# NARRABRI MINE

# SURFACE WATER MANAGEMENT PLAN

## Prepared by:

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# 1. Introduction

## 1.1 Background

The Narrabri Mine is an existing underground coal mining operation situated in the Gunnedah Coalfield, approximately 25 kilometres (**km**) southeast of Narrabri and approximately 60 km northwest of Gunnedah, within the Narrabri Shire Council (**NSC**) Local Government Area, in New South Wales (**NSW**). It is operated by Narrabri Coal Operations Pty Ltd (**NCOPL**), on behalf of the Narrabri Mine Joint Venture[1], which consists of two Whitehaven Coal Limited's (**WHC**) wholly owned subsidiaries, and other joint-venture partners.

The Narrabri Underground Mine Stage 3 Extension Project (**Stage 3**) involves a southern extension to the previously approved Stage 2 mining area (approximately 609 ha of additional surface development footprint) to gain access to additional areas of coal reserves within Mining Lease Application (**MLA**) 1 and 2, an increase in the mine life to 2044, and the development of supporting surface infrastructure[2].

## 1.2 Purpose and scope

This Surface Water Management Plan (**SWMP** or **Plan**) has been developed in accordance with the Stage 3 Extension Project State Significant Development (**SSD**) 10269 Conditions of Consent (**CoC**) B36(e)(iii), the applicable Commonwealth and NSW State regulatory framework for surface water management, the requirements of the NSW Water Group within the Department of Planning and Environment (**DPE Water**) and the Environment Protection Authority (**EPA**).

As required by CoC B38, NCOPL will implement the SWMP as approved by the Planning Secretary. In accordance with CoC B37, NCOPL will not commence construction until this Plan is approved by the Planning Secretary.

This SWMP forms Attachment 3 of the Narrabri Mine Water Management Plan (**WMP**), developed in accordance with CoC B35 to CoC B38.

## 1.3 Objectives

The objectives of this Plan are to:

- provide details of the relevant statutory requirements, including any relevant approval, licence or lease conditions;
- describe the measures to be implemented to ensure compliance with the water management performance measures in accordance with CoC B34;
- provide baseline data on channel stability, water flows and water quality within surface waters potentially impacted by the development;
- detail the Narrabri Mine surface water management system, including plans, design objectives, performance criteria and management measures for water management infrastructure;
- detail any proposed discharges of treated water to the Namoi River;

[1] For full details on the joint venture ownership, refer to the introduction of the Environmental Management Strategy.

[2] For full detail on the background of the Narrabri Mine, refer to the overarching WMP.

- provide alternatives to direct measurement or prediction of creek flows to support surface water take licensing;
- provide the adopted surface water criteria, including trigger levels for identifying and investigating any potentially adverse impacts;
- detail the program to regularly review brine management and identify beneficial use options for each water type;
- detail a program to monitor and evaluate:
    - compliance with the relevant performance measures and criteria;
    - controlled and uncontrolled discharges and seepage/leachate from the site;
    - surface water inflows, outflows and storage volumes;
    - the effectiveness of the surface water management system and the measures in the Erosion and Sediment Control Plan; and
    - reporting procedures for the results of the monitoring program.
- detail the trigger action response plan (**TARP**) to respond to any exceedances of the performance measures and manage any surface water impacts of the Narrabri Mine.

## 1.4 Regulatory requirements

In accordance with CoC E5(b), Appendix A provides a summary of the relevant regulatory requirements relating to surface water and outlines the section of the WMP (including sub-plans) in which each of these conditions and commitments have been addressed.

In accordance with CoC E5(c), Appendix B provides a summary of the relevant commitments or recommendations within the EIS relating to surface water and outlines the section of the WMP (including sub-plans) in which each of these commitments have been addressed. These relevant commitments or recommendations include those as amended or added to by the:

- Applicant's Submission Report submitted 31 May 2021;
- Applicant's Amendment Report submitted 31 May 2021; and
- Applicant's final Biodiversity Development Assessment Report dated September 2021.

A detailed overview of the statutory requirements relating to water management is described in section 3 of the WMP.

## 1.5 Definitions

The terminology used within this SWMP are defined in the WMP.

# 2. Baseline data

The local drainage network is discussed in the Erosion and Sediment Control Plan (**ESCP**) (Attachment 2 of the WMP).

## 2.1 Surface water quality

### 2.1.1 Regional water quality

Water quality of the Namoi River is generally characterised by moderate alkalinity and elevated electrical conductivity (**EC**) relative to the default trigger values for ecosystem protection in upland rivers (>150 m altitude) in the ANZECC and ARMCANZ guidelines. EC values in the Namoi River at Gunnedah have ranged between 200 micro-Siemens per centimetre (**µS/cm**) and 900 µS/cm every year since 2001 and there is no significant trend to the data.

Basic water quality indicators such as EC, turbidity, total suspended solids (**TSS**), and nutrients were monitored on a monthly basis as part of the five-year Namoi Water Quality Project, starting in July 2002. Residues of herbicides and insecticides were also measured. Outcomes from the project found that:

- the majority of sites had median EC results that did not meet the ANZECC and ARMCANZ default trigger values for the protection of aquatic ecosystems of south-eastern Australia. Median EC values were below 650 µS/cm below Boggabri, which is suitable for irrigation water;
- median total phosphorus and total nitrogen was in excess of the ANZECC and ARMCANZ default trigger values in conjunction with low flows; and
- all sites in the Namoi River basin were found to have high enough total phosphorus concentration present to encourage algae growth.

### 2.1.2 Local water quality

Surface water quality monitoring has been undertaken by NCOPL at ten sites along the watercourses draining the Narrabri Mine since July 2007 (Figure 4-1). In addition, NCOPL established surface water monitoring sites along Tulla Mullen Creek Tributary 1 and Tributary 2 in 2017 (UT1DS and UT2DS) and another along Kurrajong Creek Tributary 1 (KC1TOP) to establish background water quality.

Sampling has been undertaken during or immediately following flow events for EC, pH, TSS, oil and grease and total organic carbon (**TOC**). Since the monitoring program began, there has been minimal disturbance within the catchment areas draining to monitoring sites KCUS, KCDS, KC1US, KC2US, UT1DS and UT2DS other than minor disturbance for exploration works. Monitoring sites KC1DS and KC2DS are downstream of the Pit Top Area and may be affected if there are discharges of disturbed runoff from the sediment dams.

Monitoring locations PC1 and PCa are located downstream of the ML 1609 longwall panel subsidence zones and gas pre-drainage drill sites. Limited data is available at KC1TOP, PCUS and PC3US.

The surface water quality in the water courses draining the Narrabri Mine can be characterised as:

- slightly alkaline, with median laboratory measured pH values ranging from 7.0 to 7.7 (within the ‘Ecosystem’ trigger value range);

- fresh, with median EC values ranging from approximately 63 µS/cm to 207 µS/cm (within the 'Ecosystem' trigger values range);
- variable levels of TSS, with median values ranging from approximately 20 mg/L to 132 mg/L;
- not affected by oil and grease contamination; and
- exhibiting low levels of TOC, with median values ranging from approximately 10 mg/L to 15.5 mg/L.

Water quality samples collected during the January 2020 runoff events were also analysed for dissolved and total metals. No previous water quality samples at any monitoring sites have been analysed for dissolved and total metals; therefore, baseline data is limited. Dissolved metal concentrations at more than half of the monitoring sites exceeded the water quality objectives (**WQO's**) 'Ecosystem' trigger values for iron, chromium, copper and zinc. Concentrations for all other heavy metal toxicants were below the WQO's 'Ecosystem' trigger values.

The differences in water quality between undisturbed monitoring locations (KCUS, KC1US and KC2US) and those located downstream of the Narrabri Mine (KCDS, KC1DS, KC2DS, PC and PC1) is small. Further, there has not been an increasing (or decreasing) trend in recorded water quality over time.

Table 2-1 provides a comparison of surface water quality data against the WQO's 'Ecosystem' trigger values for EC, pH, TSS, oil and grease and TOC.

## Table 2-1 Comparison of surface water quality with the WQO's 'Ecosystem' trigger values

| Water quality parameter | | Sampling site | | | | | | | | | | Namoi WQO trigger value*[a] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Kurrajong Creek | | | | | | Pine Creek | | Tulla Mullen Creek | | |
| | | KCUS | KCDS | KC1US | KC1DS | KC2US | KC2DS | PC | PC1 | UT1DS^ | UT2DS^ | |
| pH | 20th %ile | 7.1 | 7.1 | 7.1 | 7.1 | 6.7 | 6.8 | 6.9 | 7.2 | - | - | 6.5 – 8.0 |
| | Median | 7.4 | 7.4 | 7.3 | 7.5 | 7.0 | 7.1 | 7.2 | 7.4 | 7.7 | 7.1 | |
| | 80th %ile | 7.6 | 7.6 | 7.6 | 7.7 | 7.3 | 7.4 | 7.4 | 7.7 | - | - | |
| | N | 50 | 39 | 32 | 54 | 47 | 47 | 56 | 55 | 1 | 1 | |
| Electrical conductivity (µs/cm) | 20th %ile | 72.0 | 121.0 | 83.0 | 114.0 | 45.4 | 71.2 | 58.0 | 59.0 | - | - | 30 - 350 |
| | Median | 206.5 | 203.0 | 125.0 | 171.0 | 63.0 | 95.0 | 90.5 | 99.0 | 148 | 54 | |
| | 80th %ile | 490.2 | 440.4 | 192.0 | 322.6 | 85.2 | 162.4 | 148.0 | 160.0 | - | - | |
| | N | 50 | 39 | 32 | 54 | 47 | 47 | 56 | 55 | 1 | 1 | |
| Total suspended solids (mg/L) | 20th %ile | 25.0 | 16.8 | 18.6 | 21.2 | 8.2 | 16.0 | 16.8 | 31.6 | - | - | NA |
| | Median | 132.0 | 64.0 | 54.0 | 57.0 | 26.0 | 30.5 | 82.0 | 74.0 | 20 | 124 | |
| | 80th %ile | 373.0 | 241.2 | 192.6 | 121.4 | 46.8 | 94.2 | 206.0 | 205.6 | - | - | |
| | N | 48 | 39 | 32 | 54 | 47 | 44 | 55 | 55 | 1 | 1 | |
| Oil and grease (mg/L) | 20th %ile | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | - | - | NA |
| | Median | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | |
| | 80th %ile | <5 | <5 | <5 | <5 | <5 | <5 | 5.4 | <5 | - | - | |
| | N | 48 | 37 | 30 | 51 | 45 | 44 | 55 | 55 | 1 | 1 | |
| Total organic carbon (mg/L) | 20th %ile | 7.0 | 7.0 | 8.0 | 9.0 | 9.0 | 12.0 | 7.4 | 7.0 | - | - | NA |
| | Median | 10.0 | 10.0 | 11.0 | 11.0 | 12.0 | 15.0 | 10.0 | 10.0 | 10 | 15 | |

| Water quality parameter | | Sampling site | | | | | | | | | Namoi WQO trigger value*a |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Kurrajong Creek | | | | | | Pine Creek | | Tulla Mullen Creek | |
| | | KCUS | KCDS | KC1US | KC1DS | KC2US | KC2DS | PC | PC1 | UT1DS^ | UT2DS^ | |
| | 80th %ile | 13.0 | 14.2 | 12.0 | 15.0 | 16.0 | 20.0 | 14.0 | 14.0 | - | - | |
| | N | 46 | 35 | 30 | 51 | 44 | 43 | 53 | 51 | 1 | 1 | |

* a Namoi River Water Quality and River Flow Objectives 'Ecosystem' trigger values.
N = Number of samples. NA = No WQO trigger value provided for this parameter
^ Monitoring point UT1DS renamed to TCDS and monitoring point UT2DS renamed to TC2DS.

## 2.2 Surface water flows

All watercourses traversing the mining area are ephemeral with minimal to no baseflow observed over a 15-year period, since NCOPL have been monitoring the waterways. Due to the highly ephemeral nature of the waterways, there is no recorded flow data.

## 2.3 Channel stability and riparian vegetation

### 2.3.1 Channel stability

The channel of Pine Creek and the channels of its tributaries are generally small, shallow, and ill-defined. The banks of the channels tend to be vertical indicating that the soils are highly dispersive adjacent to the drainage lines. The bed of Pine Creek and its tributaries generally consists of the same material as the surrounding soils (i.e., within the same horizon).

The main Kurrajong Creek channel originates to the west of the Narrabri Mine within the Pilliga East State Forest and drains in a north-easterly direction. It is predominately a third order watercourse under the Strahler stream ordering system. A large proportion of the creek channel consists of a broad flow path with no recognised low flow channel, however in some sections downstream, the creek channel is incised with vertical banks approximately 0.8 m deep and 10 m wide. Creek bed material predominantly consists of a sandy loam with intermittent sand deposition. The bed slope is between approximately 0.40% to 0.95%. There is a 4 metre (**m**) headcut separating the downstream incised channel and the upstream ill-defined channel immediately downstream of the mining area. The drop is associated with historical headward erosion of the channel bed (i.e. not due to the existing Narrabri Mine) and will likely continue to progress upstream with successive flood events.

Tulla Mullen Creek Tributary 1 originates to the west of the mining lease within the Pilliga East State Forest and drains in a north-easterly and then easterly direction, before draining into Tulla Mullen Creek. Tulla Mullen Creek Tributary 1 is a first order watercourse under the Strahler stream ordering system. It then becomes a third order watercourse as it crosses longwall 207. The channel of Tulla Mullen Creek Tributary 1 is generally V-shaped with a 1 m to 2 m wide base. The creek bed generally consists of a sandy loam with bed slope between approximately 0.95% to 1.2%.

### 2.3.2 Riparian vegetation

The riparian vegetation along Tulla Mullen Creek is mapped on the Groundwater Dependent Ecosystem Atlas (BoM, 2020) as a 'high potential' groundwater dependent ecosystem (**GDE**) feature. This feature is consistent with Plant Community Type (**PCT**) 399 Red Gum – Tea Tree Creek Woodland with a few small patches of PCT 244 Poplar Box Grassy Woodland. The vegetation is likely to be a facultative GDE[3] given the groundwater is approximately 5.2 meters below ground level (**mbgl**). The natural groundwater fluctuation estimated at groundwater bores in the locality is approximately 5.1 m.

The riparian vegetation on the Namoi River is mapped as PCT 53 Shallow freshwater wetland sedgeland in depressions on floodplains on inland alluvial plains and floodplains and PCT 78 River Red Gum riparian tall woodland / open forest wetland in the Nandewar Bioregion and Brigalow Belt South Bioregion, both mapped as 'high potential' GDEs. The vegetation in this location is also likely to be a facultative given the groundwater

[3] Facultative GDEs require groundwater in some locations but not in others, particularly where an alternative source of water can be accessed to maintain ecological function.

is approximately 6.8 mbgl. The groundwater fluctuation estimated at bores in the locality is approximately 8.7 m.

## 2.4 Water supply for other surface water users

There are a number of major storages in the Namoi River catchment, namely the Keepit, Chaffey and Split Rock dams located on the Namoi, Peel and Manilla Rivers, respectively, which provide water for the licensed water users in the region under the licensing and approvals provisions of the WM Act. These provisions apply to water sources that are the subject of a WSP.

# 3. Implementation and management

## 3.1 Surface water management system

The Narrabri Mine water management system includes:

- up-catchment diversion structures to separate runoff from undisturbed and mining-affected areas;
- storage dams to collect mine water or Pit Top Area runoff for treatment and/or reuse;
- water treatment facilities to treat mine water for beneficial re-use or licensed discharge to the Namoi River;
- sediment dams for treatment of sediment laden runoff from disturbed areas;
- brine storage dams to collect brine waste product for subsequent reuse/disposal; and
- the Namoi River pump station, alluvial production bore and pipeline for supply of raw water and associated raw water storage dams.

The water management system also includes ancillary infrastructure to enable the transfer of water including sumps, drains, tanks, pumps, and pipelines. NCOPL will implement minor augmentations and extensions to the above infrastructure, including the progressive development of pumps, pipelines, water storage and other water management requirements to achieve the following general water management performance measures:

- maintain separation between clean, dirty (i.e. sediment-laden) and mine water management systems;
- minimise the use of clean and potable water on the site;
- maximise water recycling, reuse and sharing opportunities;
- minimise the use of make-up water from external sources;
- design, install, operate and maintain water management systems in a proper and efficient manner; and
- minimise risks to the receiving environment and downstream water users.

The Narrabri Mine site water management system will remain relatively the same as part of Stage 3. New brine storage dams and sediment dams will be built as documented in the Stage 3 EIS. Section 3 of the Site Water Balance (**SWB**) (Attachment 1 of the WMP) provides a detailed description of the site water management system and its function.

The Narrabri Mine water balance is influenced by groundwater inflows, water treatment plant operation, site water demands and runoff from surface water catchments. An operational simulation model (Goldsim) was configured for the Stage 3 EIS to simulate the operations of all major components of the water management system and to assess the dynamics of the mine water balance under conditions of varying rainfall and catchment conditions throughout the development of the mine. The current water balance modelling presented in the SWB (Attachment 1 of the WMP) indicates that:

- there will be no uncontrolled releases of mine water or brine from the site water management system, meaning the development of the mine will not adversely affect surface water quality in downstream receiving waters; and
- over time the mine is predicted to produce excess water to meet operational demands from underground and surface runoff, with external water demands declining to zero over time.

Containment of water potentially affected by coal or other substances is stored within low permeability lined ponds within the Pit Top Area.

Chemical and hydrocarbon products will be stored in bunded areas in accordance with *Australian Standard 1940:2017 The storage and handling of flammable and combustible liquids* (Standards Australia, 2017).

### 3.1.1 Brine management and beneficial reuse options

The NCOPL brine storage dams are managed to ensure there is sufficient operational storage under all climate conditions, with no uncontrolled discharges. These dams are managed in accordance with the Dam Operating Manual which includes consideration of the following:

- real time monitoring of water levels;
- weekly inspections of the dam structure;
- monthly internal reporting of the sites water inventory compared to forecast modelling;
- annual inspections by an external dam's engineer;
- emergency response TARPs; and
- annual water balance modelling to forecast brine inventories and assess the timing of construction of new brine storage dams.

NCOPL has implemented a program for the ongoing review of brine management and to identify any beneficial use options for brine, treated water, and mine water in accordance with the requirements of CoC B36(e)(iii). The program, documented in the *Narrabri Coal Mine Brine Management and Beneficial Use Options Report* (WRM, 2019), includes recommendations for brine management based on an assessment of:

- the reverse osmosis (**RO**) water treatment capacity;
- super concentration of brine (brine squeeze);
- the construction of additional brine storage dams;
- increase in brine use;
- use of mechanical evaporators; and
- use of evaporation covers.

In addition, a beneficial use options assessment was undertaken which included:

- permeate/filtered water onsite reuse, release and/or irrigation;
- brine onsite reuse, storage and/or evaporation; and
- mine water onsite reuse and treatment via the RO treatment plants.

Towards the completion of mining, the brine stored within the brine storage ponds will be reinjected into the longwall goaf through the disused goaf gas drainage holes. The brine dams will be decommissioned and rehabilitated once dewatered.

The brine management and beneficial use options assessment will be reviewed, and where necessary, revised, every five years.

### 3.1.2 Discharge to the Namoi River

As detailed in the SWB (Attachment 1 of the WMP), some of the permeate produced by the water treatment plant will be surplus to requirements and may be discharged to the Namoi River. The existing and approved pipeline currently used for the transfer of water from the river to the mine will be modified to allow for water transfer in the opposite direction. Any discharge to the Namoi River will be directly from the RO plants, or from a dedicated permeate storage. The discharge rate and volume to the river will be sized appropriate to the site water balance surplus. Leak detection will be installed on the pipeline and discharge at the river will be through a diffuser. An auto shut-off valve will be connected through remote process control linked to in-line pH and EC monitoring probes.

Discharge will be in accordance with the conditions of EPL 12789 and meet the following criteria:

- 50% of all samples (volume based) are to be below 250 mg/L of total dissolved solids (**TDS**);
- 100% of all samples (volume based) are to be below 350 mg/L TDS; and
- pH values of all sampled water are to be between 6.5 and 8.5.

The monitoring and sampling of water discharges to the Namoi River is further described in section 4.3.

### 3.1.3 Clean water management

The NCOPL Clean water management system is design to comply with the WM Act for the take of clean water. Where possible and practical to do so, NCOPL diverts clean water around the mine operation. Clean water take at NCOPL is grouped into four categories:

- **Licensed Extraction** - take from an approval extraction source using a water access license, the only licensed extraction point at NCOPL is the Namoi River pump.
- **Excluded works exemption** - clean water runoff into mine and dirty water dams where it is not possible or practical to divert does not need to be accounted for.
- **Harvestable rights** – NCOPL does not use any water from Harvestable rights dams, however there are approximately 51 farms dams within the NCOPL mine lease which were constructed prior to the mine
- **Mixed rights** – clean runoff captured in mine or dirty water dams where it is possible of practical to divert (SD5 and SD6)

Table 3-1 summaries NCOPL compliance with harvestable rights and mixed rights within the mine lease. NCOPL has an excess harvestable rights allowance of 111 ML.

**Table 3-1 Summary of Narrabri Mine Harvestable Rights allowance**

| Description | Volume (ML) |
|---|---|
| **Mining Lease area = 5298 hectares** | |
| Maximum harvestable rights allowance | 344 |
| Harvestable rights dam capacity | 233 |
| Available harvestable rights allowance | 111 |
| Mixed rights allowance | 85 |
| Mixed rights used by site | 8 |
| Available mixed rights | 77 |

## 3.2 Mine subsidence impacts

The predicted geomorphic impacts resulting from an increase in tilt and strain induced cracking are:

- surface cracking and shearing ranging in width from 100 mm to 400 mm could occur with occasional (<5% probability) wider cracks up to approximately 390 mm in sand or loam, and up to approximately 780 mm in clay or rock;
- surface gradients are likely to increase or decrease by up to 2.5% (±1.5º) along creeks;
- discontinuous, or B-Zone sub-surface fracturing is likely to interact with D-Zone surface cracks where cover depths are <300 m above the 306 m wide panels and <390 m above the wider longwalls, meaning creek flows may be temporarily re-routed into open cracks to below-surface pathways and re-surface downstream of the mining extraction limits (within the mining area);
- the majority of potential ponding areas already exist and will develop further along the watercourses and are likely to remain 'in-channel'; and
- the maximum change in pond depths is estimated to range from -0.1 m to 0.9 m (average of 0.6 m).

The relevant Mine Subsidence Assessment undertaken for each Extraction Plan will present a more comprehensive estimate of the predicted mine subsidence impacts.

Further detail of the impacts for each creek system are given in the following sections.

### 3.2.1 Channel geomorphology

The potential impacts of subsidence on stream function will be limited, since the overlying terrain has gentle slopes, and the streambeds are not deeply incised. Impacts are expected to primarily be erosion and ponding in streambeds associated with changes in slope from each longwall subsidence trough, which has the potential for development or extension of knickpoints or headcuts. Major changes in channel geomorphology along Kurrajong Creek, Tulla Mullen Creek Tributary 1, and other minor watercourses are unlikely. Given the ephemeral nature of the creeks, bed changes, erosion and potential incision are expected to occur as part of naturally occurring phenomena.

Table 3-2 describes the potential geomorphic risks to specific watercourses that are potentially prone to incision and destabilisation.

**Table 3-2 Watercourse geomorphic risks**

| Watercourse | Geomorphic risks |
|---|---|
| Kurrajong Creek | • Pre- and post-subsidence channels are located within well-confined valleys. Therefore, major changes in channel geomorphology due to changes in channel location (avulsions) are unlikely.<br>• Some 1st order channels may drain at alternate locations and cause localised bank scour, particularly above Longwall 207 and Longwall 209.<br>• Contour banks above Longwall 203 and Longwall 204 may drain in two directions, causing contour banks to silt up and overtop, potentially resulting in minor downstream erosion by the concentration of flow.<br>• In-channel ponding is expected to occur above all longwall panels upstream of each chain pillar and are expected to accumulate sediment over time.<br>• Overbank ponding is expected to the south of Kurrajong Creek along Longwall 203.<br>• The hydraulic and geomorphic characteristics of the channel at the previously identified and recorded headcut located downstream of the mining area is expected to be unchanged by the development. |
| Tulla Mullen Creek Tributary 1 | • Pre- and post-subsidence channels are located within well-confined valleys. Therefore, major changes in channel geomorphology due to changes in channel location (avulsions) are unlikely.<br>• In-channel ponding is expected to occur above all longwall panels upstream of each chain pillar and are expected to accumulate sediment over time.<br>• Contour banks above Longwall 203 and Longwall 210 may drain in two directions, causing contour banks to silt up and overtop, potentially resulting in minor downstream erosion by the concentration of flow.<br>• An existing farm dam located on cleared agricultural land across Longwall 203 draining to the south of Tulla Mullen Creek Tributary 1 will experience additional ponding. |

Subsidence monitoring of creek lines will be conducted to determine if channel changes are mining-induced and will identify any requirements for remediation works (refer to section 4.5).

***Erosion***

Bed erosion and potential incision is expected to occur on the downstream side of each chain pillar due to an increase in channel slope. The loose sand bed material eroded from these reaches are expected to accumulate in the subsidence trough immediately upstream of the next chain pillar. This process is expected to occur across each chain pillar as mining progresses upstream.

As the beds across the chain pillars erode and the subsidence depressions accumulate the sediment, the only significant long term bed form change is predicted to l be at the upstream end of the most western longwall panel, which will remain with an increased slope, and at the eastern side of the most downstream panel, which will have a reduced bed slope. The streams are all first and second order watercourses with very little catchment at the upstream end of the most western longwall panel, significantly reducing the potential for long-term impacts, including the development or extension of knickpoints or headcuts.

The surface cracking associated with mine subsidence will expose soils to short term erosion during the first flush, which may temporarily increase turbidity and TSS in the local watercourse. It is expected that turbidity and TSS would revert back to background conditions for subsequent flow events as the cracks fill in and repair. As a result, water quality impacts associated with mine subsidence is not expected to be long term or significant.

Surface cracking associated with mine subsidence and the implementation of remedial measures (in accordance with section 3.5.4 of the ESCP [Attachment 2 of the WMP]) will be monitored to minimise potential impacts of short-term erosion during first flush events (refer to section 4.5).

***Ponding***

Impacts associated with existing subsidence (e.g. ponding) above Longwall 101 to Longwall 110 within Pine Creek and Pine Creek Tributary 1 are generally consistent with the predicted impacts, with maximum ground subsidence depths up to approximately 2.75 m.

Potential post-mining ponding locations have been identified for Stage 3, with the assessment of pre-mining surface level contours indicating that the majority of potential ponding areas already exist and will develop further along the watercourses and are likely to remain 'in-channel'. The maximum change in pre- and post-mining pond depth (where positive represents an increase in pond depth) is estimated to range from -0.1 m to 0.9 m (average of 0.6 m).

Subsidence remediation of ponding areas will include:

- ponding located in areas with no vegetation, or if vegetation is not affected, will be allowed to self-correct; and
- ponding located in areas with affected vegetation, or if ponding significantly alters or affects flows, will be assessed and remedial actions (that present the lowest environmental impact) developed in consultation with a geomorphologist.

The Stage 3 EIS has indicated that downstream riparian vegetation will already be adapted to the existing intermittent and infrequent flow conditions, and any change will be significantly less than the natural variation in flow. The total area of native vegetation predicted to be impacted by ponding is 3.6 hectares (**ha**). Riparian vegetation monitoring will be conducted in accordance with the Biodiversity Management Plan.

Detailed measures for surface crack remediation and ponding impacts will be documented in the relevant Extraction Plan/s. Remediation works within a watercourse will be undertaken in consideration of the *Guidelines for Controlled Activities on Waterfront Land* (NRAR 2018).

## 3.3 Local catchment flows

A summary of the reduction in local creek catchment areas is provided in Table 3-3. There will be a minor reduction in catchment flows associated with the proposed Southern Mine Water Storage (approximately 4.6 ha) shown in Figure 1-2 of the WMP. The reduction in Namoi River flows due to catchment excision will be insignificant.

**Table 3-3 Existing and proposed changes to local creek catchments**

| Watercourse | Pre-mining catchment area (ha) | Catchment excised (ha) | | | Total catchment excised (%) |
|---|---|---|---|---|---|
| | | Existing Narrabri Mine | Incremental change due to Stage 3 development | Total | |
| Pine Creek | 6,800 | 0.0 | 0.0 | 0.0 | 0.00 |
| Kurrajong Creek | 5,500 | 247.3 | 0.0 | 247.3 | 4.50 |
| Tulla Mullen Creek | 10,700 | 0.0 | 4.6 | 4.6 | 0.04 |

**Note:** Does not include ventilation shaft and borehole sediment dam catchment impacts.

Subsidence was predicted to increase the surface area of depressions in drainage lines from 8.3 ha (existing case) to 16.7 ha (impacted case). The removal of the existing farm dams associated with Kurrajong Creek and Kurrajong Creek Tributary 1 will reduce the surface area under the impacted case to 13.2 ha. The total volume of water retained in the local waterways by the additional surface depressions, assuming no remediation or infilling, will be 41.8 ML without the removal of the farm dams and 24.5 ML when the dams are removed. There will be a negligible to no impact on the flow regime of the watercourses as this volume is negligible when compared to the expected mean annual runoff volume for Kurrajong Creek and Tulla Mullen Creek Tributary 1 to the eastern boundary (combined) of 1,230 ML.

There will be negligible baseflow changes to the Namoi River during the life of mine. However, there will be minor reductions in baseflow in the Namoi River post-mining. The predicted reduction in baseflows in the Namoi River will not measurably affect overall baseflow.

For the purpose of restoring flow in watercourses within and in the vicinity of the mine, NCOPL will decommission the two farm dams located on Kurrajong Creek (as discussed above) as well as other farm dams (where necessary) subject to obtaining relevant approvals.

The maximum annual take of water from subsidence surface cracks (conservatively assuming the cracks will be filled twice between each six-month rehabilitation period), is estimated to be:

- 3,500 $m^3$ or 3.5 ML for the 1st and 2nd order watercourses;
- 700 $m^3$ or 0.7 ML for the 3rd order watercourses; and
- a total of 4,200 $m^3$ or 4.2 ML from all watercourses.

This capture volume is negligible when compared with the expected average annual runoff volume from all local catchments of more than 2,800 ML. For the predicted surface water take due to surface cracking within first and second order watercourses (up to 3.5 ML/annum), NCOPL may rely on its harvestable right entitlement for the water storages.

A water access license may be required for the take from the third order watercourses issued under the *WSP for the Namoi and Peel Unregulated Rivers Water Sources 2012* (Eulah Creek Water Source) and the harvestable right defined under the WM Act may be used for the take from the first and second order watercourses. NCOPL will obtain the appropriate licence under the Eulah Creek Water Source once the subsidence induced water take requirement is quantified as outlined in section 4.4.1.

## 3.4 Namoi River surface water extraction

Licensed surface water extraction from the Namoi River will be undertaken when supply from the underground mining area is insufficient to meet the mine's water demands and external make-up water is required. Water will be extracted in accordance with the licensed entitlements allocated under the relevant water access licenses (**WALs**) held by NCOPL (section 3.3.1 of the SWB [Attachment 1 of the WMP]) and the rules prescribed in the WSP.

The SWB modelling (section 3.5 of the SWB [Attachment 1 of the WMP]) demonstrates that make-up water demands can be met with water licences currently held by NCOPL.

## 3.5 Flooding

The Narrabri Mine Pit Top Area (with the exception of the Namoi River pump station, alluvial production bore and the pipeline) is located outside the Upper Namoi Valley floodplain management plan extent and at least 20 m in elevation above the Namoi River floodplain (i.e. outside the 100-year average recurrence interval (**ARI**) flood extent). As such, the Namoi River will not inundate the Pit Top Area.

Conversely, the impact of the Namoi River pump station, alluvial production bore and pipeline on the Namoi River Floodplain will be negligible, given they are mostly underground with minimal above-ground components. Consequently, the development and operation of Narrabri Mine will not have any significant impact on Namoi River flooding.

Flooding from the local watercourses has been assessed and does not pose a risk to operational areas, as the watercourses are small.

## 3.6 Water supply for other surface water users

Farm dams located downstream of the Narrabri Mine that potentially draw on creek flows may require compensation measures should surface flows or water quality be impacted by mining operations, taking into account allowable water capture associated with harvestable water rights under the WM Act. In accordance with CoC B32, if NCOPL and a landowner cannot agree on whether the loss of water is to be attributed to the development or the measures to be implemented under CoC B28 to CoC B31, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Planning Secretary for resolution.

In addition, appropriate impact management strategies for farm dams and soil contour banks will be described in the relevant Extraction Plan/s. Remediation will occur to any of the farm dams if significant drawdown is observed.

## 3.7 Sewage treatment and effluent management

The onsite sewage treatment plant will be used to treat wastewater from bath house facilities with the effluent (treated water) discharged to a suitable transpiration area. On-site sewage treatment and disposal will be managed in accordance with the requirements of the NSC.

## 3.8 Water management of rehabilitated areas

NCOPL will progressively rehabilitate disturbed land and construct drainage controls to improve soil stability and ripping to promote infiltration. Runoff from areas under active rehabilitation will be captured in sediment dams and either transferred to the site water management system for reuse in mine operations or undergo controlled release following rainfall events that exceed sediment dam design capacity via licensed discharge points (in accordance with EPL 12789). Operational sediment and erosion control devices will be maintained during the establishment of revegetation.

Once self-sustaining stable final landforms have been achieved within an area, key elements of the operational sediment control structures will be either left as passive water control storages or removed to allow the area to become free draining.

Section 3.5.6 of the ESCP (Attachment 2 of the WMP) provides measures for erosion and sediment control in rehabilitated areas.
Surface water monitoring program

## 3.9 Monitoring standards

Surface water monitoring at Narrabri Mine will be undertaken in accordance with the Australian Standard for Water Quality Sampling *AS/NZS 5667.1:1998* and the *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (EPA 2022). Laboratory analysis will be undertaken by a laboratory which has the relevant accreditation by the National Association of Testing Authorities (**NATA**).

## 3.10 Water storages

### 3.10.1 Sediment dams

Condition L2 of EPL 12789 specifies the concentration limits for each sediment dam discharge monitoring point. The impact assessment criteria detailed in Table 4-1 are relevant to water discharged from the Narrabri Mine.

**Table 3-4 Sediment dam discharge concentration limits**

| Pollutant | Units of Measure | 100 percentile concentration limit | Monitoring location |
|---|---|---|---|
| Oil and Grease | mg/L | 10 | SD2, SD4, SD7, and SD8 |
| pH | pH | 6.5 - 8.5 | SD2, SD4, SD7, and SD8 |
| Total Suspended Solids (TSS) | mg/L | 50 | SD2, SD4, SD7, and SD8 |

The TSS concentration limits in Table 4-1 may be exceeded for water discharged provided that:

- the discharge occurs solely as a result of rainfall measured at the premises that exceeds 38.4 mm over any consecutive 5-day period[4] immediately prior to the discharge occurring; and
- all practical measures have been implemented to dewater all sediment dams within 5 days of rainfall such that they have sufficient capacity to store run off from a 38.4 mm, 5-day rainfall event.

[4] 38.4 mm equates to the 5-day 90%ile rainfall depth for Gunnedah sourced from Table 6.3a *Managing Urban Stormwater: Soils and Construction Volume 1: 4th edition,* March 2004.

Table 4-2 below details the sediment dam monitoring program and Figure 4-1 shows the sediment dam monitoring locations.

**Table 3-5 Sediment dam monitoring program**

| Monitoring location | Coordinates (GDA 94 / MGA 55) | | Parameters | Frequency |
|---|---|---|---|---|
| | Easting | Northing | | |
| **SD1** | 778977 | 6619758 | **Field analysis:**<br>• Water level / storage volume<br>• EC<br>• pH<br>• Turbidity<br>• Dissolved oxygen (**DO**)<br>• Temperature<br><br>**Laboratory analysis:**<br>• pH<br>• EC<br>• TDS<br>• TSS<br>• Turbidity<br>• TOC<br>• Oil & Grease<br>• Metals and metalloids - aluminium, arsenic, cadmium, chromium, copper, lead, nickel, selenium, zinc, iron, molybdenum, antimony, mercury, cobalt. | • Monthly (water level)<br>• Quarterly (water quality)<br>• During discharge event but within 12 hours of discharge from SD2, SD4, SD7 and SD8 (monitoring required from SD2, SD4, SD7 and SD8 only). |
| **SD2** | 779147 | 6619777 | | |
| **SD3** | 778498 | 6620790 | | |
| **SD4** | 778725 | 6620664 | | |
| **SD6** | 775632 | 6620750 | | |
| **SD7** | 779219 | 6620708 | | |
| **SD8** | 773846 | 6620368 | | |

### 3.10.2 Rail loop dams and sediment basins

No discharge of mine water from the rail loop storage dams or the sediment basins is licensed to occur under EPL 12789.

Table 4-3 below details the mine water storage monitoring program and Figure 4-1 shows rail loop dams and sediment basin monitoring locations.

**Table 3-6 Mine water storage monitoring program**

| Monitoring location[1] | Coordinates (GDA 94 / MGA 55) | | Parameters | Frequency |
|---|---|---|---|---|
| | Easting | Northing | | |
| **Sediment basins** | | | | |
| **SB1** | 778249 | 6619758 | **Field analysis:**<br>• Water level / storage volume<br>• EC<br>• pH<br>• Turbidity<br>• DO<br>• Temperature<br><br>**Laboratory analysis[2]:**<br>• pH<br>• EC<br>• TDS<br>• TSS<br>• Turbidity<br>• TOC<br>• Oil & Grease<br>• Metals and metalloids - aluminium, arsenic, cadmium, chromium, copper, lead, nickel, selenium, zinc, iron, molybdenum, antimony, mercury, cobalt. | • Monthly (water level)<br>• Quarterly (water quality) |
| **SB2** | 778549 | 6619835 | | |
| **SB3** | 777336 | 6620765 | | |
| **SB4** | 778309 | 6620726 | | |

| Monitoring location[1] | Coordinates (GDA 94 / MGA 55) | | Parameters | Frequency |
|---|---|---|---|---|
| | Easting | Northing | | |
| **Rail Loop Dams** | | | | |
| **A1** | 778483 | 6620267 | **Field analysis:**<br>• Water level / storage volume<br>• EC<br>• pH<br>• Turbidity<br>• DO<br>• Temperature<br><br>**Laboratory analysis[2]:**<br>• pH<br>• EC<br>• TDS<br>• TSS<br>• Turbidity<br>• TOC<br>• Oil & Grease<br>• Total algae, Alkalinity, Acidity, Sulfate and Sodium Adsorption Ratio<br>• Metals and metalloids - aluminium, arsenic, cadmium, chromium, copper, lead, nickel, selenium, zinc, iron, molybdenum, antimony, mercury, cobalt. | • Monthly (water level) – *excluding boxcut*.<br>• Quarterly (water quality) |
| **A2** | 778419 | 6620387 | | |
| **A3** | 778393 | 6620458 | | |
| **B1** | 778507 | 6620082 | | |
| **B2** | 778614 | 6620327 | | |
| **Boxcut[3]** | 777827 | 6620316 | | |
| **C** | 778748 | 6620293 | | |

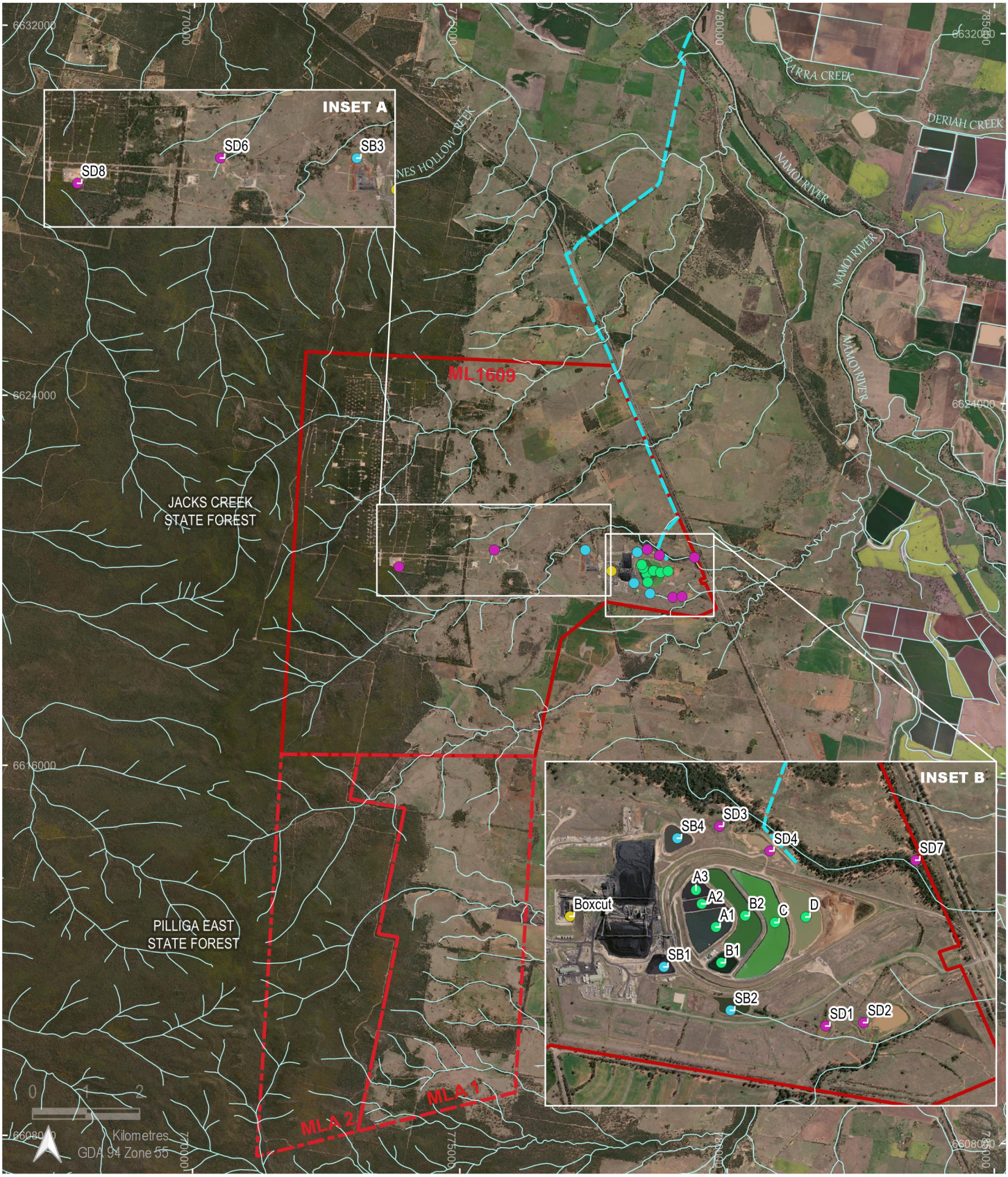
| Monitoring location[1] | Coordinates (GDA 94 / MGA 55) | | Parameters | Frequency |
|---|---|---|---|---|
| | Easting | Northing | | |
| D | 778887 | 6620323 | | |

**Note:**

[1] The new brine ponds (BR1 to BR5) will be progressively added to the monitoring program following construction of each pond.

[2] Metals (except arsenic and selenium), sodium adsorption ratio and algae are not analysed for the boxcut.

[3] Additional monitoring of water quality entering the underground mine workings is included in the Groundwater Management Plan (**GWMP [Attachment 4 of the WMP]**).

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## LEGEND

- ML1609
- MLA1
- MLA2
- Namoi River pipeline (buried)
- Watercourse

**Surface water monitoring locations**

- Boxcut
- Rail loop dam
- Sediment basin
- Sediment dam

**NARRABRI MINE**

**FIGURE 4-1**

Mine water storage and sediment dam monitoring locations

## 3.11 Treated water discharge

The criteria listed in Table 4-3 are relevant to excess treated water discharged from the Narrabri Mine to the Namoi River. The concentration limits are in accordance with EPL 12789 Condition L.2 and CoC B34. In accordance with EPL 12789 condition M2.7, NCOPL will collect samples as soon as practicable after each discharge commences from point NR1 and in any case not more than 4 hours after each discharge.

**Table 3-7 Namoi River discharge criteria and sampling requirements**

| ID | Parameter | Unit | Concentration limit | | Method | Frequency |
|---|---|---|---|---|---|---|
| | | | 50%-ile | 100%-ile | | |
| **NR1** | pH | pH | - | 6.5-8.5 | In situ | As soon as practicable after each discharge commences from point NR1 and in any case not more than 4 hours after each discharge |
| | TDS | mg/L | 250 | 350 | Grab sample | |
| | EC[1] | µs/cm | (417) ^ | (583) ^ | In-situ | |
| **NRUS** | pH | pH | - | - | In situ | |
| | TDS | mg/L | - | - | Grab sample | |
| **NRDS** | pH | pH | - | - | In situ | |
| | TDS | mg/L | - | - | Grab sample | |

**Note:**

^The numbers in brackets are not concentration limits, but represent a proxy for the TDS limits through measurement of EC. A factor of 0.6 has been adopted to represent the relationship between TDS and EC at the Narrabri Mine. The adopted value is considered reasonable and is based on known relationships throughout Australia. Monitoring data has shown the factor is very conservative but will be used until an accurate TDS to EC conversion factor has been established.

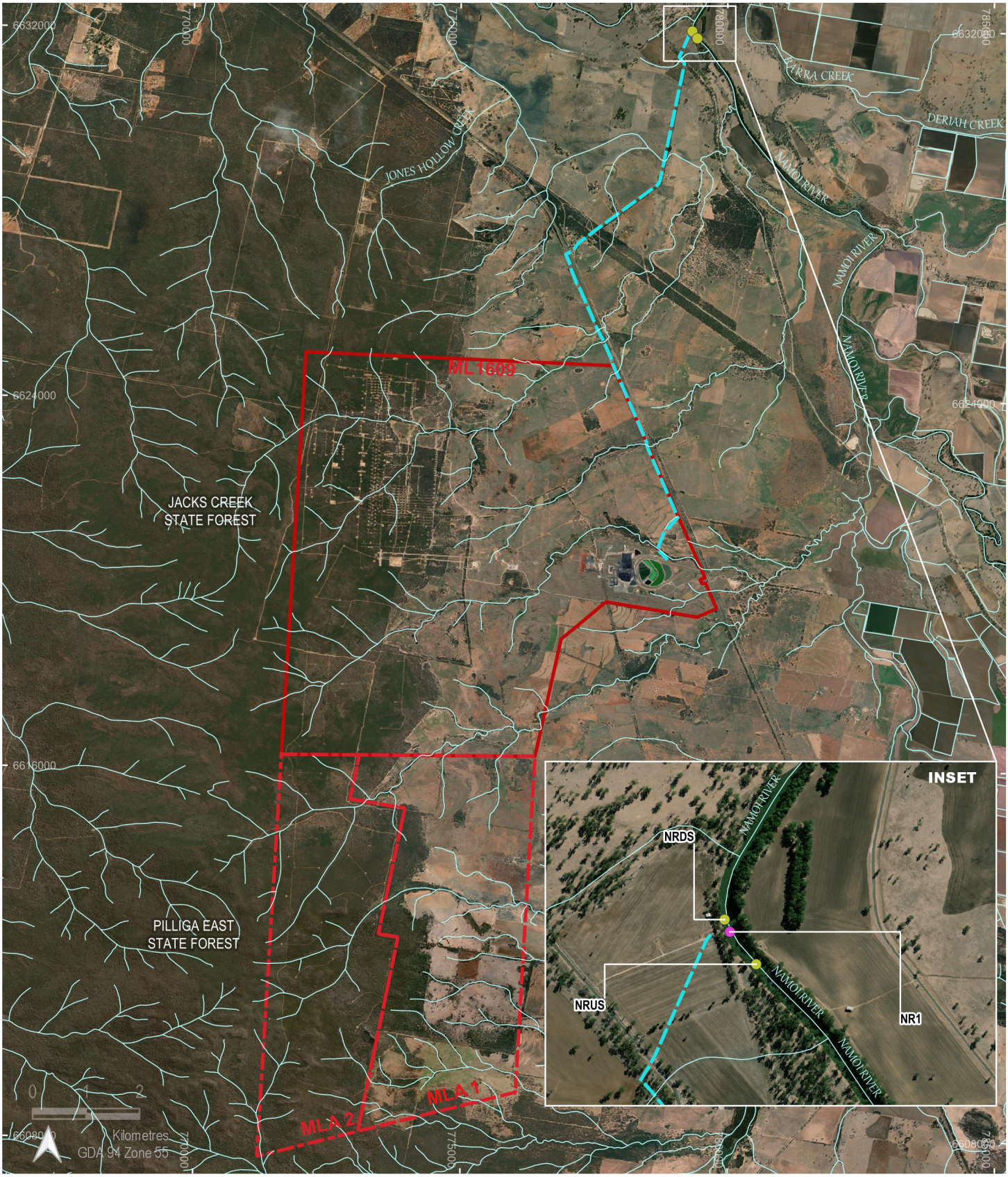
Continuous (in-line) pH and EC monitoring of the permeate will occur at the water treatment plant as an internal operational control. Grab samples for pH and TDS will be obtained at the discharge location NR1. No discharge will occur at any time if the pH or EC values are outside of the criteria in Table 4-3.

Samples of representative ambient river water will be collected at NRUS and NRDS for laboratory analysis for TDS. In-situ (field) pH analysis will be conducted using an appropriately calibrated and multi-parameter water quality meter. All permeate discharge data, including date, time, duration, volumes and the *in-situ* and laboratory analysis results will be recorded and reported as required.

The coordinates of the Namoi River discharge and monitoring locations are presented in Table 4-4, with the locations shown in Figure 4-2.

**Table 3-8 Permeate discharge and monitoring locations**

| NCOPL ID | Eastings | Northings | EPL site ID | Comment / monitoring purpose |
|---|---|---|---|---|
| **NR1** | 779308 | 6631939 | EPL 24 | Discharge point at the Namoi River |
| **NRUS** | 779387 | 6631803 | EPL 25 | Upstream ambient water quality monitoring point for Namoi River discharge point (NR1) |
| **NRDS** | 779319 | 6631992 | EPL 26 | Downstream ambient water quality monitoring point for Namoi River discharge point (NR1) |

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**LEGEND**

- ML1609
- MLA1
- MLA2
- Namoi River monitoring point
- Namoi River discharge point
- Namoi River pipeline (buried)
- Watercourse

**NARRABRI MINE**

**FIGURE 4-2**
Namoi River Discharge and Monitoring Points

## 3.12 Surface water creeks

The surface water impact assessment criteria for monitoring locations downstream of the Narrabri Mine have been established with reference to baseline data presented in section 2.1. The impact assessment criteria has been established for the purpose of assessing potential impacts on the receiving environment from mining operations in accordance with the *Australian & New Zealand Guidelines For Fresh & Marine Water Quality Australian* (ANZG 2018) and the *NSW Water Quality Objectives* (DEC 2006).

The impact assessment criteria have been derived from historical surface water quality data which has been collected at the Narrabri Mine since July 2017, as described in section 2.1.2.

The site specific impact assessment criteria for downstream receiving waters are:

- pH is outside the range of 6.5 – 8.0 for three consecutive readings.
- Stage 1 EC, TSS and TOC above 90% probability of being different from those already measured (i.e. 90% confidence level).
- Stage 2 EC, TSS and TOC above 95% probability of being different from those already measured (i.e. 95% confidence level).

The surface water quality impact assessment criteria and corresponding monitoring location are presented in Table 4-6.

**Table 3-9 Downstream surface water impact assessment criteria**

| Parameter | Trigger | Monitoring location[1] | | | | |
|---|---|---|---|---|---|---|
| | | PCa | PC1 | KC1DS | KC2DS | KCDS |
| pH[2] | - | 6.5 - 8.0 | 6.5 - 8.0 | 6.5 - 8.0 | 6.5 - 8.0 | 6.5 - 8.0 |
| EC (µs/cm) | Stage 1 | 163.5 | 235.0 | 580.0 | 181.5 | 477.3 |
| | Stage 2 | 169.3 | 511.9 | 741.0 | 204.0 | 572.0 |
| Total suspended solids (mg/L) | Stage 1 | 288.0 | 259.5 | 252.2 | 108.0 | 439.2 |
| | Stage 2 | 315.7 | 470.3 | 372.4 | 334.6 | 533.9 |
| Total organic carbon (TOC) | Stage 1 | 15.6 | 18.0 | 20.0 | 22.8 | 16.7 |
| | Stage 2 | 16.8 | 20.3 | 21.2 | 24.0 | 18.9 |

**Notes:**

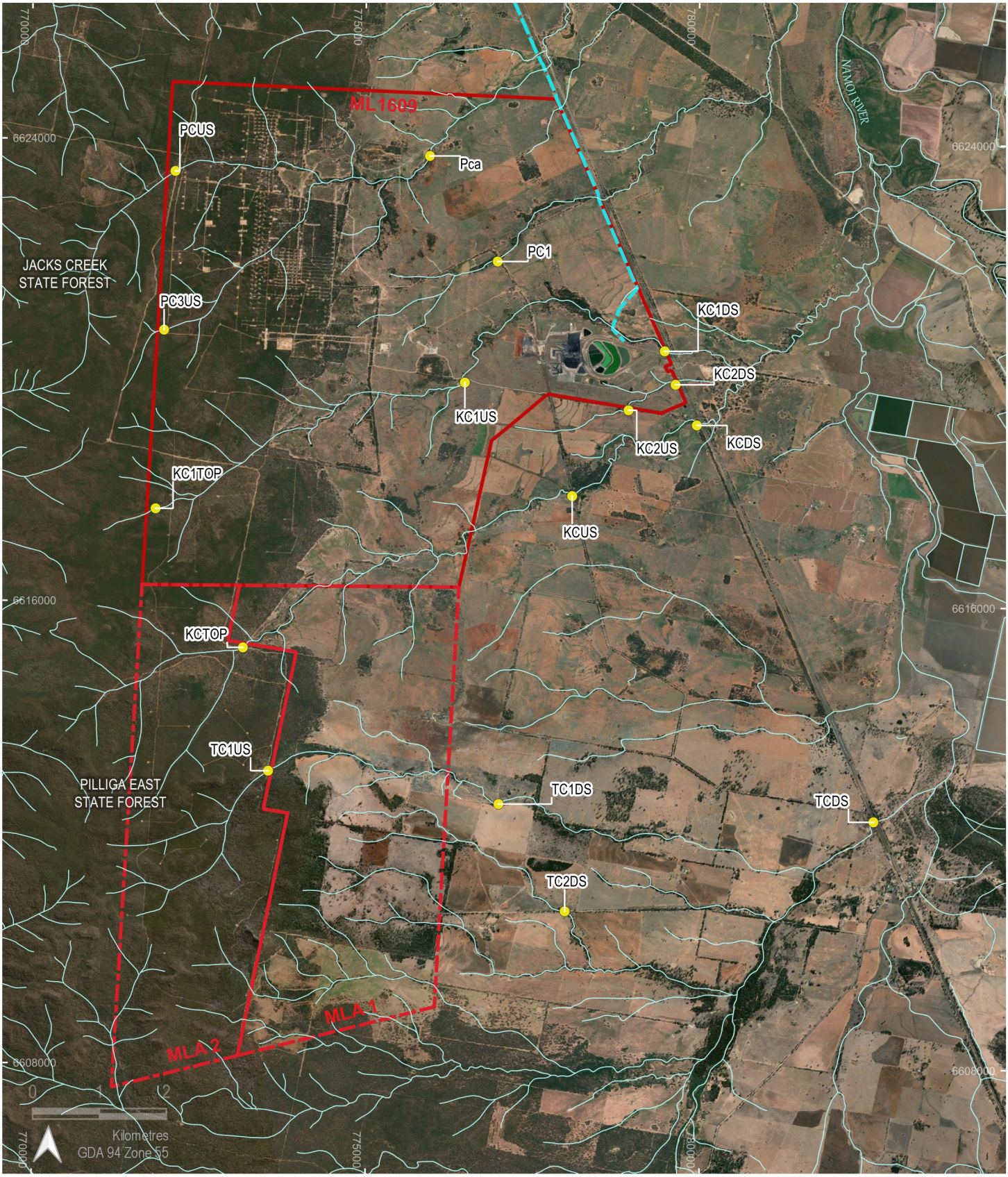
[1] Impact assessment criteria will be derived for monitoring location TCDS once sufficient baseline data has been collected.
[2] Namoi River Water Quality and River Flow Objectives 'Ecosystem' trigger values.

Table 4-7 details the surface water monitoring program and Figure 4-3 presents the monitoring locations. Any new sites that may be established will require the collection of sufficient baseline data to derive site specific impact assessment criteria as defined in this section.

### Table 3-10 Surface water monitoring program

| Monitoring location | Coordinates (GDA 94 / MGA 55) | | Parameters | Frequency |
|---|---|---|---|---|
| | Easting | Northing | | |
| **PCUS** | 771758 | 6623420 | **Field analysis:**<br>• EC<br>• pH<br>• Turbidity<br>• DO<br>• Temperature<br><br>• Laboratory analysis:<br>• pH<br>• EC<br>• TDS<br>• TSS<br>• Turbidity<br>• TOC<br>• Oil & Grease<br>• Metals and metalloids - aluminium, arsenic, cadmium, chromium, copper, lead, nickel, selenium, zinc, iron, molybdenum, antimony, mercury, cobalt. | • Quarterly, in the event of flow during the quarter<br>• During discharge event from SD2, SD4, SD7 and SD8 but within 12 hours of discharge^. Locations to be monitored during discharge events include:<br>▪ During discharge from SD2 – KC2US and KC2DS will be monitored.<br>▪ During discharge from SD4 and/or SD7 – KC1US and KC1DS will be monitored.<br>▪ During discharge from SD8 – KC1TOP and KC1US will be monitored. |
| **PCa** | 775957 | 6623752 | | |
| **PC1** | 776973 | 6621935 | | |
| **PC3US** | 771974 | 6620707 | | |
| **KC1TOP** | 771851 | 6617614 | | |
| **KC1US** | 776483 | 6619836 | | |
| **KC1DS** | 779479 | 6620404 | | |
| **KC2US** | 778937 | 6619379 | | |
| **KC2DS** | 779642 | 6619827 | | |
| **KCUS** | 778093 | 6617886 | | |
| **KCDS** | 779961 | 6619127 | | |
| **TCDS** | 782609 | 6612284 | | |
| **KCTOP** | 773161 | 6615221 | | |
| **TC1US** | 773540 | 6613092 | | |
| **TC2DS** | 777985 | 6610701 | | |
| **TC1DS** | 776993 | 6612548 | | |

**Note:**
^ Sample collected when safe to do so and access permits, generally during daylight hours.

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**LEGEND**

- ML1609
- MLA1
- MLA2
- Ambient flow monitoring point
- Namoi River pipeline (buried)
- Watercourse

**NARRABRI MINE**

**FIGURE 4-3**
Surface Water Monitoring Locations

### 3.12.1 Stream flow

In accordance with CoC B36(e)(iii), NCOPL are required to consider alternatives to measuring or predicting creek flows for the purpose of supporting water take licensing, to improve understanding of the hydrology, and to interpret water quality and erosion observations.

An assessment will be undertaken by a surface water specialist within 12 months of commencement of Stage 3 to consider alternative methodologies of measuring and/or predicting creek flows. Following the assessment, the appropriate method (if feasible) for formally recording creek flow conditions and contingency measures will be incorporated into this Plan.

An approach for quantifying losses of stream flow from surface cracking and ponding for a range of climatic scenarios will be established and included in this Plan following the assessment. The aim of this monitoring is to determine the requirement for a WAL under the *WSP for the Namoi and Peel Unregulated Rivers Water Sources 2012* (Eulah Creek Water Source).

To detect potential surface water ingress into the underground workings the monitoring of underground dewatered volumes is undertaken in accordance with the Groundwater Management Plan (Attachment 4 of the WMP). A significant increase in the monitored flow following surface runoff would indicate that surface water may have reached the underground workings.

## 3.13 Channel geomorphology and riparian vegetation

Observations of any subsidence effects such as surface cracking, ponding, and erosion will be recorded and reported to the Environment Superintendent as they are identified. Surface cracks are considered permanent if they have not closed within one month of the longwall face passing. Where this occurs, appropriate management measures will be implemented as detailed in the relevant Extraction Plan/s.

Visual inspections will be performed to determine surface crack locations and extent of ponding within the predicted subsidence zones. Monitoring will record the location, the extent of ponding (size) and if there is significant vegetation that may require monitoring of vegetation health. Where significant impacts to vegetation are detected (e.g. canopy dieback), vegetation monitoring will be conducted in accordance with the Biodiversity Management Plan. For ponding where there is little or no vegetation, the extent of ponding will be monitored to assess the risk of downstream impacts (i.e. water quality).

Creek line subsidence surveys will be designed to identify the main geomorphic zones and to provide quantitative information to document changes in channel cross-section, bed erosion and deposition. Geomorphic zones will be defined during baseline surveys based on stream order, dominant channel bed material, bed stability, and channel geometry etc.

Locations for cross-sections will also be determined during the baseline surveys to confirm channel parameters (i.e. channel width, depth, area, and bank full level). A reach of at least 100 m in length will be surveyed from each geomorphic zone and at least four cross sections recorded at equal intervals along the reach. Two to three reaches each at least 100 m long within a control zone will also be surveyed to provide information on natural channel variability between survey periods. These control surveys will provide an indication of natural variability due to rainfall events that can be used to determine if channel changes are mining-induced (e.g. changes to channel area and bed slope, erosion of channel banks and bed, or sediment deposition). Permanent pegs will be established at each cross-section to ensure comparability of cross-section sequences.

Creek line surveys will be undertaken annually and after a significant rainfall event (defined as a 5-day 90$^{th}$ percentile rainfall event which is 38.4 mm over 5 consecutive days). Restriction of flows and hence restriction

of fish passage will be assessed following a rainfall event to facilitate appropriate restorative measures (if required). The final location of on-going monitoring reaches and cross-sections will be determined following the completion of the baseline survey.

Table 4-7 provides the creek line subsidence monitoring program which is detailed further in the relevant Extraction Plan/s.

**Table 3-11 Summary of creek line subsidence monitoring program**

| Aspect/feature | Frequency | Method and analysis | Parameters |
|---|---|---|---|
| **Surface cracking and ponding** | | | |
| Surface cracking | During active subsidence, monthly and following a significant rainfall event (defined as a rainfall event >38.4 mm over 5 consecutive days). | Visual inspections directly behind to longwall face to:<br>• identify areas of surface cracking and ponding.<br>• identify erosion/potential erosion.<br>• record nature and extent of sedimentation (location, extent, depth, sediment calibre).<br>• identify a decline in riparian vegetation health in ponded areas.<br>• determine appropriate management response. | • surface crack GPS location, depth and width.<br>• bed and bank stability.<br>• erosion and potential for erosion (e.g., nick points, head cuts).<br><br>Vegetation health is to be monitored in accordance with the relevant Extraction Plan. |
| Watercourses and ponding | Baseline and then quarterly during active subsidence | Visual inspection and photographs within the active subsidence zone to:<br>• Identify areas of ponding, including vegetation.<br>• Identify erosion/potential erosion.<br>• Record nature and extent of sedimentation (location and approximate extent/depth).<br>• Determine appropriate management response. | • Ponding GPS location, width, depth, area, presence of vegetation.<br>• Bed and bank stability.<br>• Watercourse erosion and potential for erosion (e.g., knickpoints, head cuts). |
| **Remote sensing** | | | |
| Topography and landscape morphology | Baseline then every 3 years (triennially). | LiDAR over entire site. | • high resolution topography.<br>• creek line slope and volumes. |
| Vegetative cover characteristics and erosion monitoring | Baseline and then annually. | Multi-spectral imaging. | • vegetative biomass and cover (pasture).<br>• erosion. |
| **Creek line surveys** | | | |

| Aspect/feature | Frequency | Method and analysis | Parameters |
|---|---|---|---|
| Geomorphic survey | Baseline and then annually for a period of 2 years following longwall mining. | In watercourses with a predicted risk of altered bed slopes following subsidence and likely effects of increased channel gradients (e.g. upstream and downstream of chain pillars) | • mapping and description.<br>• survey (100 m reach). |
| Channel survey | Baseline and then annually for a period of 2 years following longwall mining. | • effectiveness of gully erosion stabilisation methods.<br>• cross-section diagrams. | • identification of ponding - GPS location, width, depth, area, significant vegetation.<br>• channel parameters.<br>• advancement of gully erosion. |
| Direct field survey | Following changes detected during remote sensing. | • field inspection.<br>• sampling/testing as required. | Determined during field survey. |

## 3.14 Meteorological monitoring

The meteorological monitoring program is described in the SWB (Attachment 1 of the WMP).

# 4. Trigger Action Response Plan

The TARP (Table 5-1) includes triggers to respond to any exceedances of the surface water related criteria and performance measures. The TARP also includes trigger levels for identifying and investigating any potential adverse impacts associated with channel stability and riparian vegetation health.

TARPs for water supply for other water users will be developed as part of the relevant Extraction Plan/s.

The previous Surface and Groundwater Response Plan is now incorporated into the TARP (Table 5-1) and the exceedance notification and reporting requirements are detailed in section 6 and section 7 of the WMP.

**Table 4-1 Surface water TARP**

<table>
<tr><th>Method</th><th>Status</th><th>Trigger</th><th>Action</th><th>Response</th></tr>
<tr><td colspan="5">Water quality creeks</td></tr>
<tr><td rowspan="2">To identify potential surface water quality impacts as a result of mining activities (e.g. via run off, subsidence cracking, ponding, erosion, changes in water course morphology).<br><br>Sites:<br>• PCa, PC1, KC1DS, KC2DS, KCDS.<br><br>Parameters:<br>• Field - EC, pH<br>• Laboratory - TSS, TOC<br><br>Frequency:<br>• Quarterly.<br>• During flow event (as practical).<br>• During discharge event from SD2, SD4, SD7 and SD8 but within 12 hours of discharge (as practical).<br><br>Analysis:<br>• Comparison to water quality impact assessment criteria (with consideration to upstream water quality and water quality trends over time).</td><td>Normal</td><td>Water quality below established trigger levels and CoC B34 performance measures met.</td><td>None required.</td><td>• Continue to implement surface water management measures in accordance with this Plan.<br>• Continue routine surface water monitoring and evaluation of results.</td></tr>
<tr><td>Level 1</td><td>• Less than pH 6.5 or greater than pH 8.0.<br>• EC, TSS and TOC exceeding Stage 1 trigger shown below.<br><table><tr><th rowspan="2">Parameter</th><th rowspan="2">Trigger</th><th colspan="5">Monitoring location</th></tr><tr><th>PCa</th><th>PC1</th><th>KC1DS</th><th>KC2DS</th><th>KCDS</th></tr><tr><td>EC (µs/cm)</td><td>Stage 1</td><td>163.5</td><td>235.0</td><td>580.0</td><td>181.5</td><td>477.3</td></tr><tr><td>Total suspended solids (mg/L)</td><td>Stage 1</td><td>288.0</td><td>259.5</td><td>252.2</td><td>108.0</td><td>439.2</td></tr><tr><td>Total organic carbon (TOC)</td><td>Stage 1</td><td>15.6</td><td>18.0</td><td>20.0</td><td>22.8</td><td>16.7</td></tr></table></td><td>Conduct preliminary quality assurance of data to confirm an exceedance.</td><td>For a single exceedance, the exceedance will be recorded, with no further contingency or notification measures required. If pH or a Stage 1 trigger is exceeded at the same location for three consecutive sampling events, then the actions required for Level 2 will be implemented.</td></tr>
</table>

<table>
<tr><th>Method</th><th>Status</th><th>Trigger</th><th>Action</th><th>Response</th></tr>
<tr><td></td><td>Level 2</td><td>
<ul>
<li>Less than pH 6.5 or greater than pH 8.0 for three consecutive monitoring events.</li>
<li>EC, TSS and TOC exceeding Stage 1 trigger (shown below) for the same parameter exceeded at the same location for three consecutive monitoring events.</li>
<li>EC, TSS and TOC exceeding Stage 2 trigger (shown below).</li>
</ul>
<table>
<tr><th rowspan="2">Parameter</th><th rowspan="2">Trigger</th><th colspan="5">Monitoring location</th></tr>
<tr><th>PCa</th><th>PC1</th><th>KC1DS</th><th>KC2DS</th><th>KCDS</th></tr>
<tr><td rowspan="2">EC (µs/cm)</td><td>Stage 1</td><td>163.5</td><td>235.0</td><td>580.0</td><td>181.5</td><td>477.3</td></tr>
<tr><td>Stage 2</td><td>169.3</td><td>511.9</td><td>741.0</td><td>204.0</td><td>572.0</td></tr>
<tr><td rowspan="2">Total suspended solids (mg/L)</td><td>Stage 1</td><td>288.0</td><td>259.5</td><td>252.2</td><td>108.0</td><td>439.2</td></tr>
<tr><td>Stage 2</td><td>315.7</td><td>470.3</td><td>372.4</td><td>334.6</td><td>533.9</td></tr>
<tr><td rowspan="2">Total organic carbon (TOC)</td><td>Stage 1</td><td>15.6</td><td>18.0</td><td>20.0</td><td>22.8</td><td>16.7</td></tr>
<tr><td>Stage 3</td><td>16.8</td><td>20.3</td><td>21.2</td><td>24.0</td><td>18.9</td></tr>
</table>
</td><td>
<ul>
<li>Conduct preliminary quality assurance of data to confirm an exceedance.</li>
<li>Environmental Superintendent to implement contingency and notification measures as per section 6 of the WMP.</li>
</ul>
</td><td>
<ul>
<li>Hydrologist (or similar specialist) to review sampling and climate data and compare to upstream value to confirm likely mining impact or otherwise. If mine related, undertake physical inspection of affected surface and creeks to identify potential source of water quality degradation.</li>
<li>Implement appropriate management or contingency response (i.e. repair of subsidence cracking, remediation of ponding, erosion control works and rehabilitation).</li>
</ul>
</td></tr>
<tr><td colspan="5">Water quality sediment dam storages</td></tr>
<tr><td rowspan="2">Sites:<ul><li>All licensed discharge points (SD2, SD4, SD7 and SD8).</li></ul>Parameters:<ul><li>Field - pH</li><li>Laboratory - TSS, oil and grease</li></ul>Frequency:<ul><li>During discharge event but within 12 hours of discharge from SD2, SD4, SD7 and SD8.</li></ul>Analysis:<ul><li>Comparison to water quality impact assessment criteria. Used to identify potential discharge non-compliance.</li></ul></td><td>Normal</td><td>Discharge water quality below established trigger levels and performance measures met.</td><td>None required.</td><td>
<ul>
<li>Continue to implement surface water management measures in accordance with this Plan.</li>
<li>Continue routine surface water monitoring and evaluation of results.</li>
</ul>
</td></tr>
<tr><td>Level 2</td><td>
Discharge exceeding impact assessment criteria.
<table>
<tr><th>Pollutant</th><th>Units of Measure</th><th>100 percentile concentration limit</th></tr>
<tr><td>Oil and Grease</td><td>mg/L</td><td>10</td></tr>
<tr><td>pH</td><td>pH</td><td>6.5 - 8.5</td></tr>
<tr><td>Total Suspended Solids (TSS)</td><td>mg/L</td><td>50</td></tr>
</table>
Note:<br>The TSS concentration limit may be exceeded for water discharged provided that:
<ul>
<li>the discharge occurs solely as a result of rainfall measured at the premises that exceeds 38.4 mm over any consecutive 5-day period immediately prior to the discharge occurring; and</li>
<li>all practical measures have been implemented to dewater all sediment dams within 5 days of rainfall such that they have sufficient capacity to store run off from a 38.4 mm, 5-day rainfall event.</li>
</ul>
</td><td>
<ul>
<li>Environmental Superintendent to implement contingency and notification measures as per section 6 of the WMP.</li>
<li>Environmental Superintendent to implement Pollution Incident Response Management Plan (PIRMP).</li>
</ul>
</td><td>
<ul>
<li>Report exceedance in accordance with the WMP.</li>
<li>Investigate cause of exceedance and implement identified adaptive management measures.</li>
</ul>
</td></tr>
<tr><td colspan="5">Water level in rail loop water storages A1, A2, A3, B1, B2, C, D – these storages are classified as a Declared Dam and managed in accordance with the required Dam Operations and Maintenance Manual</td></tr>
</table>

| Method | Status | Trigger | Action | Response |
|---|---|---|---|---|
| **Discharges to the Namoi River** | | | | |
| In situ sampling using multi-parameter probe to monitor the filtered water quality from the RO plants prior to and during discharge to the Namoi River at location NR1.<br><br>**Sites**:<br>• RO plant.<br><br>**Parameters**:<br>• Field – pH, EC<br><br>**Frequency**:<br>• Prior to and continuous during discharge.<br><br>**Analysis**:<br>• Comparison to the impact assessment criteria. Used to identify potential discharge non-compliance. | **Normal** | • Less than 417 µS/cm EC as a proxy for 250 mg/L TDS (50th percentile value).<br>• Greater than pH 6.7 or less than pH 8.3. | Continue discharge and continuous monitoring. | None required. |
| | **Level 1** | **Level 1A**<br>Greater than 417 µS/cm EC as a proxy for 250 mg/L TDS (50th percentile value).<br><br>**Level 1B**<br>• Greater than 525 µS/cm EC as a proxy for 315 mg/L TDS (90th percentile value).<br>• Less than pH 6.7 or greater than pH 8.3 (within 0.2 units of pH limit). | **Level 1A**<br>Monitor and adjust the RO treatment and discharge as required to maintain filtered water quality within discharge limits.<br><br>**Level 1B**<br>Cease release. | **Level 1A**<br>None required.<br><br>**Level 1B**<br>Adjust the RO treatment to within 50th percentile and monitor water quality for 24 hours before recommencing discharge. |
| | **Level 2** | • Exceed limits:<br>▪ EC – greater than 580 µS/cm as a proxy for TDS limit of 350 mg/L.<br>▪ pH – less than pH 6.5 and greater than pH 8.5. | • Cease release.<br>• Environmental Superintendent to implement contingency and notification measures as per section 6 of the WMP.<br>• Environmental Superintendent to implement Pollution Incident Response Management Plan (**PIRMP**). | • Report exceedance in accordance with the WMP.<br>• Investigate cause of exceedance and implement identified adaptive management measures. |
| **Vegetation health (ponding)** | | | | |
| To ensure that surface water ponding does not result in adverse impacts to vegetation health.<br><br>**Sites:**<br>• Within the subsidence zone above undermined longwall panels.<br><br>**Parameters**:<br>• Identification of changes in topography that leads to ponding.<br><br>**Frequency**:<br>• Monthly visual inspection when ponded water is present. | **Normal** | No adverse impacts on vegetation observed. | None required. | • Continue to implement surface water management measures in accordance with this Plan.<br>• Continue routine surface water ponding monitoring and evaluation of results. |
| | **Level 1** | Identified adverse impacts on vegetation, apparent from visual observations during monthly inspections. | Record visual observations, including photographs. | Investigate options to dewater the ponded area to limit further impacts on vegetation health and implement identified adaptive management measures. |

| Method | Status | Trigger | Action | Response |
|---|---|---|---|---|
| • Annual multi-spectral imaging.<br>• Three yearly LiDAR survey.<br><br>**Analysis**:<br>• Identification of potential ponding areas via changes in topography. Identified via creek line surveys and LiDAR survey.<br>• Riparian vegetation health. | **Level 2** | Significant impacts to vegetation identified (e.g. canopy dieback, tree death). | Record visual observations, including photographs. | • Should vegetation be at risk, undertake a geomorphological assessment to determine options to have the subsidence ponded area freely drain.<br>• Undertake survey to identify vegetation community and impacted area. The disturbance will be recorded in the site clearing register. |
| **Changes in water course morphology** | | | | |
| To determine if subsidence due to mining is impacting on the morphology of creeks. This may occur in the channel and the wider floodplain.<br><br>**Sites:**<br>• In watercourses with a predicted risk of altered bed slopes and likely effects of increased channel gradients (e.g. upstream and downstream of chain pillars).<br><br>**Parameters:**<br>• Identification of changes in planform, creek grade, bank erosion and sedimentation.<br><br>**Frequency:**<br>• Annually.<br><br>**Analysis:**<br>• Identified via creek annual creek line surveys and subsidence visual inspections. | **Normal** | No identified impacts on water course morphology. | None required. | • Continue to implement surface water management measures in accordance with this Plan.<br>• Continue routine creek line monitoring program and evaluation of results. |
| | **Level 1** | Changes in channel cross-section, bed erosion, incision and deposition identified. | Record observations, including photographs. | • A qualified geomorphologist will be consulted to develop an action plan which may involve further monitoring or remediation (with consideration given to application of the River Style Framework for classifying channel condition and recovery).<br>• Implement geomorphologists action plan.<br>• Implement contingency and notification measures as per section 6 of the WMP. |
| | **Level 2** | Further monitoring identifies remediation works are not performing (i.e. ineffective control measure. | Record observations, including photographs. | • As for Level 1<br>• If implemented erosion control measures are found to be failing, review causes and replace with like or better. Continue monitoring. |

# 5. Reporting, evaluation and review

Monitoring results will be reviewed against the impact assessment criteria detailed in this Plan. Where an exceedance of the relevant criteria or performance measures has occurred, NCOPL will implement the TARP (Table 5-1) and the procedures outlined in section 6.2 of the WMP. NCOPL will notify potentially affected water users when an elevated monitoring result becomes known and provide updates throughout any investigation or assessment.

All internal and external reporting and the review of this Plan will be undertaken in accordance with section 7 of the WMP. The revision status of this Plan is indicated in section 8.

# 6. References

Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (2000). *Water Quality Guidelines.*

*Australian and New Zealand guidelines for fresh and marine water quality* (ANZG 2018) Accessed from https://www.waterquality.gov.au/anz-guidelines

Cunningham, W.L., and Schalk, C.W., comps. (2011), *Groundwater technical procedures of the U.S. Geological Survey*: *U.S. Geological Survey Techniques and Methods* 1–A1, 151 p.

Eco Logical Australia (ELA) (2021). *Subsidence Pond Management - 2020 Monitoring Report*. Prepared for Narrabri Coal Operations Pty Ltd.

NSW Environment Protection Authority (January 2022). *Approved methods for the sampling and analysis of water pollutants in NSW.*

NSW Independent Planning Commission (April 2022). *Development Consent SSD 10269, Narrabri Underground Mine Stage 3 Extension Project.*

NSW Water Quality and River Flow Objectives (2006). *Namoi River Water Quality and River Flow Objectives.* Accessed from https://www.environment.nsw.gov.au/ieo/namoi/report-02.htm#TopOfPage

Resource Strategies Pty Ltd (October 2020) *Narrabri Underground Mine Stage 3 Extension Project – Environmental Impact Statement.* Prepared for Narrabri Coal Operations Pty Ltd.

Standards Australia (2017) *Australian Standard 1940:2017 The storage and handling of flammable and combustible liquids.*

# 7. Review history

| Revision | Comments | Author | Authorised by | Date |
|---|---|---|---|---|
| 0A | Approved by Department of Planning and Environment on 5 October 2023 | Onward Consulting | Manager HSE | 29 November 2022 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Department of Planning and Environment

Our ref: SSD-10269_PA-23

Brent Baker
Manager HSE
Narrabri Coal Operations Pty Ltd
10 Kurrajong Creek Road
Baan Baa, NSW, 2390

05/10/2023

**Subject: Narrabri Coal Stage 3 – Surface Water Management Plan**

Dear Mr. Baker

I refer to your submission, requesting review and approval of the Surface Water Management Plan for the Narrabri Coal Stage 3 project. I also acknowledge your response to the Department's review comments and request for additional information.

I note the Surface Water Management Plan has been prepared in consultation with DPE Water and EPA, and contains the information required by the conditions of approval.

The Department has carefully reviewed the document and is satisfied that it meets the requirements of the relevant conditions in Development Consent (SSD-10269).

Accordingly, as nominee of the Planning Secretary, I approve the Surface Water Management Plan (Rev 0A, dated 29 November 2022).

Please ensure you make the document publicly available on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact Wayne Jones on (02) 6575 34056.

Yours sincerely

**Stephen O'Donoghue**
**Director**
**Resource Assessments**
As nominee of the Planning Secretary

# Appendix A - Compliance conditions relevant to this Plan

## Table A-1 SSD 10269 consent conditions relevant to this Plan

| Condition | Requirement | Document reference |
|---|---|---|
| **Obligation to minimise harm to the environment** | | |
| A1. | In addition to meeting the specific performance measures and criteria established under this consent, the Applicant must implement all reasonable and feasible measures to prevent, and if prevention is not reasonable and feasible, minimise, any material harm to the environment that may result from the construction and operation of the development, and any rehabilitation required under this consent. | Section 1.3<br>Section 3<br>Section 6.2 of the WMP |
| **Evidence of Consultation** | | |
| A20. | Where conditions of this consent require consultation with an identified party, the Applicant must:<br>(a) consult with the relevant party prior to submitting the subject document; and<br>(b) provide details to the Department of the consultation undertaken including:<br>(i) the outcome of that consultation, matters resolved and unresolved; and<br>(ii) details of any matters not resolved between the party consulted and the Applicant and how the Applicant has addressed the matters not resolved. | Section 1.4 of the WMP |
| **Staging, combining and updating strategies, plans or programs** | | |
| A21. | With the approval of the Planning Secretary, the Applicant may: | |
| | a) prepare and submit any strategy, plan or program required by this consent on a staged basis (if a clear description is provided as to the specific stage and scope of the development to which the strategy, plan or program applies, the relationship of the stage to any future stages and the trigger for updating the strategy, plan, or program); | No staging of SWMP proposed |
| | b) combine any strategy, plan or program required by this consent (if a clear relationship is demonstrated between the strategies, plans or programs that are proposed to be combined); | No combining of SWMP with another plan proposed |
| | c) update any strategy, plan or program required by this consent (to ensure the strategies, plans and programs required under this consent are updated on a regular basis and incorporate additional measures or amendments to improve the environmental performance of the development); and | Section 6 |
| | d) combine any strategy, plan or program required by this consent with any similar strategy, plan or program required by an adjoining mining consent or approval, in common ownership or management. | No combining of SWMP with another plan proposed |
| **Compliance** | | |
| A30. | The Applicant must ensure that all of its employees, contractors (and their sub-contractors) are made aware of, and are instructed to comply with, the conditions of this consent relevant to activities they carry out in respect of the development. | Section 2 of the WMP |
| **Applicability of guidelines** | | |
| A31. | References in the conditions of this consent to any guideline, protocol, Australian Standard or policy are to such guidelines, protocols, Standards or policies in the form they are in as at the date of inclusion (or later update) in the condition. | Section 3.7 of the WMP |
| A32. | However, consistent with the conditions of this consent and without altering any limits or criteria in this consent, the Planning Secretary may, in respect of ongoing monitoring and management obligations, agree to or require compliance with an | |

| Condition | Requirement | Document reference |
|---|---|---|
| | updated or revised version of such a guideline, protocol, Standard or policy, or a replacement of them. | |
| **Compensatory Water Supply** | | |
| B28. | The Applicant must provide a compensatory water supply to any landowner of privately-owned land whose rightful water supply is adversely and directly impacted (other than an impact that is minor or negligible) as a result of the development, to the satisfaction of the Planning Secretary. The burden of proof that any loss of surface water or groundwater access is not due to mining impacts rests with the Applicant. | Section 3.6 |
| B29. | The compensatory water supply measures must provide an alternative long-term supply of water that is equivalent, in quality and volume, to the loss attributable to the development. Equivalent water supply will be provided as soon as practicable after commencement of development under this consent, unless otherwise agreed with the landowner. | |
| B30. | If the Applicant is unable to provide an alternative long-term supply of water, then the Applicant must provide compensation, to the satisfaction of the Planning Secretary.<br><br>**Notes:**<br>▪ *The Water Management Plan (see condition B34) is required to include trigger levels for investigating potentially adverse impacts on water supplies.* | |
| B31. | The Applicant must complete all measures that it is required to undertake under conditions B28 – B30 within two years of the date of commencement of development under this consent. | NA |
| B32. | If the Applicant and a landowner cannot agree on whether the loss of water is to be attributed to the development or the measures to be implemented under conditions B28 – B31, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Planning Secretary for resolution. | Section 3.6 |
| **Water Discharges** | | |
| B33. | The Applicant must ensure that all surface discharges from the site comply with all relevant provisions of the POEO Act, including any discharge limits (both volume and quality) set for the development in any EPL. | Section 3.1.2<br>Section 4.3<br>Section 5 |
| **Water Management Performance Measures** | | |
| B34. | The Applicant must comply with the performance measures in Table 4 (of the CoC).<br><br>***Table 4: Water management performance measures*** | |

| Feature | Performance measure | |
|---|---|---|
| Namoi River | Negligible environmental consequences. | Section 3.1.2<br>Section 3.3<br>Section 3.5 |
| Water management – general | • Maintain separation between clean, dirty (i.e. sediment-laden) and mine water management systems;<br>• Minimise the use of clean and potable water on the site;<br>• Maximise water recycling, reuse and sharing opportunities;<br>• Minimise the use of make-up water from external sources;<br>• Design, install, operate and maintain water management systems in a proper and efficient manner; and<br>• Minimise risks to the receiving environment and downstream water users. | Section 3.1 |

| Condition | Requirement | | Document reference |
|---|---|---|---|
| | Clean water diversions and storage infrastructure | Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on the site, except where clean water is captured for use on the site. | |
| | Chemical and hydrocarbon storage | Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standard. | Section 3.1 |
| | Mine water discharges | Negligible environmental consequences beyond those predicted in the document/s listed in condition A2(c). | Section 3.1 |
| | Treated water discharges | Discharges to the Namoi River are:<br>• below 250 mg/L Total Dissolved Solids (50th percentile, all samples, volume based);<br>• below 350 mg/L Total Dissolved Solids (all samples, volume based); and<br>• pH between 6.5 and 8.5 (all samples). | Section 3.1.2<br>Section4.3<br>Section 4.3<br>Section 5 |
| | Aquatic and riparian ecosystems | • Negligible environmental consequences beyond those predicted in the document/s listed in condition A2(c); and<br>• Develop site-specific in-stream water quality objectives in accordance with the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ, 2000) and Using the ANZECC Guidelines and *Water Quality Objectives in NSW* (DEC, 2006), or its latest version. | Section 3<br>Section 4<br>Section 5 |
| **Water Management Plan** | | | |
| B36. | This plan must: | | |
| | (c) be prepared by a suitably qualified and experienced person/s; | | Section 1.4 of the WMP |
| | (d) be prepared in consultation with DPE Water and the EPA; | | |
| | (e) describe the measures to be implemented to ensure that the Applicant complies with the water management performance measures (see Table 4); | | Section 3 |
| | (f) build on existing monitoring programs and utilise existing data from nearby mines, where practicable; | | Section 4 |
| | (g) include a: | | |
| | (iii) **Surface Water Management Plan** that includes: | | |
| | • detailed baseline data on channel stability, water flows and water quality in the sections or parts of watercourses and/or water bodies potentially impacted by the development, including: | | Section 2 |
| | ▪ formal records of creek flow conditions will be initiated at selected sites; | | Section 2.2<br>Section 4.4.1 |
| | ▪ stream and riparian vegetation health; | | Section 2.3 |
| | ▪ channel stability (geomorphology); and | | Section 2.3 |
| | ▪ water supply for other surface water users; | | Section 2.4 |
| | • a detailed description of the surface water management system; | | Section 3.1 |

| Condition | Requirement | Document reference |
|---|---|---|
| | • details of any proposed discharges of treated water to the Namoi River, including: | Section 3.1.2 |
| | ▪ measures for the continuous monitoring and recording of volumes of water discharged to the Namoi River; and | Section 3.1.2 |
| | ▪ a water quality monitoring program for discharged waters; | Section 4.3 |
| | • consideration of alternatives to direct measurement or prediction of creek flows to support surface water take licensing; | Section 4.4.1 |
| | • details of the proposed metering, monitoring and modelling measures; | Section 3.5 of the SWB (Attachment 1 of the WMP)<br>Section 3.4<br>Section 4 |
| | • detailed plans, design objectives and performance criteria for water management infrastructure including: | |
| | ▪ any approved creek diversions or restoration works associated with the development; | Section 3.2 |
| | ▪ water run-off diversions and catch drains; | Section 3.1 |
| | ▪ erosion and sediment controls; | Section 3.2<br>Section 3.8<br>ESCP (Attachment 2 of the WMP) |
| | ▪ any water storages, including mine water management systems; and | Section 3.1 |
| | ▪ reinstated drainage networks on rehabilitated areas of the site; | Section 3.8<br>ESCP (Attachment 2 of the WMP) |
| | • surface water performance criteria, including trigger levels for identifying and investigating any potentially adverse impacts (or trends) associated with the development for: | |
| | ▪ water supply for other water users; | Section 3.6 |
| | ▪ channel stability; | Section 4.5 |
| | ▪ downstream surface water flows and quality; | Section 4.4<br>Section 5 |
| | ▪ stream and riparian vegetation heath; and | Section 4.5<br>Section 5 |
| | ▪ post-mining water pollution from rehabilitated areas of the site; | Section 3.8 |
| | • a program to regularly review brine management and identify any beneficial use options for brine, treated water and mine water; | Section 3.1 |
| | • a program to monitor and evaluate: | |

| Condition | Requirement | Document reference |
|---|---|---|
| | ▪ compliance with the relevant performance measures listed in Table 4 and the performance criteria in this plan; | Section 4<br>Section 5 |
| | ▪ controlled and uncontrolled discharges and seepage/leachate from the site; | Section 4.2.1<br>Section 4.3 |
| | ▪ surface water inflows, outflows and storage volumes, to inform the Site Water Balance; and | Section 4.2<br>SWB (Attachment 1 of the WMP) |
| | ▪ the effectiveness of the surface water management system and the measures in the Erosion and Sediment Control Plan; | Section 4<br>Section 5 |
| | ▪ reporting procedures for the results of the monitoring program, including notifying other water users of any elevated results; and | Section 6 |
| | ▪ a trigger action response plan to respond to any exceedances of the performance measures, and repair, mitigate and/or offset any adverse surface water impacts of the development, including measures to provide compensatory water supply to any affected water user under condition B27 of this Schedule; and | Section 5 |
| **Management Plan requirements** | | |
| E5. | Management plans required under this consent must be prepared in accordance with relevant guidelines, and include: | |
| | (a) summary of relevant background or baseline data; | Section 2 |
| | (b) details of: | |
| | (i) the relevant statutory requirements (including any relevant approval, licence or lease conditions); | Section 3 of the WMP |
| | (ii) any relevant limits or performance measures and criteria; and | Section 4 |
| | (iii) the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures; | Section 4<br>Section 5 |
| | (c) any relevant commitments or recommendations identified in the document/s listed in condition A2(c) | Appendix B |
| | (d) a description of the management measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures and criteria; | Section 3 |
| | (e) a program to monitor and report on the: | |
| | i) impacts and environmental performance of the development; and | Section 4<br>Section 5<br>Section 6 |
| | ii) effectiveness of the management measures set out pursuant to paragraph (d); | |
| | (f) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible; | Section 5 |
| | (g) a program to investigate and implement ways to improve the environmental performance of the development over time; | Section 7.6 of the WMP |
| | (h) a protocol for managing and reporting any: | |

| Condition | Requirement | Document reference |
|---|---|---|
| | i) incident, non-compliance or exceedance of any impact assessment criterion or performance criterion; | Section 6 of the WMP |
| | ii) complaint; or | Section 8 of the WMP |
| | iii) failure to comply with other statutory requirements; | Section 6.2 of the WMP |
| | (i) public sources of information and data to assist stakeholders in understanding environmental impacts of the development; and | Section 3.7 of the WMP |
| | (j) a protocol for periodic review of the plan. | Section 6 |
| E6. | The Applicant must ensure that management plans prepared for the development are consistent with the conditions of this consent and any EPL issued for the site. | Appendix A<br>Appendix B |

### Table A-2 EPL 12789 conditions relevant to this Plan

<table>
<tr><th>Condition</th><th>Requirement</th><th>Document reference</th></tr>
<tr><td colspan="3">Discharges to Air and Water and Applications to Land</td></tr>
<tr><td>P1</td><td>Location of monitoring/discharge points and areas<br>P1.3 The following points referred to in the table are identified in this license for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.
<table>
<tr><th>EPA ID No.</th><th>Type of monitoring point</th><th>Type of discharge point</th><th>Location description including NCOPL ID no.</th></tr>
<tr><td>11</td><td>Wet weather discharge<br><br>Discharge water quality monitoring</td><td>Wet weather discharge<br><br>Discharge water quality monitoring</td><td>Discharge point (SD4) on northern side of mine boundary.</td></tr>
<tr><td>13</td><td>Wet weather discharge<br><br>Discharge water quality monitoring</td><td>Wet weather discharge<br><br>Discharge water quality monitoring</td><td>Discharge point (SD2) on southern side of mine boundary.</td></tr>
<tr><td>14</td><td>Ambient Water Quality Monitoring</td><td></td><td>Upstream of mine discharge point on Kurrajong Creek Tributary 1<br><br>KC1US</td></tr>
<tr><td>15</td><td>Ambient Water Quality Monitoring</td><td></td><td>Downstream of mine discharge point on Kurrajong Creek Tributary 1<br><br>KC1DS</td></tr>
<tr><td>16</td><td>Ambient Water Quality Monitoring</td><td></td><td>Upstream of mine discharge point on Kurrajong Creek Tributary 2</td></tr>
</table></td><td>Section 4</td></tr>
</table>

| Condition | Requirement | | | Document reference |
|---|---|---|---|---|
| | | | | |

| | | | |
|---|---|---|---|
| | | | KC2US |
| 17 | Ambient Water Quality Monitoring | | Downstream of mine discharge point on Kurrajong Creek Tributary 2<br><br>KC2DS |
| 18 | Wet weather discharge<br><br>Discharge water quality monitoring | Wet weather discharge<br><br>Discharge water quality monitoring | Discharge point (SD7) on western side of mine boundary |
| 19 | Ambient Water Quality Monitoring | | Upstream location of Kurrajong Creek (KCUS) |
| 20 | Ambient Water Quality Monitoring | | Upstream location of Kurrajong Creek (KCDS) |
| 21 | Ambient Water Quality Monitoring | | Northern portion of mining area (PCa) in Pine Creek |
| 22 | Ambient Water Quality Monitoring | | Monitoring point (PC1) in Pine Creek Tributary 1 |
| 24 | Water Quality Monitoring | Water Quality Monitoring | Discharge point (NR1) at Namoi River |
| 25 | Ambient Water Quality Monitoring | Ambient Water Quality Monitoring | Discharge point (NRUS) at Namoi River |
| 26 | Ambient Water Quality Monitoring | Ambient Water Quality Monitoring | Discharge point (NRDS) at Namoi River |
| 27 | Wet weather discharge<br><br>Discharge water quality monitoring | Wet weather discharge<br><br>Discharge water quality monitoring | Discharge point (SD8) at Ventilation Shaft |

P1.4 Point W1 in the table, is identified in this licence for the purpose of monitoring of weather parameters at that point.

| EPA identification number | Type of Monitoring Point | Description of Location |
|---|---|---|
| W1 | Weather analysis | Weather station identified as "W1" on map titled EPL 12789 Monitoring Locations" dated 21/02/2017 - EPA DOC17/131971. |

**Limit Conditions**

| | | |
|---|---|---|
| L2 | **Concentration limits**<br>L2.1 For each monitoring/discharge point or utilisation area specified in the table/s below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table.<br><br>L2.2 Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges. | Section 4 |

| Condition | Requirement | Document reference |
|---|---|---|

L2.3 To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in L2.4.

L2.4 Water and/or Land Concentration Limits

| Point 11, 13, 18, 27 | | | | | |
|---|---|---|---|---|---|
| **Pollutant** | **Units of measure** | **50th percentile conc** | **90th percentile conc** | **3DGM conc limit** | **100th percentile conc** |
| Oil and Grease | mg/L | - | - | - | 10 |
| TSS | mg/L | - | - | - | 50 |

| Point 11, 13, 18, 24, 27 | | | | | |
|---|---|---|---|---|---|
| **Pollutant** | **Units of measure** | **50th percentile conc** | **90th percentile conc** | **3DGM conc limit** | **100th percentile conc** |
| pH | pH | - | - | - | 6.5-8.5 |

| Point 24 | | | | | |
|---|---|---|---|---|---|
| **Pollutant** | **Units of measure** | **50th percentile conc** | **90th percentile conc** | **3DGM conc limit** | **100th percentile conc** |
| TDS | mg/L | 250 | - | - | 350 |

L2.5 The TSS concentration limits specified for Points 11, 13, 18 and 27 may be exceeded for water discharged provided that:

a) the discharge occurs solely as a result of rainfall measured at the premises that exceeds 38.4 millimetres over any consecutive 5 day period immediately prior to the discharge occurring; and

b) all practical measures have been implemented to dewater all sediment dams within 5 days of rainfall such that they have sufficient capacity to store run off from a 38.4 millimetre, 5 day rainfall event.

**Note:** 38.4 mm equates to the 5 day 90%ile rainfall depth for Gunnedah sourced from Table 6.3a *Managing Urban Stormwater: Soils and Construction Volume 1*: 4th edition, March 2004.

**Monitoring and Recording Conditions**

| | | |
|---|---|---|
| M1 | M1. Monitoring records<br><br>M1.1 The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition.<br><br>M1.2 All records required to be kept by this licence must be:<br>(a) in a legible form, or in a form that can readily be reduced to a legible form;<br>(b) kept for at least 4 years after the monitoring or event to which they relate took place; and<br>(c) produced in a legible form to any authorised officer of the EPA who asks to see them.<br><br>M1.3 The following records must be kept in respect of any samples required to be collected for the purposes of this licence: | Section 7.4 of WMP |

| Condition | Requirement | Document reference |
|---|---|---|
| | (a) the date(s) on which the sample was taken;<br>(b) the time(s) at which the sample was collected;<br>(c) the point at which the sample was taken; and<br>(d) the name of the person who collected the sample. | |
| **Monitoring and Recording Conditions** | | |
| M2 | **Requirement to monitor concentration of pollutants discharged**<br>M2.1 For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns:<br><br>M2.3 Water and/or Land Monitoring Requirements | Section 4 |

**Point 11, 13, 18, 27**

| Pollutant | Units of measure | Frequency | Sampling Method |
|---|---|---|---|
| Conductivity | µS/cm | Special Frequency 1 | In situ |
| Oil and Grease | mg/L | Special Frequency 1 | Grab sample |
| pH | pH | Special Frequency 1 | In situ |
| TOC | mg/L | Special Frequency 1 | Grab sample |
| TSS | mg/L | Special Frequency 1 | Grab sample |

**Point 14, 15, 16, 17, 19, 20, 21, 22**

| Pollutant | Units of measure | Frequency | Sampling Method |
|---|---|---|---|
| Conductivity | µS/cm | Special Frequency 2 | In situ |
| Oil and Grease | mg/L | Special Frequency 2 | Grab sample |
| pH | pH | Special Frequency 2<br>Special Frequency 3 | In situ |
| TOC | mg/L | Special Frequency 2 | Grab sample |
| TSS | mg/L | Special Frequency 2 | Grab sample |
| TDS | mg/L | Special Frequency 3 | Grab sample |

M2.4 For the purposes of the table(s) above Special Frequency 1 means the collection of samples as soon as practicable after each discharge commences and, in any case, not more than 12 hours after each discharge commences.

M2.5 For the purposes of the table(s) above Special Frequency 2 means the collection of samples quarterly (in the event of flow during the quarter) at a time when there is flow and as soon as practicable after each wet weather discharge from points 11, 13,18 or 27 commences and in any case not more than 12 hours after each discharge commences.

M2.7 For the purposes of the table(s) above Special Frequency 3 means the collection of samples as soon as practicable after each discharge commences from point NR1 and in any case not more than 4 hours after each discharge.

| | | |
|---|---|---|
| M3 | **Testing methods – concentration limits**<br>M3.2 Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless | Section 4.1 |

<table>
<tr><th>Condition</th><th>Requirement</th><th>Document reference</th></tr>
<tr><td></td><td>another method has been approved by the EPA in writing before any tests are conducted.</td><td></td></tr>
<tr><td>M4</td><td>Requirement to monitor weather<br>M4.1 For each monitoring point specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the parameter specified in Column 1. The licensee must use the sampling method, units of measure, averaging period and sample at the frequency, specified opposite in the other columns:
<table>
<tr><th colspan="5">Point W1</th></tr>
<tr><th>Parameter</th><th>Units of measure</th><th>Frequency</th><th>Averaging Period</th><th>Sampling Method</th></tr>
<tr><td>Rainfall</td><td>mm</td><td>Continuous</td><td>1 hour</td><td>AM-4</td></tr>
</table></td><td>Section 4.6</td></tr>
</table>

# Appendix B - Key EIS commitments

## Table B-1 Key EIS surface water management commitments

| Source | Aspect | Details | Reference |
|---|---|---|---|
| EIS Section 6.5.3 | Water Management System | Stage 3 will involve the use of the existing/approved water management infrastructure with minor augmentations and extensions, including the progressive developments of pumps, pipelines, water storages and other water management infrastructure. | Section 3.1 |
| EIS Section 2.12.4 | Sewage and Effluent | At the Pit Top Area, the existing wastewater treatment plant will continue to be used to treat effluent on-site, with the treated water discharged to a rehabilitation area. Treated effluent will be irrigated in accordance with the *Environmental Guidelines: Use of Effluent by Irrigation* (Department of Environment and Conservation, 2004), and managed in accordance with the Water Management Plan (NCOPL, 2017a) (or the latest approved version). | Section 3.7 |
| EIS Section 6.5.3 | Flow Regime - Changes in Contributing Catchment | Runoff from Narrabri Mine disturbance areas and areas under active rehabilitation will be captured in sediment dams and:<br>• transferred to Narrabri Mine site water management system for re-use in mine operations; and/or<br>• controlled release via licensed discharge points, in accordance with the requirements of EPL 12789 following rainfall events that exceed sediment dam design capacity. | Section 3.8 |
| EIS Section 6.5.3 | Surface Water Quality | Sediment dams will continue to be dewatered following runoff events and will comply with EPL 12789 limits for wet weather discharges from licensed discharge points. | Section 4.2.1<br>ESCP (Attachment 2 of WMP) |
| EIS Section 6.5.3 | Surface Water Quality | The controlled release of treated water, which will be undertaken in accordance with EPL 12789, will not adversely impact Namoi River water quality. | Section 3.1.2<br>Section 4.3 |
| Section 6.5.4 | Water Management Plan - Permeate Discharge and Transfer Control and Monitoring Plan | Consistent with Schedule 4, Condition 13(d) of Project Approval 08_0144, a Permeate Discharge and Transfer Control and Monitoring Plan will be prepared to monitor potential Namoi River water quality impacts prior to commencing controlled releases to the Namoi River. In addition, NCOPL will investigate options for the beneficial re-use of excess water or underground injection of excess mine water. | Section 3.1.2<br>Section 4.3 |

| Source | Aspect | Details | Reference |
|---|---|---|---|
| EIS Section 6.5.4 | Subsidence Remediation | Despite the minor nature of potential reduction in catchment flows due to mine subsidence, the existing stream impact management measures (outlined in the Extraction Plan Water Management Plan [NCOPL, 2017[or the latest approved version]) will continue to be implemented for Stage 3. | Section 3.2 |
| EIS Section 6.5.4 | Subsidence Remediation | In addition, subsidence remediation of ponding areas will include:<br>• ponding areas located in areas with no significant vegetation and the water quality of the ponded water is non-saline to be allowed to self-correct.<br>• ponding areas located in areas with significant vegetation to be assessed and remedial measures (e.g. drainage) developed and implemented in consultation with the landholder and a suitably qualified specialist (e.g. hydrogeologist, geomorphologist). | Section 3.2 |
| EIS Section 6.5.4 | Water Management Plan - Surface Water Monitoring Program | The existing surface water monitoring network will continue to be implemented for Stage 3. The network will include the installation of two additional receiving water monitoring sites (KCTOP and UT1US) recommended by WRM (2020) within MLAs 1 and 2, locations will be confirmed in consultation with relevant government agencies and landowners. | Section 4 |
| EIS Section 6.5.4 | Water Management Plan - Surface Water Monitoring Program | The site water monitoring network of sediment dams and sediment basins will continue to be implemented for Stage 3, in accordance with the Water Management Plan (NCOPL, 2017a) (or the latest approved version). In addition, the Southern Mine Water Storage will be included in the monitoring network. | Section 4 |
| EIS Section 6.5.4 | Water Management Plan - Surface Water Monitoring Program | The suite of monitoring parameters will remain as per the approved Water Management Plan (NCOPL, 2017a) (or the latest approved version) with the addition of the following parameters to monitor the potential impacts of Stage 3 waste materials:<br>• total alkalinity;<br>• acidity;<br>• sulphate;<br>• As;<br>• Co;<br>• Mo;<br>• Sb; and | Section 4 |

| Source | Aspect | Details | Reference |
|---|---|---|---|
| | | • Se.<br>The frequency of monitoring will remain as per the approved Water Management Plan (NCOPL, 2017a) (or the latest approved version). | |
| Section 6.5.4 | Water Management Plan - Surface and Groundwater Response Plan | The Surface and Groundwater Response Plan and TARPs (NCOPL, 2017a; 2017c) will be reviewed and updated for Stage 3. The Surface and Groundwater Response Plan will describe any additional measures and procedures that will be implemented over the life of Narrabri Mine to respond to any potential exceedances of surface water-related criteria and contingent mitigation compensation, and/or offset options if downstream private surface water users or riparian vegetation are adversely affected by Narrabri Mine. | Section 5 |
| EIS Section 6.5.5 | Adaptive Measures | As described in Section 6.5.4, the existing TARP for the Narrabri Mine (NCOPL, 2017a; 2017c) will be updated to incorporate Stage 3. | Section 5 |
| BDAR Section 7.13 | Lower Darling River aquatic ecological community | **Biodiversity Measure 13**<br>Remediation of mine subsidence effects (e.g. surface cracking and minor erosion). A preliminary assessment will be undertaken to minimise impact of remediation actions. Prior to any remediation of surface cracks, NCOPL will undertake a review of environmental impacts that may result from the remediation at the specific location and consider whether remediation of surface cracks is environmentally beneficial or if alternative methods of remediating the crack are warranted (e.g. without machinery). The review will consider, among other factors, avoidance of known locations of threatened flora species. | Section 3.2 |