Illawarra Coal

ENVIRONMENTAL MANAGEMENT PLAN

Appin Area 7 Longwalls 705 to 706
Environmental Management Plan

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Background

In accordance with Condition 13 of the Longwall 705 to 706 Subsidence Management Plan (SMP) Approval, dated 28th February 2012, the preparation and implementation of an Environmental Management Plan (EMP) is required.

The Environmental Management Plan approved for Longwalls 705 and 706 comprises the following documents:

i. Table 1.1 – Appin Area 7 Environmental Monitoring (attached).
ii. Table 1.2 – Appin Area 7 Environment Trigger, Action, Response Plan (TARP) (attached).
iii. Plan of Appin Area 7 Surface and Groundwater Monitoring Locations (attached).
iv. Appin Colliery Area 7, Longwalls 705 to 710 Proposed Subsidence Management Plan, Volume 2, June 2008. http://www.bhpbilliton.com/home/aboutus/regulatory/Documents/appin705to710Volume2.pdf

Note: Environmental monitoring and TARPs outlined in Document iv. above have been superseded by documents i., ii. and iii. In particular Tables 23.1 and 24.1 of Document iv. have been superseded by documents i. and ii. respectively.

Table 1.1: Appin Area 7 Environmental Monitoring

Monitoring Site	Site Type	Monitoring Frequency	Parameters
WATER QUALITY			
Nepean River Baseline upriver sites for cross-checking for upriver perturbations: ▪ NR0 ▪ NR2 (pre Area 9 mining) ▪ NR110 (New site - post Area 9 mining) ▪ NR4 ▪ NR5 ▪ NR6 Impact monitoring sites adjacent to each longwall: ▪ NR11 ▪ NR12 ▪ NR13 ▪ NR20 ▪ NR30 Other sites ▪ NR7 ▪ NR9 ▪ NR50 Refer Figure 1a	Grab Sample and field measurements	▪ Monthly baseline prior to mining (data has been recorded for most sites since 2003). ▪ Weekly observations and field analysis during mining. ▪ Monthly detailed laboratory analysis during mining. ▪ Monthly monitoring for 2 years post mining (or as otherwise required/approved). ▪ If required as a result of assessment of mining impacts.	▪ Field measurements of: – Temperature – Dissolved Oxygen (DO) – Electrical Conductivity (EC) – pH – ORP – Time – General Comments. ▪ Laboratory analysis of: – pH – EC – Na filtered – K filtered – Ca filtered – Mg filtered – Cl filtered – Br filtered – I filtered – As filtered – Cu filtered – Pb filtered – Ni filtered – Se filtered – Zn filtered – Fe filtered – Mn filtered – Al filtered – SO4 filtered – Fe Total – Mn Total – Al Total – TKN – NH3-N – NOx-N – FRP – TP – Total Alkalinity – TSS – TDS – DOC – CH4* – C2H6* – Trace Phenols* – Sulphide*
Ephemeral Watercourses ▪ Lower Harris Creek (NR3) ▪ Elladale Creek (NR8) ▪ Ousedale Creek (NR10) ▪ Menangle Creek (NR40) ▪ Upper Harris Creek (HC10) ▪ Foot Onslow Creek (FO1) ▪ Navigation Creek (NAV1) Refer Figure 1a	Grab sample and field measurements	▪ Prior to mining of longwall underlying watercourse or mining of any immediately adjacent longwall. ▪ Monthly detailed laboratory analysis during mining. ▪ Following the development of incremental subsidence for each longwall that will impact on the feature.	

Monitoring Site	Site Type	Monitoring Frequency	Parameters
LEVEL AND FLOW			
Nepean River ▪ At benchmark sites and water pump sites: – NRL05 – NRL10 – NRL12 – NRL13 – NRL15 – NRL20 – Pump 1 NRL – Pump 2 NRL – NRL25 – NRL30 – NRL33 – NRL35 – NRL40 – NRL45 – NRL48 – NRL50 – Pump 5 NRL – Pump 6 NRL Refer Figure 1a	Water Level Water flow (measured at SCA weirs)	▪ Monthly baseline prior to mining (data has been recorded for most sites since 2007). ▪ Weekly manual monitoring at nails during mining. ▪ Flow monitoring at weirs (data supplied by SCA). ▪ Ongoing monthly monitoring for 2 years post mining (or as otherwise required/approved).	▪ Areas of dry riverbed compared with baseline environmental conditions. ▪ Areas of flooded riverbed compared with baseline environmental conditions. ▪ Field measurement of water height compared with baseline environmental conditions.
Ephemeral Watercourses ▪ Lower Harris Creek (NR3) ▪ Elladale Creek (NR8) ▪ Ousedale Creek (NR10) ▪ Menangle Creek (NR40) ▪ Upper Harris Creek (HC10) ▪ Foot Onslow Creek (F01) ▪ Navigation Creek (NAV1) Refer Figure 1a	Water Level	▪ Prior to mining of longwall underlying watercourse or mining of any immediately adjacent longwall. ▪ Following the development of incremental subsidence for each longwall that will impact on the feature.	▪ Photo points ▪ Areas of increased flooding or drying of ephemeral streams

Monitoring Site	Site Type	Monitoring Frequency	Parameters
APPEARANCE			
Nepean River ▪ Visual observations along the length of the Nepean River within the active mining area.	Observational and photographic monitoring	▪ Monthly baseline prior to mining (data has been recorded for most sites since 2003). ▪ Weekly observations and field analysis during mining. ▪ Monthly monitoring for 2 years post mining (or as otherwise required/approved). ▪ If required as a result of assessment of mining impacts.	▪ Iron or salinity staining (e.g. orange or white staining in water or on banks/seeps). ▪ Water cloudiness ▪ Evidence of springs in Nepean River ▪ Visual signs of impacts (e.g. cracking, vegetation changes, increased erosion, changes in water colour etc.) ▪ Impacts determined from comparing photo points taken prior to, during and post mining. ▪ Erosion and/or sedimentation compared with baseline environmental conditions.
Ephemeral Watercourses ▪ Lower Harris Creek (NR3) ▪ Elladale Creek (NR8) ▪ Ousedale Creek (NR10) ▪ Menangle Creek (NR40) ▪ Upper Harris Creek ▪ Foot Onslow Creek ▪ Navigation Creek	Observational and photographic monitoring	▪ Prior to mining of longwall underlying watercourse or mining of any immediately adjacent longwall. ▪ Following the development of incremental subsidence for each longwall that will impact on the feature.	▪ Observable iron or salinity staining. ▪ Visual signs of impacts (e.g. cracking, vegetation changes, increased erosion, changes in water colour etc.) ▪ Impacts determined from comparing photo points taken prior to, during and post mining.
Water Pumps ▪ Pump 1 NRL ▪ Pump 2 NRL ▪ Pump 3 ▪ Pump 4 ▪ Pump 5 NRL ▪ Pump 6 NRL	Observational and photographic monitoring	▪ Pre mining photographs ▪ Weekly visual inspection during mining ▪ If required as a result of assessment of mining impacts.	▪ Pump submergence and disturbance

Monitoring Site	Site Type	Monitoring Frequency	Parameters
AQUATIC ECOLOGY			
Nepean River ▪ Sites 1 and 2 (located upstream of Longwall 701 near Douglas Park Weir). ▪ Sites 3 and 4 (located adjacent to Longwalls 701 and 702 near confluence of the Nepean River and Elladale Creek). ▪ Sites X1 and X2 (located adjacent to Longwalls 703 and 704). ▪ Sites 5 and 6 (located adjacent to Longwalls 705 and 706 downstream of the confluences with Mallaty and Ouesdale Creeks) ▪ Sites 7 and 8 (located downstream of all proposed Longwalls 701-710) Refer Figure 20.1 in LW705-710 SMP	Quantitative and observational monitoring	▪ Two Baseline monitoring campaigns (autumn/spring) prior to mining ▪ Annual monitoring campaigns (autumn and spring) during mining (i.e. longwall within 400m of monitoring site) ▪ Two monitoring campaigns (autumn/spring) post mining ▪ General observation of all streams in the active mining areas during all other monitoring	▪ Photographic records ▪ Macro-invertebrate Assessment ▪ Fish sampling ▪ Water Quality ▪ Monitored in conjunction with: – Flow – River Morphology
Ephemeral Watercourses ▪ Sites F1 and F2 (located on Foot Onslow Creek, over Longwalls 708 and 710) ▪ Site N1 (located on Navigator Creek northeast of Longwall 710) ▪ General observation of all other watercourses in active mining areas. Refer Figure 20.1 in SMP			

Monitoring Site	Site Type	Monitoring Frequency	Parameters
GROUNDWATER			
Water Level IC monitoring bores ▪ NGW3 ▪ NGW4 ▪ NGW6 ▪ NGW5 ▪ NGW7 ▪ NGW9 ▪ NGW10 ▪ NGW11 ▪ EAW5 ▪ EAW7 (S1936) ▪ S1584 ▪ S1809 ▪ S1853 ▪ S1854 Private bores ▪ 10 registered bores within the SMP area (refer to Built Feature Management Plans for monitoring/management) Refer Figure 1a	Groundwater level	IC Bores ▪ Pre-mining (data has been recorded since September 2004 for some sites) ▪ Water level logged hourly ▪ Post-mining – following the development of incremental subsidence for each longwall that will potentially impact on the borehole. ▪ Monitoring to continue for at least 12 months post mining. Private Bores ▪ Prior to mining of longwall underlying bore or mining of any immediately adjacent longwall (if in agreement with landholder). ▪ Post-mining – following the development of incremental subsidence for each longwall that will impact on the borehole (if in agreement with landholder). ▪ As requested by landholder or if physical impacts to bore identified (landholder to observe during use of bore).	NGW Bores (open holes) ▪ Standing groundwater level in bore using vibration wire Piezometer and logger – 1 hour recording. Grouted monitoring holes ▪ Piezometric head in various strata Private bores ▪ Water level measured with dip metre (where access to property is available and in agreement with landholder)

Monitoring Site	Site Type	Monitoring Frequency	Parameters
Water Quality IC monitoring bores ▪ NGW6 ▪ NGW5 Private bores ▪ 10 registered bores within the SMP area (refer to Built Feature Management Plans for monitoring/management)	Grab Sample	IC Bores ▪ Pre-mining – prior to mining of longwall underlying bore or mining of any immediately adjacent longwall. ▪ Post-mining – following the development of incremental subsidence for each longwall that will impact on the feature (i.e. each longwall). ▪ As required to provide additional data for any bore impact investigation or if physical impacts to bore identified. Private Bores ▪ Prior to mining of longwall underlying bore or mining of any immediately adjacent longwall (if in agreement with landholder). ▪ Post-mining – following the development of incremental subsidence for each longwall that will impact on the borehole (if in agreement with landholder). ▪ As requested by landholder or if physical impacts to bore identified (landholder to observe during use of bore).	▪ Observable iron or salinity staining determined from comparison of pre-mining and post-mining photographs. ▪ Water quality field and lab parameters as outlined in the Nepean River Water Quality section.
Mine Water Inflows Active mining areas – longwall face and roadway development. Mined goaf areas – 705 and 706	▪ Visual ▪ Flow Meter	▪ Daily statutory mine inspections ▪ Mine dewatering monitored throughout the mining process by flow meter of water pumped into and discharged from workings.	▪ Groundwater make increasing from historical range as measured by mine dewatering monitoring ▪ Inflow event from mining area ▪ Water sample of any inflow event (Laboratory Analysis for major Cations & Anions as well as Stable Isotopes) for comparison to surface waters

Monitoring Site	Site Type	Monitoring Frequency	Parameters
LANDSCAPE FEATURES			
Cliffs ▪ Along Nepean Gorge **Steep Slopes** ▪ Along Nepean Gorge, associated tributaries and above western end of the proposed longwalls. Refer Figure 19.1 in LW705-710 SMP		▪ Once prior to mining. Photographic records taken. ▪ During mining, monthly visual inspections, increased to weekly inspections during critical periods (for cliffs and steep slopes along the Nepean Gorge and associated tributaries). ▪ Monitoring to continue 6 monthly for 2 years following the completion of mining (or as otherwise required/approved). ▪ As required when specific impacts are identified or when concern is raised by a landowner. ▪ As required, in accordance with Built Feature Management Plans and landholder agreement.	▪ Cliff and steep slopes will be observed for any instability (e.g. rock falls, mass movement) and seeps.
TERRESTRIAL ECOLOGY			
Monitored in conjunction with general observational monitoring for the Nepean River, ephemeral watercourses and landscape.		▪ If required as a result of assessment of mining impacts. ▪ General observation of active mining areas during all other monitoring.	▪ Vegetation communities ▪ Vegetation condition ▪ Changes in vegetation. ▪ Tree health ▪ Threatened species.

Monitoring Site	Site Type	Monitoring Frequency	Parameters
ABORIGINAL ARCHAEOLOGY			
▪ Nepean River 4 (52-2-2098) ▪ Nepean River 5 (52-2-2097) ▪ Nepean River 6 (52-2-2095) ▪ Nepean River 7 (52-2-2096) ▪ Nepean River 8 (52-2-2239) ▪ Upper Nepean Hand Stencils ▪ Bulli Site 40 (BS 40) Refer to Figure 5-22 of Bulli Seam Operations EA and Figure 3 Bulli Seam Operations Appendix G (Aboriginal Cultural Heritage Assessment)	Observational and photographic monitoring	▪ Baseline archival recording prior to longwall mining. ▪ Final impact assessment recording 12 months after undermining or final subsidence movement at the site.	▪ Macro and micro recording using digital photography ▪ Detailed elevation plans of shelter walls recording structural and surface features including but not limited to the art itself, graffiti, joints, bedding planes, exfoliation scars, cracks, mineral and micro-organism growth, drip line and water seepage locations.
HISTORIC HERITAGE			
▪ Buildings or structures of identified heritage significance *Note: Detailed Heritage Management Plans to be developed prior to any heritage item being influence by mining*	Observational, photographic monitoring and structural inspections.	▪ Baseline assessment recording prior to longwall mining. ▪ Monitoring during subsidence (if in agreement with landholder) ▪ Final assessment recording 12 months after undermining or final subsidence movement at the site.	▪ Building/structure condition ▪ Heritage value

** Analytes tested for only when gas release observed*

Table 1.2: Appin Area 7 Environment (Trigger, Action, Response, Plan) TARP

Monitoring	Trigger	Action
WATER QUALITY		
Nepean River Impact monitoring sites adjacent to each Longwall: ▪ NR11 ▪ NR12 ▪ NR13 ▪ NR20 ▪ NR30 Refer Figure 1a ***Notes:*** *Baseline upriver sites will be used for cross-checking for upriver perturbations*[3] *Baseline Upriver site NR2 data to be updated at end of panel following completion of each longwall, subject to checks-for, and discard-of upriver perturbed data*	***Level 1 (Within Prediction)***[1] Impact monitoring sites: ▪ pH reduction greater than 1 standard deviation but less than 2 standard deviation from pre-mining mean resulting from the mining for two consecutive months ▪ DO reduction greater than 1 standard deviation but less than 2 standard deviation from pre-mining mean resulting from the mining for two consecutive months ▪ Identification of strata gas plume of flow rate < 3000 L/min [2]	▪ Continue monitoring program ▪ Report impacts to key stakeholders ▪ Summarise impacts and record
	Level 2 (Within Prediction – CMAs may be required)[1] Impact monitoring sites: ▪ pH reduction greater than 2 standard deviation from pre-mining mean resulting from the mining for two consecutive months ▪ DO reduction greater than 2 standard deviation from pre-mining mean resulting from the mining for two consecutive months ▪ EC, total Fe and total Mn increases greater than 2 standard deviation from pre-mining mean resulting from the mining for two consecutive months ▪ Identification of strata gas plume of flow rate >3000 L/min[2]	▪ Actions as stated for Level 1 plus: ▪ Review monitoring program ▪ Notify relevant specialists (BHPBIC) and develop and implement remedial action if necessary *Strata Gas Emission Plume:* ▪ Estimate gas emission flow rates. Re-estimate should significant change be observed ▪ Take sample of plume (if possible) for: - chemical composition - dissolved methane from exactly above gas plume and at established downriver monitoring sites - dissolved sulfide and total phenols from exactly above gas plume and at nearest downriver monitoring site(s)
	Level 3 (CMAs likely to be required)[1] Impact monitoring sites: ▪ Level 2-type reduction in water quality resulting from the mining observed for more than 6 consecutive months	▪ Actions as stated for Level 2 plus: ▪ Immediately notify OEH, D&PI, NoW & DRE and any other relevant specialist. ▪ Consultation with stakeholders. ▪ Collect laboratory samples and analyse for: - pH, EC, Total Fe and Mn - Suite of Filterable metals. - Dissolved methane, sulfide and total phenols (if relevant). ▪ Develop site management measures as soon as practically possible (pending stakeholder availability) and seek any approvals required to implement
	Exceeding Prediction ▪ More than negligible gas releases	▪ *Actions as stated for Level 3* ▪ Investigate reasons for the exceedance ▪ Update future predictions based on the outcomes of the investigation

Monitoring	Trigger	Action
WATER LEVEL AND FLOW		
Nepean River ▪ Visual observations along the length of the Nepean River within the active mining area	***Level 1 (Within Prediction)***[(1)] ▪ Observation of areas of dry and/or flooded riverbed in comparison to pre-mining baseline observations and flows, for less than 2 consecutive months.	▪ Continue monitoring program ▪ Report impacts to key stakeholders ▪ Summarise impacts and record
	Level 2 (Within Prediction – CMAs may be required)[(1)] ▪ Observation of areas of dry and/or flooded riverbed in comparison to pre-mining baseline observations and flows, for more than 2 consecutive months.	▪ *Actions as stated for Level 1* ▪ Review monitoring program ▪ Notify relevant technical specialists and seek advice on any CMA required ▪ Implement agreed CMAs as approved
	Level 3 (CMAs likely to be required)[(1)] ▪ Observation of areas of dry and/or flooded riverbed in comparison to pre-mining baseline observations and flows, for more than 6 consecutive months.	▪ *Actions as stated for Level 2* ▪ Immediately notify relevant government agencies, other resource managers and relevant technical specialists and seek advice on any CMA required. ▪ Site visits with stakeholders if required ▪ Develop site CMA in consultation with key stakeholders within 1 month. ▪ Completion of works following approvals ▪ Issue CMA report within 1 month of works completion ▪ Conduct initial follow up monitoring & reporting within 2 months of CMA completion if required ▪ Review the relevant TARP and Management Plan in consultation with key stakeholders
APPEARANCE		
Nepean River ▪ Visual observations along the length of the Nepean River within the active mining area	***Level 1 (Within Prediction)***[(1)] ▪ Identified iron staining resulting from the mining for two consecutive months ▪ Identified water cloudiness resulting from the mining for two consecutive months	▪ Continue monitoring program ▪ Report impacts to key stakeholders ▪ Summarise impacts and record
	Level 2 (Within Prediction – CMAs may be required)[(1)] ▪ Iron staining greater than baseline monitoring resulting from the mining for two consecutive months ▪ Water cloudiness greater than baseline monitoring resulting from the mining for two consecutive months	▪ *Actions as stated for Level 1* ▪ Review monitoring program ▪ Notify relevant technical specialists and seek advice on any CMA required ▪ Implement agreed CMAs as approved

Monitoring	Trigger	Action
	Level 3 (CMAs likely to be required) [1] ▪ Iron staining greater than baseline monitoring resulting from the mining for six consecutive months ▪ Water cloudiness greater than baseline monitoring resulting from the mining for six consecutive months	▪ *Actions as stated for Level 2* ▪ Immediately notify relevant government agencies, other resource managers and relevant technical specialists and seek advice on any CMA required. ▪ Site visits with stakeholders if required ▪ Develop site CMA in consultation with key stakeholders within 1 month. ▪ Completion of works following approvals ▪ Issue CMA report within 1 month of works completion ▪ Conduct initial follow up monitoring & reporting within 2 months of CMA completion if required ▪ Review the relevant TARP and Management Plan in consultation with key stakeholders
	Exceeding Prediction ▪ More than negligible iron staining resulting from the mining ▪ More than negligible increase in water cloudiness resulting from the mining	▪ *Actions as stated for Level 3* ▪ Investigate reasons for the exceedance ▪ Update future predictions based on the outcomes of the investigation
Ephemeral Watercourses ▪ Upper Harris Creek (HC10) ▪ Foot Onslow Creek (FO1) ▪ Navigation Creek (NAV1) Visual observations at water quality monitoring sites and along the length of the stream within the active mining area where landholder access is granted	***Level 1 (Within Prediction)*** [1] ▪ Fracturing with no observable loss of surface water flow ▪ Fracturing with no reduction in pool water level when compared to similar environmental conditions in baseline period ▪ Increase in turbidity, iron staining, algal growth, or other visible water quality parameters resulting from the mining for two consecutive months determined by comparing baseline photos with photos during the mining period	▪ Continue monitoring program ▪ Report impacts to key stakeholders ▪ Summarise impacts and record
	Level 2 (Within Prediction – CMAs may be required) [1] ▪ Fracturing resulting in loss of surface flow in some creeks or tributary ▪ Fracturing resulting in water loss from some permanent pools ▪ Reduced water retention time in pools ▪ Increase in turbidity, iron staining, algal growth, or other visible water quality parameters resulting from the mining for two consecutive months determined by comparing baseline photos with photos during the mining period	▪ *Actions as stated for Level 1* ▪ Review monitoring program ▪ Notify relevant technical specialists and seek advice on any CMA required ▪ Implement agreed CMAs as approved

Monitoring	Trigger	Action
	Level 3 (CMAs likely to be required) [1] ▪ Fracturing resulting in total loss of surface flow in all sections of a creek or tributary ▪ Fracturing resulting in total water loss from all permanent pools in the mining area ▪ Reduced water retention time in all pools in the mining area	▪ *Actions as stated for Level 2* ▪ Immediately notify relevant government agencies, other resource managers and relevant technical specialists and seek advice on any CMA required. ▪ Site visits with stakeholders if required ▪ Develop site CMA in consultation with key stakeholders within 1 month. ▪ Completion of works following approvals ▪ Issue CMA report within 1 month of works completion ▪ Conduct initial follow up monitoring & reporting within 2 months of CMA completion if required ▪ Review the relevant TARP and Management Plan in consultation with key stakeholders
	Exceeding Prediction ▪ Fracturing of controlling rockbars and/or stream bed, resulting in the diversion of all stream flow in the mining area ▪ Increased leakage from all pools in the mining area	▪ *Actions as stated for Level 3* ▪ Investigate reasons for the exceedance ▪ Update future predictions based on the outcomes of the investigation
Water Pumps ▪ There are six pumps in the Nepean River which will be monitored for the effects from subsidence: - Pump 1 - Pump 2 - Pump 3 - Pump 4 - Pump 5 - Pump 6	▪ Pump not functioning due to physical disturbance from subsidence	▪ Continue monitoring program ▪ Report impacts to key stakeholders ▪ Summarise impacts and record ▪ Develop and implement CMA (if required) in consultation with key stakeholders
AQUATIC ECOLOGY		
Nepean River ▪ Sites 5 and 6 (located adjacent to Longwalls 705 and 706 downstream of the confluences with Mallaty and Ouesdale Creeks)	***Level 1 (Within Prediction)*** [1] ▪ 1 season reduction in aquatic habitat resulting from the mining when comparing to baseline condition	▪ Continue monitoring program ▪ Report impacts to key stakeholders ▪ Summarise impacts and record

Monitoring	Trigger	Action
▪ Sites 7 and 8 (located downstream of all proposed Longwalls 701-710) **Ephemeral Watercourses** ▪ Sites F1 and F2 (located on Foot Onslow Creek, over Longwalls 708 and 710) ▪ Site N1 (located on Navigator Creek northeast of Longwall 710) ▪ General observation of all other watercourses in active mining areas Refer Figure 20.1 in LW705-710 SMP	***Level 2 (Within Prediction – CMAs may be required)*** [1] ▪ 2 consecutive season reduction in aquatic habitat resulting from the mining when comparing to baseline condition	▪ *Actions as stated for Level 1* ▪ Review monitoring program ▪ Notify relevant technical specialists and seek advice on any CMA required ▪ Implement agreed CMAs as approved
	Level 3 (CMAs likely to be required) [1] ▪ Reduction in aquatic habitat resulting from the mining for > 2 consecutive seasons or complete loss of habitat	▪ *Actions as stated for Level 2* ▪ Immediately notify relevant government agencies, other resource managers and relevant technical specialists and seek advice on any CMA required. ▪ Site visits with stakeholders if required ▪ Develop site CMA in consultation with key stakeholders within 1 month. ▪ Completion of works following approvals ▪ Issue CMA report within 1 month of works completion ▪ Conduct initial follow up monitoring & reporting within 2 months of CMA completion if required ▪ Review the relevant TARP and Management Plan in consultation with key stakeholders
	Exceeding Prediction ▪ More than negligible environmental consequences for a threatened species, threatened population or endangered ecological community	▪ *Actions as stated for Level 3* ▪ Investigate reasons for the exceedance ▪ Update future predictions based on the outcomes of the investigation
GROUNDWATER		
Water Level IC monitoring bores: ▪ NGW3 ▪ NGW4 ▪ NGW6 ▪ NGW5 ▪ EAW5 ▪ EAW7 (S1936) Private Bores ▪ Registered bores and any new bores within the SMP area	***Level 1 (Within Prediction)*** [1] ▪ Up to an additional 2.5m reduction from the predicted standing water level or pressure (outside of pumping influences) over 2 consecutive months	▪ Continue monitoring program ▪ Report impacts to key stakeholders ▪ Summarise impacts and record
	Level 2 (Within Prediction – CMAs may be required) [1] ▪ Between 2.5m and 5m additional reduction from the predicted standing water level or pressure (outside of pumping influences) over 2 consecutive months	▪ *Actions as stated for Level 1* ▪ Review monitoring program ▪ Notify relevant technical specialists and seek advice on any CMA required ▪ Implement agreed CMAs as approved

Monitoring	Trigger	Action
Notes: *Impact monitoring data during longwall mining is compared to predicted groundwater levels from the BSOP (or later updates) groundwater model, during preparation of the End of Panel Report* *Privately owned water supplies are monitored as agreed with landowners in the Built Feature Management Plans* Refer Figure 1a	***Level 3 (CMAs likely to be required)*** [1] ▪ Greater than 5m of additional reduction from the predicted standing water level or pressure (outside of pumping influences) over 2 consecutive months ▪ Privately owned water supply adversely impacted from the mining (other than impact that is negligible)	▪ *Actions as stated for Level 2* ▪ Immediately notify relevant government agencies, other resource managers and relevant technical specialists and seek advice on any CMA required. ▪ Site visits with stakeholders if required ▪ Develop site CMA in consultation with key stakeholders within 1 month. ▪ Completion of works following approvals ▪ Issue CMA report within 1 month of works completion ▪ Conduct initial follow up monitoring & reporting within 2 months of CMA completion if required ▪ Review the relevant TARP and Management Plan in consultation with key stakeholders ▪ Compensatory water supply measures must be provided as an alternative long-term supply that is equivalent to the loss attributed to the mining impact, and be provided (at least on an interim basis) within 24 hours of the loss being identified.
Water Quality IC monitoring bores ▪ NGW6 ▪ NGW5 Private Bores ▪ Registered bores and any new bores within the SMP area (where water quality samples can be taken)	***Level 1 (Within Prediction)*** [1] ▪ Groundwater quality reduction greater than 1 standard deviation but less than 2 standard deviation from pre-mining mean resulting from the mining for two consecutive months	▪ Continue monitoring program ▪ Report impacts to key stakeholders ▪ Summarise impacts and record
	Level 2 (Within Prediction – CMAs may be required) [1] ▪ Groundwater quality reduction greater than 2 standard deviation from pre-mining mean resulting from the mining for two consecutive months	▪ *Actions as stated for Level 1* ▪ Review monitoring program ▪ Notify relevant technical specialists and seek advice on any CMA required ▪ Implement agreed CMAs as approved
	Level 3 (CMAs likely to be required) [1] ▪ Level 2-type reduction in water quality resulting from the mining observed for more than 6 consecutive months	▪ *Actions as stated for Level 2* ▪ Immediately notify relevant government agencies, other resource managers and relevant technical specialists and seek advice on any CMA required. ▪ Site visits with stakeholders if required ▪ Develop site CMA in consultation with key stakeholders within 1 month. ▪ Completion of works following approvals ▪ Issue CMA report within 1 month of works completion ▪ Conduct initial follow up monitoring & reporting within 2 months of CMA completion if required ▪ Review the relevant TARP and Management Plan in consultation with key stakeholders ▪ Compensatory water supply measures must be provided as an alternative long-term supply that is equivalent to the loss attributed to the mining impact, and be provided (at least on an interim basis) within 24 hours of the loss being identified

Monitoring	Trigger	Action
Mine Water Inflows	***Level 1 (Within Prediction)*** [1] ▪ Abnormal rise in water flow from the goaf between 2.7 and 3ML/day (over 20 day average)	▪ Continue monitoring program ▪ Report impacts to key stakeholders ▪ Summarise impacts and record
	Level 2 (Within Prediction – CMAs may be required) [1] ▪ Abnormal rise in water flow from the goaf between 3 and 3.4ML/day (over 20 day average)	▪ *Actions as stated for Level 1* ▪ Review monitoring program ▪ Notify relevant technical specialists and seek advice on any CMA required ▪ Implement agreed CMAs as approved
	Level 3 (CMAs likely to be required) [1] ▪ Abnormal rise in water flow from the goaf >3.4ML/day (over 20 day average)	▪ *Actions as stated for Level 2* ▪ Immediately notify relevant government agencies, other resource managers and relevant technical specialists and seek advice on any CMA required. ▪ Site visits with stakeholders if required ▪ Develop site CMA in consultation with key stakeholders within 1 month. ▪ Completion of works following approvals ▪ Issue CMA report within 1 month of works completion ▪ Conduct initial follow up monitoring & reporting within 2 months of CMA completion if required ▪ Review the relevant TARP and Management Plan in consultation with key stakeholders
LANDSCAPE FEATURES		
Cliffs ▪ Along Nepean Gorge **Steep Slopes** ▪ Along Nepean Gorge, associated tributaries and above western end of the proposed Longwalls Refer Figure 19.1 in LW705-710 SMP	***Level 1 (Within Prediction)*** [1] ▪ Any rock fall, displacement, dislodgement of boulders or slabs or fracturing of a cliff line flanking the Nepean River resulting from mining ▪ Erosion resulting from mining localised to a small area that should naturally stabilise within the monitoring period ▪ Surface movement resulting from mining with no more than negligible soil surface exposed	▪ Continue monitoring program ▪ Report impacts to key stakeholders ▪ Summarise impacts and record
	Level 2 (Within Prediction – CMAs may be required) [1] ▪ Any rock falls, displacements, dislodgements of boulders or slabs or fracturing of a cliff line(s) flanking the Nepean River resulting from mining that in total impacts 0.3% of the total cliff line face area of the mining domain. ▪ Erosion resulting from mining likely to naturally stabilise within the monitoring period. ▪ Surface movement or rock displacement resulting from mining with no more than minor soil surface exposed	▪ *Actions as stated for Level 1* ▪ Review monitoring program ▪ Notify relevant technical specialists and seek advice on any CMA required ▪ Implement agreed CMAs as approved

Monitoring	Trigger	Action
	Level 3 (CMAs likely to be required) [1] ▪ Any rock falls, displacements, dislodgements of boulders or slabs or fracturing of a cliff line(s) flanking the Nepean River resulting from mining that in total impacts up to 0.5% of the total cliffline face area of the mining domain. ▪ Any rock falls, displacements, dislodgements of boulders or slabs or fracturing of a cliffline(s) flanking the Nepean River resulting from mining that in total impacts 0.4% of the total cliffline face area of the mining domain after 1 longwall. ▪ Mass movement of a slope causing large areas of exposed soil ▪ Any form of rockfall or erosion that poses a threat to public safety	▪ *Actions as stated for Level 2* ▪ Immediately notify relevant government agencies, other resource managers and relevant technical specialists and seek advice on any CMA required. ▪ Site visits with stakeholders if required ▪ Develop site CMA in consultation with key stakeholders within 1 month. ▪ Completion of works following approvals ▪ Issue CMA report within 1 month of works completion ▪ Conduct initial follow up monitoring & reporting within 2 months of CMA completion if required ▪ Review the relevant TARP and Management Plan in consultation with key stakeholders
▪ Cliffs flanking the Nepean River	***Exceeding Prediction*** ▪ More than negligible environmental consequences (that is occasional rockfalls, displacement or dislodgement of boulders or slabs, or fracturing, that in total impacts more than 0.5% of the total face area of such cliffs within the Longwall mining domain) ▪ Rockfall or erosion that poses more than a negligible increased risk to public safety	▪ *Actions as stated for Level 3* ▪ Investigate reasons for the exceedance ▪ Update future predictions based on the outcomes of the investigation
TERRESTRIAL ECOLOGY		
Monitored in conjunction with general observational monitoring for the Nepean River, ephemeral watercourses and active mining area	***Level 1 (Within Prediction)*** [1] ▪ Vegetation impacted by mining (by rockfalls, soil slippage, gas emissions) that is likely to naturally regenerate within the monitoring period	▪ Continue monitoring program ▪ Report impacts to key stakeholders ▪ Summarise impacts and record
	Level 2 (Within Prediction – CMAs may be required) [1] ▪ Vegetation impacted by mining (by rockfalls, soil slippage, gas emissions) that is unlikely to naturally regenerate within the monitoring period	▪ *Actions as stated for Level 1* ▪ Review monitoring program ▪ Notify relevant technical specialists and seek advice on any CMA required ▪ Implement agreed CMAs as approved

Monitoring	Trigger	Action
	Level 3 (CMAs likely to be required) [1] ▪ Vegetation impacted by mining that is not responding to CMAs	▪ *Actions as stated for Level 2* ▪ Immediately notify relevant government agencies, other resource managers and relevant technical specialists and seek advice on any CMA required. ▪ Site visits with stakeholders if required ▪ Develop site CMA in consultation with key stakeholders within 1 month. ▪ Completion of works following approvals ▪ Issue CMA report within 1 month of works completion ▪ Conduct initial follow up monitoring & reporting within 2 months of CMA completion if required ▪ Review the relevant TARP and Management Plan in consultation with key stakeholders
	Exceeding Prediction ▪ More than negligible environmental consequences on threatened species, threatened populations, or endangered ecological communities	▪ *Actions as stated for Level 3* ▪ Investigate reasons for the exceedance ▪ Update future predictions based on the outcomes of the investigation
ABORIGINAL ARCHAEOLOGY		
▪ Nepean River 4 (52-2-2098) ▪ Nepean River 5 (52-2-2097) ▪ Nepean River 6 (52-2-2095) ▪ Nepean River 7 (52-2-2096) ▪ Nepean River 8 (52-2-2239) ▪ Upper Nepean Hand Stencils ▪ Bulli Site 40 (BS 40) Any other newly identified Aboriginal Archaeology sites Refer to Figure 5-22 of Bulli Seam Operations EA and Figure 3 Bulli Seam Operations Appendix G (Aboriginal Cultural Heritage Assessment)	***Level 1 (Within Prediction)*** [1] ▪ Change in shelter conditions not attributable to natural weathering or preservation – mineral growth or micro-organism growth (as observed by comparing pre-mining photographs with post-subsidence/mining photographs) ▪ Changes external to the shelter that affect the site context – ground cracking, boulder slumping, rock and/or tree falls	▪ Continue monitoring program ▪ Report impacts to key stakeholders ▪ Summarise impacts and record
	Level 2 (Within Prediction – CMAs may be required) [1] ▪ Change in shelter conditions not attributable to natural weathering or preservation – change in drip line or seepage, cracking or exfoliation of overhang or shelter, movement or opening of existing planes and joints at panel, block fall within shelter or overhang	▪ *Actions as stated for Level 1* ▪ Review monitoring program ▪ Notify relevant technical specialists and seek advice on any CMA required ▪ Implement agreed CMAs as approved
	Level 3 (CMAs likely to be required) [1] ▪ Shelter or overhang collapse not attributable to natural weathering ▪ Level 2 impacts at greater frequency than predicted ▪ Level 2 impacts attributable to mining remote from the mining area	▪ *Actions as stated for Level 2* ▪ Immediately notify relevant government agencies, other resource managers and relevant technical specialists and seek advice on any CMA required. ▪ Site visits with stakeholders if required ▪ Develop site CMA in consultation with key stakeholders within 1 month. ▪ Completion of works following approvals ▪ Issue CMA report within 1 month of works completion ▪ Conduct initial follow up monitoring & reporting within 2 months of CMA completion if required ▪ Review the relevant TARP and Management Plan in consultation with key stakeholders

Monitoring	Trigger	Action
▪ Sites determined to hold high or moderate significance as a result of studies required for Extraction Plans	***Exceeding Prediction*** ▪ More than 10% of such sites across the mining area are affected by subsidence impacts (other than negligible impacts or environmental consequence)	▪ *Actions as stated for Level 3* ▪ Investigate reasons for the exceedance ▪ Update future predictions based on the outcomes of the investigation
▪ Other Aboriginal heritage sites	▪ Less than 10% of such sites (or 1 such site, whichever is the greater) within any longwall mining domain are/is affected by subsidence impacts (other than minor impacts or environmental consequence)	
HISTORIC HERITAGE		
▪ Buildings or structures of identified heritage significance ***Note:*** *Detailed Heritage Management Plans to be developed prior to any heritage item being influence by mining.*	***Exceeding Prediction*** ▪ Loss of heritage value greater than predicted under the Heritage Management Plan	▪ Continue monitoring program ▪ Report impacts to key stakeholders ▪ Summarise impacts and record ▪ Immediately notify relevant government agencies, other resource managers and relevant technical specialists and seek advice on any CMA required. ▪ Site visits with stakeholders if required ▪ Develop site CMA in consultation with key stakeholders within 1 month. ▪ Completion of works following approvals ▪ Issue CMA report within 1 month of works completion ▪ Conduct initial follow up monitoring & reporting within 2 months of CMA completion if required ▪ Review the relevant TARP and Management Plan in consultation with key stakeholders ▪ Investigate reasons for the exceedance ▪ Update future predictions based on the outcomes of the investigation

(1) These may be revised in consultation with DoPI and DPI and other key stakeholders

(2) If strata gas emission plumes are detected – particularly coinciding with low river flow and significant gas evolution

(3) Baseline upriver sites for cross-checking for upriver perturbations impacting Area 7 monitoring sites:

- NR0 - possible perturbations from Allens Creek (>2 standard deviation)
- NR2 - upstream perturbations (>2 standard deviations) pre-Area 9 mining
- New site NR110 - possible perturbations from Area 9 (>2 standard deviations) post-Area 9 mining commencement
- Checks at Upriver sites NR4, NR5 and NR6 for possible Cataract River-based perturbations (>2 standard deviation)

Current values:

Level 1

NR11
- pH>6.93;<7.33
- DO>47.8%;<66.0%
- EC>561 uS/cm;<758 uS/cm
- Total Fe>0.589;<0.866mg/L
- Total Mn>0.044;<0.074 mg/L

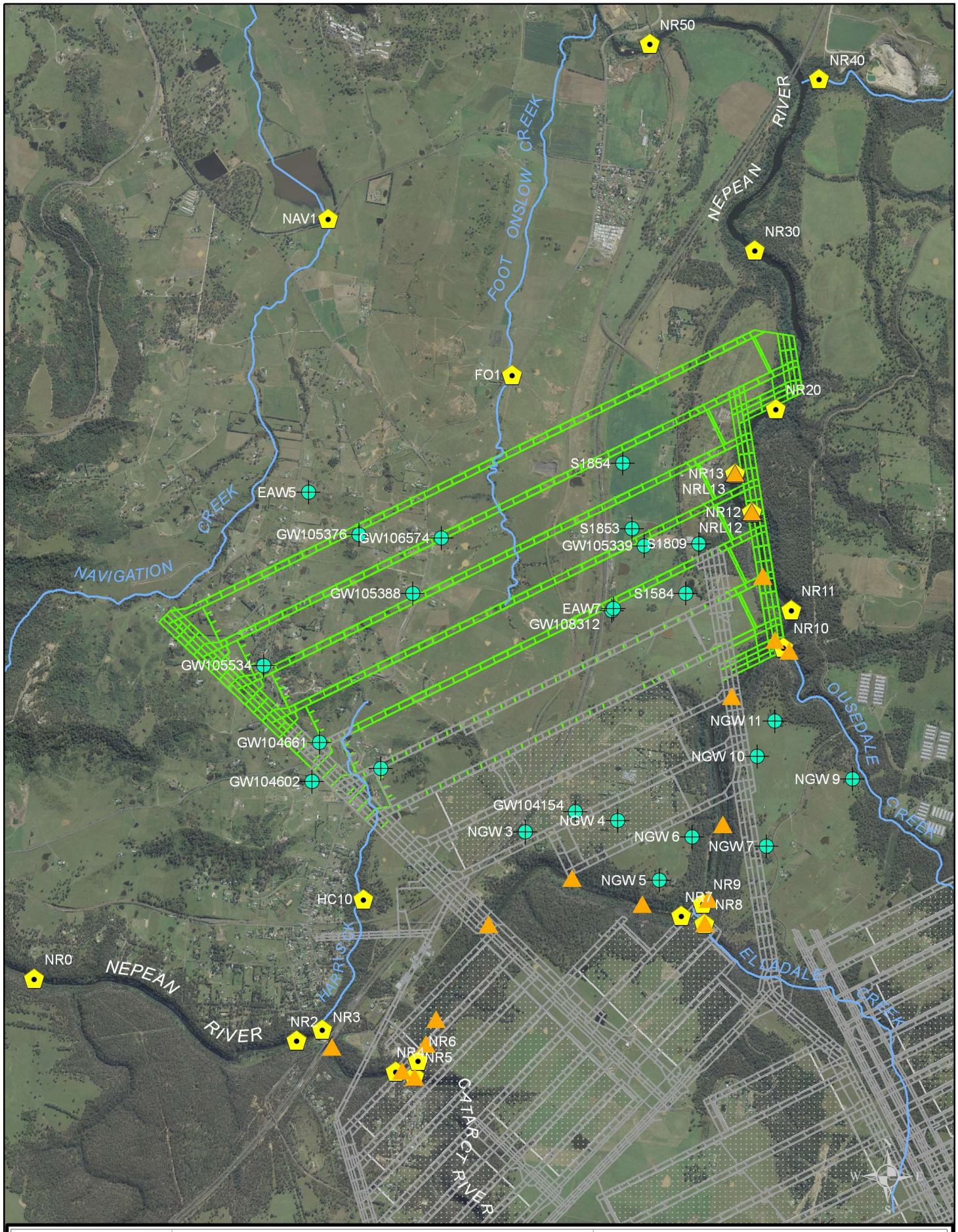
NR2 upstream normality checks
- pH>7.01
- DO>55.3%
- EC<890 uS/cm
- Total Fe<1.220 mg/L
- Total Mn<0.090 mg/L

Level 2 and 3

NR11
- pH<6.93
- DO<47.8%
- EC>758 uS/cm
- Total Fe>0.866
- Total Mn>0.074

NR2 upstream normality checks
- pH>7.01
- DO>55.3%
- EC<890 uS/cm
- Total Fe<1.220 mg/L
- Total Mn<0.090 mg/L

The above data values are updated during the preparation of each End of Panel Report



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Illawarra Coal

Legend

- Water Quality Sites
- Groundwater Bores
- Proposed Longwalls
- Pool Level
- Appin Workings

Appin Area 7

SURFACE AND GROUNDWATER MONITORING LOCATIONS

0 250 500 1,000 1,500
Metres

Date: June 2012
Horizontal Datum
MGA - Zone 56