Master Trigger Action Response Plan

Trigger Action Response Plan - Water Management Plan

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Impact to pool water level	AUTOMATED POOL WATER LEVEL **Locations** (refer to Figure 5-2) Impact sites: • Cedar Creek (CA, CB, CD, CE and CG) • Matthews Creek (ME, MG) • Stonequarry Creek (SA, SD, SF) • SR17 (SB, SC2) Control sites: • Cedar Creek (Cedar US, CCR, CC1A) • Matthews Creek (MB) • Stonequarry Creek (SE, SG) **Frequency** Pre-mining – Continuous record, data downloaded monthly. Baseline data recorded since October 2018 in the Western Domain at the majority of Western Domain sites. During mining - Continuous record, data downloaded monthly. Post mining - Continuous record, data downloaded monthly for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details). MANUAL POOL WATER LEVEL **Locations** Impact sites: • Cedar Creek (CC, CF) • Matthews Creek (MC, MD U/S (upstream), MF) Control sites: • Matthews Creek (MA) • Stonequarry Creek (SC) **Frequency** Pre-mining - Monthly manual level reading. Visual inspection of natural drainage behaviour using photo points. Baseline data recorded since October 2018 in the Western Domain. During mining - Monthly manual level reading. Visual inspection of natural drainage behaviour using photo points. Post mining - Monthly manual level reading and visual inspection of natural drainage behaviour using photo points for 12 months following the completion of LW W2. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details).	Level 1		
		• The recorded water level has not declined below the recorded baseline minimum level (in one 24 hour period for automated pool water level). OR • The recorded water level has declined below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level) but the decline is due to a monitoring or sensor error or the magnitude of the decline (below the recorded baseline minimum level) is within the range of sensor accuracy.	• Continue monitoring as per monitoring program. • Continue monthly review of data.	• No response required.
		Level 2		
		• The recorded water level has declined below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level). AND • The above has occurred at one of the upstream pools (beyond mining effects).	• Continue monitoring as per monitoring program. • Continue monthly review of data. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by Environmental Response Group.
		Level 3		
		• The recorded water level has declined, although not atypically^, below the recorded baseline minimum level (for more than one 24 hour period for automated pool water level). AND • The above has not occurred at one of the upstream pools (beyond mining effects).	• Continue monitoring as per monitoring program. • Continue monthly review of data. • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by Environmental Response Group. • Consider increasing download and review of data frequency to fortnightly for sites where Level 3 has been reached. • Review manual water level measurements for additional monitoring sites to identify potential spatial trends in water level decline.
		Level 4		
		• The recorded water level has declined atypically^ below the previously recorded minimum level (for more than one 24 hour period for automated pool water level). AND • Similar behaviour has not occurred at one of the upstream pools (beyond mining effects).	• Increase download and review of data frequency to fortnightly for sites where Level 4 has been reached. • Continue monthly download and review of data for all other sites. • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends. • Convene Tahmoor Coal Environmental Response Group to undertake an investigation to assess if the change in behaviour is related to LW W3-W4 mining effects, other catchment changes or the prevailing climate.	• Report to DPIE and relevant government agencies within 7 days of investigation completion (according to Table 6-1 of the Extraction Plan Main Document). • Conduct detailed investigation of surface water level decline including review and assessment of streamflow records for downstream monitoring sites in comparison with suitable reference sites. • Review manual water level measurements for additional monitoring sites to identify potential spatial trends in water level decline. • If it is concluded that there has been a mining-related impact then implement a corrective management action plan in accordance with a

				timeframe as recommended by the Environmental Response Group in consultation with the Resources Regulator (refer to Section 6.2.2 of the WMP).

Footnotes:

^ ‘Atypical’ surface water characteristics relate to a notable and / or rapid water level decline or change in the slope of the falling limb of the hydrograph or the water level recessionary behaviour below the CTF level which is inconsistent with baseline conditions and cannot be attributed to climatic conditions.

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Impact to physical features and natural behaviour of pools	VISUAL INSPECTIONS **Locations** Baseline / Impact sites - Stream reaches of Cedar Creek, Matthews Creek and Stonequarry Creek including SR17 within the Study Area (refer to Figure 5-1 in the Water Management Plan). Reference / Control sites - Stream reaches of Cedar Creek, Matthews Creek and Stonequarry Creek outside of the Study Area (refer to Figure 5-1 in the Water Management Plan). **Frequency** Pre-mining- Observations prior to mining using fixed location photo points. Baseline data first recorded in 2014, and in November 2019 prior to mining. During mining – Observations every month during active subsidence period excluding SR17** (after 200 m of secondary extraction of LW W3-W4), for sites within and adjacent to active subsidence zone*, by Tahmoor Coal using fixed location photo points. Reduce frequency of observations to 2-monthly after 1,000 m of extraction of LW W3-W4 for sections of valleys that are located behind the active subsidence zone unless continuing adverse changes are observed. Post mining - Observations using fixed location photo points on a 3-monthly basis for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details). **Note: Refer to Stonequarry Creek Rockbar Management Plan for visual inspections of pools at SR17	Level 1		
		• No observed impacts to pool level, drainage or overland connected flow.	• Continue monthly monitoring. • Continue monthly review of data.	• No response required.
		Level 2		
		• Visually observed reduction in pool level, drainage or overland connected flow. AND • The above has occurred at one of the upstream pools (beyond mining effects). OR • Visual monitoring of pools has not noted any mining related impacts¥.	• Continue monitoring as per monitoring program. • Continue monthly review of data. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by Environmental Response Group.
		Level 3		
		• Rock bar and/or stream base cracking, gas release, or iron precipitation noted during visual inspection (in excess of baseline conditions). AND • No reduction in pool water level, drainage or overland connected flow, taking into account climatic conditions and observations during baseline monitoring period.	• Continue monitoring as per monitoring program. • Continue monthly review of data. • Convene Tahmoor Coal Environmental Response Group to undertake an investigation to assess if the change in behaviour is related to LW W3-W4 mining effects, other catchment changes or the prevailing climate.	• As defined by Environmental Response Group. • Consider increasing inspection and review of data frequency to fortnightly for sites where Level 3 has been reached.
		Level 4		
		• Visually observed reduction in pool water level, drainage or overland connected flow, taking into account climatic conditions and observations during baseline monitoring period. AND • The above change has not occurred at one of the upstream pools (beyond mining effects).	• Increase inspection and review of data frequency to fortnightly for sites where Level 4 has been reached. • Continue monthly download and review of data for all other sites. • Convene Tahmoor Coal Environmental Response Group to undertake an investigation to assess if the change in behaviour is related to LW W1-W2 mining effects, other catchment changes or the prevailing climate. • Conduct visual inspection of downstream reaches beyond mining effects to identify if flow re-emergence is occurring. • If flow re-emergence sites are located, implement water quality monitoring at these location(s).	• Report to DPIE and relevant agencies within 7 days of investigation completion (according to Table 6-1 of the Extraction Plan Main Document). • Conduct detailed investigation of surface water level decline including review and assessment of streamflow records for downstream monitoring sites in comparison with suitable reference sites. • If it is concluded that there has been a mining-related impact then implement a corrective action management plan in accordance with a timeframe as recommended by the Environmental Response Group in consultation with the Resources Regulator (refer to Section 6.2.2 of the WMP).

Footnotes:

* Survey area to include upstream pools (beyond mining effects) where a potential Level 4 TARP trigger has occurred at an impact site(s).

¥ Rockbar and/or stream base cracking, or gas release, iron precipitation in excess of baseline conditions.

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Impact to flood levels	FLOOD LEVELS **Locations** All dwellings within the 1% AEP flood extent **Frequency** Pre-mining – Pre-mine modelling (using surveyed pre-mine topography) to estimate 1% AEP flood levels and extents in areas potentially impacted by subsidence. Pre-mining modelling was completed in May 2019. Post mining and subsidence - Post-mine modelling (using surveyed post-mine topography) to estimate 1% AEP flood levels and extents in areas potentially impacted by subsidence.	Level 1		
		• No dwellings that were outside the pre-mine 1% AEP flood extent are within the post-mine 1% AEP flood extent.	• No action required.	• No response required.
		Level 4		
		• Subsidence results in the post-mining 1% AEP flood level being above the floor level of one or more dwellings.	• Provide up-to-date predicted flood information (including actual subsidence and flooding predictions) to the State Emergency Service, Wollondilly Shire Council and landowners.	• Negotiate remediation or compensation with landowners.

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Impacts to dams	PRIVATE DAMS **Locations** Identified farm dams within the Study Area **Frequency** Pre-mining - Dam embankment integrity and water level observation by a geotechnical consultant every month for at least two months immediately prior to undermining using fixed location photo points. During mining - Dam embankment integrity and water level observation every week during active subsidence period using fixed location photo points by Tahmoor Coal; and every month during the active subsidence period using fixed photo points by a geotechnical consultant. Post mining - Dam embankment integrity and water level observation using fixed location photo points on a 3-monthly basis for 12 months following the completion of LW W2. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details).	Level 1		
		• No cracks develop within dam wall (i.e. other than natural desiccation cracking).	• Continue monitoring in accordance with the monitoring program. • Continue monthly review of data.	• No response required.
		Level 2		
		• Development of isolated cracks (<10 mm wide) within dam wall (i.e. other than natural desiccation cracking).	• Continue monitoring in accordance with the monitoring program. • Continue monthly review of data.	• No response required.
		Level 3		
		• Development of isolated cracks (> 10 mm wide) within the dam wall (i.e. other than natural desiccation cracking); AND / OR • Development of isolated seepage from the face or toe of the farm dam embankment.	• Increase frequency of monitoring of geotechnical consultant to weekly during active subsidence period. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by Environmental Response Group.
		Level 4		
		• Development of persistent longitudinal or arcuate cracking within dam wall > 10 mm; AND / OR • Development of seepage from the face or toe of the farm dam embankment.	• Increase frequency of monitoring of geotechnical consultant to weekly during active subsidence period. • Convene Tahmoor Coal Environmental Response Group to review response. • Erect warning signs where necessary. • Reduce dam water level as recommended by Geotechnical Consultant. • Geotechnical consultant inspection to determine need for further action / investigation.	• Notify relevant Government Agencies and other stakeholders. • Repair cracks and embankment instability at the completion of the active subsidence period by excavation, grouting and re-compaction where practical.

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Stream water quality impact	STREAM WATER QUALITY **Locations** (refer to Figure 5-2) Impact sites: • Cedar Creek (CA, CB, CC, CD, CE, CF, CG) • Matthews Creek (MC1, MG) • Stonequarry Creek (SC2, SC, SD SF) Control sites: • Cedar Creek (Cedar US, CC1) • Matthews Creek (MB) • Stonequarry Creek (SC1, SE, SG) **Frequency** Pre-mining- Monthly sampling for 12 months prior to secondary extraction. Baseline data was recorded at some site during 2014 and all sites since January 2019. During mining - Monthly sampling and analysis. Post mining - Monthly sampling and analysis for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details).	Level 1		
		• The triggers for pH, EC and dissolved metals defined below do not occur, and there is no visual evidence of an increase in iron precipitation that was not observed in the baseline period.	• Continue monitoring as per monitoring program. • Continue monthly review of data.	• No response required.
		Level 2		
		• The trigger for pH, EC or dissolved metals defined below occurs in one month, and there is no visual evidence of an increase in iron precipitation that was not observed in the baseline period.	• Continue monitoring as per monitoring program. • Continue monthly review of data including analysis of water quality trend along creek (upstream to downstream) to identify spatial changes. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by Environmental Response Group.
		Level 3		
		• The trigger for pH, EC or dissolved metals defined below occurs in one month, and there is visual evidence of an increase in iron precipitation that was not observed in the baseline period.	• Continue monitoring as per monitoring program. • Continue monthly review of data to assess if the trigger was exceeded during the baseline period prior to commencement of mining and undertake analysis of water quality trend along creek (upstream to downstream) to identify spatial changes. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by Environmental Response Group. • Consider increasing monitoring and review of data frequency to fortnightly at sites where Level 3 has been reached.
		Level 4		
		Any of the following: • pH: the value* falls below a corresponding control (upstream) site(s) mean minus two standard deviations or the site-specific baseline mean minus two standard deviations (i.e. the sample becomes more acidic) for more than two consecutive months OR the value rises above the corresponding control (upstream) site(s) mean plus two standard deviations or the site-specific baseline mean plus two standard deviations (i.e. the sample becomes more alkaline) for more than two consecutive months. • EC: the value* rises above corresponding control (upstream) site(s) mean plus two standard deviations or the site-specific baseline mean plus two standard deviations for more than two consecutive months. • Dissolved metals: a specific metal or metals laboratory value/s rises above corresponding control (upstream) site(s) mean plus two standard deviations or the site-specific baseline mean plus two standard deviations for more than two consecutive months.	• Increase monitoring and review of data frequency to fortnightly for sites where Level 4 has been reached. • Continue monthly monitoring and review of data for all other sites. • Convene Tahmoor Coal Environmental Response Group to undertake an investigation to assess if the change in behaviour is related to LW W3-W4 mining effects, other catchment changes or the prevailing climate. • Immediately undertake additional water quality sampling and analysis of the site where the trigger has occurred and relevant control sites to confirm results and that the trigger exceedance is continuing. • Undertake an investigation to assess if the change in behaviour is related to LW W3-W4 mining effects (e.g. whether there has been subsidence induced cracking upstream), other catchment changes, unrelated pollution or the prevailing climate.	• Report to DPIE and relevant government agencies within 7 days of investigation completion (according to Table 6-1 of the Extraction Plan Main Document). • Conduct detailed investigation of water quality changes. • If it is concluded that there has been a mining-related impact then implement a corrective action management plan in accordance with a timeframe as recommended by the Environmental Response Group in consultation with the Resources Regulator (refer to Section 6.2.2 of the WMP).

Footnote:

* Field and laboratory records of pH and EC are collected for quality assurance purposes. The field values will be used in the TARP assessment unless erroneous values are identified in which the laboratory values will be adopted in the assessment.

‡ Log transformations (i.e. base 10 logs of the water quality concentrations) will be used to calculate the arithmetic means and standard deviations. Log transformations are commonly applied to concentrations as part of statistical analyses in water resources studies as is evidenced by the following statement from a US Geological Survey publication regarding such analyses: "In order to make an asymmetric distribution become more symmetric, the data can be transformed or re-expressed into new units. These new units alter the distances between observations on a line plot. The effect is to either expand or contract the distances to extreme observations on one side of the median, making it look more like the other side. The most commonly-used transformation in water resources is the logarithm. Logs of water discharge, hydraulic conductivity, or concentration are often taken before statistical analyses are performed." (Helsel and Hirsch, 2002).

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Groundwater Quality at monitoring bores and private groundwater bores.	GROUNDWATER QUALITY – Monitoring bores **Locations** (refer to Figure 3-5) Impact sites – P12, P13, P14, P15, P16, and any additional bore(s) (to be drilled) Control sites – P17 **Frequency** Pre-mining - Field water quality and laboratory analysis monthly (refer to Section 5.2.1 for parameters). During mining - Field water quality and laboratory analysis monthly (refer to Section 5.2.1 for parameters). Post mining - Field water quality and laboratory analysis monthly (refer to Section 5.2.1 for parameters) for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details). GROUNDWATER QUALITY – Private groundwater bores **Locations** (refer to Figure 3-5) Control sites - GW72402, GW105228, GW105467, GW115860 and GW105546 and any other private bores where access is negotiated with landholder. **Frequency** Pre-mining - Field water quality (EC, pH) and iron staining. Pre-mining testing completed during bore census (GeoTerra, 2019). During mining - Field water quality and laboratory analysis on a 3-monthly basis (refer to Section 5.2.1 for parameters). Post mining - Field water quality and laboratory analysis on a 3-monthly basis (refer to Section 5.2.1 for parameters) for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details).	Level 1		
		• No observable change in salinity, pH or metals outside of the baseline variability.	• Continue monitoring program. • Ongoing review of water quality data.	• No response required.
		Level 2		
		• Short term increase (< 3 months) in salinity and/or metals, or change in pH outside of baseline variability*. The effect does not persist after a significant rainfall recharge event. AND/OR • A similar trend or response has been noted at other monitored bores or private groundwater bores.	• Continue monitoring program. • Ongoing review of water quality data. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 3		
		• Short term increase (< 3 months) in salinity and/or metals or change in pH outside of baseline variability*. The effect persists after a significant rainfall recharge event. AND/OR • The change in water quality is determined not to be controlled by climatic or anthropogenic factors.	• Continue monitoring program. • Ongoing review of water quality data and consideration of mining and external stresses (in groundwater monthly report). • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 4		
		• Medium to long term increase in salinity and / or metals or a change in pH outside of baseline variability* with the effect persisting for greater than 3 months or after a significant rainfall recharge event. AND • The reduction in water quality is determined not to be controlled by climatic or anthropogenic factors.	• Continue monitoring and review as per monitoring program. • Continue review of water quality data and consideration of mining and external stresses (in groundwater monthly report). • Convene Tahmoor Coal Environmental Response Group to review response.	• Report to DPIE and relevant government agencies within 7 days of investigation completion (according to Table 6-1 of the Extraction Plan Main Document). • For monitoring bores: If it is concluded that there has been a mining-related impact, then implement an investigation report. • For private groundwater bores: If it is concluded that there has been a mining-related impact, then implement actions in accordance with the make good provisions (Section 6.2.4 of the Water Management Plan) in consultation with the affected landholder.

Footnote:

* The baseline variability was estimated using available data and refers to the proposed trigger levels (refer to Section 6.2.2 and Table 6.2 of the Groundwater Technical Report.

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Groundwater Levels at monitoring bores and private groundwater bores.	GROUNDWATER LEVEL – Monitoring bores **Locations** (refer to Figure 3-5) Impact sites – P12, P13, P14, P15, P16, and any additional bore(s) (to be drilled) Control sites – P17, and possibly P11 **Frequency** Pre-mining - Minimum continuous 24-hourly readings with monthly logger download and dip meter. Baseline data available since May 2019. During mining - Minimum continuous 24-hourly readings with monthly logger download and dip meter. Post mining - Minimum continuous 24-hourly readings with monthly logger download and dip meter for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details). GROUNDWATER LEVEL – Private groundwater bores **Locations** (refer to Figure 3-5) Control sites - GW72402, GW105228, GW105467, GW115860 and GW105546 and any other private bores where access is negotiated with landholder. **Frequency** Pre-mining - Standing Water Level (where available) and yield data. Pre-mining testing completed in bore census (GeoTerra, 2019). During mining - Manual monitoring (flow rate and, where available, standing water level) on a 3-monthly basis. Post mining - Manual monitoring (flow rate and, where available, standing water level) on a 3-monthly basis for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details).	Level 1		
		• Groundwater level remains consistent within baseline variability and/or pre-mining trends, with reductions in groundwater level less than two metres and does not trigger Level 2 to Level 4 Significance Levels (refer to Table 6-2).	• Continue monitoring program. • Ongoing review of water level data.	• No response required.
		Level 2		
		• Greater than 2 m water level reduction following the commencement of extraction at LW W1 (and LW W2, W3, W4) (refer to Table 6-2 for TARP Significance Level 2). AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	• Continue monitoring program. • Ongoing review of water level data. • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 3		
		• Water level declines below the water level of TARP Significance Level 3 (refer Table 6-2, calculated as the average of TARP Significance Level 2 and Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	• Continue monitoring program. • Ongoing review of water level data and consideration of mining and external stresses (in groundwater monthly report). • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends. • Compare against base case and deterministic model scenarios. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 4		
		• Water level reduction greater than the maximum modelled drawdown (refer to Table 6-1 for TARP Significance Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	• Continue monitoring and review as per monitoring program. • Ongoing review of water level data and consideration of mining and external stresses (in groundwater monthly report). • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends. • Convene Tahmoor Coal Environmental Response Group to review response. • Compare against base case and deterministic model scenarios.	• Report to DPIE and relevant government agencies within 7 days of investigation completion (according to Table 6-1 of the Extraction Plan Main Document). • For monitoring bores: If it is concluded that there has been a mining-related impact, then implement an investigation including review and assessment of streamflow records for downstream monitoring sites in comparison with suitable reference sites. • For private groundwater bores: If it is concluded that there has been a mining-related impact, then implement actions in accordance with the make good provisions (Section 6.2.4 of the Water Management Plan) in consultation with DPIE and the affected landholder.

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Shallow Groundwater Pressures at VWPs TNC036, TNC040, WD01 and WD02 (once installed).	GROUNDWATER PRESSURE **Locations** Impact sites – TNC36, WD01 and WD02 (once installed) (refer to Section 5.2.2). Control sites - Groundwater bores/VWPs TNC40 (refer to Figure 3-5). **Frequency** Pre-mining - Minimum continuous 24-hourly readings with monthly logger download. During mining - Minimum continuous 24-hourly readings with monthly logger download. Post mining - Minimum continuous 24-hourly readings with monthly logger download for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details).	Level 1		
		• No observable mining induced change at VWP intakes located at or above (i.e. shallower than) 200 m depth.	• Continue monitoring program. • Ongoing review of water level data.	• No response required.
		Level 2		
		• Greater than 5 m water level reduction in VWP intakes located at or above (i.e. shallower than) 200 m depth following the commencement of extraction at LW W1 (and LW W2, W3 and W4) (refer to Table 6-2 for TARP Significance Level 2). AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	• Continue monitoring program. • Ongoing review of water level data. • Convene with Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 3		
		• Water level declines below the water level of TARP Significance Level 3 (refer Table 6-2, calculated as the average of TARP Significance Level 2 and Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	• Continue monitoring program • Ongoing review of water level data and consideration of mining and external stresses (in groundwater monthly report). • Compare against base case and deterministic model scenarios. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 4		
		• Water level reduction greater than the maximum modelled drawdown (refer to Table 6-2 for TARP Significance Level 4) following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND • The reduction in water level is determined not to be controlled by climatic or anthropogenic factors.	• Continue monitoring and review as per monitoring program. • Ongoing review of water level data and consideration of mining and external stresses (in groundwater monthly report). • Convene Tahmoor Coal Environmental Response Group to review response. • Compare against base case and deterministic model scenarios.	• Report to DPIE and relevant government agencies within 7 days of investigation completion (according to Table 6-1 of the Extraction Plan Main Document). • If it is concluded that there has been a mining-related impact, implement an investigation report.

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Deep Groundwater Pressures at VWPs TNC036.	GROUNDWATER PRESSURE **Locations** Impact site – TNC36 (refer to Figure 3-5). Control site - Groundwater bores/VWPs TNC40 (refer to Figure 3-5). **Frequency** Pre-mining - Minimum continuous 24-hourly readings with monthly logger download. During mining - Minimum continuous 24-hourly readings with monthly logger download. Post mining - Minimum continuous 24-hourly readings for 12 months after LW W4 completed. Monthly logger downloaded for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details).	Level 1		
		• Observed data does not exceed predicted (modelled) impacts at VWP intakes located below (i.e. deeper than) 200 m depth (excluding those monitoring the Bulli Coal Seam).	• Continue monitoring program. • Ongoing review of water level data.	• No response required.
		Level 2		
		• Calculated or observed drawdown (based on 2009-2015 baseline data) for VWP intakes below 200 m depth (excluding those within the Bulli Coal Seam) is within 30 m of predicted (modelled) drawdown.	• Continue monitoring program. • Ongoing review of water level data. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 3		
		• Calculated or observed drawdown (based on 2009-2015 baseline data) for VWP intakes below 200 m depth (excluding those within the Bulli Coal Seam) exceeds predicted (modelled) drawdown by 30 m for a period of 6 months or more.	• Continue monitoring program. • Ongoing review of water level data. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group. • Consider increasing download frequency at groundwater bores where Level 3 has been reached to a fortnightly basis. Consider increasing review frequency to fortnightly.
		Level 4		
		• Calculated or observed drawdown (based on 2009-2015 baseline data) for VWP intakes below 200 m depth (excluding those within the Bulli Coal Seam) exceeds predicted (modelled) drawdown by 30 m for a period of 12 months or more.	• Continue monitoring and review as per monitoring program. • Convene Tahmoor Coal Environmental Response Group to undertake an investigation to assess whether change in behaviour is related to LW W1-W2 mining effects.	• Report to DPIE and relevant government agencies within 7 days of investigation completion (according to Table 6-1 of the Extraction Plan Main Document). • If it is concluded that there has been a mining-related impact, implement an investigation report.

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Groundwater – Surface Water Interaction (Stonequarry Creek)	The aim of this TARP is to provide a leading indicator for potential changes to hydrology in Stonequarry Creek near LW W3, and is considered complementary to other TARPS. The Performance Indicator of flow over the rockbar at SR17 is more directly assessed via other TARPs described above: • Impact to pool water level; and • Impact to physical features & natural behaviour of pools. SURFACE WATER **Location:** Impact site – Monitoring Site SB (Pool SR17) **Frequency** Pre-mining – Continuous record, data downloaded monthly. Baseline data recorded since October 2018 in the Western Domain at the majority of Western Domain sites. During mining to 400 m (LW W3) – Continuous record, data downloaded monthly. Post mining – Continuous record, data downloaded monthly for 12 months after LW W4 completed. Monthly logger downloaded for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details). GROUNDWATER **Location:** Impact site – P14, P15 **Frequency** Pre-mining - Minimum continuous 24-hourly readings with monthly logger download. Baseline data available since May 2019 (P14) and since March 2021 (P15). During mining to 400 m (LW W3) - Minimum continuous 24-hourly readings with fortnightly logger download and dip meter. Post mining - Minimum continuous 24-hourly readings with monthly logger download and dip meter for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details). **TARP Trigger Levels:** TARP Level 2 = base of the pool [mAHD] +1.1m = 165.0 mAHD TARP Level 3 = base of the pool [mAHD] +0.6 m = 164.5 mAHD TARP Level 4 = base of the pool [mAHD] +0.1 m = 164.0mAHD	Level 1		
		• Inferred groundwater and surface water interaction remains consistent with baseline variability and pre-mining trends with weakening of gaining or strengthening of losing condition not persisting after significant rainfall recharge event.	• Continue monitoring program. • Ongoing review of water level data.	• No response required.
		Level 2		
		• Inferred groundwater levels at surface water monitoring site decline below the TARP Level 2 following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	• Continue monitoring program. • Ongoing review of water level data. • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 3		
		• Inferred groundwater levels at surface water monitoring site decline below the TARP Level 3 following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	• Continue monitoring program. • Ongoing review of water level data and consideration of mining and external stresses (in impact report) • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends. • Compare against base case and deterministic model scenarios. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group. • Review manual water level measurements for additional monitoring sites to identify potential spatial trends in water level decline. • Report to DPIE.
		Level 4		
		• Inferred groundwater levels at surface water monitoring site decline below the TARP Level 4 following the commencement of extraction at LW W1 (and LW W2, W3 and W4). AND • The reduction in water level is determined not to be controlled by climatic or external anthropogenic factors.	• Continue monitoring and review as per monitoring program. • Ongoing review of water level data and consideration of mining and external stresses (in impact report) • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends. • Compare against base case and deterministic model scenarios. • Convene Tahmoor Coal Environmental Response Group to review response.	• Report to DPIE and relevant government agencies within 7 days of investigation completion (according to Table 6-1 of the Extraction Plan Main Document). • Review surface water data to assess for surface water level decline at SB (SR17). • Review manual water level measurements for additional monitoring sites to identify potential spatial trends in water level decline. • If it is concluded that there has been a mining-related impact, then implement a corrective management action plan in accordance with a timeframe as recommended by the Environmental Response Group in consultation with the Resources Regulator (refer to Section 6.2.2 of the WMP).

Feature	Methodology and relevant monitoring	Management		
		Trigger	Action	Response
Shallow Groundwater Level Decline (Stonequarry Creek)	The aim of this TARP is to provide a leading indicator for potential changes to hydrology in Stonequarry Creek near LW W3, and is considered complementary to other TARPS. The Performance Indicator of flow over the rockbar at SR17 is more directly assessed via other TARPs described above: • Impact to pool water level; and • Impact to physical features & natural behaviour of pools. GROUNDWATER **Location**: Impact site – P14B, P15A (spatial average) Groundwater level change (m/d) is calculated as a rolling fortnightly average (to filter out short-term fluctuations) of the shallowest HBSS piezometer at each site, and compare this to historically observed rates of decline (m/d). **Frequency**: Pre-mining - Minimum continuous 24-hourly readings with monthly logger download. Baseline data available since May 2019 (P14) and since March 2021 (P15). During mining to 400 m (LW W3) - Minimum continuous 24-hourly readings with fortnightly logger download and dip meter. Post mining - Minimum continuous 24-hourly readings with monthly logger download and dip meter for 12 months following the completion of LW W4. This period may be extended as per the decision by the Environmental Response Group (refer to Section 5.2 for further details). **TARP Trigger Levels (rate of GWL decline):** TARP Level 2 >= similar to Sept/Oct-2020 = 0.012 m/d TARP Level 3 >= historical max (early Jan-2021) = 0.030 m/d. TARP Level 4 >= historical max +50% = 0.045 m/d	Level 1		
		• Inferred groundwater levels decline by less than Level 2 rate following commencement of LW W3.	• Continue monitoring program. • Ongoing review of water level data.	• No response required.
		Level 2		
		• Inferred groundwater levels decline by more (faster than) than Level 2 rate following start of LW W3.	• Continue monitoring program. • Ongoing review of water level data. • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group.
		Level 3		
		• Inferred groundwater levels decline by more (faster than) than Level 3 rate following start of LW W3.	• Continue monitoring program. • Ongoing review of water level data and consideration of mining and external stresses (in impact report) • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends. • Compare against base case and deterministic model scenarios. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by the Environmental Response Group. • Review manual water level measurements for additional monitoring sites to identify potential spatial trends in water level decline. • Report to DPIE.
		Level 4		
		• Inferred groundwater levels decline by more (faster than) than Level 4 rate following start of LW W3.	• Continue monitoring and review as per monitoring program. • Ongoing review of water level data and consideration of mining and external stresses (in impact report) • Review relevant surface water level, groundwater level and streamflow data to assess comparative trends. • Compare against base case and deterministic model scenarios. • Convene Tahmoor Coal Environmental Response Group to review response.	• Report to DPIE and relevant government agencies within 7 days of investigation completion (according to Table 6-1 of the Extraction Plan Main Document). • Review surface water data to assess for surface water level decline at SB (SR17). • Review manual water level measurements for additional monitoring sites to identify potential spatial trends in water level decline. • If it is concluded that there has been a mining-related impact, then implement a corrective management action plan in accordance with a timeframe as recommended by the Environmental Response Group in consultation with the Resources Regulator (refer to Section 6.2.2 of the WMP).

Trigger Action Response Plan – Land Management Plan

Feature	Management		
	Trigger	Action	Response
Steep slope damage or instability	Level 1		
	• Surface cracking < 10 mm wide on slope	• Continue monitoring in accordance with the monitoring program.	• No response required.
	Level 2		
	• Surface cracking 10 – 20 mm wide on slope	• Continue monitoring in accordance with the monitoring program. • Convene Tahmoor Coal Environmental Response Group to review response. • Erect warning signs and restrict access to areas where necessary.	• As defined by the Tahmoor Coal Environmental Response Group. • Repair cracks at the completion of the active subsidence period.
	Level 3		
	• Surface cracking > 20 mm wide, tree fall.	• Increase frequency of monitoring by geotechnical consultant to weekly during active subsidence period. • Convene Tahmoor Coal Environmental Response Group to review response. • Erect warning signs and restrict access to areas where necessary. • Geotechnical engineer inspection to determine need for further action/investigation.	• Notify relevant Government Agencies and other stakeholders. • Repair cracks at the completion of the active subsidence period.

Feature	Management		
	Trigger	Action	Response
Surface cracking of landform	Level 1		
	• Surface cracking < 10 mm wide.	• Continue monitoring in accordance with the monitoring program.	• No response required.
	Level 2		
	• Surface cracking 10 – 20 mm wide.	• Continue monitoring in accordance with the monitoring program. • Convene Tahmoor Coal Environmental Response Group to review response. • Erect warning signs and restrict access to areas where necessary.	• As defined by Tahmoor Coal Environmental Response Group. • Repair cracks at the completion of the active subsidence period.
	Level 3		
	• Surface cracking > 20 mm wide.	• Increase frequency of monitoring by geotechnical engineer to weekly during active subsidence period. • Convene Tahmoor Coal Environmental Response Group to review response. • Erect warning signs and restrict access to areas where necessary. • Geotechnical engineer inspection to determine need for further action/investigation.	• Notify relevant Government Agencies and other stakeholders. • Repair cracks > 20 mm in width with excavation, grouting and re-compaction where practical.

Feature	Management		
	Trigger	Action	Response
Agricultural land	Level 1		
	• Vertical subsidence within predicted range. • Negligible impact to agricultural productivity or use of the land. • Negligible change to ponding. • No or minor impact to buildings or improvements. • Negligible increase in soil or tunnel erosion.	• Continue monitoring in accordance with the monitoring program.	• No response required.
	Level 2		
	• Impact to agricultural land from subsidence or increased flooding or ponding within predicted impacts. • Minor increase in ponding or changes to drainage systems that can be remediated.	• Continue monitoring in accordance with the monitoring program. • Convene Tahmoor Coal Environmental Response Group to review response.	• As defined by Tahmoor Coal Environmental Response Group. • Repair any subsidence impacts at the completion of the active subsidence period.
	Level 3		
	• Significant impact and change to agricultural land functionality or agricultural productivity greater than predicted.	• Increase frequency of monitoring to weekly during active subsidence period. • Convene Tahmoor Coal Environmental Response Group to review response. • Erect warning signs and restrict access to areas where necessary.	• Notify relevant Government Agencies and other stakeholders. • Repair any subsidence impacts at the completion of the active subsidence period with excavation, re-levelling and re-compaction where required.

Trigger Action Response Plan – Biodiversity Management Plan

Feature	Management		
	Trigger	Action	Response
Decline or significant negative change in macroinvertebrate indicators. These indicators include: • Density • Family richness • Community assemblages • EPT index • SIGNAL score • AUSRIVAS score	Level 1		
	• Monitoring macroinvertebrate indicators are within range of baseline data as supported by statistical analysis.	• Continue monitoring as per monitoring program.	• No action required.
	Level 2		
	• One or more macroinvertebrate indicators are not within range of baseline data as supported by statistical analysis. AND ONE OR BOTH OF THE FOLLOWING: • Subsidence monitoring program identifies potential for impact to watercourse parameters associated with aquatic habitat areas compared to baseline (e.g. cracking). • Surface monitoring program identifies potential impacts to hydrology/water quality parameters compared to baseline.	• Continue monitoring as per monitoring program. • Convene Tahmoor Coal Environmental Response Group to review possible cause and response. • Review and confirm monitoring data, cross check aquatic biodiversity monitoring data against other related environmental data (e.g. control sites and benchmark data) and subsidence monitoring upon identification of the potential trigger. • Undertake further investigations as appropriate to confirm the potential issue and analyse data with the aim of determining whether the exceedance is likely to be mining related.	• As defined by Environmental Response Group. • Assess need for any increase to monitoring frequency or additional monitoring where relevant.
	Level 3		
	• Monitoring indicates that three or more macroinvertebrate indicators are not within range of baseline data as supported by statistical analysis. AND ONE OR BOTH OF THE FOLLOWING: • Subsidence monitoring identifies mining induced impacts compared to baseline watercourse parameters associated with aquatic habitat (e.g. cracking). • Subsidence monitoring identifies significant impacts to hydrology/water quality that exceed predictions compared to baseline.	• Continue monitoring as per monitoring program. • Convene Tahmoor Coal Environmental Response Group to review possible cause and response. • Review and confirm monitoring data, cross check aquatic biodiversity monitoring data against other related environmental data (e.g. control sites and benchmark data) and subsidence monitoring upon identification of the potential trigger. • Undertake further investigations as appropriate to confirm the potential issue and analyse data with the aim of determining whether the exceedance is likely to be mining related.	• Notify DPIE and relevant stakeholders within 7 days of investigation completion. • Investigate and implement any additional management measures as recommended and contingency plan as required in consultation with DPIE.

Feature	Management		
	Trigger	Action	Response
Reduction in aquatic habitat though loss of pools or associated reduction in water quality (AUSRIVAS habitat assessment).	Level 1		
	• Visual monitoring indicates aquatic habitat parameters are similar to baseline observations at aquatic ecology monitoring sites.	• Continue monitoring as per monitoring program.	• No action required.
	Level 2		
	• Visual monitoring indicates potential change in aquatic habitat compared to baseline observations at aquatic ecology monitoring sites. AND ONE OR BOTH OF THE FOLLOWING: • Subsidence monitoring identifies potential for impact to watercourse parameters associated with macroinvertebrate indicators compared to baseline. • Surface monitoring program identifies potential for impact to hydrology/water quality parameters compared to baseline.	• Continue monitoring as per monitoring program. • Convene Tahmoor Coal Environmental Response Group to review possible cause and response. • Review and confirm monitoring data, cross check aquatic biodiversity monitoring data against other related environmental data (e.g. control sites and benchmark data) and subsidence monitoring upon identification of the potential trigger. • Undertake further investigations as appropriate to confirm the potential issue and analyse data with the aim of determining whether the exceedance is likely to be mining related.	• As defined by Environmental Response Group. • Assess need for any increase to monitoring frequency or additional monitoring where relevant.
	Level 3		
	• Visual monitoring indicates a significance change in aquatic habitat compared to baseline observations at aquatic ecology monitoring sites. AND ONE OR BOTH OF THE FOLLOWING: • Subsidence monitoring identifies potential for impact to watercourse parameters associated with macroinvertebrate indicators compared to baseline.	• Continue monitoring as per monitoring program. • Convene Tahmoor Coal Environmental Response Group to review possible cause and response. • Review and confirm monitoring data, cross check aquatic biodiversity monitoring data against other related environmental data (e.g. control sites and benchmark data) and subsidence monitoring upon identification of the potential trigger. • Undertake further investigations as appropriate to confirm the potential issue and analyse data	• Notify DPIE and relevant stakeholders within 7 days of investigation completion. • Investigate and implement any additional management measures as recommended and contingency plan as required in consultation with DPIE.

	• Subsidence monitoring identifies significant impacts to hydrology/water quality that exceed predictions.	with the aim of determining whether the exceedance is likely to be mining related.	

Feature	Management		
	Trigger	Action	Response
Decline in amphibian populations within watercourses of the Study Area	Level 1		
	• Monitoring indicates amphibian population parameters are predominantly within a reasonable range of baseline data as supported by statistical analysis.	• Continue monitoring as per monitoring program.	• No response required.
	Level 2		
	• Monitoring indicates amphibian population parameters are predominantly not within a reasonable range of baseline data as supported by statistical analysis. AND • Subsidence monitoring program identifies potential for impact of watercourse parameters associated with sensitive amphibian habitat areas (within prediction compared to baseline).	• Continue monitoring as per monitoring program. • Convene Tahmoor Coal Environmental Response Group to review possible cause and response. • Review and confirm monitoring data, cross check biodiversity monitoring data against other related environmental data (e.g. control sites and benchmark data) and subsidence monitoring upon identification of the potential trigger. • Undertake further investigations as appropriate to confirm the potential issue and analyse data with the aim of determining whether the exceedance is likely to be mining related.	• As defined by Environmental Response Group. • Consider increasing monitoring frequency or additional monitoring where relevant.
	Level 3		
	• Monitoring indicates amphibian population parameters are significantly not within a reasonable range of baseline data as supported by statistical analysis. AND • Mining induced impacts (exceeds predicted compared to baseline) for	• Continue monitoring as per monitoring program. • Convene Tahmoor Coal Environmental Response Group to review possible cause and response. • Review and confirm monitoring data, cross check biodiversity monitoring data against other related environmental data (e.g. control sites and benchmark	• Notify DPIE and relevant stakeholders within 7 days of investigation completion. • Investigate and implement any additional management measures as recommended and contingency plan as required in consultation with DPIE.

	watercourse parameters associated with sensitive amphibian habitat are identified by environmental monitoring.	data) and subsidence monitoring upon identification of the potential trigger. • Undertake further investigations as appropriate to confirm the potential issue and analyse data with the aim of determining whether the exceedance is likely to be mining related.	

Feature	Management		
	Trigger	Action	Response
Dieback of riparian vegetation within watercourses of the Study Area	Level 1		
	• Monitoring indicates riparian vegetation parameters are predominantly within a reasonable range of baseline data as supported by statistical analysis.	• Continue monitoring as per monitoring program.	• No response required.
	Level 2		
	• Monitoring indicates riparian vegetation parameters are predominantly not within a reasonable range of baseline data as supported by statistical analysis. AND • Subsidence monitoring program identifies potential for impact of watercourse parameters associated with sensitive riparian habitat areas (within prediction compared to baseline).	• Continue monitoring as per monitoring program. • Convene Tahmoor Coal Environmental Response Group to review cause and response. • Review and confirm monitoring data, cross check Biodiversity monitoring data against other related environmental data (e.g. control sites and benchmark data) and subsidence monitoring upon identification of the potential trigger. • Undertake further investigations as appropriate to confirm the potential issue and analyse data with the aim of determining whether the exceedance is likely to be mining related.	• As defined by Environmental Response Group. • Consider increasing monitoring frequency or additional monitoring where relevant.
	Level 3		
	• Monitoring indicates riparian vegetation parameters are significantly not within a reasonable range of baseline data as supported by statistical analysis. AND	• Continue monitoring as per monitoring program. • Convene Tahmoor Coal Environmental Response Group to review cause and response. • Review and confirm monitoring data, cross check biodiversity monitoring data against other related environmental data (e.g. control sites and	• Notify DPIE and relevant stakeholders within 7 days of investigation completion. • Investigate and implement any additional management measures as recommended and contingency plan as required in consultation with DPIE.

	• Mining induced impacts (exceeds predication compared to baseline) for watercourse parameters associated with riparian vegetation are identified by environmental monitoring.	benchmark data) and subsidence monitoring upon identification of the potential trigger. • Undertake further investigations as appropriate to confirm the potential issue and analyse data with the aim of determining whether the exceedance is likely to be mining related.	

Trigger Action Response Plan – Heritage Management Plan

Feature	Management		
	Trigger	Action	Response
Aboriginal Heritage items*	Level 1		
	• Aboriginal heritage site monitoring indicates no detectable environmental consequences.	• Continue monitoring as per monitoring program.	• No response required.
	Level 2		
	• Aboriginal heritage site monitoring indicates potential detectable environmental consequences.	• Continue monitoring as per monitoring program. • Convene Tahmoor Coal Environmental Response Group to review response. • An archaeologist to inspect the relevant site(s) within the area of potential impact. • Review monitoring program and modify if necessary.	• If impacts to heritage sites are observed, notify DPIE and Heritage NSW within one week of the event. • Notify RAPs within on week of the event and co-ordinate a site inspection with RAPs. • Investigate and implement any additional management measures as required in consultation with RAPs, Heritage NSW and DPIE.
	Level 3		
	• Aboriginal heritage site monitoring indicates environmental consequences to heritage site(s).	• Continue monitoring as per monitoring program. • Convene Tahmoor Coal Environmental Response Group to review response. • Investigate exceedance of subsidence prediction. • Review mine design/predictions against mine criteria. • Review monitoring program and modify if necessary.	• Notify RAPs within 1 week of the event and co-ordinate a site inspection with RAPs. • Notify DPIE and Heritage NSW within one week of the event. • Investigate and implement any additional management measures as required in consultation with RAPs, Heritage NSW and DPIE.

*This TARP outlines performance indicators to be implemented to ensure compliance with negligible subsidence impacts or environmental consequences to the Aboriginal modified tree within the Study Area, Clearview (#52-2-2100) and considers the management or remediation of any impacts and/or environmental consequences relating to this Aboriginal heritage site. A site-specific TARP for Stonequarry Creek 1 is included in the SCRMP.

Feature	Management		
	Trigger	Action	Response
Historical Heritage	Level 1		
	• Historical heritage site monitoring indicates no detectable environmental consequences.	• Continue monitoring as per monitoring program.	• No response required.
	Level 2		
	• Historical heritage site monitoring indicates potential detectable environmental consequences but with negligible impacts to heritage site(s).	• Continue monitoring as per monitoring program.	• No response required.
	Level 3		
	• Historical heritage site monitoring indicates environmental consequences to heritage site(s).	• Continue monitoring as per monitoring program. • Convene Tahmoor Coal Environmental Response Group to review response. • Co-ordinate a site inspection with a structural engineer and qualified archaeologist or heritage architect. • Investigate exceedance of subsidence prediction. • Review mine design/predictions against mine criteria. • Review monitoring program and modify if necessary.	• Notify DPIE and Heritage NSW within one week of the event. • Investigate and implement any additional management measures as recommended and contingency plan as required in consultation with Heritage NSW and DPIE.

Trigger Action Response Plan – Stonequarry Creek Rockbar Management Plan

GENERAL TRIGGER LEVELS

Trigger Level	Description
GREEN	Observations within survey tolerance and environmental effects.
BLUE	Repeatable measurable differential movements consistent with low level mining influence.
YELLOW	Increased differential movements indicating increasing potential for greater than negligible subsidence impacts, environmental consequences or loss of heritage value of the AHIMS site.
RED	Differential movements indicating imminent potential for greater than negligible subsidence impacts, environmental consequences or loss of heritage value of the AHIMS site.
GREY	Loss of Monitoring Control.

ABBREVIATIONS WITHIN THESE TABLES:
DPIE = Department of Planning, Industry & Environment
EMM = EMM Consulting (heritage consultants)
MSEC = Mine Subsidence Engineering Consultants
MNC = MNC Consulting (high resolution surveys)
RAP = Registered Aboriginal Party
SCT = SCT Operations
SMEC = SMEC (ground surveys)
TC = Tahmoor Coal

RISK ISSUE	TRIGGER	CONTROL PROCEDURES	TIMING & FREQUENCY	BY WHOM?
General Procedures				
	GREEN	**GNSS MONITORING**		
		Install Goaf GNSS unit 23 (located approximately 100 m inside the commencing end of LW W3)	Install GNSS unit 23 above LW W3 prior to commencement of LW W3 Continuous readings, with data averaged over 24 hours and recorded once per day until end of LW W3-W4	MNC
		Continuous, automated GNSS units 12A and 13 across Rockbar SR17	Continuous readings, with data averaged over 24 hours and recorded once per day until end of LW W3-W4	MNC
		Continuous, automated GNSS units across Tahmoor Western Domain Network as per MSEC Drawing No. MSEC1173-00-01	Continuous readings, with data averaged over 24 hours and recorded once per day until end of LW W3-W4	MNC
		HIGH RESOLUTION SURVEYS ACROSS ROCKBAR SR17		
		Seven (7) High resolution closure lines HRC-A to HRC-G inclusive *Note: Frequency will be increased if recommended by the Technical Committee if adverse changes are observed, as described later in the TARP*	Install and baseline survey prior to LW W3 A minimum of twice weekly after start of LW W3 Continue until agreed to reduce by Technical Committee	MNC
		3D rockbar survey across grinding groove sites (3D array)	A minimum of twice weekly after start of LW W3 Continue until agreed to reduce by Technical Committee	MNC
		GROUND SURVEYS ACROSS STONEQUARRY CREEK AND ROCKBAR SR17		
		Absolute 3D and relative 3D Rockbar SR17 surveys *Note: Frequency will be increased if recommended by the Technical Committee if adverse changes are observed, as described later in the TARP*	Absolute 3D monthly from start of LW W3 Relative 3D a minimum of twice weekly after start of LW W3 Continue until agreed to reduce by Technical Committee	SMEC
		Valley closure monitoring lines across Stonequarry Creek (SQ104 to SQ120) and Cedar Creek (C102 to C106), as shown in Drawing No. MSEC1173 00-01. *Note: Frequency will be increased if recommended by the Technical Committee if adverse changes are observed, as described later in the TARP*	A minimum of weekly after the start of LW W3 Continue until agreed to reduce by Technical Committee	SMEC
		Rockbar / Valley floor closure lines across Stonequarry Creek (SQ04 to SQ13, as shown in Drawing No. MSEC1173 00-01. *Note: Frequency will be increased if recommended by the Technical Committee if adverse changes are observed, as described later in the TARP*	A minimum of weekly after the start of LW W3 Continue until agreed to reduce by Technical Committee	SMEC
		2D survey along LW W3 Centreline above commencing end of LW W3 from Peg CLW3-1 (Northernmost peg) to Peg CLW3-14 (Stonequarry WTP dam)	A minimum of weekly after the start of LW W3 Continue until agreed to reduce by Technical Committee	SMEC

RISK ISSUE	TRIGGER	CONTROL PROCEDURES	TIMING & FREQUENCY	BY WHOM?
	GREEN			
		VISUAL INSPECTIONS		
		Aboriginal heritage recording and visual inspection *Note: Frequency will be increased if recommended by the Technical Committee if adverse changes are observed, as described later in the TARP*	Baseline inspection complete End of LW W1 and W2 complete End of LW W3 and W4	EMM
		Detailed visual inspections, including measurement of existing joints and fractures and water level of pool upstream of Rockbar SR17 and pools within Rockbar SR17 Baseline photographs of 10 key joints plus additional baseline photograph of secondary joints *Note: Frequency will be increased if recommended by the Technical Committee if adverse changes are observed, as described later in the TARP*	As per timing and frequency for High Resolution Surveys	MNC
		3D photogrammetric survey at Rockbar SR17 *Note: Frequency will be increased if recommended by the Technical Committee if adverse changes are observed, as described later in the TARP*	Baseline inspection completed End of LW W1 and W2 complete End of LW W3 and W4	MNC
		GEOTECHNICAL MONITORING		
		Inclinometer monitoring of borehole adjacent to Rockbar SR17	Install and baseline survey subject to granting of approvals Weekly after installation Continue until agreed to reduce by Technical Committee	TC / SCT
		In situ stress measurement and continuous, automated stress change monitoring of borehole adjacent to Rockbar SR17	Install and in-situ stress measurement subject to granting of approvals Download weekly stress change measurements after installation Continue until agreed to reduce by Technical Committee	TC / SCT
		SURFACE AND GROUNDWATER MONITORING		
		Continuous surface water level monitoring of pool behind Rockbar SR17 (as part of Water Management Plan)	Downloaded and reported monthly	HCS /HEC
		Groundwater level monitoring along Stonequarry Creek (as part of Water Management Plan)	Downloaded and reported monthly	SLR
		Visual inspection of Stonequarry Creek upstream and downstream of Rockbar SR17	Monthly	Geoterra
		ASSESSMENT OF MONITORING RESULTS		
		Analyse and report results to Technical Committee	A minimum of twice weekly after start of LW W3	Refer Table 7.1
		Technical Committee discuss results, **consider whether any additional management measures are required and make recommendations** to Tahmoor Coal Steering Committee *Note: Frequency will be increased if recommended by the Technical Committee if adverse changes are observed, as described later in the TARP*	A minimum of twice weekly after start of LW W3 Continue until agreed to reduce by Technical Committee	Technical Committee
		STATUS REPORT		
		Status report to be prepared by the Technical Committee and provided to the Steering Committee and DPIE	Weekly after start of LW W3 Continue until agreed to reduce by Technical Committee	Technical Committee

<table>
<tr><th>RISK ISSUE</th><th>TRIGGER</th><th>CONTROL PROCEDURES</th><th>TIMING & FREQ</th><th>BY WHOM?</th></tr>
<tr><td rowspan="11">Aboriginal grinding site experiences greater than negligible subsidence impacts, environmental consequences or loss of negligible value, as defined below:
Table A1: Definition of negligible loss of heritage value
<table>
<tr><th>Type of value</th><th>Subsidence effects within threshold of negligible loss of heritage value</th><th>Subsidence effects exceeding threshold of negligible loss of heritage value</th></tr>
<tr><td>Values of primary significance:

Aboriginal grinding groove features</td><td>No visually perceptible subsidence impacts such as cracking through grinding groove features.</td><td>Visually perceptible subsidence impacts such as cracking through grinding groove features.</td></tr>
<tr><td>Values of contributory significance:

Sandstone rockbar feature</td><td>Visually perceptible isolated cracking of rockbar feature to a level comparable to existing naturally caused examples on rockbar</td><td>Multiple visually perceptible cracks of rockbar feature to a level comparable to existing naturally caused examples on rockbar; or

A single visually perceptible crack of the rockbar feature to a level distinctly more severe than existing naturally caused examples on rockbar</td></tr>
</table>
<table>
<tr><th>Monitoring</th><th>Accuracy</th><th>Blue</th><th>Yellow</th><th>Red</th></tr>
<tr><td>HRC (closure) lines</td><td>+/- 0.5 mm</td><td>C, D, E, F or G > 2 mm</td><td>C, D, E or F > 10 mm</td><td>C, D, E or F > 15 mm</td></tr>
<tr><td>Visual inspections</td><td>-</td><td>N/A</td><td>New crack identified on Rockbar SR17</td><td>New crack identified in Grinding Groove Groups A, B and C*</td></tr>
<tr><td>Joint measurements with normal movement to the joint plane</td><td>Photograph with measurement card +/- 0.5 mm</td><td>Movement in key joints > +/- 0.5 mm</td><td>Movement in key joints > +/- 1.0 mm</td><td>Movement in key joints > +/- 2.0 mm in Grinding Groove Groups A, B and C*</td></tr>
<tr><td>Joint measurements with shear movement parallel to the joint plane</td><td>Photograph with measurement card +/- 0.5 mm</td><td>Movement in key joints > +/- 0.5 mm</td><td>Movement in key joints > +/- 1.0 mm</td><td>Movement in key joints > +/- 2.0 mm in Grinding Groove Groups A, B and C*</td></tr>
<tr><td>Tensile strain across the grinding groove area** (3D array)***</td><td>+/- 0.2 mm/m</td><td>Repeatable at 0.3 mm/m</td><td>Repeatable at 0.5 mm/m</td><td>Repeatable at 1.0 mm/m</td></tr>
<tr><td>Compressive strain across the grinding groove sites (3D array)***</td><td>+/- 0.2 mm/m</td><td>Repeatable at 0.5 mm/m</td><td>Repeatable at 1.0 mm/m</td><td>Repeatable at 1.5 mm/m</td></tr>
<tr><td>Tensile strain across the surrounding rockbar grid measured by HRC-G</td><td>+/- 0.5 mm/m</td><td>Repeatable at 0.3 mm/m</td><td>Repeatable at 0.5 mm/m</td><td>Repeatable at 1.0 mm/m</td></tr>
<tr><td>Tensile strain across the surrounding rockbar grid***</td><td>+/- 0.5 mm/m</td><td>Repeatable at 1.0 mm/m</td><td>Repeatable at 1.3 mm/m</td><td>Repeatable at 1.6 mm/m</td></tr>
<tr><td>Compressive strain across the surrounding rockbar grid***</td><td>+/- 0.5 mm/m</td><td>Repeatable at 1.0 mm/m</td><td>Repeatable at 1.5 mm/m</td><td>Repeatable at 2.0 mm/m</td></tr>
<tr><td>GNSS closure SR17N-SR17S</td><td>+/- 3 mm</td><td>> 10 mm</td><td>Refer to trigger for HRC lines C, D, E or F > 10 mm</td><td>Refer to trigger for HRC lines C, D, E or F > 15 mm</td></tr>
<tr><td>GNSS 3D ground movements Site 23 (above Longwall W3)</td><td>+/- 5 mm</td><td colspan="3">Trending information only</td></tr>
<tr><td>Surface and Ground Water level monitoring</td><td>Variable</td><td colspan="3">Refer to Water Management Plan</td></tr>
<tr><td>4 x GNSS units at Stonequarry Creek - 3D ground movements</td><td>+/- 5 mm</td><td colspan="3">Trending information only</td></tr>
<tr><td>Valley closure lines upstream and downstream of Rockbar SR17</td><td>+/- 3 mm</td><td colspan="3">Trending information only</td></tr>
<tr><td>Stress cell (dependent on approval)</td><td>+/- 1 MPa</td><td colspan="3">Trending information only</td></tr>
<tr><td>Inclinometer (dependent on approval)</td><td>+/- 3 mm deflection</td><td colspan="3">Trending information only</td></tr>
</table>
Note: The Technical Committee will assess information from all relevant monitoring devices into consideration when making recommendations.
The actual triggering process that moves the rockbar management from one TARP level to the next, can be triggered by an exceedance of any one of the multiple sets of triggering parameters, without the need for an exceedance on other parameters.
* Rockbar SR17 grinding groove zones refer to sites labelled Group A, B and C.
** Yellow polygon in Figure A1
*** Non-standard bay lengths of nominally 10 m.</td><td>GREEN</td><td>Follow general procedures (as listed above)</td><td>-</td><td>-</td></tr>
<tr><td rowspan="3">BLUE</td><td>Contact Technical Committee and arrange teleconference</td><td>Within 24 hours</td><td>TC</td></tr>
<tr><td>Technical Committee undertake following action(s) in consideration of Key Assessment Criteria:
o increase survey frequencies
o increase visual inspections of rockbar
o increase frequency of Technical Committee assessments and meetings
o conduct additional monitoring and inspections as required
o consider whether any other additional management measures are required
o assess all available monitoring data for trends and forecast if and/or when the YELLOW trigger levels might be exceeded</td><td>Technical Committee meet via teleconference within 24 hours</td><td>Technical Committee</td></tr>
<tr><td>Report details of exceedance of trigger level and actions undertaken</td><td>Within one week</td><td>TC</td></tr>
<tr><td rowspan="3">YELLOW</td><td>Stop the progress of longwall</td><td>Immediately (subject to mine safety requirements)</td><td>TC</td></tr>
<tr><td>Contact Technical Committee and arrange teleconference</td><td>Technical Committee meet via teleconference ASAP (no later than 24 hours)</td><td>TC</td></tr>
<tr><td>Technical Committee to review potential of exceedance of performance measures (refer to Table A1) in consideration of Key Assessment Criteria and provide a formal Report to the Steering Committee and DPIE recommending either continued Longwall operations or cessation and relocation of longwall equipment

Review all available monitoring data for trends including:
o arrange visual inspection by Technical Committee member(s) as appropriate
o arrange visual inspection by Aboriginal heritage consultant and RAP representative(s)
o increase survey and/or inspection frequencies as appropriate
o increase frequency of Technical Committee assessments as required
o conduct additional monitoring and inspections as required
o implement additional management measures as required
o forecast if and/or when the RED trigger level might be exceeded
o consider reducing longwall retreat rate
Make recommendation to Steering Committee</td><td>Within one week</td><td>Technical Committee</td></tr>
<tr><td rowspan="4">RED</td><td>Stop Longwall operations</td><td>Immediately</td><td>TC</td></tr>
<tr><td>Contact Technical Committee and arrange teleconference</td><td>Technical Committee meet via teleconference asap (no later than 24 hours)</td><td>TC</td></tr>
<tr><td>Technical Committee meet to determine new start location for Longwall Operations based on all available monitoring data for trends and consideration of Key Assessment Criteria.
Additional actions include:
o arrange visual inspection by Technical Committee member(s) as appropriate
o arrange visual inspection by Aboriginal heritage consultant and RAP representative(s)
o increase survey and/or inspection frequencies as appropriate
o increase frequency of Technical Committee assessments as required
o conduct additional monitoring and inspections as required
o implement additional management measures as required
Make recommendation to Steering Committee</td><td>Technical Committee meet via teleconference asap (no later than 24 hours)</td><td>Technical Committee</td></tr>
<tr><td>Cease Longwall operations and safely relocate to new start position defined by the Technical Committee</td><td>Within 24 hours</td><td>TC</td></tr>
</table>

RISK ISSUE	TRIGGER	CONTROL PROCEDURES	TIMING & FREQ	BY WHOM?
Loss of monitoring measures due to damage, vandalism or flooding	**GREEN**	Follow general procedures (including multiple redundancies in monitoring system including backup prism for HRC - E, GNSS units 12A and 13, SMEC Rockbar SR17 survey)	-	-
	Loss of Monitoring Control	Technical Committee meet and consider whether any additional management measures are required, including: o reinstate monitoring controls (e.g. HRC-E Line) o apply trigger levels to other HRC Lines o increase monitoring and reporting procedures	As required	Technical Committee
		Report details of exceedance of trigger level and actions undertaken	Within 24 hours	TC
	Forecast of extreme wet weather	Technical Committee meet and consider whether any additional management measures are required, including: o bring forward ground surveys and other monitoring activities ahead of the forecast wet weather event o additional inspections or monitoring before or after the weather event o consider actions if monitoring and visual inspections of the rockbar is not possible for an extended period of time after the wet weather event	As required	Technical Committee
		Report details of weather event and actions undertaken	Within one week	TC

KEY ASSESSMENT CRITERIA

- **The current length of extraction and rate of longwall retreat;**
- **Current and forecast weather conditions, particularly at times of survey;**
- **Development of conventional subsidence directly above and beyond the commencing end of LW W3;**
- **The current magnitudes and rates of change in mine subsidence movements along and across Stonequarry Creek. This includes absolute horizontal movements, closure or ground extension movements across Rockbar SR17;**
- **Indications of where valley closure might be concentrating within the valley – that is, whether it is concentrating at the interface between the Wianamatta Shale and Hawkesbury Sandstone above the horizon of the rockbar, or whether it is concentrating at particular joints or bedding planes within Rockbar SR17, or whether it is distributing uniformly across the width of Rockbar SR17.**

Figure A1