NARRABRI MINE

EXTRACTION PLAN
WATER MANAGEMENT PLAN

PANELS 201 - 202

Prepared by:

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Document review history

In accordance with Project Approval Schedule 6 Condition 3, this document has been reviewed as follows:

Review Date	Reason for review	Reviewed by	Revision required (Y/N)

Acronyms and abbreviations

Acronym	Description
º	degree
ACARP	Australian Coal Association Research Program
AHD	Australian Height Datum
AIP	NSW Aquifer Interference Policy
AR	Annual Review
BCS	The Biodiversity Conservation and Science Directorate within DPE
CCC	Community Consultative Committee
CHPP	Coal Handling and Preparation Plant
CRRP	Coal Resource Recovery Plan (as Appendix A to the Extraction Plan)
DEM	digital elevation model
DGS	Ditton Geotechnical Services
DPE	The NSW Department of Planning and Environment
DPE Water	The Water group within DPE
EA	Environmental Assessment
EC	electrical conductivity
EMP	Environmental Management Plan
EMS	NCOPL's Environmental Management System
EPA	The NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EP&A Regulation	Environmental Planning and Assessment Regulation 2000
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPL	Environment Protection Licence
GAB	Great Artesian Basin
GDE	groundwater dependent ecosystem
ha	hectare
IDC	Index of Diversion Condition
IEA	Independent Environmental Audit
km	kilometre
km^2	square kilometre
LiDAR	light detection and ranging
LMP	Land Management Plan (as Appendix I to the Extraction Plan)
LSMP	Landscape Management Plan
LW	longwall panel
m	metre
MCP	Mine Closure Plan (as part of Appendix F to the Extraction Plan)
mg/L	milligram per litre

Acronym	Description
MHRDC	maximum harvestable right dam capacity
ML	megalitre
ML 1609	Mining Lease 1609
mm	millimetre
mm/m	millimetre per metre
MOP	Mining Operations Plan
Mt	mega (million) tonnes
Mtpa	million tonnes per annum
NCOPL	Narrabri Coal Operations Pty Ltd
NSC	Narrabri Shire Council
OEH	The former NSW Office of Environment and Heritage
PED	personal emergency device (communications system)
pH	logarithmic scale used to specify the acidity or basicity of an aqueous solution
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
POEO Regulation	Protection of the Environment Operations (General) Regulation 2009
PSMP	Public Safety Management Plan (as Appendix E to the Extraction Plan)
REA	Reject Emplacement Area
RMP	Rehabilitation Management Plan (as part of Appendix F to the Extraction Plan)
RO	reverse osmosis
ROM	run of mine
SMP	Subsidence Monitoring Program (as Appendix C to the Extraction Plan)
SoC	Statement of Commitments
TARP	trigger action response plan
TDS	total dissolved solids
TSS	total suspended solids
U95%CL	upper 95 % confidence level
UCS	unconfined compressive strength
VWP	vibrating wire piezometer
WAL	water access licence
WHC	Whitehaven Coal Limited
WM Act	*Water Management Act 2000* (NSW)
WMP	Water Management Plan (this document)
WQO	Water Quality and River Flow Objectives
WSP	water sharing plan

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1. Introduction

1.1 Background

The Narrabri Mine is an existing underground coal mining operation situated in the Gunnedah Coalfield. It is located approximately 25 kilometres (**km**) south-east of Narrabri and approximately 60 km north-west of Gunnedah, within the Narrabri Shire Council (**NSC**) Local Government Area in New South Wales (**NSW**). The Narrabri Mine includes an underground coal mine, a coal handling and preparation plant (**CHPP**) and associated rail siding and surface infrastructure.

The Narrabri Mine is operated by Narrabri Coal Operations Pty Ltd (**NCOPL**), on behalf of the Narrabri Mine Joint Venture, which consists of two Whitehaven Coal Limited (**WHC**) wholly owned subsidiaries, and other joint-venture partners[1]. The underground mine is covered by Mining Lease 1609 (**ML 1609**) which covers an area of 5,298 hectares (**ha**) for the predominant purpose of mining for coal from the Hoskissons Coal Seam.

Stage 1 of the Narrabri Mine was approved in November 2007 under Part 3A of the *Environmental Planning and Assessment Act 1979* (**EP&A Act**). Construction of the mine and supporting infrastructure commenced in 2008, with production using a continuous miner following in 2010. Following the approval of the Stage 2 Environmental Assessment (R.W Corkery & Co., 2009) (the **EA**) and the issue of Project Approval 08_0144 for Stage 2 (**Project Approval**) in July 2010 and EPBC approval (2009/5003) in January 2011, the Narrabri Mine was converted to an 8 million tonnes per annum (**Mtpa**) run of mine (**ROM**) longwall mining operation, which commenced in 2012.

The Project Approval has subsequently been modified on a number of occasions. The environmental assessment for Modification 5 (Resource Strategies, 2015) (**MOD 5**), approved in December 2015, changed the mine geometry by reducing the number of longwall (**LW**) panels from 26 to 20, increased some LW panel widths and increased the production to 11 Mtpa of ROM coal until July 2031.

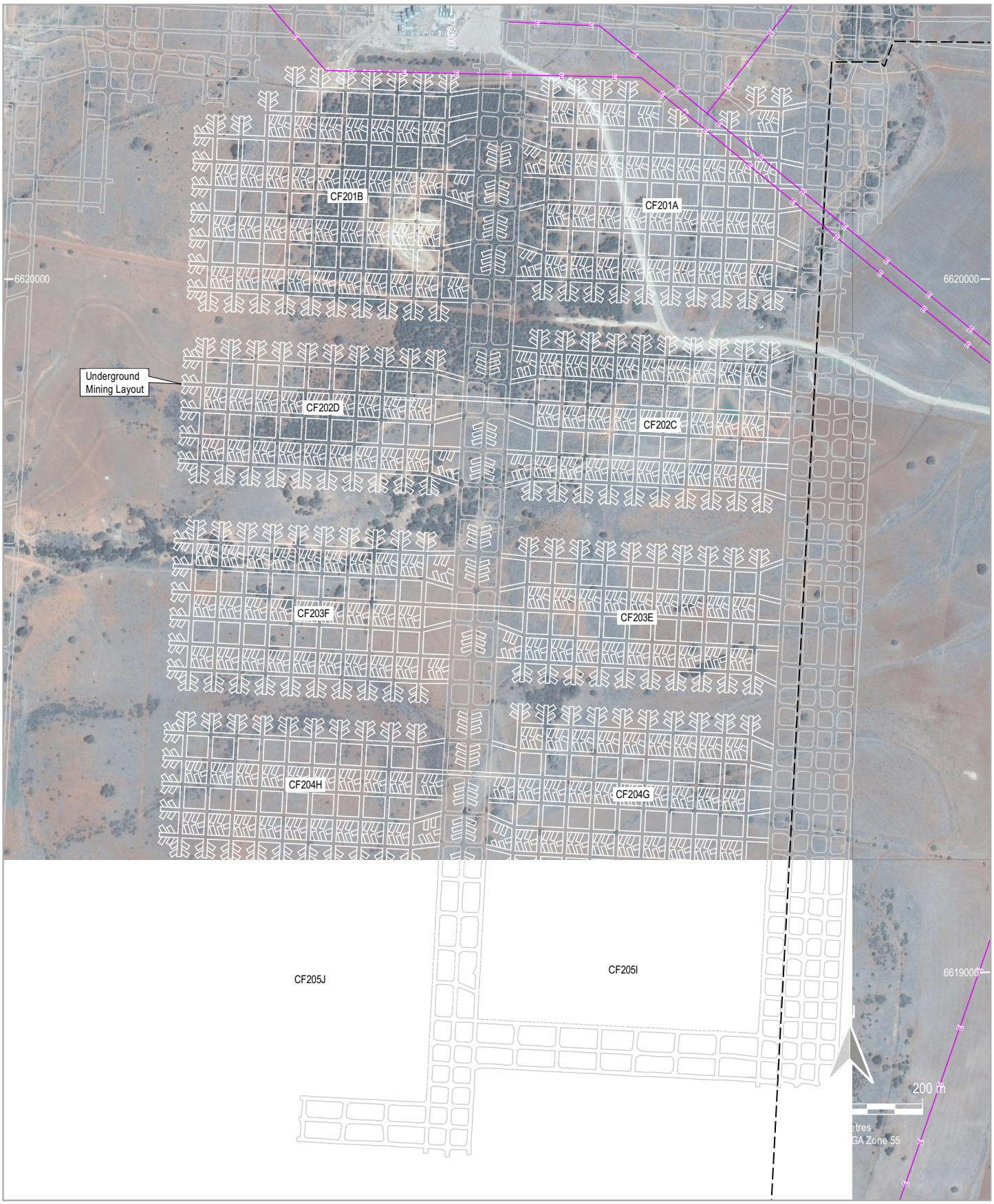
Modification 7, the most recent modification of the Project Approval, was approved on 23 November 2021. The environmental assessment for Modification 7 (Resource Strategies, 2021) (**MOD 7**) describes the change in mining method within the extent of the previously approved LW 201 and LW 202 and allows for up to 0.7 Mtpa via bord and pillar extraction at pillar reduction panels CF 201 to CF 205[2]. The bord and pillar mining will occur concurrently with existing longwall operations and is scheduled to commence in 2022 for a period of approximately five years. There is no change to the previously approved longwall panels LW 203 to LW 205. The maximum ROM coal production rate of the concurrent operation remains within the approved limit of 11 Mtpa.

The Extraction Plan provides further details of the Narrabri Mine operations to date; a consideration of the applicable statutory requirements and the modifications to the Project Approval; and information relevant to the extraction of coal from pillar reduction panels CF 201 to CF 205 (hereafter referred to as **Panels 201 to 202**). The surface area predicted to be affected by the proposed secondary extraction of Panels 201 to 202 has been defined as the **Extraction Plan Area**.

The underground mining layout for Panels 201 to 202 is presented in Figure 1.1.

[1] [1] For full details on the joint venture ownership, please refer to the introduction of the Extraction Plan.

[2] The pillar reduction panel naming 'CF' is an acronym for 'cut and flit'.



Source: Geoscience Australia (2011); NSW Spatial Services (2019)

LEGEND

Underground Mine Footprint

Electricity Transmission Line (Constructed)

NARRABRI COAL MINE

Figure 1.1 : Underground Mining Layout for Panels 201 and 202

1.2 Purpose and scope

As required by Project Approval Schedule 6 Condition 2, this Water Management Plan (**WMP**) for Panels 201 to 202 has been prepared in accordance with the NSW Department of Planning and Environment (**DPE**) *Draft Guidelines for the Preparation of Extraction Plans* (unpublished) (**Extraction Plan Guidelines**). It complies with Schedule 3 Condition 4(h) of the Project Approval, which requires the Extraction Plan is to include a WMP which:

- has been prepared in consultation with the NSW Environment Protection Authority (**EPA**) and the Water group within the NSW Department of Planning and Environment (**DPE**) (generally referred to as **DPE Water**);
- provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on surface water resources, groundwater resources and flooding; and
- includes:
  - surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or water quality;
  - a program to monitor and report groundwater inflows to underground workings; and
  - a program to manage and monitor impacts on groundwater bores on privately-owned land;

It should be noted that a Site Water Management Plan (**Site WMP**) has been prepared for the Narrabri Mine as required under Project Approval Schedule 3 Condition 13. In general terms, the Site WMP encompasses all operational mine activities, and includes the following sub-plans:

- Site Water Balance;
- Erosion and Sediment Control Plan;
- Surface Water Monitoring Plan;
- Groundwater Monitoring Program; and
- Surface and Groundwater Response Plan.

Due to the association between the documents, this WMP refers to the Site WMP and the listed sub-plans, where relevant and possible. This is to avoid duplication and repeat, and to minimise the possibility of inconsistencies between the documents.

1.3 Objectives

The objectives of this WMP are to provide management approaches for the potential impacts of the process of mining Panels 201 to 202 on surface water resources, groundwater resources or flooding. NCOPL will implement all practical measures to prevent and/or minimise any harm to the environment that may result from construction, operation or rehabilitation activities at the Narrabri Mine.

Subsidence impacts associated with Panels 201 to 202 have been identified in the Stage 2 EA, MOD 5 and MOD 7 and the Mine Subsidence Predictions Report for Panels 201-205 (Ditton Geotechnical Services [**DGS**], 2021), provided in full as Appendix B to the Extraction Plan.

1.4 Statutory requirements

This WMP has been prepared in accordance with the applicable conditions and requirements of the Project Approval, EPBC 2009/5003, ML 1609 and all relevant legislation and guidelines as set out in the following sections. A full consideration of the applicable compliance requirements is provided in section 2 of the Extraction Plan.

1.4.1 Project Approval

Apart from the requirement of Project Approval Schedule 3 Condition 4(h) for the Extraction Plan to include an WMP (refer section 1.2), Schedule 3 Condition 5 states that the WMP shall include:

(g) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since the Project Approval;

(h) a detailed description of the measures that would be implemented to remediate predicted impacts; and

(i) a contingency plan that expressly provides for adaptive management.

The Project Approval conditions directly relevant to this WMP have been presented in full in Table A1.1 in Attachment 1, together with a cross-reference where the requirements are addressed within this Plan.

Statement of Commitments

The Statement of Commitments for Site Operations and Management (**SoC**) is contained as Appendix 3 of the Project Approval. The specific commitments applicable to this WMP are listed in Table 1.1.

Table 1.1 - Relevant SoC requirements

SoC requirements		WMP reference
SoC	**Summary of the requirement**	
6.17	Undertake remedial action if the available drawdown attributable to the mine for the existing groundwater users is reduced by over 15%. In the event that an existing water supply is deemed (by the hydrogeologist) to be adversely affected by secondary mining activity, the Proponent will mitigate, or compensate for this impact through the provision of a replacement water supply.	Section 6.5.3
6.18	Undertake remedial action if the water quality of the dewatering discharge indicates an inflow salinity of more than 20% above predicted levels	Section 7.3
6.19	Ensure the Narrabri Mine is appropriately licensed for all groundwater take and use in accordance with required licensing arrangements through DPE Water.	Section 2.2

1.4.2 EPBC approval

The Narrabri Mine is subject to EPBC 2009/5003 issued under the EPBC Act. There are no specific EPBC approval conditions related to this WMP.

1.4.3 Mining lease

The original ML 1609 issued in 2008 has been amended to include a reference to Extraction Plans, removing the requirements for a Subsidence Management Plan. There are no specific ML 1609 conditions related to this WMP.

1.4.4 Extraction Plan Guidelines

As stated in the Extraction Plan Guidelines, the WMP should give appropriate consideration to risk assessment and risk management. This is further addressed in section 1.5. There are no specific requirements identified in the Extraction Plan Guidelines that relate directly to this WMP.

1.5 Risk assessment

A subsidence risk assessment has been undertaken to identify the risks associated with subsidence at the Narrabri Mine. It builds on previous risk assessments completed for LW 101 to LW 110 and is presented as Appendix K to the Extraction Plan. The updated risk assessment for Panels 201 to 202 has not identified any high-risk items and as a result, risks associated with subsidence within the Extraction Plan Area for the Narrabri Mine have been assessed as low to moderate.

The potential environmental consequences are further discussed in section 4.

1.6 Consultation and approval

In accordance with Schedule 3 Condition 4(h) of the Project Approval, NCOPL has prepared this WMP in consultation with the EPA and DPE Water.

A draft (Revision B) of the WMP was provided to the EPA and DPE Water on 3 December 2021. The EPA provided a response with no specific comments on 20 December 2021. DPE Water provided comments on 17 March 2022, summarised as follows:

- the requirement to provide water quality baseline summaries for both surface water and groundwater;
- the requirement to provide details on responding to complaints and non-compliances with statutory requirements

The consultation correspondence is presented in Attachment 2, including a reconciliation table provided as Table A2.1 addressing all comments.

The overall Extraction Plan consultation and approval process as required by the Project Approval is detailed in section 1.9 of the Extraction Plan.

1.7 Access to information

In accordance with Schedule 6 Condition 10 of the Project Approval, the approved Extraction Plan including all appendices, audits and reports, and summaries of all monitoring data (where relevant) will be made publicly available on the WHC website. All information will be kept up to date.

Note that any printed copies of this WMP are uncontrolled.

2. Narrabri Mine water management

2.1 Water management approach

Surface water generated at the Narrabri Mine is divided into seven types, based on water quality:

- **raw** - raw water imported to the Narrabri Mine from external sources (e.g. the Namoi River);
- **clean** - surface runoff from the Narrabri Mine site areas unaffected by mining operations;
- **rehabilitated mine area runoff** - runoff from rehabilitated mine areas that have established stable vegetation cover. This runoff is expected to have similar water quality characteristics to clean water and is therefore managed as undisturbed area runoff and not captured in the water management system;
- **filtered** - water treated by the reverse osmosis (**RO**) or microfiltration plants, suitable for use in the underground workings or controlled release to the Namoi River in accordance with Condition 11 Schedule 4 of the Project Approval or provided to other water users within ML 1609 for beneficial reuse;
- **disturbed area runoff** - surface runoff water from the Narrabri Mine site areas that are disturbed by mining operations. This runoff may contain silt and sediment, but does not contain other pollutants (e.g. chemicals or hydrocarbons). This water can be released from site in accordance with Environment Protection Licence (**EPL**) 12789, if required.
- **mine** - water pumped from the underground workings containing elevated concentrations of total dissolved solids (**TDS**);
- **Pit Top area runoff** - surface water from the Narrabri Mine site areas affected by mining operations and potentially containing silt/sediment and other pollutants (e.g. chemicals and/or hydrocarbons). Pit Top area runoff water areas include coal stockpile areas, service ponds and fuel storage areas. Pit Top area runoff water is actively managed to avoid its discharge from the Narrabri Mine; and
- **brine** - waste or concentrate produced by the RO plant containing high concentrations of TDS (salts).

There should be no contaminated water produced by the actual mining process, however groundwater inflows into the mine are typically saline and are pumped to the surface as part of normal operations. These flows are managed by the surface infrastructure on site. Monitoring of these mine inflow rates are documented in this WMP as an indicator of subsidence behaviour in the overlying strata and associated consequences to the overlying groundwater and surface water resources.

A description of the strategies for monitoring and management of water impacts relating to secondary extraction of panels 201 to 202 are given below.

2.1.1 Clean water management

The Extraction Plan Area underlies one 3rd-order watercourse: Kurrajong Creek Tributary 1 and a number of smaller drainage features.

These are clean water catchments and will be potentially affected by the mine through subsidence and limited surface activities (i.e. installation of gas drainage and other associated infrastructure). Data gathered through the historical monitoring program has been used to derive baseline water quality data, which are used as trigger values for the monitoring documented in this WMP. A trigger action response Plan (**TARP**) has been developed to investigate and remedy issues, should a degradation of water quality be identified as a result of mining activities.

2.1.2 Pit Top area water management

Management of water on the Pit top area, which includes all of the above water types (excluding clean water runoff) is undertaken in accordance with the Site WMP. The main principles of the Pit Top area surface water management strategy are to separate the clean, disturbed, reclaim and saline water generated on the mine site and to provide targeted strategies to minimise the impact of each water quality type. A description of the strategies for each water type is provided below.

Raw, clean and filtered water management

Clean water flowing from upstream Kurrajong Creek Tributaries is separated from the pit top working areas by a buffer and flow is maintained within the natural watercourse. The use of drains/contours to divert flows from working areas to treatment dams ensures separation of clean water from dirty or contaminated water. Clean water catchment areas above any area of disturbance that could generate dirty or contaminated water are directed around these areas and delivered to the natural water course. The use of spreaders and energy dissipaters ensure that erosion does not occur when delivering concentrated flows directly back into the Kurrajong Creek Tributaries.

Pond D is a clean water and raw water storage. Disturbed runoff captured in the sediment dams may also be pumped back to Dam D for use in the mine water management system. This storage is to remain separated from the other lined ponds. In the unlikely event of cross contamination or spills into these ponds, water quality is to be taken and a remediation plan is to be formulated if water quality in these ponds has been compromised.

Pond B1 stores filtered water generated by the RO water treatment plants. Filtered water stored in Pond B1 may be released to the Namoi River as required in accordance with Condition 11, Schedule 4 of the Project Approval. A licence variation to EPL 12789 was approved to add NR1 (Namoi River pump) as a licenced discharge point, with appropriate concentration limits for TDS and pH to allow releases of treated mine water (filtered) water to the Namoi River. However, prior to undertaking any raffinate discharge a Raffinate Discharge and Transfer Control and Monitoring Plan will need to be approved under Schedule 4 Condition 17.

Saline water management

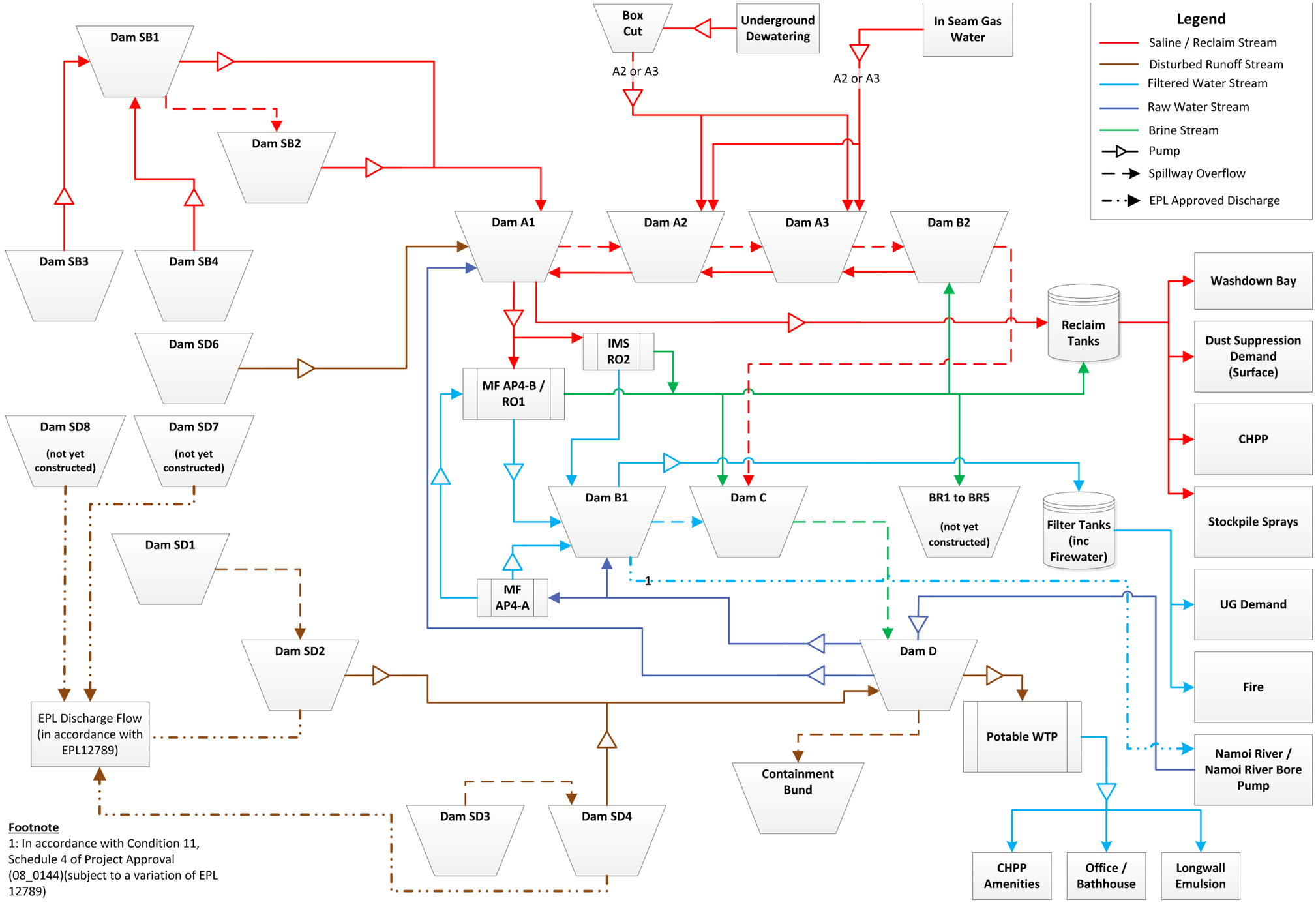
A series of ponds have been constructed within the rail loop as a depository for saline water (A1, A2 and A3). Underground process water and groundwater entering the underground workings are pumped to the box cut sump, then transferred to A2 or A3 for reclaim use or treatment in the RO plants. Gas drainage water is also pumped from the bores into A2 or A3. Water deposited in A2 and A3 overflows via gravity into A1.

The capacity of the RO plants will be increased or decreased as required to treat saline water generated at the Narrabri Mine. The RO plant capacity will be upgraded in accordance with water balance modelling based on predicted groundwater inflows to the underground mine, as detailed in the *Narrabri Coal Mine Water Balance Model Report* (WRM, 2019a).

The concentrated brine by-product of the RO plants is stored in Pond C and Pond B2. The brine is evaporated in storage dams on site without releasing it to the environment. Brine and saline water may also be used in the ROM and product stockpile spray systems.

Saline water contingency plan

Management and contingency plans for saline water and concentrated brine at Narrabri Coal mine is detailed in the *Narrabri Coal Mine Brine Management and Beneficial Use Options Report* (WRM, 2019b).



Footnote
1: In accordance with Condition 11, Schedule 4 of Project Approval (08_0144)(subject to a variation of EPL 12789)

Figure 2.1 - Water cycle process diagram

Dirty water management

Figure 2.1 shows the areas likely to cause dirty water runoff on the Pit Top area. Sediment dams SD1, SD2, SD3 and SD4 collect water from around the disturbed areas. Runoff reporting to SD5 is from undisturbed catchments associated with agricultural land use areas and undisturbed water from Kurrajong Creek Tributary 2 during significant flow events. This runoff is typically within the 'Ecosystem' trigger values for pH and EC, and below the EPL 12789 discharge limits for pH, TSS and oil and grease; and as such SD5 is no longer listed as discharge point on EPL 12789.

Water balance modelling detailed in the *Narrabri Coal Mine Water Balance Report* (WRM, 2019a) indicates that dirty water storage inventories on the site are forecast to be generally well below the maximum dirty water storage volume of 103 ML (total storage volume in SD1 to SD6). Spills from SD1 to SD6 are predicted to occur infrequently and in accordance with the EPL 12789 limits for wet weather discharges (i.e. only during events which exceeds the minimum requirements in the EPL.

As the revegetation of previously disturbed areas becomes established, sediment loads are expected to be reduced.

Reclaim water management

The main area of disturbance on the Pit Top area that may generate reclaim runoff is the stockpiling, crushing and sizing area and the surface facilities area which is confined to a 44.6 ha site containing the following:

- conveyor and transport drift portals;
- ROM and product stockpiles;
- Coal Handling and Processing Plant (CHPP);
- rail load-out bin;
- substation;
- surface facilities area; and
- gas extraction and venting pads and bund.

Runoff from the above areas is captured by SB1, SB2 and SB4. SB2 was constructed to capture any overflow from SB1, and has a relatively small contributing catchment area (1.9 ha).

A further 25 ha area consisting of the Reject Emplacement Area (**REA**) generates reclaim water runoff that is captured in SB3. This represents the entire REA (25 ha total). The REA is managed such that the maximum catchment area draining to SB3 at any time is limited to 10 ha, with runoff from rehabilitated or undisturbed areas bypassing SB3.

Water collected in these dams is pumped to A1 for reclaim use or treatment in the RO plant. Reclaim water is transferred from A1 to the reclaim water tanks at the box cut for use in the coal handling and preparation plant (CHPP), dust suppression (trucks and ROM and product coal stockpiles) and washdown bay. SB1 and SB3 have permanent automatic pumps, but all other reclaim dams are dewatered as required using mobile diesel pumps. SB3 and SB4 are pumped into SB1 before being pumped on to A1.

The water balance modelling (WRM, 2019a) indicates that there is less than a 1% chance of an uncontrolled release occurring from SB2, SB3 and SB4. SB1 overflows to SB2.

Routine inspections of the sediment basins, as well as appropriate maintenance of pumps, will assist with ensuring adequate capacity is maintained in SB1, SB2, SB3 and SB4. In the unlikely case of an extreme rainfall

event producing overflow from SB2 the overflow will cascade through the sediment dams SD1 and SD2 prior to discharge from site. Any overflow from SB4 will cascade through SD3 and SD4 prior to discharge from site.

It is expected that overflow water from SB2 and SB4 will have a negligible impact on site discharge waters following dilution with large quantities of clean water runoff generated during the extreme event and the mixing effect of cascading through Dams SD1 and SD2 (SB2), and Dams SD3 and SD4 (SB4).

Overflows from SB3 during extreme rainfall discharges directly to a natural watercourse and leave site. The impact of this is thought to be small due to the extreme event required to cause the basin to spill and the volumes of clean water available to dilute any discharge. Any discharges that occur from SB2, SB3 or SB4 will be sampled for water quality analysis and an estimate of the volume of water discharged will be recorded and managed under the Surface and Groundwater Response Plan, as section 7 of the Site WMP.

2.2 Available water allocations

A pump station and production bore have been developed at (and adjacent to, in the case of the bore) the Namoi River to allow for supplementary water supply to the Narrabri Mine. The construction and operations of two buried pipelines between the Narrabri Mine and the Namoi River is previously approved as part of the Narrabri Mine. One pipeline has been constructed to date, and the second approved pipeline may be constructed if required in the future.

In accordance with NCOPL operational procedures, makeup water is preferentially taken from the Namoi River (Lower Namoi Regulated River Water Source in the *Water Sharing Plan for the Upper Namoi and Lower Namoi Regulated River Water Sources 2016*) in accordance with the water access licences (**WALs**) held by NCOPL.

When low or no flow conditions in the Namoi River prevent the extraction of water from the river, groundwater is extracted from NCOPL's bore to provide a supplementary water supply. The production bore has been constructed to allow groundwater extraction from the Namoi alluvium (Upper Namoi Zone 5 Namoi Valley [Gins Leap to Narrabri] Groundwater Source in the *Water Sharing Plan for the Namoi Alluvial Groundwater Sources 2020*), in accordance with WALs held by NCOPL (or transferred to NCOPL from other Whitehaven operations).

The current WALs held by NCOPL for extraction from the pump station and production bore are listed in Table 2.1.

Table 2.1 - Existing surface and groundwater licences

Works Approval	WAL	Water source	Nominal allocation (units/yr)
Surface Water			
90CA802130	20152	Lower Namoi Regulated River Water Source (General security)	600
90CA802130	2728		10
90CA802130	6762		20
90CA802130	2671		48
Groundwater			
90WA812891	12833	Upper Namoi Zone 5 Namoi Valley (Gins Leap to Narrabri) Groundwater Source	67
90WA812891	20131		150
90CA807255	12822		43
90WA822539	29549	Gunnedah - Oxley Basin Murray Darling Basin Groundwater Source	818
90WA822539*	43017		403
90WA822539	15922	Southern Recharge Water Source	248

2.3 Maximum harvestable right dam capacity

Under the *Water Management Act 2000* (**WM Act**), landholders in rural areas are permitted to collect a proportion of the rainfall runoff on their property and store it in one or more dams up to a certain size on minor streams. A dam can capture up to 10% of the average regional rainfall runoff for their landholding without requiring a licence. According to the Water NSW calculator, the maximum harvestable right for the Narrabri Mine is 0.065 megalitre (**ML**) per ha. The landholding area required for the purposes of the harvestable right calculation is the NCOPL's contiguous landholding, which is 8,723.6 ha. Based on the NCOPL's contiguous landholding and the harvestable rights multiplier value of 0.065 ML/ha for the relevant area, the maximum harvestable right dam capacity (**MHRDC**) for NCOPL is 567 ML.

There are 176 existing farm dams on contiguous land owned by NCOPL within and in the vicinity of Narrabri Mine, none of which are declared dams under the *Dams Safety Act 2015*. These farm dams are mostly less than 1 ML in capacity.

2.4 Hydrostratigraphic units

As discussed in the Site WMP, several geological units are present within the NCOPL mining lease (ML 1609) boundary and similarly relevant to this WMP. The nature of geological strike and dip at NCOPL means that these units may occur at surface (outcrop), depth (subcrop) or in combination. Each of these units have the potential to form aquifers and transmit groundwater.

The geological units (in descending stratigraphic order) include:

- Quaternary sediments (surficial cover):
  - alluvium - associated with the Namoi River and its major tributaries; and
  - colluvium/regolith - undifferentiated Quaternary colluvium and residual soils.

- Pilliga Sandstone;
- Purlawaugh Formation;
- Garrawilla Volcanics;
- The Napperby Formation;
- The Digby Formation;
- Hoskissons Coal Seam;
- Arkarula Formation;
- Pamboola Formation; and
- Watermark Formation

Of the listed units, only the Namoi River alluvium and Pilliga Sandstone are considered regionally significant aquifers ("highly productive" under the *NSW Aquifer Interference Policy* (DPI, 2012) (**AIP**). The Namoi River alluvium is present at outcrop approximately 5 km east of mine panel CF201 and not present within the Extraction Plan Area. Whilst the remaining units may support minor extractions for stock and domestic purposes, they are relatively low yielding aquifers ("less productive" unit under the AIP).

The local geology and stratigraphy are further described in the Coal Resource Recovery Plan (**CRRP**), provided as Appendix A to the Extraction Plan.

2.5 Recharge, discharge and receptors

Recharge to the hydrostratigraphic units occurs through diffuse rainfall recharge as well as limited seepage through the non-perennial Kurrajong Creek Tributary 1 when flowing. No aquifer discharge occurs above the Extraction Plan Area related to baseflow since groundwater levels are generally deep and well below the non-perennial tributaries associated with the Extraction Plan Area and as mentioned above, they are highly ephemeral creeks.

Accordingly, no alluvium is present along these creeks and are either entirely disconnected (or possibly only very occasionally connected) to the Namoi Alluvium. No groundwater dependent ecosystems (**GDEs**) occur within the Extraction Plan Area.

3. Subsidence assessment and impacts

3.1 Extraction Plan Area mining methodology

The Extraction Plan Area includes the approved pillar reduction panels CF201 to CF205 where the previously approved longwall panels 201 and 202 were located, as shown in Figure 1.1. The five pillar reduction panels will be extracted from north to south and from east to west.

Panels 201 and 202, as shown in Figure 1.1, will be mined by bord and pillar (first workings) and pillar reduction (second workings) and identified as pillar reduction panels CF 201 to CF 205. They will be orientated east-west and have two sub-panels each (A/B to I/J) in the Lower Hoskisson Seam. The panels will have widths ranging from 154 to 280 m and 'critical' to 'supercritical' width/height (W/H) ratios of 0.80 to 1.39. The panel lengths will range from 155 to 348 m.

The sub-panels (production panels) will be developed on a grid of 30.5 m square pillars (solid) in the upper 3.2 m of the lower Hoskissons Seam. Second workings will 'pocket' every second row of pillars and increase the extraction ratio from 31% to 66%. The north-south orientated, intra-panel (gate road) pillars will separate the production panels and the inter-panel (barrier) pillars between the CF Panels will be orientated east-west and be 34 to 64 m wide after the second workings. Subsidence across the panels will predominantly be across the production panels with lower subsidence across the gate road and inter-panel pillars between the production panels.

The mining methodology and coal recovery are further described in the CRRP, provided as Appendix A to the Extraction Plan.

3.2 Potential subsidence

The subsidence predictions for the Extraction Plan Area are presented in the Mine Subsidence Predictions Report for Panels 201 to 205 (Ditton Geotechnical Services [**DGS**], 2021), presented as Appendix B to the Extraction Plan. They are based on several empirical and calibrated analytical models of overburden and chain pillar behaviour developed in New South Wales Coalfields. The subsidence predictions have been refined based on the actual subsidence that has occurred across the existing Narrabri Mine. The predicted values may be occasionally exceeded (up to 5% of the time) due to discontinuous strata behaviour associated with near surface cracking, joint displacement, geological features (e.g. faults) and/or rapid changes in topography (creek beds). For the pillar reduction panels (CF201 to CF 205):

- the maximum subsidence estimates after mining is completed ranges from 0.50 to 1.77 m;
- the timing of subsidence is difficult to predict and may not occur at all or years after mining is completed;
- maximum production panel subsidence ranges from 1.42 to 1.77 m;
- maximum gate road access pillar subsidence ranges from 0.50 to 0.73 m;
- maximum panel tilt ranges from 14 to 36 millimetre per metre (mm/m);
- maximum panel concave curvatures range from 0.7 per kilometre (km-1) to 3.3 km-1 (radii of curvature 1.4 to 0.3 km);
- maximum panel convex curvatures range from 0.7 to 3.1 km-1 (radii of curvature 1.4 to 0.32 km);
- maximum panel compressive strains range from 7 to 31 mm/m;
- maximum panel tensile strains range from 7 to 33 mm/m.

3.3 Impacts of subsidence

3.3.1 General

The Subsidence Predictions Report (Appendix B) acknowledges the uncertainties inherent in subsidence prediction and recognises that, in some cases, only worst-case outcomes can be presented. The terms which have been used throughout the Subsidence Predictions Report to reflect the general probability of the impacts of subsidence are also used in this Plan.

3.3.2 Surface cracking

The void created by extracting coal as part of the secondary workings invariably results in the collapse of the immediate roof strata, which is subject to bending and shearing stresses, as the overburden tries to span the void created by mining. The extent of fracturing and shearing up through the strata is dependent on mining geometry and overburden geology.

Based on the predicted range of maximum strains and cover depths, the surface cracking widths for sandy or loamy soils above the Extraction Plan Area are expected range between 130 to 320 mm. Where strain concentrations occur in near-surface rock or cohesive soils, these widths are expected to range between 260 mm to 640 mm. As shown in Table 3.1, there is a 5% chance that the crack widths would exceed 310-325 mm in the sandy loamy soils or double to between 620-650 mm and these are more likely to occur near steep creek banks along Kurrajong Creek Tributary 1.

Table 3.1 - Predicted maximum crack width for Extraction Plan Area in flat terrain

LW	XL	Panel width (m)	Cover depth (m)	Effective bay length (m)	Predicted maximum tensile strain (mm/m)		Predicted U95%CL crack width (mm)	
					Mean	U95%	Sand or loam	Clay or rock
CF201-CF205	6	235	182	10.0	7	31	310	620
	6	273	210	10.5	7	31	325	650

Source: Table 12 in DGS, 2021.

3.3.3 Sub-surface cracking

Sub-surface fracturing can either be continuous or discontinuous. Continuous fracturing occurs within the caved (mining) area and in the unconstrained overburden area directly above the caved zone (A-Zone). Continuous cracking would create a hydraulic connection to the workings if a sub-surface aquifer were intersected, which may result in increased water at seam level during extraction. Discontinuous fracturing occurs above the A-Zone and has been classified as B-Zone (minor fracture zone), C-Zone (elastic deformation zone) or the D-Zone (surface cracking zone). Discontinuous fracturing refers to an increase in horizontal and vertical permeability due to bending or curvature deformation of the rock mass. This type of fracturing can result in surface and sub-surface flow paths being altered, and rock mass conductivity and storage magnitudes being altered, however, groundwater or surface water resources may not undergo significant long-term change.

As summarised in Table 3.2, the subsidence prediction report presents results of several modelling methodologies to determine the height of the continuous fracture zone (A-Zone) above the mining area. The geology model gave the best fit to Narrabri Mine data, which determined that direct hydraulic connection to the mine workings due to sub-surface fracturing is estimated to encroach within 49 to 70 m depth below the surface. Four of the six models indicated that the continuous fracture zone will likely develop below the surface, with surface to seam connectivity predicted as 'likely' by the SCT and Tammetta, which was based on non-Narrabri Coalfield models.

Table 3.2 - Summary of sub-surface fracture model predictions

Panel	Panel width (m)	Cover depth (m)	Predicted maximum A-zone height above Panel (m)		Depth to A-Zone (m)	Height of depressurisation (m)
			Geology model	Geometry Model	Geology Model	Tammetta
CF201-CF205	188-287	182 - 210	99 - 149	89 - 131	49 - 70	0 - 59

Discontinuous fracturing would normally be expected to occur above the Extraction Plan Area, causing an increase in rock mass storage capacity and horizontal permeability without direct hydraulic connection to the workings.

Impacts associated with the discontinuous fracturing zone include:

- potential re-routing of creek flows into open cracks to below-surface pathways, with subsequent re-surfacing down-stream of the mining extraction limits;
- lowering of the water table; and
- disruption of tree root systems.

3.3.4 Land slip and erosion

General and localised slope instability (soil and rockslides) along the steep rocky slopes is considered very unlikely to develop due to the predicted cracking and tilting. The rate of soil erosion is expected to increase significantly in areas with exposed dispersive/reactive soils. Slopes less than 10˚ are expected to have low erosion rate increases, except for the creek channels, which would be expected to re-adjust to any changes in gradient for predicted gradient changes in the Extraction Plan Area of +/- 1.5˚.

Erosion along the creek beds would be expected to develop above chain pillars between the panels and on the side where the gradients increase. Sediment would be expected to accumulate where gradients decrease.

3.3.5 Valley closure and uplift

Valley closure (or opening) movements can be expected across deep valleys whenever longwalls are mined beneath them. Valley closure can also occur across broader drainage gullies where shallow surface rock is present.

When creeks and river valleys are subsided, the observed subsidence in the base of the creek or river is generally less than would normally be expected in flat terrain. This reduced subsidence is due to the floor rocks

of a valley floor 'buckling' upwards when subject to compressive stresses generated by surface deformation. This phenomenon is termed 'upsidence' and mostly occurs in the Southern NSW Coalfields.

As the valleys across the Extraction Plan Area (characterised by the ephemeral creek lines) are very broad between crests, the development of 'upsidence' and closure along the creek beds above the bord and pillar Extraction Plan Area is likely to be negligible.

3.3.6 Ponding and drainage lines

A total of three potential ponding locations were assessed as part of the Mine Subsidence Assessment, as presented in Table 3.3. All of the potential ponding areas already exist along the watercourses and dams. Post-mining pond depths are estimated to range from 0.41 to 0.71 m, which are generally similar to the existing pond depths. The changes in pond volume (where positive represents an increase in pond size) are estimated to range from 0.052 to 3.363 megalitres. There are two dams above CF203(F) that are associated with the post-mining ponding.

Overall, the existing ponds are expected to be similar to existing conditions but may extend laterally. The additional ponding can cause water logging resulting in tree stress, canopy die back and occasional tree death, altered drainage patterns, and loss of fauna habitat.

Surface water flowing to Kurrajong Creek Tributary 1 may pond in areas where it currently does not pond as a result of surface gradients changing. There may be a decrease in the quantity of water reaching the creeks as it ponds and evaporates rather than flowing to the creeks. There may also be a change in water quality as salinity may increase if water ponds over saline soils.

Subsidence ponds can become important features within an environmentally degraded landscape as they can provide habitat for waterbirds (including migratory species), frogs, eels, invertebrates and other aquatic species. Overtime it is expected that ponding will create enhanced ephemeral aquatic habitats.

3.3.7 Water storage dams and soil conservation (contour) banks

There are five farm dams for livestock watering (D49, D65, D66, D67 and D68) that have been assessed in the Extraction Plan Area. The dams are nearly all located within the 20 mm subsidence contour from the proposed Panels 201 to 202.

Several farm dams have already been subsided by LW 101 to 109 but have not required remedial works to be undertaken. Notwithstanding, non-engineered farm dams and water storages are susceptible to surface cracking and tilting (i.e. storage level changes) due to mine subsidence. The tolerable tilt and strain values for the Extraction Plan Area dams (before remediation is required) will depend upon the dam wall materials, construction techniques, and foundation type. The expected phases of tensile and compressive strain development may result in breaching of the dam walls or water losses through the floor of the dam storage areas. Loss or increase of storage areas may also occur due to the predicted tilting. Maximum tensile crack widths across dam wall or storage areas are estimated to range between 30 and 400 mm. Two farm dams (D67 bd D68) above CF 203 may be inundated by post-mining ponding. The likely subsidence effects at the dams above each of the panels are summarised in section 11.1 of the Subsidence Predictions Report, provided as Appendix B to the Extraction Plan.

Surface 'steps' or heaving due to compressive shear failures are estimated to range between 30-500 mm. Impacts to windmills and fences near the dams and soil conservation (contour) banks may also occur and require repairing.

A number of contour banks exist across the area covered by the Extraction Plan Area, particularly in cleared areas which have been historically used for cropping. These banks act to manage water flow across the site, minimise erosion and reduce sediment transport. Generally speaking, contour banks are constructed to have very low longitudinal gradients (i.e. less than 0.5 %) or even zero grade. The banks are generally constructed from local soil material, as either a back-push or front-push bank). Subsidence of sections of contour banks are likely to prevent the banks performing their intended purpose by altering the longitudinal grade, either steepening the grade, or causing a section to pond (i.e. unable to drain). Cracking and ground deformations may also cause damage to the bank, resulting in possible erosion or bank failure.

Table 3.3 - Potential ponding summary for Panels 201 to 202

Potential Pond No. (Dam No.)	Panel	Pre-Mining Pond Levels (m, AHD)		Maximum Pre-Mining Pond			Post-Mining Pond Levels (m, AHD)		Maximum post-mining pond			Pond area change (10^6 L)
		Top	Bottom	Depth h(m)	Area (ha)	Vol (ML)	Top	Bot	Depth h(m)	Area (ha)	Volume (ML)	
Pillar reduction panels												
P19	CF201(B)	299.9	299.3	0.60	0.336	0.672	298.6	298.2	0.41	0.530	0.724	**0.052**
P20	CF203(F)	290.0	289.9	0.10	0.280	0.093	289.1	288.8	0.33	1.214	1.335	**1.242**
P21 (D67/68)	CF203(F)	289.9	289.76	0.15	0.355	0.178	289.3	288.6	0.71	1.496	3.541	**3.363**

4. Environmental consequences

4.1 Surface water

4.1.1 General principals

Surface water, in terms of this WMP, relates to any above-ground water directly affected by the mining process. Across the Extraction Plan Area, the water body that may be impacted is the ephemeral Kurrajong Creek Tributary 1 that traverse the mining panels and adjacent farm dams.

This WMP considers management strategies to minimise any subsidence effects on surface water that may be caused by the mining process. This will be achieved by a combination of regular monitoring and reactive works. The surface water quantity and quality of the ephemeral creeks that traverse some of the mining panels and adjacent farm dams may be impacted upon by the following:

- surface cracking;
- slope instability and erosion;
- surface uplift;
- ponded water;
- breach or alteration of farm dams and soil conservation (contour) banks; and
- ground disturbance above mining panels.

4.1.2 Surface cracking

Surface cracking has the potential to reduce surface runoff volumes. Water entering the surface cracks may lead to water in Kurrajong Creek Tributary 1 and its tributaries (when they are flowing) leaving the creek and flowing into aquifers or into the mine. Water entering the cracks may resurface again further downstream thus resulting in a negligible net loss in water for Kurrajong Creek Tributary 1. However, water flowing into the mine may lead to a decrease in surface flows and potentially cause problems in the underground mining areas.

Surface cracking may also cause localised erosion and sedimentation. Surface runoff entering the surface cracks, particularly in the dispersive soils evident across the Extraction Plan Area, may form a collapsed trench or depression feature after a period of time. The eroded sediment may fill the cracks along the lower elevations and then potentially reach the waterways.

4.1.3 Slope instability and erosion

Increased erosion and sediment transport may occur as a result of localised increases in the bed gradient of local watercourses due to differential ground movement or creek bank instability. Localised increases in bed gradient are most likely to occur immediately downstream of each chain pillar (where flow direction is perpendicular to the panel orientation) and would result in increased flow velocity and erosive potential of surface flows. Localised creek bank instability would provide a potential sediment load source for transportation downstream and associated degradation of water quality.

Areas of the overbank area will also experience an increase in slope, which may in turn lead to an increase in erosion thus affecting surface water quality. Erosion and sediment transport would result in a degradation of water quality which may impact downstream water bodies and users. Changes in water quality as a result of erosion are generally observed as an increase in total suspended solids (**TSS**) and turbidity.

4.1.4 Surface uplift

Surface uplift affects surface water in a similar manner to surface cracking and slope stability and erosion. Water may be diverted underground and an increase in erosion thus decrease in water quality may occur due to the change in slope.

4.1.5 Ponded water

Surface water flowing to the creek may pond in areas where it currently does not pond as a result of surface gradients changing due to the above mechanisms. Both the quantity and quality of surface water is affected should areas of ponded water develop. There may be a decrease in the quantity of water reaching the creek as it ponds and evaporates rather than flowing to the creek. There may be a change in water quality as salinity may increase if water ponds over saline soils.

4.1.6 Farm dams and soil conservation (contour) banks

Water quality of farm dams may be affected by ponding water and redirection of flows with higher sediment loads due to erosion. This is due to the additional salts absorbed by the stationary water stored in the dam. The effects will have a short duration due to the limited capacity of the dams when compared to the catchment size for the downstream areas. The environmental impact is therefore secondary to the impact on the utility of the dam. This may result in a social and /or economic impact due to the effect on livestock.

4.1.7 Ground disturbance above mining panels

Surface water may also be impacted upon by ground disturbance above the mining panels associated with works to enable mining, such as the installation of drainage (gas and water) boreholes. Borehole installation generally requires:

- construction of access tracks to access the drill sites: this will involve the use of machinery to construct the track and may require the import of fill and implementation of temporary drainage crossings;
- clearing and ground disturbance (i.e. cut and fill) required to construct the drill pads: the drill rig will require a minimum area of 5 m x 5 m for each borehole;
- ongoing access to the installed boreholes for monitoring and maintenance purposes: which will involve vehicular traffic with consequent wear and maintenance.

The above activities have the potential to exacerbate erosion and have a direct impact on runoff quality from the disturbed areas. These bores will also require licencing by DPE, and the water extracted will make up part of the Narrabri Mine 818-unit shares in the Gunnedah-Oxley Basin Murray Darlin Basin Groundwater Source. NCOPL will submit licence applications with as much notice as possible guided by the findings from future revisions of the Site WMP or this WMP.

4.1.8 Effect on harvestable right

As presented in section 2.3, harvestable rights for the NCOPL land holdings are 567 ML and there are 176 existing farm dams across the NCOPL landholdings. Assuming each of these dams contain 1 ML, there would be 391 ML available for use in the surface water capture due to subsidence ponding and the cracks. It is

estimated that the additional surface capture from ponding would be less than 5 ML, which is less than the MHRDC.

4.2 Groundwater

This section provides an outline of the mining sequence to be followed in the Extraction Plan area and for this WMP. In addition, it provides an overview of the potential groundwater impacts as predicted in the Stage 2 EA and the groundwater impact assessments completed for the subsequent MOD 5 and MOD 7.

4.2.1 Mine sequencing

Extraction via the bord and pillar method will occur concurrently with the existing longwall operations and is scheduled to commence in 2022. Bord and pillar mining will occur over approximately five years at a rate of 0.7 Mtpa OM coal. Anticipated and actual start and completion dates are dependent on relevant mining constraints and status of subordinate approvals. The maximum annual mining rate will not exceed 11 Mt.

Further details of the mining schedule are provided in section 3.4 of the CRRP, provided as Appendix A to the Extraction Plan.

4.2.2 Predicted groundwater impacts

Overall, as summarised in section 10.3.8 of the Mine Subsidence Predictions Report in Appendix B of the Extraction Plan, it is evident that the seam to surface connectivity would be unlikely to occur above the bord and pillar mine panels CF201-CF205. Furthermore, it can be concluded that the switch to bord and pillar mining for former mine panels LW 201 and LW 202 would likely reduce the height of continuous fracturing.

The assessment of groundwater impacts for the approved mine plan is primarily based on predictions from a numerical model of the groundwater system around the Narrabri Mine, developed by HydroSimulations (2015) for the MOD 5 mine plan. Principal findings of the modelling after all 20 mining panels (LW 101 to LW 209) have been mined include the following:

- drawdowns are predicted to occur within the target Permian coal measures (Hoskissons Seam) close to the mine, as a result of groundwater flows into the mine workings;
- the predicted drawdown in shallow units above the Hoskissons Coal Seam is largely limited to within the mine area where coal seam terminates in the east;
- the HydroSimulations report indicates that, over the period of the approved mine plan the Napperby Formation will experience significant decline;
- impacts on Jurassic Pilliga strata would be extremely small, and there will be effectively no measurable impact above the Purlawaugh Formation aquitard (i.e. in the Great Artesian Basin (**GAB**) intake beds);
- negligible impacts on groundwater levels in the Namoi Valley alluvium are predicted beyond the mine plan, and existing groundwater users will not be affected; and
- as discussed in section 6.5.3, the calibrated model predicts drawdown in excess of two metres in two registered groundwater bores.

Since the mining footprint and the total volume of coal to be extracted are not expected to increase, the total volume of water extracted is not expected to be increased by the mining of mine panels CF201-CF205. Long term groundwater level and flow impacts may be slightly reduced since inflows to the bord and pillar operations may be slightly lower relative to the originally approved longwall extraction. Overall, the Groundwater Impact

Assessment as part of MOD 7 does not indicate any material changes to the predicted groundwater impacts (as described above) due to the proposed Extraction Plan.

The following impacts can be related to the Extraction Plan:

- whilst concurrent mining of mine panels CF201-CF205 and longwall panels would generate some additional inflow during the period from 2023 to 2025, inflows are still expected to peak at up to 3.78 megalitres per day;
- however, as discussed in the Site WMP, recent actual inflows to the mine have been around half of those predicted and hence it is likely that actual peak inflows will be substantially less than predicted;
- similarly, and as per the predictions made in the HydroSimulations report, drawdown of more than 2 m (i.e. the AIP threshold) is not predicted in any existing privately-owned water supply bores thought to extract water from either the Pilliga Sandstone or Namoi Alluvium aquifers as a result of the Extraction Plan;
- no GDEs or alluvial aquifer systems will be impacted upon since these features are not present within the Extraction Plan Area;
- dewatering leading to drawdown in overlying strata above the Extraction Plan Area mine panels exacerbated by fracturing due to collapse into the goaf;
- dewatering impacts would continue to develop in each of the “less productive” hydrostratigraphic units in which impacts have already been observed, namely the Digby Formation, Napperby Formation, Garrawilla Volcanics and Purlawaugh Formation; and
- the potential for impact on the two identified local groundwater users, as a result of the overall approved mine plan is covered in the Site WMP.

Given the above, no changes to the existing groundwater monitoring or management measures as approved for the existing Narrabri Mine are proposed for the mining of Panels 201-202. This is further discussed in section 6.

The groundwater assessment undertaken for MOD 7 concluded that there would be negligible impact on water quality from the underground mine workings.

5. Surface water monitoring and management

5.1 Surface water monitoring

The surface water monitoring system is discussed in detail in the Site WMP. The surface water monitoring locations are shown in Figure 5.1.

5.2 Baseline water quality

Surface water quality monitoring is undertaken at eight sites on the watercourses draining the Narrabri Mine, as shown on Figure 5.1. Sampling has been undertaken during or immediately following flow events, for EC, pH, TSS, oil and grease and total organic carbon.

Table 5.1 shows a summary of the background water quality data based on 190 samples recorded from July 2007 to March 2020 at KC1US, KC2US and KCUS monitoring locations. Data recorded at these stations have not been affected by the construction activities at the mine and as such, they represent appropriate background values. Monitoring locations KC1DS and KC2DS are downstream of the mine site surface infrastructure areas and may be affected by discharges of disturbed runoff from the sediment dams. Monitoring locations PC1 and PCA are located downstream of longwall panel subsidence and drill site/track disturbance.

Further detail on the baseline water quality is provided in the Site WMP.

5.3 Water quality criteria and triggers

Surface water compliance criteria will be based on background water quality values measured from the local watercourses or based on regional values from the Namoi River Water Quality and River Flow Objectives[3] (**WQO**), which in turn are based on the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018). These are based on guidance published in the (then) Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment and Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), 2000) (**ANZECC guidelines**). ANZG (2018) sets quantitative and qualitative values for a range of water quality parameters for the protection of aquatic ecosystems, aquaculture, recreation, drinking and agricultural values. Table 5.1 shows the Namoi WQO for upland rivers together with baseline data for the background creeks for parameters of interest in this WMP.

Table 5.1 - Comparison of background and receiving water quality

Parameter	Namoi WQO upland trigger value	Local creek background concentration	
		Median	80th percentile
pH	6.5-8	7.2	7.5
Electrical conductivity (µS/cm)	30-350	90	235
Total suspended solids (mg/L)	-	47	219
Turbidity (NTU)	2-25	-	-
Oil & greases (mg/L)	-	<5	<5
Total organic carbon (mg/L)		11	14

[3] https://www.environment.nsw.gov.au/ieo/Namoi/report-02.htm

The surface water compliance trigger values in this WMP are as follows:

- pH range of 6.5 to 8 adopted from the range of Namoi WQO upland triggers;
- EC value of 235 µS/cm adopted from the 80th percentile background value;
- TSS value of 219 mg/L adopted from the 80th percentile background value;
- the Namoi WQO “visual amenity” objective for oils and greases of “should not be noticeable as a visible film on the water, nor should they be detectable by odour”.
- total organic carbon value of 14 mg/L adopted from the 80th percentile background value.

Compliance is required at the downstream monitoring location at KC1US, which changes from upstream (background) to a downstream compliance monitoring location for the Extraction Plan Area. The upstream monitoring location of KC1TOP will continue to be monitored to provide supplementary information, should a non-compliance occur at the downstream location. Note that the upstream station has historically been difficult to monitor as it has a small catchment, which produce short and infrequent runoff events.

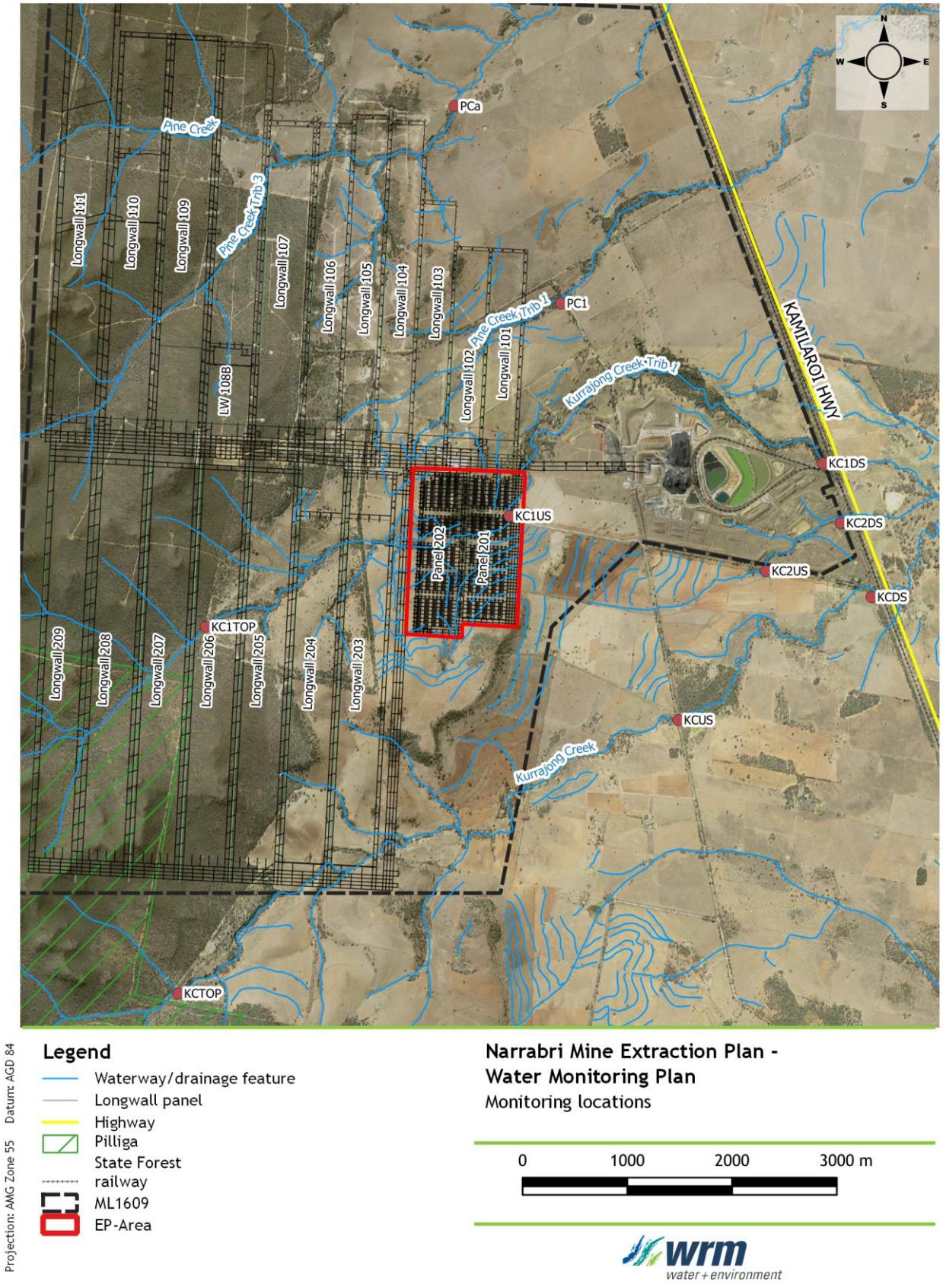


Figure 5.1 - Surface water monitoring locations

5.4 Surface water monitoring parameters and schedule

5.4.1 Water quality monitoring schedule

Current monitoring locations together with the additional monitoring locations will continue to be monitored in accordance with the sampling parameters and sampling frequencies set out in Table 5.2. Due to the ephemeral nature of the watercourses, sampling will be undertaken on an event basis. The water quality monitoring program provides for the assessment of background (upstream) data for flow events in the various creeks and comparison to samples taken downstream of the mining impact area which should enable water quality changes as a result of mining to be identified.

Monitoring is the responsibility of the Environmental Superintendent (or delegate) and is conducted by a suitably qualified professional in accordance with the relevant Australian Standards. The frequency of monitoring and range of parameters analysed during flow and routine monitoring is reviewed after the first two years of operations.

Table 5.2 - Water quality monitoring schedule

Location	Parameters	Frequency
Site meteorological monitoring	Rainfall Wind speed and direction Temperature Relative Humidity Solar Radiation	Recording every 15 minutes
Ponding areas when identified	EC	Monthly (see note)
KC1US, KC1TOP	EC Oil and grease pH TSS TOC Turbidity	During runoff events, as practical at least quarterly if flow within quarter

Note:

The monitoring trends reported in the 2020 subsidence pond monitoring (data reported on since 2013) indicates that trends are understood. The ponds go through cycles of inundation and drying. Higher records for EC correlate to periods of low rainfall and subsequent drying of the ponds. EC has remained within ANZECC guidelines. The monitoring frequency will be reviewed based on this finding.

5.4.2 Inspection monitoring schedule

The water quality data will need to be complimented with a programme of visual inspection. The existing monitoring program would be extended to include the monitoring of the impact of mining on the watercourses that traverse the proposed mining panels. The inspection monitoring would include the following components:

- the creek traversing the Extraction Plan Area will be surveyed at regular intervals to determine the ultimate level of the area. Monitoring will be undertaken:
  - immediately pre- and post-mining;
  - monthly during mining of the panels and for three months following cessation of mining with visual inspections undertaken following significant rainfall events (defined as a 5 day 95th%ile rainfall event which is 38.4 mm over 5 consecutive days); and

- quarterly inspection for two years following cessation of mining.

- photographs of the creek would be taken prior to mine subsidence and for one year after significant mine subsidence has ended. These photographs would be taken following rainfall events of 38.4 mm over a consecutive 5-day period, to assess whether erosion has occurred. This requirement is to be re-evaluated at the end of the monitoring period.
- a log of when inspections occur (and photographs taken) would be kept together with an assessment of the changes in erosion.

The above will be supplemented with aerial photography and aerial laser scanning (**ALS**) survey data when they are made available on the existing monitoring schedule. These visual inspections coupled with survey will be able to easily identify changes in creek beds and erosion that may be attributed to mining activities rather than natural phenomena. For further detail of monitoring of surface cracking and erosion refer to the Land Management Plan, provided as Appendix I to the Extraction Plan.

5.5 Proposed management actions

The following management strategies will be employed to address the predicted impacts of bord and pillar and pillar reduction mining on surface water. Contingency measures are also presented should they be required. The presented actions focus on visual inspection as these can be easily conducted on a regular basis.

All works in the catchment will be carried out in accordance with the approved Erosion and Sediment Control Plan (**ESCP**) as part of the Site WMP for all operations. The ESCP is based on *Managing Urban Stormwater: Soils and Construction: Volume 1* (Landcom, 2004)[4], and *Managing Urban Stormwater: Soils and Construction, Volume 2E Mines and Quarries* (OEH, 2008). These reference documents provide methods for assessing the potential for erosion and sedimentation as well as describing methods and systems for controlling negative impacts.

Given the variable nature of impact, mitigation strategies would be tailored to each individual location, considering the geomorphic characteristics, vegetation and soil types of each location.

5.5.1 Surface cracking

NCOPL will monitor areas above the underground workings that are likely to be affected by surface cracking on a monthly basis and after significant rain events (defined as a 5-day 95 percentile rainfall event which is 38.4 mm over 5 consecutive days). This would involve inspection of the areas on foot, or where access is available, by vehicle.

When cracks are identified, the location will be noted but no immediate action will be taken. It is expected that natural erosive forces will fill smaller cracks naturally. For larger cracks (>100 mm) or those persisting without being naturally filled in, remedial works will be required. This will involve the scarification or light ripping of ground over, and on both sides of, the crack.

If these remedial works are insufficient to fill in a deeper or wider crack, a different approach will be required. NCOPL will excavate the required volume of subsoil from stockpiles located at nearby gas drainage sites, ventilation sites or footprint of the REA, transfer it to the crack site and fill it in. The creek traversing a mining panel will be inspected within 6 months of being crossed.

[4] *Managing Urban Stormwater: Soils and Construction - Volume 1* (Landcom 2004) is commonly known as 'the Blue Book'.

5.5.2 Slope stability and erosion

Given the ephemeral nature of the creeks, bed changes and erosion would be expected to occur as part of naturally occurring phenomena. Therefore, the creeks are expected to naturally readjust to any changes in gradient and short term increase in erosion as a result of subsidence.

Part of the monitoring of the surface above the mine workings will include an assessment of the areas most susceptible to post-mining surface gradient changes. This assessment will focus on the potential for accelerated erosion in creek beds and slopes with exposed soil. The creek will be monitored for erosion following 38.4 mm rainfall over a consecutive 5-day period. Any “non-natural” or erosion deemed to be in excess of natural rates of erosion will be repaired and remedial measures, such as check dams or drop structures, will be constructed, if necessary.

While considered unlikely, should large-scale slope instability be identified after mining, mitigation works will be required. Stabilisation works will be carried out, such as the installation of deep sub-surface drainage trenches (to reduce pore pressures) and the construction of strategic catch drains to improve surface run-off. In the event that erosion is identified, especially along the creek channels, the sections of damaged or steeply eroded banks would be stabilised.

5.5.3 Surface uplift

The monitoring and remediation for uplift is very similar to that of surface cracking. The surface above the mining operations should be inspected for signs of uplift and associated cracking. If found, then the cracks should be filled in as previously described. Where uplift is identified, this should be reviewed to allow improved predictions after the completion of each mining panel.

5.5.4 Ponded water

Inspection of the watercourss over the subsidence zone of the mine site will occur on a monthly basis and following rainfall events. If ponding is identified, NCOPL will implement the following mitigation strategy:

- if little vegetation of significance is impacted and water quality analysis confirms no increase in salinity, the ponding would be left to “self-correct” over time. The Stage 2 EA suggests that the continual action of erosion and sedimentation without mitigation measures is likely to ‘self-correct’ the geomorphic characteristics of the waterways over time;
- if important environmental features are impacted (i.e. riparian vegetation, Endangered Ecological Community or archaeological deposits) or water quality analysis indicates an increase in salinity, the ponding will be assessed and remediation options will be developed to protect the affected environmental features and prevent saline water discharging downstream. The remediation will consider the requirements of the Biodiversity Management Plan and the Extraction Plan - Heritage Management Plan, provided respectively as Appendix H and J to the Extraction Plan;
- should modification of any watercourses be required, a suitably qualified geomorphologist will be consulted and DPE shall be notified.

5.5.5 Farm dams and soil conservation (contour) banks

Appropriate impact management strategies for the farm dams and soil contour banks are described in the Built Features Management Plan, provided as Appendix D to the Extraction Plan. As all farm dams within the Extraction Plan Area are owned by NCOPL, no testing of farm dams is proposed.

5.5.6 Ground disturbance above mining panels

Appropriate management strategies during construction of access tracks and clearing will be implemented as per the approved ESCP. A ground disturbance protocol outlining the standard practices to control soil erosion and sedimentation will be implemented ahead of the planned disturbance. Strategies to control the impacts may include:

- limit clearing to a designated path whilst seeking to disturb the minimum amount of vegetation (i.e. avoid mature trees, etc);
- avoid drainage lines wherever possible;
- implement erosion control measures for roadways, e.g. drainage socks along table drains, rock check dams to slow down runoff, etc;
- implement erosion control measures for disturbed slopes, e.g. silt fences along contours;
- schedule construction in the dry season wherever possible.

For the drill pads, rehabilitate using fast growing pasture grasses once wells have been installed.

5.5.7 Contingency measures

An impact mitigation strategy will be developed in the event that significant erosion, ponding that inundates significant areas of vegetation, or increased surface water salinity or pH outside the target range of the Namoi WQO is identified. The impact mitigation strategy may include the following approaches:

- undertake a more detailed survey of watercourses based on the principles of the Index of Diversion Condition (IDC) developed for creek diversions as part of the ACARP program 'Monitoring and Evaluation Program for Bowen Basin Diversions' (ID&A, 2000). IDC provides a rapid assessment of the condition of diversions and adjoining stream reaches. The purpose of the IDC is to flag potential management issues rather than provide a scientific assessment of a diversion or stream. It is an integrated suite of indicators that measures the geomorphic and riparian condition of a diversion and its upstream control and downstream reaches hence it could be adapted to monitor significant changes in surface morphology as a result of subsidence;
- visible crack in the bed of the creek will be in-filled;
- contour banks that cross chain pillars would be removed and reconstructed if appropriate for the ongoing land use (noting that NCOPL owns all of the land over the Extraction Plan Area and as such is being managed to achieve lower stocking rates and higher vegetation cover than has been historically the case); and
- if significant areas of ponding are identified, i.e. above the predicted levels, an assessment will be made.

6. Groundwater monitoring and management

6.1 Baseline data

Groundwater level and quality information has been routinely collected since 2007 and the commencement of mining operation in 2009. Whilst this is not the case for all monitoring locations, measurements and sampling is undertaken as soon as a location becomes operational.

Historical water quality sampling and field data collection has been undertaken at 44 monitoring locations and the Mayfield Spring. These bores are screened within the various geological units identified in section 2.4. Depending on the monitoring location, Narrabri Mine has collected groundwater data over a period ranging from three to 12 years. A summary of the historical Narrabri Mine groundwater monitoring locations including bore details, geological unit and sampling period is provided in Table 6.1. Statistical summaries of the results of historical water quality sampling are provided in the Site WMP.

It can be seen from Table 6.1 that 25 of the groundwater monitoring sites were sampled from 2008 and four of the groundwater monitoring sites from 2009. These datasets provided reference data for the establishment of baseline and background water level and quality data. The results of data processing for each monitoring location and the dominant water types are provided in Appendix A of the Site WMP.

Through this process it was established that unique water types exist with a rather large variation across each geological zone and across all monitoring bores. Because of the high variability in groundwater chemistry, it is therefore not feasible to single out individual bores for the establishment of background references.

Historical water level measurements have been collected at monitoring locations and used to inform calibration of and updates to the numerical groundwater modelling undertaken for Narrabri Mine. Water level trigger values have been developed for monitoring locations with sufficient pre-mining baseline data based on the maximum predicted drawdown generated from the recalibrated numerical groundwater model (AGE, 2020).

To further demonstrate how baseline groundwater data was applied in the groundwater impact assessment the steady state and transient model (AGE, 2020) simulated water levels in all available monitoring bores within the bedrock and alluvial aquifers. A total of 262 monitoring points were used to calibrate the model, comprising:

- 129 NSW State groundwater monitoring points, predominantly completed into the Namoi Alluvium;
- 115 monitoring points which form part of the Narrabri Coal Mine monitoring network including a number of nested vibrating wire piezometer (**VWP**) facilities; and
- 18 monitoring points installed in the area to the west of the existing Narrabri coal mine as part of the Santos Narrabri Gas Project EIS.

The baseline data used to derive site-specific groundwater quality and groundwater level trigger levels for the monitoring bores is further discussed in the Site WMP.

Table 6.1 - NCOPL groundwater monitoring locations summary

Site ID	Geological unit	Outcrop / subcrop	Easting (MGA 55)	Northing (MGA 55)	Bore depth (m)	Screen interval (mbgl)	Sampling period	
							From	To
P1	Garrawilla Volcanics	Subcrop	776116	6614694	50	44-50	9/09/2008	24/06/2019
P2	Napperby Formation	Outcrop	777282	6616355	50	44-50	9/09/2008	24/06/2019
P3	Pamboola Formation	Subcrop	780433	6620115	45	34-40	9/09/2008	26/06/2019
P4	Napperby Formation	Subcrop	777490	6625553	30	24-30	9/09/2008	24/06/2019
P5	Pamboola Formation	Subcrop	778180	6628195	30	24-30	12/09/2008	24/06/2019
P6[1]	Pilliga Sandstone	Outcrop	772726	6626021	90	78-90	24/08/2009	24/06/2019
P7	Pilliga Sandstone	Outcrop	768998	6624338	90	78-90	10/09/2008	24/06/2019
P8	Purlawaugh Formation	Subcrop	772697	6618421	65	57-63	12/09/2008	24/06/2019
P9	Purlawaugh Formation	Outcrop	775127	6620209	30	24-30	12/09/2008	25/06/2019
P10	Napperby Formation (no sill)	Subcrop	774063	6616444	130	118-130	9/09/2008	24/06/2019
P11	Purlawaugh Formation	Subcrop	774066	6616447	50	44-50	12/09/2008	24/06/2019
P12	Napperby Formation (above sill)	Subcrop	776513	6619964	90	84-90	12/09/2008	25/06/2019
P13	Garrawilla Volcanics	Outcrop	776526	6619972	30	24-30	12/09/2008	25/06/2019
P14[1]	Napperby Formation (above sill)	Subcrop	775221	6622816	78	72-78	24/08/2009	25/06/2019
P15[1]	Garrawilla Volcanics	Subcrop	775221	6622818	30	24-30	24/08/2009	25/06/2019
P16	Garrawilla Volcanics	Subcrop	772233	6623740	146	137-146	12/09/2008	24/06/2019
P17[1]	Purlawaugh Formation	Subcrop	772222	6623712	56	47-56	9/06/2009	24/06/2019
P19	Pamboola Formation	Subcrop	776827	6621543	189	184-187	Yet to commence	Yet to commence
P20[1]	Arkarula Formation		776482	6621837	Unknown	Unknown	9/09/2008	25/06/2019
P29	Napperby Formation (above sill)	Outcrop	778541	6619978	25	19-25	1/06/2012	25/06/2019
P30	Napperby Formation (above sill)	Outcrop	778808	6620071	15	9-15	1/06/2012	25/06/2019
P31	Napperby Formation (above sill)	Outcrop	778318	6620343	15	9-15	1/06/2012	25/06/2019
P32	Napperby Formation (above sill)	Outcrop	778993	6620335	15	9-14	1/06/2012	25/06/2019
P33	Napperby Formation (above sill)	Outcrop	778772	6620523	15	9-14	1/06/2012	25/06/2019
P34	Napperby Formation (above sill)	Outcrop	778542	6620604	15	9-14	1/06/2012	25/06/2019
P47	Garrawilla Volcanics	Outcrop	776166.1	6622586	31	8-30.5	4/09/2013	25/06/2019
P39A	Watermark Formation	Subcrop	782024	6620076	80	72-78	2/06/2016	26/06/2019

Site ID	Geological unit	Outcrop / subcrop	Easting (MGA 55)	Northing (MGA 55)	Bore depth (m)	Screen interval (mbgl)	Sampling period	
							From	To
P39B	Alluvium	Outcrop	782018	6620077	32	15-30	2/06/2016	26/06/2019
P43	Watermark Formation	Subcrop	781248	6619992	66	59-65	2/06/2016	30/05/2019
P51	Garrawilla Volcanics	Outcrop	777437	6620859	17	9-12	29/01/2015	25/06/2019
P52	Napperby Formation	Subcrop	777118	6620808	24	18-21	15/12/2015	25/06/2019
P53	Garrawilla Volcanics	Outcrop	776995	6620655	24	18-21	15/12/2015	25/06/2019
Mayfield Spring (Top)	Pilliga Sandstone	Outcrop			Spring		28/09/2016	24/06/2019
WB1	Garrawilla Volcanics		777251	6622763	Unknown	Unknown	28/09/2016	27/10/2016
WB2	Garrawilla Volcanics	Outcrop	776382	6619701	Unknown	22-26	12/09/2008	12/09/2008
WB3a	Alluvium	Outcrop	779133	6631524	Unknown	8.2-8.5	11/09/2008	25/06/2019
WB3b	Alluvium	Outcrop	779133	6631524	Unknown	35.1-36.3	11/09/2008	24/06/2019
WB4	Alluvium	Outcrop	778957	6629746	Unknown	11.3-15.9	11/09/2008	24/06/2019
WB5a	Alluvium	Outcrop	785892	6618196	Unknown	11-14.5	12/09/2008	24/06/2019
WB5b	Alluvium	Outcrop	785892	6618196	Unknown	26.5-28	12/09/2008	24/06/2019
WB6a	Alluvium	Outcrop	786976	6615621	Unknown	11.5-13	12/09/2008	24/06/2019
WB6b	Alluvium	Outcrop	786976	6615621	Unknown	76.7-78	12/09/2008	24/06/2019
WB7	Alluvium	Outcrop	784440	6620521	Unknown	Unknown	12/09/2008	24/06/2019

Note:

1. No longer functional or dry

6.2 Groundwater monitoring

NCOPL has a groundwater monitoring program in place across the mine site that incorporates the collection of water quality and water level data from groundwater monitoring and local production bores. The overall groundwater monitoring network for Narrabri Mine is presented in the Site WMP.

Four site-specific monitoring bores, P9, P12, P13 and WB02 as shown in Figure 6.1 are selected to specifically monitor groundwater at Panels 201-202. Several other bores exist directly north of mine panels A, C, G and I which are screened in the Hoskissons Coal Seam only and were not selected for this WMP.

The four monitoring locations will be used as early warning indicators as per the identified triggers tabulated in Table 6.2 to flag any observed exceedances in conjunction with the Site WMP. The monitoring frequencies are tabulated in Table 6.3 and water quality parameters to be analysed are listed in Table 6.4.

Table 6.2 - Summary of the groundwater monitoring site types and assessment criteria

Location ID	Type	Coordinates (MGA55)		Bore depth (m)	Screen interval (mbgl)	Formation	Monitoring purpose	Trigger criteria	
		Easting	Northing					Level	Quality
P9	Standpipe	775127	6620209	30	24-30	Purlawaugh Formation	Level and quality	Predicted drawdown	EC two tiered, bore specific
P12	Standpipe	776513	6619964	90	84-90	Napperby Formation	Level and quality	Predicted drawdown	ANZG (stock)
P13	Standpipe	776526	6619972	30	24-30	Garrawilla Volcanics	Level and quality	Predicted drawdown	ANZG (stock)
WB2	Production	776382	6619701	26	22-26	Garrawilla Volcanics	Level and quality	Predicted drawdown	ANZG (stock)

6.2.1 Monitoring bores impacted by subsidence

Except for groundwater monitoring bore P9, monitoring bores P12, P13 and WB2 are not predicted to have a ‘high’ risk of significant impact to well casing.

Where groundwater monitoring points are identified as having been impacted by subsidence, NCOPL will undertake to reinstate or correct the monitoring point. DPE Water will be notified within two weeks of identification of detection of the impacted bore. A determination of the appropriate action for reinstatement or correction of the groundwater bore will be determined in consultation DPE Water. Impacted monitoring locations will be rectified within three months of detection. Additional monitoring bores may be required to replace the function of impacted monitoring bores, if necessary.

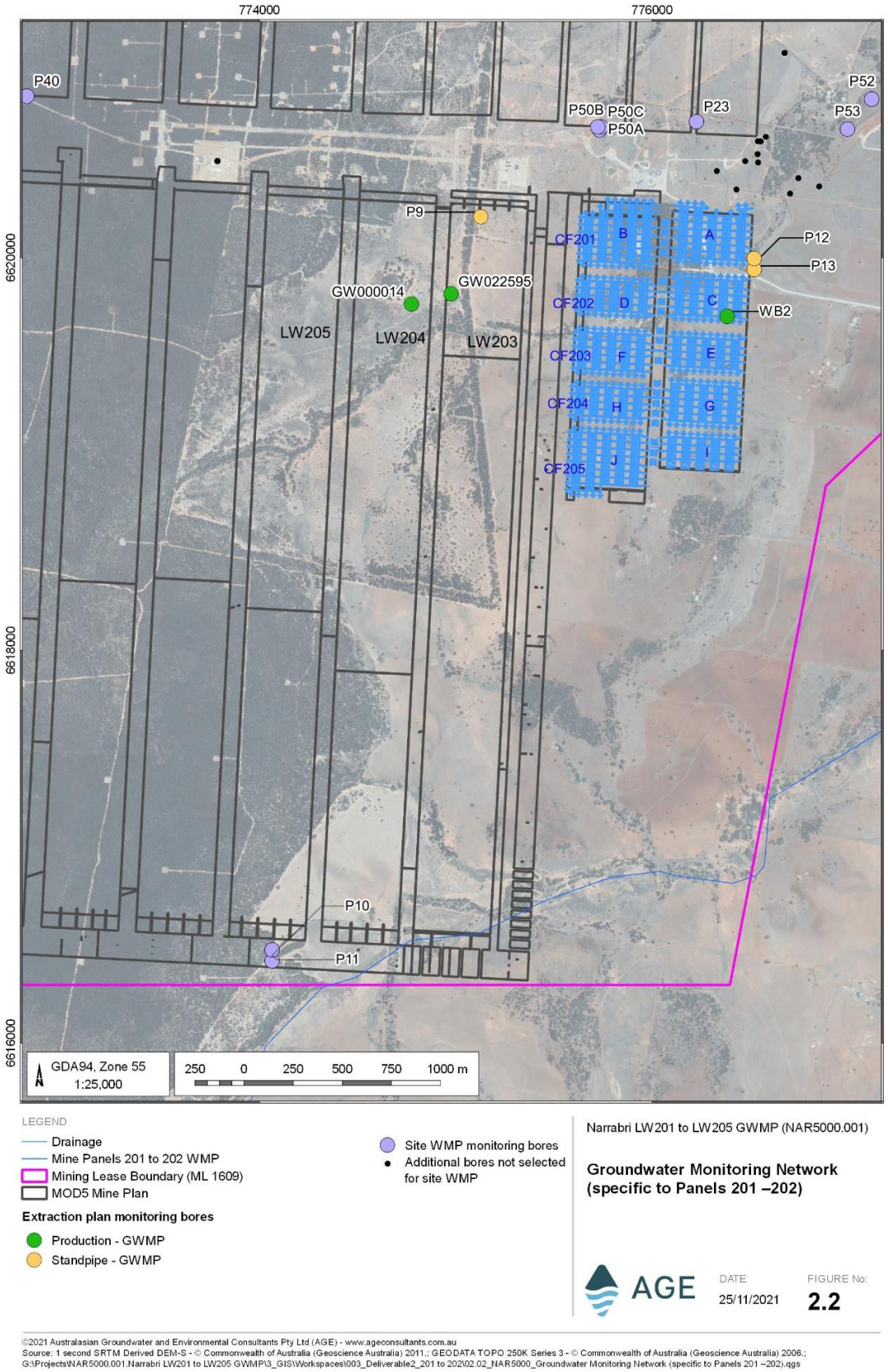


Figure 6.1 - Groundwater monitoring network specific to Panels 201-202

6.3 Monitoring schedule

Tables 6.3 and 6.4 respectively define the frequency and the parameters for laboratory analysis for each sampling location.

Table 6.3 - Groundwater monitoring schedule for Panels 201-202

Monitoring Type	Monitoring sites	Parameter	Frequency
Standpipe	P9, P12, P13, WB2	Water level	Quarterly
		EC, pH, TDS	Quarterly
		Metals	Annual
		Anions and cations	Annual
Vibrating wire piezometer (**VWP**)		Water level	Daily - data logger
Mine water pumped into and out of the mine	Underground mine panels 201-202	Water quality (as above)	Daily - flow rate Monthly - EC and pH Quarterly - Full water quality analysis suite

Notes:

EC = electrical conductivity
TDS = total dissolved solids

Table 6.4 - Laboratory analysis suite for groundwater

Class	Parameter
Physical parameters	EC, TDS, TSS and pH
Major cations	Calcium, magnesium, sodium and potassium
Major anions	Carbonate, bicarbonate, sulphate and chloride
Dissolved metals	Aluminium, arsenic, boron, cobalt, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, selenium, zinc
Nutrients	Ammonia, nitrate, phosphorus, reactive phosphorus

6.4 Data collection methodology

Groundwater data will be collected through a monitoring program for the duration of the Extraction Plan. Groundwater data collection is and will be undertaken at the intervals listed in Table 6.2 by suitably qualified and experienced personnel. Water level measurements and water sample collection, as well as storage and transportation, will be conducted in accordance with the Site WMP. The sampling procedures are drawn from relevant aspects of the following Australian Standards:

- AS/NZS 5667.1:1998 - Australian/New Zealand Standard Water quality – Sampling, Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples and
- AS/NZS 5667.11:1998 - Water quality – Sampling, Part 11: Guidance on sampling of groundwaters.

Groundwater data collected from each monitoring round will be collated into a database. The database should include, as a minimum requirement, the following:

- records of manual standing level water measurements and electronic pressure logger or VWP download;
- records of field water quality parameters and sampling methodologies to achieve representative samples;
- tabulated water quality laboratory results and comparison to trigger values;
- a chain of custody supplied to the laboratory of the water samples collected;
- records of original laboratory analysis certificates; and
- records of any issues encountered.

6.4.1 Requirements for subsidence impact monitoring

NCOPL has implemented a comprehensive monitoring program to investigate the subsidence impacts as they develop Panels 201-202. A number of existing multi-level vibrating wire piezometers and the standpipe bores listed in Table 6.1 enable ongoing groundwater level monitoring for the life of the operation and specific to Panels 201-202. Where monitored seasonal levels vary significantly from baseline levels and modelled levels in the environmental assessment, the groundwater model will be used to determine the likely source of the discrepancy and to what extent the mining associated with the Extraction Plan is influencing groundwater levels.

The groundwater level and quality information collected, together with the mine water inflows and outflows, would show changes in surface or groundwater flow entering the mine for comparison to and updating of the groundwater model. Hydrogeological data is reviewed annually and included in the annual monitoring report.

6.5 Groundwater impact assessment criteria

Impact assessment criteria have been adopted for the potential impacts related to the Extraction Plan discussed in section 4.2:

- mine inflow rate and water quality; and
- near surface groundwater levels, in particular groundwater levels within the Garrawilla Volcanics.

The basis for and development of these adopted impact assessment criteria are discussed below. Again, impacts on groundwater, GDEs and private groundwater users predicted as a result of the approved mine plan and modification are discussed in the Site WMP.

6.5.1 Mine inflow rates and quality

Daily recording of mine water inflows and outflows will be conducted (refer to Table 6.2) to record potential sudden inflows as subsidence develops (as a result of groundwater inflow or connection to surface water

flows). In consideration of the sensitivity analysis conducted on the groundwater model (HydroSimulations, 2015) and the potential variability of mine inflows (on a daily basis compared to the weighted average annual inflow of the model), an observed inflow rate 100% in excess[5] of the predicted base case mean monthly inflow rate at any stage during the Extraction Plan mine life sustained for three consecutive months would trigger an investigation and preparation of a response plan as detailed in section 7.2.

The volumes extracted from the Extraction Plan mine workings are passed through the box cut sump and flows pumped from here are measured. These volumes are included as part of the monitoring network and are reported in the Annual Review. This forms the largest portion of flow that contributes to Narrabri Mine's licenced groundwater extraction volume.

Mine inflow water quality is presented in the Site WMP.

6.5.2 Bore and gas drainage water extraction

The groundwater volumes extracted from bores and gas drainage activities will be measured using flow meters on the pumping equipment. This water contributes to Narrabri Mine's total licenced extraction volume. The volumes extracted from each location will be recorded and included in the Annual Review where flows warrant installation of flow meters, as flows from vertical gas bores are usually very low to insignificant.

6.5.3 Impacts to licensed users

Due to the generally high groundwater salinities and low bore yields, there is very limited existing groundwater abstraction in the immediate mining area other than for coal mine dewatering. No private bore exists within the immediate area of Panels 201-202.

Numerical model predictions based on the approved mine plan suggest maximum impacts of greater than 2 m may occur in one landholder bores, GW013858 at some point in the future. Accordingly, bore GW013858 will be monitored for levels, water quality and pumping rates unless other make-good arrangements with the landholder apply.

It is to be noted that the property of GW054227 was visited in April 2021 during a follow-up bore census and it was confirmed by the landholder that this bore cannot be located, and its existence is unknown. The bore is therefore deemed not in use and destroyed and will not be considered further as a monitoring bore.

6.5.4 Groundwater quality criteria

Due to the generally high naturally occurring groundwater salinity in the area, there is limited existing groundwater abstraction in the immediate mining area other than for coal mine dewatering. Some local bores, however, target relatively permeable horizons within the Napperby Formation and the Garrawilla Volcanics which can support stock and domestic extractions. Irrigated agriculture utilises groundwater in the Namoi River Alluvium. Where suitable, the guideline water quality objectives for stock drinking water (beef cattle) and long-

[5] 'Day to day inflow rates may be highly variable as subsidence develops. A fracture zone may be intercepted which contributes increased inflow for a short period of time (days to weeks), but then inflow would be expected to return to the long-term average. The groundwater model also assessed variability in parameters, including hydraulic conductivity, to examine potential variability in impact on groundwater (groundwater level drawdown and inflow rate) compared to the base case. The adoption of a 100% trigger level for variation in inflow rates is based on these two considerations.'

term irrigation are adopted. The selected trigger criteria are further explained and presented in detail in the Site WMP.

6.5.5 Groundwater level criteria

The annual trigger levels for each monitoring point listed in Table 6.2 and the detailed methodology and associated trigger criteria are further detailed in Appendix B in the Site WMP, along with baseline hydrographs. Measured water levels at each monitoring location will be assessed annually against the derived water level trigger values.

6.5.6 Further development of the groundwater model

SoC 6.16 in Appendix 3 of the Project Approval requires NCOPL to carry out audits of the groundwater model predictions against the monitoring data every 5 years, or more frequently if inflows deviate significantly from the predictions.

This requirement is discussed in detail in the Site WMP.

7. Surface and groundwater response plan

The surface and ground water response plan includes a protocol for managing and reporting any:

- incidents;
- complaints;
- non-compliances with statutory requirements; and
- exceedances of the impact assessment criteria and or performance criteria.

Records of any of these items along with the data collected as outlined in this section are to be maintained and available for review by the appropriate agency or department.

7.1 Surface water response plan

Monitoring will involve both the sediment and chemical content of the surface water and the physical movement of the flow. If these elements are altered significantly, then remediation will be required. The monitoring will be as described in section 5.1.

7.1.1 Contingency measures

The methods used to correct or compensate for the various changes in the surface water flow are described in section 5.5. While there are no specific triggers, the general aim is to minimise the effect of subsidence to the surface water flow routes. There are performance indicators for the quality of the water and these may indicate the presence of subsidence; however visual inspection of the area is essential. The corrective action may not always be immediate, but this is intended to allow the majority of subsidence effects to occur before any action is taken.

7.1.2 Response action

If an exceedance of the performance indicators within the creek crossing the Extraction Plan Area are observed (detailed in section 5.3), then NCOPL will follow the procedure listed below:

- record the timing, location, environmental conditions and any potential contributing factors;
- issue advice of the apparent exceedance to relevant department(s) immediately;
- inspect sampling point and areas upstream inspected to ascertain cause of exceedance;
- review operational practices to determine if any current operational practice contributed to the exceedance;
- implement ameliorative measures on site to minimise the potential for future exceedance, including:
  - alteration to operational practice, or
  - maintenance for subsidence effects.
- provide written advice to relevant agencies identifying actions undertaken to reduce future risk of exceedance within 14 days;
- seek external advice where specific cause of exceedance cannot be identified; and
- implement ongoing monitoring to ensure ameliorative measures have been successful with concentration criteria being met.

All other surface water monitoring will be discussed in the Annual Review with reference to background water quality and relevant guidelines, such as the NSW WQO.

The ongoing monitoring program and collation of relevant data will provide the basis for continuing improvement in surface water management across the site.

A TARP is presented in Table 7.1.

7.2 Groundwater response plan

The groundwater response plan includes a protocol for managing and reporting any:

- incidents;
- complaints;
- non-compliances with statutory requirements; and
- exceedances of the impact assessment criteria and or performance criteria.

Records of any of these items along with the data collected as outlined in this section are to be maintained and available for review by the appropriate agency/authorities.

If adverse impacts or groundwater quality degradation are beyond predictions in the Stage 2 EA and this is caused by mine operations, contingency measures will be required. NCOPL will commission an assessment of the causes; develop a staged response program satisfactory to DPE Water to mitigate the adverse impacts; and establish and implement measures to manage further impact.

7.2.1 Contingency measures

The identification process and response protocol to adverse outcomes are provided in the TARP (refer section 7.3). The responses proposed incorporate a staged assessment and development of management measures deemed appropriate for each individual event should it occur.

Specific trigger levels have been designed to alert NCOPL to observed parameter responses which are outside of normal variation and predicted responses, or where observed parameter values do not follow anticipated trends.

The triggers for instigation of response actions would occur when observed changes to monitored parameters exceed specified levels (refer to section 6). Such changes in observed parameters or conditions include:

- sudden in-rush of groundwater into the mine or measured flows in exceedance of predicted inflows;
- significant change in observed water quality or groundwater levels between sampling rounds;
- changes in trends over an extended period for groundwater levels and quality that are not consistent with the prediction models; and
- a significant increase or variation from predicted models.

7.2.2 Response action

In the event of any exceedance detailed in section 6.5 the following response action may be initiated:

- NCOPL assessment to determine the reason for the exceedance which may include resampling or increasing monitoring frequency to confirm trend / exceedance or identify sampling anomaly;
- refer the matter to an independent hydrogeologist for review if NCOPL investigation is unable to identify reason for exceedance. Any such investigation (depending on nature of trigger) may include:
  - review monitoring data;
  - review groundwater model;
  - review site water balance; and
  - assessment of potential causes and consequences.
  - key considerations of the assessment may include:
  - does the monitoring and investigation indicate that a performance measure, development consent condition or water licensing limit has been exceeded, (or is likely to be exceeded in the immediate future); and
  - what are the implications of the exceedance (other water users, mine water balance, Namoi River alluvium, GAB).
  - what are the potential factors that may have contributed to the exceedance;
  - what actions, if any are required, to mitigate or minimise the potential for future impacts; and
  - develop recommendations and report.
- if assessed as being caused by the mining operation, and it is further assessed to be likely to cause an adverse impact on an existing beneficial or environmental use of groundwater, then an appropriate preventative or remedial strategy would be recommended, which may comprise:
  - additional monitoring;
  - modification to mine plans;
  - provision of alternative water supply or other agreed compensation; or
  - (if appropriate) no change to operations.

The above response program would be carried out in consultation with EPA and DPE Water.

Should any review or post-audit indicate a significant variance (refer section 4.2) from the model predictions with respect to either water quality or groundwater levels, then the implications of such variance will be assessed, and appropriate response actions implemented in consultation with the DPE Water and other departments as appropriate.

If inflows deviate significantly from predictions, regular review of the groundwater model predictions against monitoring data will be carried out. Should the recalibrated model show groundwater inflows beyond these cases described in MOD 5 and MOD 7, a separate detailed impact assessment will be conducted and mitigating measures determined.

7.3 Trigger action response plan

The TARP has been developed to focus upon appropriate trigger and response actions for mitigation of impacts to the natural environment as a result of mining. Monitoring serves to advise of changes to surface water and groundwater levels or quality that occur or to raise alert that an abnormal condition relating to mining has developed.

Each monitoring program has established trigger levels of particular impacts at which a response is needed, and to help define an appropriate response, as presented in Table 7.1. Management of impacts within predictions follows standard assessment review and response protocols.

The TARP has been designed to reference the risks that mining poses to the environmental receptors both within the mining area and beyond. Aspects assessed to be at risk are summarised in section 4 and 6.5 of this Plan. These include both predicted and unpredicted impacts, and include:

- groundwater level;
- groundwater quality;
- hydraulic connection to alluvium associated with the Namoi River;
- discharges;
- pumping bores/underground pumping stations;
- groundwater users (Private Bores);
- surface water quality; and
- ponding

Table 7.1 - Trigger action response plan

Monitoring	Trigger	Action
Surface water		
Water Quality		
To identify potential surface water quality impacts as a result of mining activities (e.g. via subsidence cracking, ponding, erosion). **Sites:** KC1US, KC1TOP (see Figure 5.1) **Parameters:** EC, oil and grease, pH, TSS, TOC, Turbidity. **Analysis:** Comparison downstream results to the adopted water quality trigger levels (see section 5.3). Comparison of upstream results to downstream results. Review of water quality trends over time. **Frequency:** During runoff events (as practical).	**Level 1** Long term upwards trend towards adopted water quality trigger value (for six consecutive months)	• Repeat sampling to confirm results exceed trigger level. • 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. Implement appropriate management or contingency response (i.e. repair of subsidence cracking, remediation of ponding, erosion control works and rehabilitation)
	Level 2 Exceedance of adopted water quality trigger value for three consecutive monitoring results	• Actions stated for Level 1 • Implement contingency and notification measures as per section 5.5.7.
Water Quality (Ponding)		
To monitor potential salinity increases in water ponding over potential saline soils. To ensure that surface water ponding does not provide a potential source of salinity for downstream watercourses (Namoi River). **Sites:** Panels 201-202 **Parameters:** Water quality sampling (EC) of surface water ponding in overbank areas. Identification of changes in topography that leads to ponding. **Analysis:** Comparison to adopted water quality trigger value and observing trend in quality over time. Identification of potential ponding areas via changes in topography. Identified via visual inspection and ALS survey. **Frequency:** Following formation of surface ponding and monthly during ponding occurrence. Monthly visual inspection and three yearly ALS survey.	**Level 1** Long term upwards trend towards adopted water quality trigger value (for six consecutive months) or identified changes in topography either by visual inspection during an event or via survey information	• Ecological benefits of ponded water should be considered before any action is taken. • If little vegetation of significance is impacted and water quality analysis confirms no increase in salinity, the ponding would be left to “self-correct” over time. • Should vegetation of significance be at risk or there is an exceedance of salinity, construct drainage (i.e. open channel / drain) works to ensure area is able to drain freely once substantial subsidence has ended. Rehabilitate and stabilise. • Should vegetation of significance be at risk or there is an exceedance of salinity, construct drainage (i.e. open channel / drain) works to ensure area is able to drain freely once substantial subsidence has ended. Rehabilitate and stab
	Level 2 Exceedance of adopted water quality trigger value for three consecutive monitoring re	• Actions stated for Level 1 • Implement contingency and notification measures as per section 5.5.7.
Changes in water course morphology		
To determine if subsidence due to mining is impacting on the morphology of Kurrajong Creek Tributary 1. This can appear as changes in; planform, creek grade, bank erosion and sedimentation which effects water quality. This may occur in the channel and the wider floodplain. **Sites:** Where Kurrajong Creek Tributary 1 traverse the EP-Area. **Parameters:** Water quality – use results from ‘water quality’ section above. Identification of changes in planform, creek grade bank erosion and sedimentation. **Analysis:** Identified via visual inspection and subsidence monitoring survey. **Frequency:** Water quality - during runoff events (as practical). Morphology - monthly visual inspection and 3 yearly ALS survey	**Level 1** Water quality triggers as described above may indicate changes in channel morphology	• Identified changes in topography should be allowed to “self-correct” unless there is evidence of significant erosion. (or variation from predicted model results see figures 20 to 23b of the Subsidence Predictions Report (as Appendix B to the Extraction Plan).
	Level 2 Identified changes in topography either by visual inspection during an event or via survey information	• Actions stated for Level 1 • If erosion and deposition is identified as being significant, a qualified geomorphologist will be consulted to develop action plan which may involve further monitoring or remediation. • Monitoring may involve use of Index of Diversion Condition principles as per ACARP. • Remediation works will be identified; these may include erosion protection works, removal of sedimentation and realignment of the watercourse. • Implement contingency and notification measures as per section 5.5.7 including contact with DPE.
Ground disturbance above mining panels		

Monitoring	Trigger	Action
To determine if activities above mining panels required to enable mining is impacting on surface erosion and in turn impact on water quality. **Sites:** Areas that traverse the long wall panels. **Parameters:** Water quality – use results from 'water quality' section above. **Analysis:** Identified via visual inspection. **Frequency:** Water quality - during runoff events (as practical)	**Level 1** Water quality triggers as described above may indicate increased rates of erosion.	• Continued monitoring of erosion; control measures as described in the mine site erosion and sediment control plan
	Level 2 Visual inspection revealing excessive erosion or ineffective control measures	• Actions stated for Level 1: • If implemented erosion control measures are found to be failing, review causes and replace with like or better. Continue monitoring.
Groundwater		
Groundwater levels (Permian to Jurassic hard rock aquifer		
For comparison to baseline water level data and to identify water level impacts. To verify that impacts on GAB aquifers are consistent with model predictions. To re-calibrate and validate model with additional data. **Sites:** • Vibrating wire piezometers and groundwater bores in Permian. • Private landholder bores (including identified springs to the south of the mine). **Parameters:** Water level. **Analysis:** Comparison to predicted drawdown taking into account natural variations. **Frequency:** Manual monitoring of groundwater bores monthly and automatic groundwater level monitoring of VWPs daily	**Level 1** Adopted water level triggers (mbgl): Bore P9 – 29.0 Bore P12 – 89.0 Bore P13 – 20.4 Bore WB2 – 25.0	• Engage hydrogeologist to undertake investigation and report on any identified changes /likely causes and recommendations in accordance with section 7.2.2. • Notify agencies when exceedance becomes known (as per section 5.2 of the Extraction Plan), and provide updates throughout investigation above, and at conclusion of assessment. • Implement contingency responses as agreed with government agencies and in accordance with hydrogeologist recommendations. • If quarterly groundwater monitoring identifies that the groundwater level trigger has been exceeded, the water level in the affected piezometer will be measured within one month of the initial measurement. If the water level no longer exceeds the trigger level, the groundwater level measurements will continue as per the quarterly monitoring program. If the SWL still exceeds the trigger level, and NCOPL is unable to ascertain the cause of the exceedance the matter will be referred to relevant agencies and an independent hydrogeologist for review.
Hydraulic connectivity		
To identify changes (pre and post mining) in permeability and provide data for on-going review and recalibration of groundwater predictive models. To obtain site-specific data on fracturing behaviour and extent in overlying strata. **Sites:** • Vibrating wire piezometers (existing and others as constructed at ends of panels, over panels and over chain pillars). • Monitoring bores (existing and others as constructed at ends of panels, over panels and over chain pillars). • Extenseometers to be constructed at ends of panels, over panels and over chain pillars. **Parameters:** Water level **Analysis:** • Comparison to predicted drawdown taking into account natural variations. • Horizontal and vertical permeability compared to values used in groundwater model. **Frequency:** • Manual monitoring of groundwater bores monthly. • Automatic groundwater level monitoring of VWPs daily (downloaded monthly) from commencement of adjacent longwall continuing until 6 months of longwall pass, otherwise as for 'Groundwater Levels – Permian to Jurassic hard rock aquifers'. Annual review by an experienced hydrogeologist to collate and review monitoring data collected.	**Level 1** Drawdown greater than 15% above predicted trend in VWPs and monitoring bores, or permeability greater than upper limits used in sensitivity analysis in groundwater model, or fracturing extends above Garrawilla Volcanics.	• Engage hydrogeologist and/or subsidence specialist to undertake investigation and report on any identified changes/likely causes and recommendations in accordance with section 7.2.2. • Notify agencies when exceedance becomes known (as per section 5.2 of the Extraction Plan), and provide updates throughout investigation above, and at conclusion of assessment. • Implement contingency responses as agreed with government agencies and in accordance with hydrogeologist recommendations.
Mine water inflows – volume/rate		

Monitoring	Trigger	Action
To verify that impacts of subsidence and groundwater drawdown are consistent with model predictions. To re-calibrate and validate model with additional data. **Sites:** Surface to in seam extraction bores, sumps/pumps, water entry to mine. **Parameters:** Volume. **Analysis:** Comparison to predicted volumes in mine water management and groundwater models. **Frequency:** Daily recording of volumes.	**Level 1** An observed inflow rate 100% in excess of the predicted base case mean monthly inflow rate at any stage during the mine life sustained for 3 consecutive months or inflow rate for a 3 month period 100% greater than the predicted base case total for that 3 month period.	• Engage hydrogeologist or subsidence specialist to undertake investigation and report on any identified changes /likely causes and recommendations in accordance with section 7.2.2. • Notify agencies when exceedance becomes known (as per section 5.2 of the Extraction Plan), and provide updates throughout investigation above, and at conclusion of assessment. • Implement contingency responses as agreed with government agencies and in accordance with hydrogeologist recommendations.
Mine water inflows – quality		
To verify that impacts of subsidence and groundwater drawdown are consistent with model predictions. To re-calibrate and validate model with additional data. **Sites:** Underground sumps/pumps, water entry to mine. **Parameters:** Water quality – full laboratory analysis suite (refer to Table 6 4). **Analysis:** Comparison to predicted water quality in mine water management and groundwater models. **Frequency:** Monthly for EC and pH. Quarterly (full water quality).	**Level 1** Should the TDS of the mine inflows or dewatering discharge indicate an inflow salinity of more than 20% above that predicted by modelling at any stage during the mine life sustained for three consecutive months (or the 3-month rolling average exceeds the criteria)	• Engage hydrogeologist or subsidence specialist to undertake investigation and report on any identified changes /likely causes and recommendations in accordance with section 7.2.2. • Notify agencies when exceedance becomes known (as per section 5.2 of the Extraction Plan), and provide updates throughout investigation above, and at conclusion of assessment. • Implement contingency responses as agreed with government agencies and in accordance with hydrogeologist recommendations.
Groundwater quality		
For comparison to baseline water quality data and to identify water quality impacts. **Sites:** As per the Site WMP. **Parameters:** Water quality – full laboratory analysis suite (refer to Table 6.4). **Analysis:** Comparison to NEPM and baseline water quality (groundwater quality conducted up to and including the first two years of mining). **Frequency:** Quarterly for EC and pH. Annually for other water quality.	**Level 1** groundwater quality trigger criteria: Bore P9 – EC two tiered Bore P12 – ANZG (stock) Bore P13 – ANZG (stock) Bore WB2 – ANZG (stock)	• Engage hydrogeologist to undertake investigation and report on any identified changes /likely causes and recommendations in accordance with section 7.2.2. • Notify agencies when exceedance becomes known (as per section 5.2 of the Extraction Plan), and provide updates throughout investigation above, and at conclusion of assessment. • Implement contingency responses as agreed with government agencies and in accordance with hydrogeologist recommendations.

Notes:

If quarterly groundwater monitoring identifies that the groundwater level trigger has been exceeded, the water level in the affected piezometer will be measured within one month of the initial measurement. If the water level no longer exceeds the trigger level, the groundwater level measurements will continue as per the quarterly monitoring program. If the SWL still exceeds the trigger level, and NCOPL is unable to ascertain the cause of the exceedance (e.g. windmill in operation) the matter will be referred to relevant agencies and an independent hydrogeologist for review.

For the TARP for Groundwater levels (Namoi River alluvial aquifer), refer to Site WMP.
All actions are the responsibility of the Environmental Superintendent.

7.4 Unforeseen impacts protocol

Table 7.2 outlines the procedure to be followed (in general accordance with the criteria exceedance protocols detailed in sections 5 and 6) in the event that any unforeseen surface or groundwater impacts are detected. This is in addition to the procedures already described and is intended to allow an initial response that can be tailored for similar future occurrences.

Table 7.2 - Unforeseen impact procedure

Stage	Procedure
1	Review the unforeseen impact including consideration of: • any relevant monitoring data; and • current mine activities and land management practices in the relevant catchment
2	Commission an investigation by an appropriate specialist into the unforeseen impact, if considered appropriate by the Environmental Specialist.
3	Develop appropriate ameliorative measures based on the results of the above investigations, in consultation with the relevant authorities.
4	Implement additional monitoring where relevant to measure the effectiveness of the improvement measures.

8. Plan implementation

8.1 Roles and responsibilities

To ensure adequate implementation of this WMP, the following responsibilities have been assigned to relevant NCOPL personnel as detailed in Table 8.1. It is also noted that additional responsibilities are referred to within the Extraction Plan and the appended sub-plans.

Table 8.1 - Roles and responsibilities

Roles	Responsibilities
General Manager	• Ensure that adequate resources are available to NCOPL personnel to facilitate the completion of their responsibilities under this WMP. • Communication with statutory agencies and departments, public authorities and the community.
Mine Manager	• Ensure all contractors, sub-contractors and service-personnel are appropriately qualified, competent and licensed to undertake the required work and have a good environmental performance record. • Ensure the WMP is implemented and adhered to.
Environmental Superintendent	• Ensure that all surface and groundwater monitoring and reporting is undertaken in accordance with this WMP and various approval requirements, and is checked, processed, and filed appropriately. • Advise on matters identified in all approval, permit, licence and consent documents and ensure all operations are conducted in compliance with those conditions, and all other environmental obligations. • Liaise with stakeholders regarding subsidence impact management. • Authorise changes to this WMP.

9. Reporting, evaluation and review

9.1 Annual Review

In accordance with Schedule 6 Condition 6, NCOPL will review the performance of its water management for the previous calendar year and report the relevant results within the Annual Review, to the satisfaction of the Secretary. The Annual Review will at minimum provide information regarding the effectiveness of the management measures to prevent, and if prevention is not reasonable and feasible, to minimise any impact to surface water resources and groundwater resources.

Further, the Annual Review requires a number of items to be reviewed or assessed. In summary these are:

- monitoring results and complaints;
- non-compliances and incidents;
- compliance with performance measures;
- discrepancies between predicted and actual impacts; and
- measures to be implemented to improve environmental performance.

The Annual Review may also make recommendations for any additions, changes or improvements to the water resources management process, and will include specific reporting on the items detailed in section 9.1.1 to 9.1.4.

The Annual Review will be available on the WHC website.

9.1.1 Surface water

The Environmental Superintendent retains an active database of monitoring results which will be updated on a regular basis. This will cover both catchment flows crossing the mine lease and water flowing or stored in the surface operating area. Any runoff event within affected surface watercourses will result in the triggering of a sampling event.

9.1.2 Groundwater

The active database of monitoring results, to be retained by the Environmental Superintendent, will be updated on a regular basis. The Annual Review will present an overview of the performance of the groundwater monitoring network during the preceding calendar year and identify the proposed extraction, processing and rehabilitation activities and environmental management planned for the following calendar year.

As part of annual monitoring and in accordance with SoC 6.12, it is the responsibility of NCOPL to commission an experienced hydrogeologist to collate and review the monitoring data collected. This review will assess the impacts of mining associated with the Extraction Plan on the groundwater environment, and to compare any observed impacts with those predicted from groundwater modelling. If significant variation is found between predicted impacts and observed operational monitoring data then notification of remediation will be required.

The ongoing monitoring program and collation of relevant data will provide the basis for continuing improvement in groundwater management across the site.

9.1.3 Groundwater level

The methods for analysis of groundwater level data are summarised in the flowchart in Figure 9.1. The flowchart outlines the pre-processing steps, including quality assurance/quality control (QA/QC) that will be undertaken for groundwater level data analysis.

As indicated in the flowchart, manual standing water levels and electronic pressure logger data from VWPs will be converted to a reduced water level with respect to mAHD. Pressure logger data will be adjusted to remove the effects of barometric pressure changes where required. The reduced water level data will be visualised as time series charts (hydrographs).

Hydrographs will be utilised as a tool to identify occurrence of anomalous data points, which can form part of the QA/QC process. Once anomalous data points are rectified or removed, the hydrographs will be used to understand the behaviour of water in the groundwater regime including:

- recharge/discharge events as indicated by the relationship to the cumulative rainfall departure from mean;
- the influence of regional abstraction from irrigation, stock and domestic bores; and
- any effects from mining.

Hydrographs will be compared between monitoring locations to reveal more significant water level changes that could be a result of the Project activities. Where water level measurements are outside the trigger threshold the TARP process (as outlined in section 7.3) will be initiated.

The Mine Subsidence Predictions Report in Appendix B of the Extraction Plan should be used in parallel with review of data to validate and cross-reference any groundwater level anomalies identified.

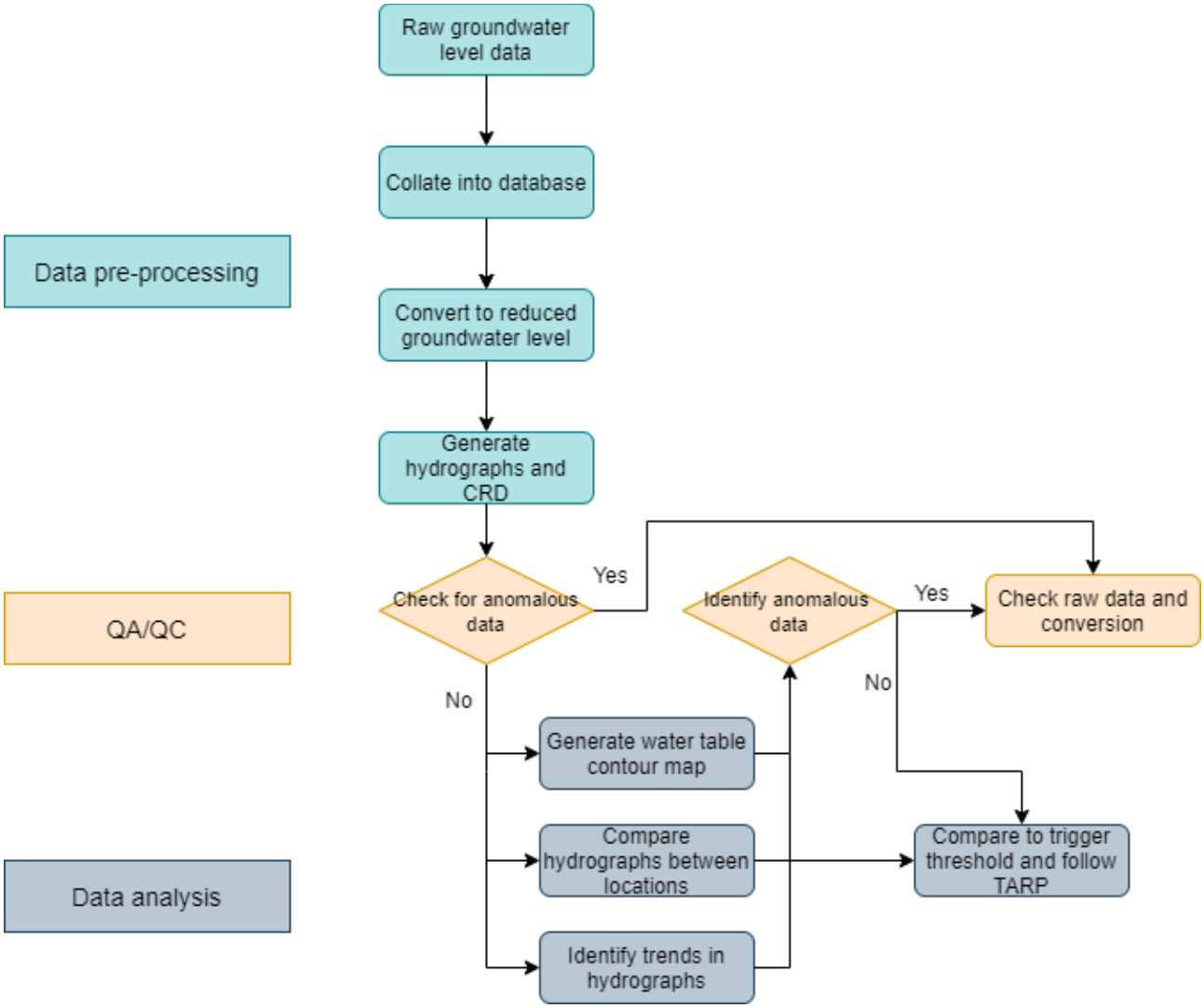


Figure 9.1 - Groundwater level data pre-processing and analysis flowchart

9.1.4 Groundwater quality

The methodology for analysis of groundwater quality data is summarised in the flowchart in Figure 9.2. Similar to the water level flowchart in Figure 9.1, this flowchart outlines the pre-processing, including QA/QC, as well as the steps that will be undertaken for groundwater quality data analysis.

The coal extraction associated with the Extraction Plan will not change the current quality of groundwater as the current recharge pathways are not proposed to be altered. Changes to groundwater levels and quality will be investigated if monitoring results deviate from historical monitoring results.

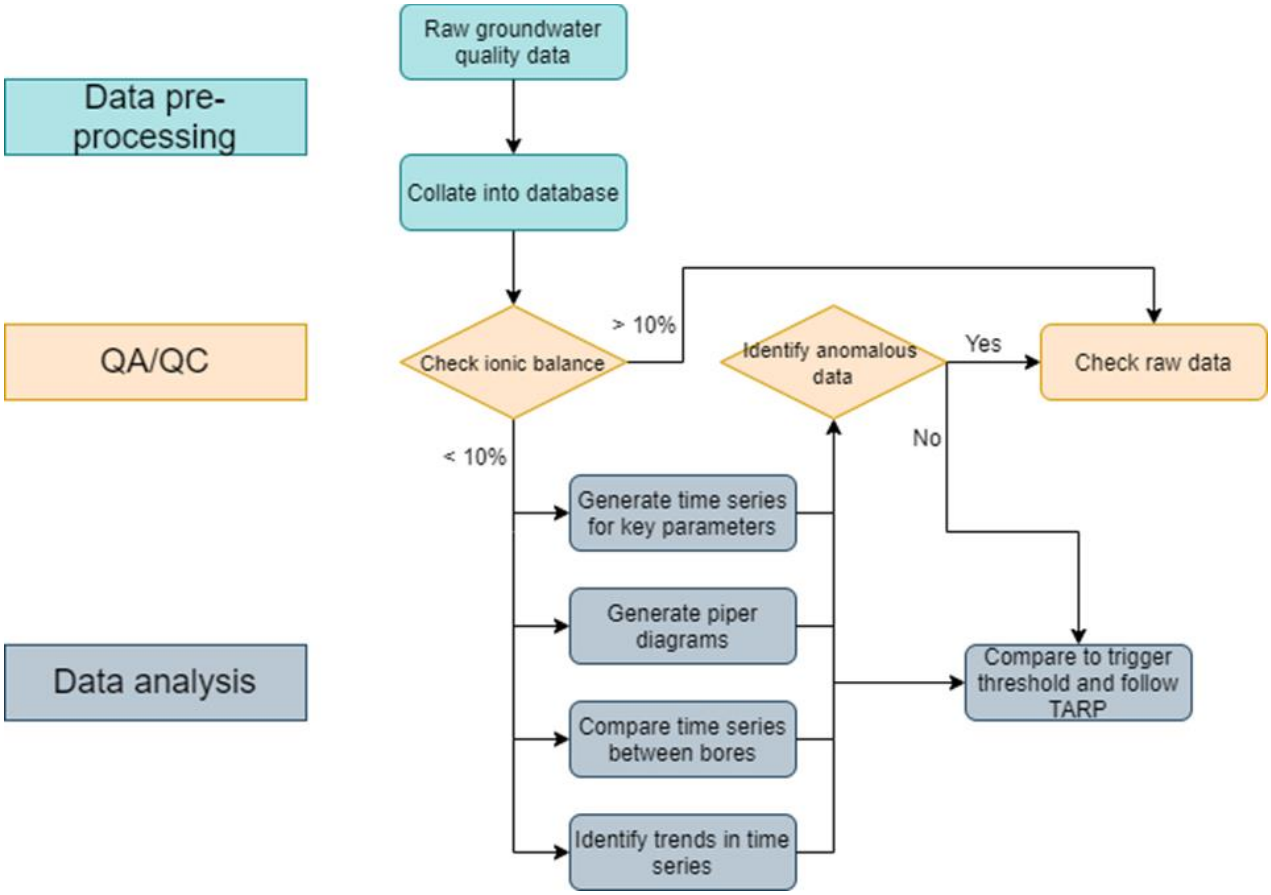


Figure 9.2 - Groundwater quality data pre-processing and analysis procedures

Groundwater quality data will be pre-processed for analysis in a similar approach as the method adopted for groundwater levels. Field and laboratory results will be collated and tabulated in a single database that will identify:

- key parameters including pH and EC/TDS concentrations exceeding the identified water quality trigger values as per the WMP;
- ionic balance results which are >± 10%; and
- dissolved metal concentrations that exceed ANZECC guidelines for stock and/or irrigation water. Dissolved metals are used for guideline comparison because of their higher bioavailability when compared to total metals.

Groundwater samples with ionic balance beyond the ± 10% range will be identified and the cause determined. If necessary, an additional sample will be collected for laboratory analysis. Samples that are determined not to be representative will be flagged and not used in subsequent data analysis. Records of sampling method, sample transportation and laboratory consistency of reporting limits are also some items that could influence the occurrence of nonrepresentative values.

Time series plots will be generated for water indicators that have trigger values and compared with short- and long-term trends. In addition to location specific trigger thresholds for pH and EC all field and laboratory analytes will be tabulated and compared against ANZECC guideline values for stock and/or irrigation water.

Exceedances against ANZECC guidelines will form water quality trigger thresholds for dissolved metal concentrations as discussed in section 7.3

Piper diagrams will be generated as a visualisation tool to understand the relative major ion abundance and water chemistry at each monitoring site and different geology types. Piper diagrams are useful in identifying differing, or mixing, chemistry signatures between hydrostratigraphic units, and how signatures change over with time.

9.2 Independent environmental audits

Prior to 13 September 2010, and every 3 years thereafter, unless the Secretary directs otherwise, NCOPL will commission and pay the full cost of an Independent Environmental Audit (**IEA**) of the operations at Narrabri Mine (Stages 1 and 2), to be conducted in accordance with the requirements under Schedule 6 Condition 7.

The audit team must be led by a suitably qualified auditor and the IEA must be conducted by suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary.

9.3 Management plan review and evaluation

As required by Schedule 6 Condition 3 of the Project Approval, within three months of any of the following:

- completion of an independent environmental audit (as required by Schedule 6 Condition 7);
- submission of an Incident Report (as required by Schedule 6 Condition 4);
- submission of an Annual Review (as required by Schedule 6 Condition 6); and
- any modification to the conditions of the Project Approval (unless the conditions require otherwise),

NCOPL will the review, and if necessary, revise this WMP. This is to ensure that the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the Narrabri Mine operations. The review history table in the front of this Plan provides the details of each review.

Condition 3 of Schedule 6 further states that if the review determines that the WMP requires revision, then this will be completed to the satisfaction of the Secretary.

10. Incidents and non-compliance

10.1 Incident notification

An incident is defined under the Project Approval as *a set of circumstances that causes or threatens to cause material harm, and/or breaches or exceeds the limits of performance measures/criteria*. Material harm to the environment is defined under the Project Approval as *involving actual or potential harm to the health or safety of human beings or to the environment that is not trivial.* This definition excludes "harm" that is authorised under either the Project Approval or any other statutory approval (e.g., the EPL).

In the event of any exceedance in concentration criteria, NCOPL will advise the Secretary and any other relevant agencies as soon as practicable after becoming aware of the incident, in accordance with Schedule 6 Condition 4. Within 7 days of the event, NCOPL will also provide the Secretary and any relevant agencies a detailed report which will:

- describe the date, time and nature of the exceedance/incident;
- identify the cause (or likely cause) of the exceedance/incident;
- describe what action has been taken to date; and
- describe the proposed measures to address the exceedance/incident.

Notifications to the EPA will be made by contacting the Environment Line service on 131 555 and written details of the notification will be provided within 7 days of the date on which the incident occurred.

Incident reporting and emergency response is further described in NCO's Environmental Management System.

10.2 Non-compliance notification

In accordance with Schedule 6 Condition 2, where a non-compliance with statutory requirements or an exceedance of the relevant criteria or performance measures has occurred, NCOPL will, at the earliest opportunity, take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur. Once this has been achieved, all reasonable and feasible options for remediation (where relevant) will be considered.

In accordance with Schedule 6 Condition 4, within seven days of becoming aware of a non-compliance, NCOPL will notify DPE of the non-compliance[6]. The notification will be made in writing via the Major Projects website and identify the development (including the development application number and name), set out the condition or requirement that the development is non-compliant with, why it does not comply and the reasons for the non-compliance (if known) and what actions have been, or will be, undertaken to address the non-compliance.

NCOPL will implement any reasonable remediation measures as directed by the Secretary, to the satisfaction of the Secretary.

[6] A non-compliance which has been notified as an incident under section 10.1 does not need to also be notified as a non-compliance.

11. Complaints management

Any complaints received in relation to this WMP will be managed in accordance with the complaints management protocol, as follows:

- publicly advertised telephone complaints line, 1800WHAVEN, will be in place to receive complaints;
- each complaint received will be recorded in the Complaints Register, which will include the following details:
  - date and time of complaint;
  - method by which a complaint was made;
  - personal details the complainant wishes to provide or, if no such details are provided, a note to that effect;
  - nature of the incident that led to the complaint;
  - action taken by NCOPL in relation to the complaint (i.e., any required remedial actions), including any follow-up contact with the complainant; and
  - if no action was taken, the reason why no action was taken;
- the Environmental Superintendent will be responsible for ensuring that an initial response is provided within 24 hours of receipt of a complaint (except in the event of complaints recorded when the mine is not operational or outside of usual business hours);
- once the identified measures are undertaken, the Environmental Superintendent will sign off on the relevant complaint within the Complaints Register;
- if necessary, follow-up monitoring will take place to confirm the source of the complaint is adequately mitigated; and
- a summary of the complaints will be maintained by NCOPL and made available to the Community Consultative Committee, the complainant (on request) and on the WHC website. A summary of complaints received every 12 months will be provided in the Annual Review.

The Environmental Superintendent retains ultimate responsibility to ensure that complaints received are properly recorded and addressed appropriately.

In the event that any complainant considers that NCOPL has not adequately addressed their concerns, the NCOPL representative will convene additional meetings with the complainant. If the complainant believes the matter remains unresolved, and no further agreement can be reached as to additional measures to be undertaken, then they may refer the matter to DPE.

12. References

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13. Glossary

Term	Definition[7]
Angle of draw	The angle between the vertical and the line joining the edge of the mining void with the limit of vertical subsidence, usually taken as 20 mm.
Anomalous subsidence	Normally refers to unexpected subsidence effects and is usually caused by latent geological conditions (joints, faults, dykes)
Chain pillar	The pillar(s) of coal left between adjacent longwall panels. This forms a barrier that allows the goaf to be sealed off and facilitates tailgate roof stability.
Compressive strain	A decrease in the distance between two points on the surface. This can cause shear cracking or steps at the surface if > 3 millimetres per metre (mm/m).
Council	Narrabri Shire Council
Cover depth	The depth of coal seam from the ground surface (metres).
Department	The NSW Department of Planning and Environment (DPE)
Environmental consequences	The environmental consequences of subsidence impacts including: damage to built features; loss of surface flows to the sub-surface; loss of standing pools; adverse water quality impacts; development of iron bacterial mats; cliff falls; rock falls; damage to Aboriginal heritage sites; impacts to aquatic ecology; ponding.
Extraction Plan Area	The area predicted to be affected by the proposed secondary extraction of the approved pillar reduction panels CF 201-CF205
Far-field subsidence	Mining-induced movements of the ground surface in areas where vertical subsidence is less than 20mm.
First workings	Development headings created by a continuous mining machine - designed to remain stable during development and longwall extraction. Provide ventilation and services, access for staff and materials, and allow for transportation of raw coal out of the mine (i.e. also referred to as mains headings, gate roads, maingate, tailgate).
Goaf	The mined-out area into which the immediate roof strata breaks.
Groundwater	Water contained in the interconnected pore spaces and voids of the saturated zone of sediments and rocks.
Incident	An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance
Material harm	Material harm to the environment is defined in section 147 of the POEO Act
Minimise	Implement all reasonable and feasible mitigation measures to reduce the impacts of the Narrabri Mine
MOD 5	Reduced the number of longwall panels from 26 to 20; increased the longwall panel widths for LW 107 to LW 120 from approximately 295 m to approximately 400 m; extended the western footprint approximately 60 m; and increased the maximum ROM coal processing rate from 8 Mtpa to 11 Mtpa.
MOD 7	Describes the change in mining method within the extent of the previously approved LW 201 and LW 202 and allows for up to 0.7 Mtpa via bord and pillar extraction at pillar reduction panels CF 201 to CF 205

[7] The majority of the definitions are as provided in Project Approval 08_0144.

Term	Definition[7]
Panels 201 to 202	Pillar reduction panels CF 201 to CF 205
Planning Secretary	Planning Secretary under the EP&A Act, or nominee
Pollution incident	Has the same meaning as in the POEO Act
Project Approval	Development consent (DA_08_0144) issued on 26th July 2010 under Section 75J of the Environmental Planning and Assessment Act 1979 by the Department of Planning & Infrastructure (as modified).
Rehabilitation	The restoration of land disturbed by the development to ensure it is safe, stable and non-polluting over the short, medium and long term
Second workings	Extraction of coal from longwall panels, mini-wall panels, or pillar extraction.
Subsidence	The totality of subsidence effects, subsidence impacts and environmental consequences of subsidence impacts.
Subsidence effects	Deformation of the ground mass due to mining, including all mining-induced ground movements, including both vertical and horizontal displacement, tilt, strain and curvature.
Subsidence impacts	Physical changes to the ground and its surface caused by subsidence effects, including tensile and shear cracking of the rock mass, localised buckling of strata caused by valley closure and upsidence and surface depressions or troughs.
Tailgate	Refers to the tunnels or roadways down the side of a longwall block which provides a ventilation pathway for bad or dusty air away from the longwall face. It is usually located on the side of the longwall panel adjacent to extracted panels or goaf.
Tensile strain	An increase in the distance between two points on the surface. This is likely to cause cracking at the surface if it exceeds 2 mm/m. Tensile strains are usually associated with convex (hogging) curvatures near the sides (or ends) of the panels.
Tilt	The rate of change of subsidence between two points (A and B), measured at set distances apart (usually 10m). Tilt is plotted at the mid-point between the points and is a measure of the amount of differential subsidence
Unacceptable risk	The level of risk at which mitigation actions are deemed to be warranted.
Upsidence	Relative vertical upward movements of the ground surface associated with subsidence.
Vertical subsidence	Vertical downward movements of the ground surface caused by underground coal mining.
Watercourse	A river, creek or other stream, including a stream in the form of an anabranch or tributary, in which water flows permanently or intermittently, regardless of the frequency of flow events: In a natural channel, whether artificially modified or not, or in an artificial channel that has changed the course of the stream. It also includes weirs, lakes and dams

Attachment 1 Compliance conditions relevant to the WMP

Table A1.1 - Relevant Project Approval 08_0144 requirements

Project Approval 08_0144 conditions		Document reference
Condition	**Requirement**	
Schedule 2 Condition 1	The Proponent shall implement all practicable measures to prevent and/or minimise any harm to the environment that may result from the construction, operation, or rehabilitation of the project.	Section 1.3
Schedule 2 Condition 11	With the approval of the Secretary, the Proponent may submit any management plan or monitoring program required by this approval on a progressive basis. ***Note**: The conditions of this approval require certain strategies, plans, and programs to be prepared for the project. They also require these documents to be reviewed and audited on a regular basis to ensure they remain effective. However, in some instances, it will not be necessary or practicable to prepare these documents for the whole project at any one time, particularly as these documents are intended to be dynamic and improved over time. Consequently, the documents may be prepared and implemented on a progressive basis, subject to the conditions of this approval. In doing this however, the Proponent will need to demonstrate that it has suitable documents in place to manage the existing operations of the project.*	There is no staging for the WMP for Panels 201-202
Schedule 3 Condition 4	The Proponent shall prepare and implement Extraction Plans for any second workings to be mined to the satisfaction of the Secretary. Each Extraction Plan must:	
	(h) include a	
	• Water Management Plan, which has been prepared in consultation with EPA and DPE Water, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on surface water resources, groundwater resources and flooding, and which includes:	This Plan
	▪ surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or water quality;	Section 3
	▪ a program to monitor and report groundwater inflows to underground workings; and	Section 6.5.1
	▪ a program to manage and monitor impacts on groundwater bores on privately-owned land;	Section 6.5.3
	***Notes**:* *Management plans prepared under condition 4(h) should address all potential impacts of proposed underground coal extraction on the relevant features. Other similar management plans required under this approval (eg under conditions 13 and 23 of schedule 4 or condition 3 of schedule 5) are not required to duplicate these plans or to otherwise address the impacts associated with underground coal extraction.*	
Schedule 3 Condition 5	The Proponent shall ensure that the management plans required under condition 4(h) above include:	

Project Approval 08_0144 conditions		Document reference
Condition	**Requirement**	
	(a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this approval;	Section 4
	(b) a detailed description of the measures that would be implemented to remediate predicted impacts; and	Sections 5 and 6
	(c) a contingency plan that expressly provides for adaptive management.	Section 7
Schedule 6, Condition 2	The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
	(a) detailed baseline data;	Refer to the Site WMP
	(b) a description of:	
	• the relevant statutory requirements (including any relevant approval, licence or lease conditions);	Section 1.4
	• any relevant limits or performance measures/criteria;	Section 1.4
	• the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures	Section 1.4
	(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria:	Section 2
	(d) a program to monitor and report on the:	
	• impacts and environmental performance of the project;	Sections 5 and 6
	• effectiveness of any management measures (see (c) above);	Section 7
	(e) a contingency plan to manage any unpredicted impacts and their consequences;	Sections 7.1 and 7.2
	(f) a program to investigate and implement ways to improve the environmental performance of the project over time;	Section 8.3
	(g) a protocol for managing and reporting any;	Section 8.2
	• incidents;	
	• complaints;	
	• non-compliances with statutory requirements; and	
	• exceedances of the impact assessment criteria and/or performance criteria; and	
	(h) a protocol for periodic review of the plan.	Section 8.3
Schedule 6 Condition 3	Within 3 months of the submission of an:	Section 8.3
	(a) audit under condition 7 of Schedule 6;	
	(b) incident report under condition 4 of Schedule 6; and	

Project Approval 08_0144 conditions		Document reference
Condition	**Requirement**	
	(c) annual review under condition 5 of Schedule 6; and	
	(d) any modification to the conditions of this approval (unless the conditions require otherwise),	
	the Proponent shall review, and if necessary revise, the strategies, plans, and programs required under this approval to the satisfaction of the Secretary.	
Schedule 6 Condition 4	The Proponent shall notify the Secretary in writing via the Major Projects website and any other relevant agencies of any incident associated with the project as soon as practicable after the Proponent becomes aware of the incident. Within 7 days of the date of the incident, the Proponent shall provide the Secretary and any relevant agencies with a detailed report on the incident.	Section 9.1
Schedule 6 Condition 5	The Proponent shall provide regular reporting on the environmental performance of the project on its website, in accordance with the reporting arrangements in any plans or programs approved under the conditions of this approval, and to the satisfaction of the Secretary.	Section 1.7
Schedule 6 Condition 6	By the end of March each year, the Proponent must submit a review of the environmental performance of the project for the previous calendar year to the satisfaction of the Secretary.	Section 9.1
Schedule 6 Condition 7	Prior to 13 September 2010, and every 3 years thereafter, unless the Secretary directs otherwise, the Proponent shall commission and pay the full cost of an Independent Environmental Audit of the project (Stages 1 and 2).	Section 9.2
Schedule 6 Condition 10	The Proponent shall: (a) make copies of the following publicly available on its website: • the documents referred to in Condition 2 of Schedule 2; • all current statutory approvals for the project; • all approved strategies, plans and programs required under the conditions of this approval; • a comprehensive summary of the monitoring results of the project, reported in accordance with the specifications in any conditions of this approval, or any approved plans and programs; • a complaints register, updated on a monthly basis; • minutes of CCC meetings; • the annual reviews of the project; • any independent environmental audit of the project, and the Proponent's response to the recommendations in any audit; • any other matter required by the Secretary; and	Section 1.7
	(b) keep this information up-to-date, to the satisfaction of the Secretary.	Section 1.7

Attachment 2 Consultation records

DOC21/1079998-2
20 December 2021

Planning and Assessment Division
Department of Planning, Industry and Environment
Locked Bag 5022
PARRAMATTA NSW 2124

Attention: Mr Phillip Nevill – via Major Planning Portal

No Comment to Planning Advice Request

Dear Mr Neville

Thank you for the request for advice from Public Authority Consultation (PAE-32929973), requesting input from the NSW Environment Protection Authority (EPA) on the Water Management Plan for the Narrabri Coal – Stage Modification 7, as required by Project Approval 08_0144.

The EPA has briefly reviewed the Water Management Plan to ensure consistency with Environment Protection Licence 12789 (EPL). References to the EPL are generally consistent with the current requirements of the EPL. Please note there are several automated reference source errors in the plan, and these should be corrected for clarity.

The EPA encourages licensees to develop management plans as tools to ensure environmental impacts from the approved activity are minimised as far as possible. Management Plans can also assist licensees in meeting requirements of the EPL. As such, the EPA does not endorse or approve management plans.

If you have any questions about this request, please contact Daniel Stokes on 4908 6804 or via email at info@epa.nsw.gov.au.

Yours sincerely

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NSW GOVERNMENT

Department of Planning and Environment

Brent Baker

Email: NCO-approval@whitehavencoal.com.au

Contact: DPE Water Assessments

Email: water.assessments@dpie.nsw.gov.au

Our ref: OUT22/1844

16 March 2022

Dear Mr Baker

Re: Extraction Plan 201-202 – Water Management Plan for Narrabri Coal Mine – Stage 2 – MP08_0144-PA-23

I refer to your email request to the Department of Planning and Environment (DPE) Water about the above matter.

Department of Planning and Environment - Water (DPE Water) has reviewed the Extraction Plan 201-202 – Water Management Plan (WMP) and has a number of recommendations to further understand the management of water. Please see **Attachment A** for more detail.

Should you have any further queries in relation to this submission please do not hesitate to contact DPE Water Assessments at water.assessments@dpie.nsw.gov.au.

Yours sincerely,

E Rogers

Liz Rogers

Manager, Assessments, Knowledge Division

Department of Planning and Environment: Water

4 Parramatta Square, 12 Darcy Street, Parramatta NSW 2150 | Locked Bag 5022, Parramatta NSW 2124 | dpie.nsw.gov.au

Attachment A

Detailed advice regarding the Extraction Plan 201-202 – Water Management Plan for Narrabri Coal Mine – Stage 2 – MP08_0144-PA-23

1.0 Management of water on the pit top area

1.1 Recommendation

- That the proponent summarise the management of water on the pit top area in the WMP.

1.2 Explanation

Details on pit top area water management were not included in the WMP (Section 2.1.2), rather the Site WMP was referenced. Details regarding the management of water on the pit top area should be summarised in the WMP from the Site WMP to make the WMP a standalone document.

2.0 Baseline water quality

2.1 Recommendation

- That the proponent summarise baseline water quality for surface water (Section 5.2) and groundwater (Section 6.3) in the WMP

2.2 Explanation

In Sections 5.2 and 6.3 in the WMP, surface and groundwater baseline quality and/or level information are not included and only the Site WMP is referenced. Baseline data should be summarised in the WMP from the Site WMP to make the WMP a standalone document.

3.0 Trigger Levels

3.1 Recommendation

- That the proponent include all trigger levels in Section 6.5.3 and Tables 6.1 and 7.

3.2 Explanation

In Sections 6.5.3 and Tables 6.1 and 7.1 in the WMP, trigger levels are referenced to the Site WMP and not included in the WMP. All trigger levels should be summarised in the WMP from the Site WMP to make the WMP a standalone document.

4.0 Complaints and Non-Compliances

4.1 Recommendation

- That the proponent include details on responding to complaints and non-compliances with statutory requirements.

4.2 Explanation

Details on responding to complaints and non-compliances with statutory requirements was not presented in the WMP as required by the Project Approval, Schedule 6 Condition 2(g). These details should be included in the WMP.

5.0 Consultation Records

5.1 Recommendation

- That the proponent include consultation records in Attachment 2, as referenced in the WMP.

5.2 Explanation

The WMP states that consultation records are supplied in Attachment 2 of the WMP; however, were not included in the WMP version supplied for review. Consultation records should be provided to comply with the Project Approval, Schedule 3 Condition 4(g).

6.0 Reports on Website

6.1 Recommendation

- That the proponent ensure the Extraction Plan, WMP, and all appendices are available on the Whitehaven Coal Limited website

6.2 Explanation

Section 1.7 of the WMP indicates that the Extraction Plan and all appendices, including the WMP, are publicly available on the Whitehaven Coal Limited website as per the Project Approval; however, at the time of this review, these reports did not appear to be present.

7.0 Subsidence Assessment

7.1 Recommendation

- That the proponent include the Subsidence Assessment in Appendix B, as referenced in the WMP.

7.2 Explanation

The full Subsidence Assessment that was undertaken in accordance with Schedule 3 Condition 4(e) of the Project Approval and referenced to be in Appendix B of the WMP, was not attached to the WMP report supplied for review.

8.0 Approval Requirements Reference

8.1 Recommendation

- That the proponent fix reference in Table A1.1 for Approval requirements to Section (h), not (g).

8.2 Explanation

In Table A1.1 in the WMP, the section of the Project Approval that provides details on the WMP is referenced as Schedule 3 Condition 4(g), whereas it should be Schedule 3 Condition 4(h). The reference should be updated to avoid confusion.

9.0 Broken Links/References

9.1 Recommendation

- That the proponent fix broken links/references to figures and/or tables throughout the WMP.

9.2 Explanation

References in various sections of the WMP appear to incorrectly linked, as the WMP shows "**Error! Reference source not found.**" Instead of the reference to a table or figure. These links should be updated.

End Attachment A

Table A2.1 - Water Management Plan (Draft Revision B) - comments reconciliation

EPA comments

Item	Section #	Section heading	Existing text / explanation	Comment / recommendation	Response
No comments provided by the EPA on the WMP					

DPE Water comments

Item	Section #	Section heading	Existing text / explanation	Comment / recommendation	Response
1	2.1.2	Pit top area water management	Details on pit top area water management were not included in the WMP (Section 2.1.2), rather the Site WMP was referenced. Details regarding the management of water on the pit top area should be summarised in the WMP from the Site WMP to make the WMP a standalone document.	That the proponent summarises the management of water on the pit top area in the WMP.	Details of the management of water at the pit top have been expanded, in section 2.1.2. The water cycle process diagram has been provided as a new Figure 2.1.
2	5.2 6.3	Baseline water quality (surface water) Baseline data (groundwater)	In Sections 5.2 and 6.3 in the WMP, surface and groundwater baseline quality and/or level information are not included and only the Site WMP is referenced. Baseline data should be summarised in the WMP from the Site WMP to make the WMP a standalone document.	That the proponent summarises baseline water quality for surface water (Section 5.2) and groundwater (Section 6.3) in the WMP	Baseline water quality details for surface water and groundwater have been included in sections 5.2 and 6.1 respectively.
3	6.5.3 6.3 7.3	Impacts to licenced users Table 6.1 – Summary of the groundwater monitoring site types and assessment criteria Table 7	In Sections 6.5.3 and Tables 6.1 and 7.1 in the WMP, trigger levels are referenced to the Site WMP and not included in the WMP. All trigger levels should be summarised in the WMP from the Site WMP to make the WMP a standalone document.	That the proponent includes all trigger levels in Section 6.5.3 and Tables 6.1 and 7.	Note that there is no Table 7. It has been assumed that the reference is meant to be to Table 7.1. The trigger levels for water levels and quality have been included in Table 6.2 (originally Table 6.1), Table 7.1 and section 6.5.3.
4	N/A	N/A	Details on responding to complaints and non-compliances with statutory requirements was not presented in the WMP as required by the Project Approval, Schedule 6 Condition 2(g). These details should be included in the WMP.	That the proponent includes details on responding to complaints and non-compliances with statutory requirements.	Protocols for managing and reporting the following have been included in the WMP: • incidents notification – section 9 • complaints management – section 10, • non-compliance with statutory requirements – section 9.2 • exceedances of the impact assessment criteria and/or performance criteria – section 9.2
5	Section 1.6 Attachment 2	Consultation records	The WMP states that consultation records are supplied in Attachment 2 of the WMP; however, were not included in the WMP version supplied for review. Consultation records should be provided to comply with the Project Approval, Schedule 3 Condition 4(g).	That the proponent includes consultation records in Attachment 2, as referenced in the WMP	Section 1.6 of the WMP contains the following forward-looking sentence, based on the expectation that the document will be approved by DPE: *Schedule 3 Condition 4(h) of the Project Approval requires this WMP to be prepared in consultation with the EPA and DPE Water. The consultation correspondence is presented in Attachment 2.* Since no consultation records from DPE Water or the EPA had yet been received, no consultation records were available to be inserted into the WMP. Note that (post consultation) the wording has been amended as follows: *In accordance with Schedule 3 Condition 4(h) of the Project Approval, NCOPL has prepared this WMP in consultation with the EPA and DPE Water.* … *The consultation correspondence is presented in Attachment 2, together with a reconciliation table addressing all comments.*

Item	Section #	Section heading	Existing text / explanation	Comment / recommendation	Response
6	Section 1.7	Access to information	Section 1.7 of the WMP indicates that the Extraction Plan and all appendices, including the WMP, are publicly available on the Whitehaven Coal Limited website as per the Project Approval; however, at the time of this review, these reports did not appear to be present.	That the proponent ensures the Extraction Plan, WMP, and all appendices are available on the Whitehaven Coal Limited website	Section 1.7 states that, in accordance with Schedule 6 Condition 10 of the Project Approval, the ***approved*** Extraction Plan and all appendices, including this WMP, are publicly available on the WHC website The plans (including the Extraction Plan, WMP and all appendices) will only be placed on the Whitehaven Coal Limited website once they are approved by the Secretary. At the time of DPE Water review for consultation purposes, the documents were not yet approved by DPE, and as such they were not yet placed on the WHC website.
7		Existing groundwater environment	No specific text reference.	That the proponent includes the Subsidence Assessment in Appendix B, as referenced in the WMP.	The Subsidence Assessment has been inserted as Appendix B.
8	Appendix A	Table A1.1 – Relevant Project Approval 08_0144 requirements	In Table A1.1 in the WMP, the section of the Project Approval that provides details on the WMP is referenced as Schedule 3 Condition 4(g), whereas it should be Schedule 3 Condition 4(h). The reference should be updated to avoid confusion.	That the proponent fix reference in Table A1.1 for Approval requirements to Section (h), not (g).	The correction has been made in Table A1.1. The section of the Project Approval that provides details on the WMP is now correctly referenced as Schedule 3 Condition 4(h).
9	N/A	No specific reference	References in various sections of the WMP appear to incorrectly linked, as the WMP shows “Error! Reference source not found.” Instead of the reference to a table or figure. These links should be updated.	That the proponent fix broken links/references to figures and/or tables throughout the WMP.	All broken links and references to figures and tables have been fixed and corrected. All cross-references have been validated.