Monitoring of pumping volumes (inflow) from the North Wambo Underground (NWU), including a trigger level.
- Figure showing the location of P5 and P6 over Longwall panels. The proposed location of North Wambo Creek Stage 3 Diversion is to be included. Note: the exact route is yet to be finalised.
- Additional information to be added to Section 4 regarding North Wambo Creek Stage 3 Diversion.
- Monitoring of P5 and P6 to commence immediately. Monitoring will be undertaken weekly while NWU is within 100m of Alluvial. Monitoring will then be undertaken on a monthly basis unless a change detected.(Section 3.1)
- If it is likely that connective cracking has occurred, Water Quality Signature (cation/ anion) monitoring in P5 and P6 will be plotted and analysed by a specialist hydrologist. (Section 3.1)
- Details of monitoring and mitigation measures to be included in the End of Panel Report in addition to reporting in the AEMR. (Section 6)

MEETING NOTES
NORTH WAMBO CREEK TEMPORARY PIPELINE
DWE OFFICES NEWCASTLE
11.00 AM ON 7 JULY 2008

ATTENDEES

Greg Summerhayes	Department of Primary Industries
Fergus Hancock	Department of Water and Energy
Lindsay Gilbert	Gilbert and Associates
Michael Alexander	Wambo Coal
Jeff Hanlon	Wambo Coal
Sarah Bailey	Wambo Coal

PURPOSE

To discuss the North Wambo Creek Temporary Pipeline detailed design that was sent to DWE and DPI on the 16 June 2008. Report titled, "*Low Flow Pipe By – pass of North Wambo Creek (for flow loss mitigation during longwall mining)*" by Gilbert and Associates Pty Ltd, May 2008.

In accordance with Wambo Coal's development consent (DA 305-7-2003) Condition 26, Wambo are required to design the North Wambo Creek temporary pipeline in consultation with DPI and DWE.

DISCUSSION

The risk of in-rush to the underground workings is low and the pipeline would only convey low flows. The pipeline is not intended to prevent in-rush to the underground workings during high flows. During high flow and possible flooding, exceedance of the design capacity of the pipeline would result in overtopping of the pipeline block embankments. There is a risk of erosion of the block embankments and other areas of the creek disturbed during construction.

DPI and DWE - concerned that the controls on the proposed trench to contain the pipeline will become more of a problem than a solution. As confirmed by Lindsay, the pipeline needs to be trenched due to gradient requirements.

DPI and DWE –the pipeline channel has a certain capacity however even that has the potential to flood. There may be implications from above bank flows on the creek given that there will be subsidence. Instead of constructing the pipeline the preferred option is to set up a comprehensive monitoring and test regime as each panel is being subsided, monitoring of pulse flows would assist in determining if water is being lost due to connective cracking. The monitoring program would also need to look at the water levels in the alluvials adjacent to North Wambo Creek. If cracking and water loss is

apparent, the installation of the pipeline will need to be revisited. If the pipeline is to be installed, it will be installed on the surface of the existing creek bed and anchored to prevent movement during a flood.

Longwall 1 has the least depth of cover of all panels so it is likely that if connective cracking at Longwall 1 is minimal, we would not expect significant cracking in the other panels.

OUTCOME

Instead of constructing the NWCTP as per the design detailed in the report sent to DWE and DPI on the 16 June 2008, Wambo will develop a comprehensive program to monitor the subsidence of each longwall as it passes under the creek. The program/ plan will include but is not limited to: pulse flow testing; detailing the methods that will be employed to monitor for connective cracking and seepage; monitoring of water loss from alluvials; visual monitoring; and triggers for determining if the pipeline does need to be installed. The plan will also detail remedial works that will be completed as soon as cracking is evident and the design details of the pipeline which will be constructed as a last resort. The plan will align with Wambo's and the North Wambo Creek Diversion Plan and the Site Water Management Plan, which includes the Erosion and Sediment Control Plan and Surface and Ground Water Response Plan.

The program/ plan for monitoring the subsidence of North Wambo Creek will be developed in consultation with DPI and DWE.

DWE and DPI to specify any additional requirements that must be incorporated into the plan.

Wambo to contact DoP to let them know about the outcome of this meeting.

- Meeting notes were approved by DPI in an email from Greg Summerhayes to Sarah Bailey on Thursday 10th July 2008.
- Meeting notes were approved by DWE (Fergus Hancock) via a phone call to Sarah Bailey on the 23rd July 2008.
- Meeting Minutes were emailed to Colin Phillips (DoP) on 24 July 2008 to inform DoP of decision to proceed with a Subsidence Response Strategy. Discussion re Meeting Minutes was held between Colin Phillips and Sarah Bailey in a phone conversation on 24 July 2008 at approximately 3.20pm.

APPENDIX B
REGULATORY CORRESPONDENCE



13 April 2010

File Ref: L93/0257

General Manager
Wambo Mine
PMB 1
SINGLETON NSW 2330

ATTENTION: Sarah Bailey – Environment & Community Manager

Dear Sir, *Sarah*

**WAMBO COAL
REVISED SITE WATER MANAGEMENT PLAN DOCUMENTS**

I refer to your letter of 1 March 2010 providing to I&I NSW for review the Site Water Management Plan (SWMP) according to Wambo Consent Condition 33. I refer also to your related letter of 9 April 2010 providing tables summarising changes to each of the plans.

I&I NSW acknowledges consultation by Wambo and accepts the SWMP documentation:

Erosion and Sediment Control Plan;

Surface Water Monitoring Program;

Groundwater Monitoring Program;

Site Water Balance

Surface and Groundwater Response Plan.

For clarification or further information please contact me at the Maitland Office on (02)49316705.

Yours faithfully,

**Greg Summerhayes
Principal Environmental Officer
Environmental Sustainability Unit**

1 March 2010

Mr Greg Summerhayes
Department of Industry and Investment
PO Box 344
Hunter Region Mail Centre
NSW 2310

Dear Greg

**WAMBO COAL
REVISED SITE WATER MANAGEMENT PLAN DOCUMENTS**

In accordance with Consent Condition 33, Schedule 4, DA 305-7-2003, Wambo Coal's Site Water Management Plan (SWMP) must be revised in consultation with Department of Industry and Investment (DII) and Department of Environment, Climate Change and Water (DECCW), prior to submission to the Department of Planning (DoP) by the 30 April 2010.

The SWMP has been revised three times since 2005 in response to consent modifications. The latest revision of the SWMP was triggered by consent modifications relating to the approval of the Chitter Dam and South Dam in June and August 2009, respectively.

Wambo Coal's SWMP is comprised of the following documents which are enclosed for your review:

- The predicted site water balance;
- An Erosion and Sediment Control Plan;
- A Surface Water Monitoring Program;
- A Groundwater Monitoring Program; and
- A Surface and Groundwater Response Plan.

Please review and provide comment by Friday 9 April 2010 to allow changes to be made prior to the DoP submission date.

Please contact me on (02) 6570 2217 if you would like to arrange a meeting to discuss these documents.

Yours sincerely



Sarah Bailey

Environment and Community Manager

1 March 2010

Mr Fergus Hancock
DECCW – Office of Water
Honeysuckle Drive
Newcastle NSW 2330

Dear Fergus

**WAMBO COAL
REVISED SITE WATER MANAGEMENT PLAN DOCUMENTS**

In accordance with Consent Condition 33, Schedule 4, DA 305-7-2003, Wambo Coal's Site Water Management Plan (SWMP) must be revised in consultation with Department of Industry and Investment (DII) and Department of Environment, Climate Change and Water (DECCW), prior to submission to the Department of Planning (DoP) by the 30 April 2010.

The SWMP has been revised three times since 2005 in response to consent modifications. The latest revision of the SWMP was triggered by consent modifications relating to the approval of the Chitter Dam and South Dam in June and August 2009, respectively.

Wambo Coal's SWMP is comprised of the following documents which are enclosed for your review:

- The predicted site water balance;
- An Erosion and Sediment Control Plan;
- A Surface Water Monitoring Program;
- A Groundwater Monitoring Program; and
- A Surface and Groundwater Response Plan.

Please review and provide comment by Friday 9 April 2010 to allow changes to be made prior to the DoP submission date.

Please contact me on (02) 6570 2217 if you would like to arrange a meeting to discuss these documents.

Yours sincerely



Sarah Bailey
Environment and Community Manager

Sarah Bailey

From: Sarah Bailey
Sent: Friday, 9 April 2010 10:38 AM
To: Fergus Hancock
Subject: Wambo Coal SWMP - table of changes to assist DECCW in the review
Attachments: 100409 let to DECCW OoW re revised SWMPs table of changes.pdf

Hi Fergus

I hope all is well and I hope you had a good Easter.

As per my phone message yesterday, we have put together tables summarizing the changes to the revised Site Water Management Plan documents.

In accordance with Consent Condition 33, Schedule 4, DA 305-7-2003, Wambo Coal's Site Water Management Plan (SWMP) must be revised in consultation with Department of Industry and Investment (DII) and Department of Environment, Climate Change and Water (DECCW), prior to submission to the Department of Planning (DoP) by the 30 April 2010.

Please let me know if you did not receive the SWMP which was posted to you on 1st March 2010.

Please let me know if you will be unable to review the SWMP documents in time to allow us to make any requested changes before submitting the SWMP to DoP before 30th April. I will need to talk to DoP re an extension to the submission date if this is the case.

Regards

Sarah Bailey

Manager Environment & Community
Wambo Coal Pty Ltd
Peabody Energy Australia
PMB 1, Singleton, NSW, 2330
Phone: +61 (0)2 6570 2217
Fax: +61 (0)2 6570 2290
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Planning

Major Projects Assessment

Mining

Phone: (02) 9228 6306

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Email: belinda.parker@planning.nsw.gov.au

Room 305

23-33 Bridge Street

GPO Box 39

SYDNEY NSW 2001

Ms Sarah Bailey
Environment and Community Manager
Wambo Coal Pty Limited
PMB 1
SINGLETON NSW 2330

Our Ref: S02/02197

Dear Ms Bailey

Wambo Coal Mine (DA 305-7-2003) Environmental Management Plans

I refer to your letter dated 21 October 2009, requesting an extension to the date for submission of the revised Flora and Fauna Management Plan (Condition 44, Schedule 3) and revised Site Water Management Plan (Condition 30, Schedule 3), for approval by the Director-General, as required under the Minister's consent for the mine (DA 305-7-2003).

The Department has reviewed the information supplied and Wambo's Independent Offset Strategy Audit Report dated 16 October 2009, and is satisfied that the proposed extension would enable:

- the audit recommendations to be included in Wambo's Flora & Fauna Management Plan; and
- a comprehensive review of the Site Water Management Plan, incorporating comments from relevant government agencies.

Consequently, I wish to advise you that the Department accepts your request to delay submission of the Flora and Fauna Management Plan and the Site Water Management Plan. The revised Plans are now required to be submitted to the Department by 30 April 2010.

If you have any queries, please contact Belinda Parker on 9228 6306.

Yours sincerely

dkitto 4/11/09

David Kitto
Director
Major Development Assessment
as delegate for the Director-General



NSW DEPARTMENT OF
PRIMARY INDUSTRIES

Now incorporating Department of Mineral Resources
ABN 51 73 412 4190-003

8 August 2008

File Ref: L93/0257

General Manager
Wambo Mine
PMB 1
SINGLETON NSW 2330

ATTENTION: Sarah Bailey – Environmental Specialist

Dear Sir,

WAMBO - GROUND WATER MANAGEMENT PROGRAM

I refer to your letter of 31 July 2008 providing the subject GWMP. The DPI acknowledges and accepts the GWMP documentation.

I also confirm the referenced components of the Wambo Site Water Management Plan have been provided to DPI for review. DPI have been consulted and have provided comment in March 2008.

For clarification or further information please contact me at the DPI Maitland Office on (02)49316705.

Yours faithfully,

Greg Summerhayes
Principal Environmental Officer
Environmental Sustainability Division



NSW GOVERNMENT
Department of Planning

Contact: Colin Phillips
Phone: (02) 9228 6483
Fax: (02) 9228 6466
Email: colin.phillips@planning.nsw.gov.au

Our ref: S02/02197


Mr Chris Millard
General Manager
Wambo Coal Pty Limited
PMB 1
SINGLETON NSW 2330

Dear Mr Millard

**Wambo Coal Mine
Site Water Management Plan**

I refer to your letter, dated 18 December 2007, requesting an extension of time to finalise the preparation of the revised Wambo Site Water Management Plan required by condition 30 of schedule 4 of Wambo coal mine's development consent (DA 305-7-2003).

The Department has considered the importance of gaining input from DPI and DWE to this plan and accordingly extends the submission date of this plan until 31 March 2008 to allow consultation with these agencies to be finalised.

Yours sincerely,



Howard Reed 20.12.07
A/Manager
Mining and Extractive Industries
as Delegate for the Director-General



NSW GOVERNMENT
Department of Planning

Contact: Colin Phillips
Phone: (02) 9228 6483
Fax: (02) 9228 6466
Email: colin.phillips@planning.nsw.gov.au

Ms Sarah Bailey
Environmental Officer
Wambo Coal Pty Limited
PMB 1
SINGLETON NSW 2330

Our ref: S02/02197

Dear Sarah

**Wambo Coal Mine
Site Water Management Plan**

I refer to a letter from Ms Sarah Withell, dated 30 October 2007, requesting an extension of time to finalise the preparation of the revised Wambo Site Water Management Plan required by condition 30 of schedule 4 of Wambo coal mine's development consent (DA 305-7-2003).

The Department has considered the importance of gaining input from DPI and DWE to this plan and accordingly extends the submission date of this plan until 31 December 2007 to allow consultation with these agencies to be finalised.

Yours sincerely,

Howard Reed
A/Manager
Mining and Extractive Industries
as Delegate for the Director-General

12-11-07



NSW GOVERNMENT
Department of Planning

Mining & Extractive Industries
Major Development Assessment
Phone: (02) 9228 6487
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Level 4 Western Gallery
23-33 Bridge Street
GPO Box 39
SYDNEY NSW 2001

Mr Tony Sutherland
Wambo Coal Pty Ltd
PMB 1
SINGLETON NSW 2330

24.10.05
D → J.T.
WD
RH
GH

Dear Mr Sutherland

**Wambo Development Project
Management Plans and Monitoring Programs**

Thank you for forwarding the following documents required under the Wambo development consent (DA 305-7-2003) for the Department's consideration:

- ~~Noise Monitoring Program (condition 9, Schedule 4);~~
- Site Water Balance (condition 25, Schedule 4);
- Erosion and Sediment Control Plan (condition 32, Schedule 4);
- Surface Water Monitoring Program (condition 33, Schedule 4);
- Groundwater Monitoring Program (condition 34, Schedule 4); and
- Environmental Management Strategy (condition 1, Schedule 6).

The Department has reviewed these documents and is generally satisfied they address the requirements of the relevant conditions in the development consent. ~~Consequently, I would like to advise you that the Director-General has approved these documents.~~ However, the Surface Water Monitoring Programme has been approved on the proviso that it is revised following the approval of the North Wambo Creek Diversion Plan.

The Director-General has previously approved the Air Quality Monitoring Program, Flora and Fauna Management Plan, and Landowner Notification Strategy for the development, but notes there are several other matters which must be satisfied prior to commencing certain operations under the new consent. These matters include:

- Blast Monitoring Program (condition 19, Schedule 4);
- Blast Management Plan (condition 20, Schedule 4);
- Site Water Management Plan (condition 30, Schedule 4);
- Surface and Groundwater Response Plan (condition 35, Schedule 4);
- Surface and Sub-Surface Investigation Program (condition 36, Schedule 4);
- Archival Record of the Wambo Homestead Complex (condition 62, Schedule 4);
- Assessment of options for reducing the greenhouse gas emissions of the development (condition 87, Schedule 4);
- Environmental Monitoring Program (condition 2, Schedule 6).

The Department also notes that under condition 5 of Schedule 4, the development consent will only commence after all previous development consents for the Wambo coal mine have been surrendered, excluding DA No. 108/91 issued by Singleton Shire Council, to the satisfaction of the Director-General.

I would appreciate it if you would advise the Department of when you expect to commence open cut and underground operations under DA 305-7-2003, and when you are likely to submit the various outstanding documents required under the consent.

If you have any enquiries about this matter, please contact Mike Young on 9228 6481.

Yours sincerely

per David Kitto
Manager
Mining & Extractive Industries
as delegate for the Director-General

10/10/05



Department of
Environment and Conservation (NSW)

Your reference :
Our reference : 270075A12; NEF17395; 17455; 17093; 17579
Contact : Karen Marler; ph: 49086803

Wambo Coal Pty Limited
PMB 1
SINGLETON NSW 2330

- 7 SEP 2005

Attention: Mr Tony Sutherland

Dear Mr Sutherland

WAMBO DEVELOPMENT PROJECT:

1. SURFACE WATER MONITORING PROGRAM (31 August 2005)
2. GROUNDWATER MONITORING PROGRAM (31 August 2005)
3. AIR QUALITY MONITORING PROGRAM (ORIGINAL (7 June 2005) AND REVISIONS 16 June 2005 AND 31 August 2005)
4. ~~EROSION AND SEDIMENT CONTROL PLAN (29 July 2005)~~
5. LANDOWNER NOTIFICATION PROCEDURE – AIR QUALITY (9 August 2005)

I refer to the above documents sent to the Department of Environment and Conservation (DEC) on the dates indicated. With regard to these documents the DEC provides the following advice:

1. SURFACE WATER MONITORING PROGRAM
2. GROUNDWATER MONITORING PROGRAM
3. AIR QUALITY MONITORING PROGRAM
4. EROSION AND SEDIMENT CONTROL PLAN

The DEC encourages the preparation of strategies, programs and plans as useful tools for industry to ensure that it meets the environmental objectives specified in conditions of Environment Protection Licences. As a regulatory authority, the DEC does not review or comment on these plans.

5. LANDOWNER NOTIFICATION PROCEDURE – AIR QUALITY

The fact sheet contains comprehensive advice regarding what particulate emissions are. You should contact NSW Health for comment on the adequacy of the information provided about the potential health impacts that may result from exposure to particulate matter.

The DEC understands that the primary aim of this procedure is to provide tenants and prospective tenants with information on likely health-related impacts associated with air quality at the place they are leasing or considering leasing. It will be important to ensure that landowners, tenants or prospective tenants are provided with site specific information regarding the predicted future particulate matter levels for each residence (particularly those Warkworth Mining Limited owned dwellings on Wallaby Scrub Road). The fact sheet should be provided to assist tenants to interpret this information and understand the likely future impacts of mining on air quality and potentially their health and amenity when making a decision to live in these residences.

If you have any questions regarding this matter, please contact Karen Marler on 4908 6803.

Yours sincerely



MITCHELL BENNETT
Head – Regional Operations Unit - Hunter
North East Branch
Environment Protection and Regulation Division

APPENDIX C
METHODOLOGY FOR DEVELOPING MG08 TRIGGER LEVEL

TRIGGER LEVEL FOR MG08

The “Trigger Level” for MG08 was developed based on the following methodology:

1. The mean water level for MG08 was calculated based on all available monitoring data.
2. A probability distribution was developed for water level on all available P5³ and P6⁴ data.
3. The mean water level for P5 and P6 was calculated based on data collected for the period of available MG08 data.
4. The probability of the values for P5 and P6 calculated in Step 3 was determined based on the probability distribution developed in Step 2.
5. The probability of the value for MG08 calculated in Step 1 was assumed to be equal to the average of the probabilities for P5 and P6 calculated in Step 4.
6. The probability distribution calculated in Step 2 was translated to probability distributions for MG08 using the values and equivalent probabilities calculated in Steps 1 and 5 above.
7. The maximum depth to groundwater level Trigger Level for MG08 was set equal to the equivalent maximum historical values based on the probability distributions developed in Step 6 plus an allowance equal to the difference between the maximum values and 90th percentile equivalent values.

³ P5 was previously a monitoring site for the NWCSRS and has a data record from September 2008 to March 2014. This site was removed by open cut operations and is no longer active.

⁴ P6 was previously a monitoring site for the NWCSRS and has a data record from September 2008 to October 2013. This site was removed by open cut operations and is no longer active.
