Extraction Plan for 918 Panel: Surface Water Assessment

Clarence Colliery Pty Ltd

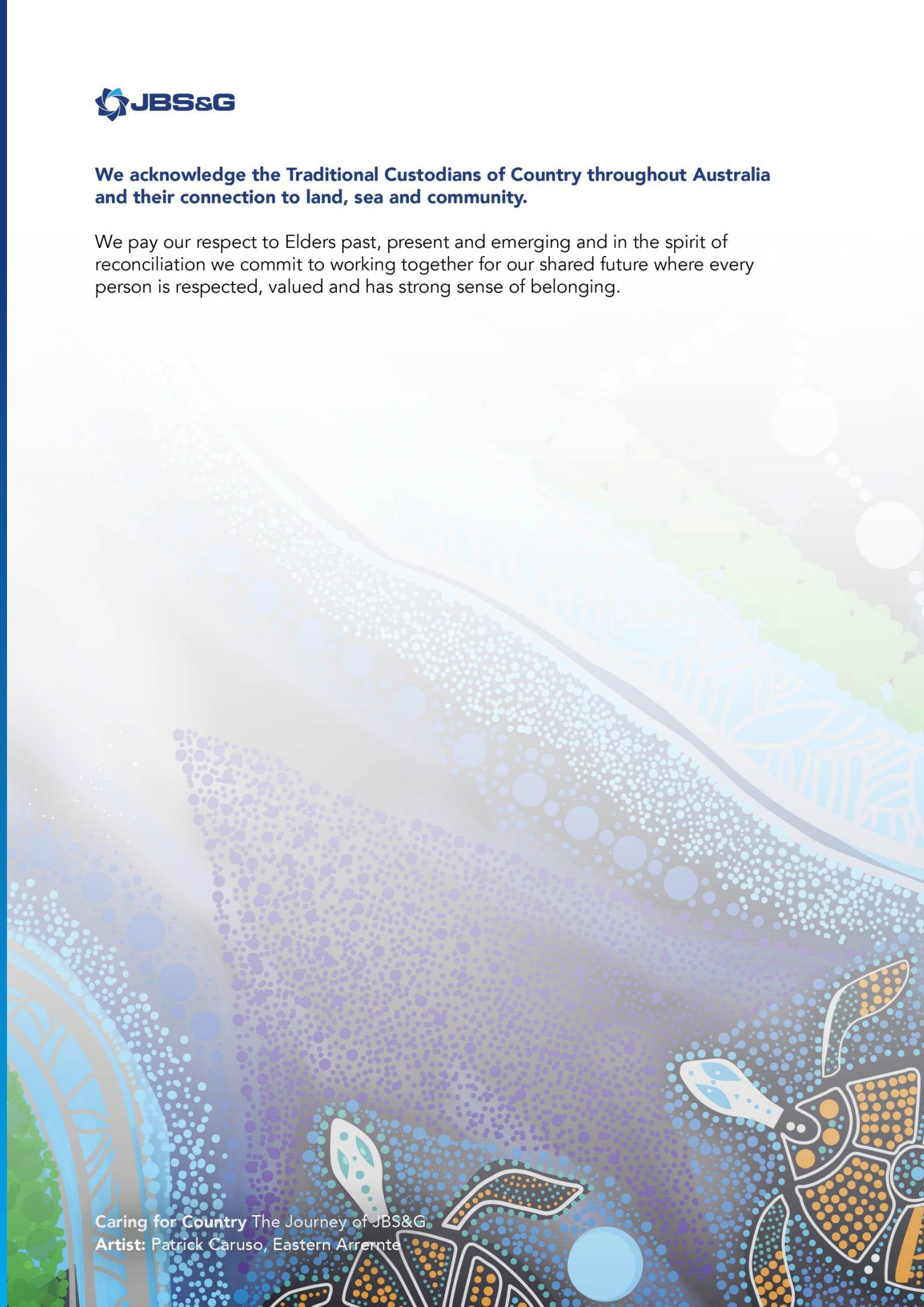
Report

JBS&G 68229 | 172385 (R02Rev0)

13 February 2026

We acknowledge the Traditional Custodians of Country throughout Australia and their connection to land, sea and community.

We pay our respect to Elders past, present and emerging and in the spirit of reconciliation we commit to working together for our shared future where every person is respected, valued and has strong sense of belonging.



Caring for Country The Journey of JBS&G
Artist: Patrick Caruso, Eastern Arrernte

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Nomenclature

Categorical Definition of Magnitude:

The following nomenclature has been adopted in this report when describing the magnitude of values (numerical) with respect to the Site and Project.

Surface Water

Table NM-A1. Definition of Magnitude (Numerical) – Flow (General)

Term	Definition
Negligible	<0.01m^3/s (equivalent to less than 10L/s, or 0.864ML/d)
Small	0.01 to 0.1m^3/s (equivalent to between 10 and 100L/s, or 0.864 to 8.64ML/d)
Medium	0.1 to 1m^3/s (equivalent to between 100 to 1000L/s, or 8.64 to 86.4ML/d)
Large	More than 1m^3/s (equivalent to greater than 1000L/s, or 86.4ML/d)

This table pertains to surface water flow in ephemeral and perennial watercourses. It considers everyday flow in a watercourse, as well as flows during periods of flooding.

Categorical Definition of Change:

The following nomenclature has been adopted in this report when describing the magnitude of changes (numerical) due to the Site and Project.

Surface Water

Table NM-B1. Definition of Magnitude of Change (Numerical) – Flow (General)

Term	Definition
Negligible	change is <2%
Small	change is 2 to 5%
Medium	change is 5 to 15%
Large	change is >15%

This table pertains to flow in surface watercourses. It is usually analysed in the context of a flow duration curve, which is a cumulative distribution function. i.e. the percent of time a specified discharges were equalled or exceeded during a given period.

Table NM-B2. Definition of Magnitude of Change (Qualitative, Numerical) – Water Quality (General)

Term	Definition
Negligible	change is <2%
Small	change is 2 to 5%
Medium	change is 5 to 15%
Large	change is >15%

Notes. 1. For watercourses, the NSW Water Quality Objectives (NSW DCCEEW, 2006) include protection of aquatic ecosystems, visual amenity, primary and secondary contact recreation, livestock water supply, irrigation water supply, drinking water – groundwater, aquatic foods (cooked), industrial supply, as relevant to a specific catchment.

This table pertains to numerical change in individual analytes, however, mostly is with respect to salinity.

Categorical Definition of Significance:

The following nomenclature has been adopted in this report when describing the significance of impacts due to the Site and Project.

It is noted that whilst a particular property may be subject to a large change, that does not mean, necessarily, that the impact of that change is significant. Conversely, a change to particular property may be numerically small, however, the impact of that change may still be significant.

Table NM-C1: Definition of Significance of Impact

Term	Definition1
Not Significant or Insignificant	Impact is so small or unimportant as to be not worth considering; insignificant.
Significant	Impact is sufficiently great or important to be worthy of attention; noteworthy.

Notes. 1. The definition of significance can be, as appropriate, informed by statistical significance, with respect to statistical hypothesis testing; however, statistical significance does not imply importance. In this report, the definition of significance is based on importance and may, or may not, take into account statistical significance.

Categorical Definition of Salinity:

The following definitions have been adopted when describing the salinity of surface and groundwater.

"Fresh *waters are sufficiently dilute to be potable, that is less than 1,000mg/L.* Brackish *waters are too saline to be potable, but are significantly less saline than seawater; the range is approximately 1,000mg/L to 20,000mg/L TDS.* Saline *waters have salinities similar to or greater than seawater (35,000mg/L), and* brines *are waters significantly more saline than seawater.*"

[Page 13 of Drever, 1997]

Executive Summary

This report presents a Surface Water Assessment of implementation of the Extraction Plan for 918 Panel at Clarence Colliery. This report was written in conjunction with the Groundwater Assessment (JBS&G, 2026).

Clarence Colliery is located in the Western Coalfields of NSW and the target coal seam, within the Illawarra Coal Measures is the Katoomba Seam. Mining commenced at Clarence in 1979 and has used a range of extraction methods that result in partial extraction (i.e. limited extraction ratio from the coal seam) and/or total extraction (i.e. higher extraction ratio from the coal seam).

Extraction of 918 Panel will use the panel and pillar partial extraction method (PPPE), by continuous miner and shortwall. This mining technique limits extraction and results in minimal subsidence (less than or equal to 100mm), which is consistent with contemporary mining performance at Clarence Colliery.

918 Panel has three sub panels, two of which are adjacent. For the southern, adjacent sub panels, Sub Panel 918A and Sub Panel 918B2, these are separated by a solid spine of pillars, with solid coal barrier on the outside of those sub panels. For the northern sub panel, there will be a single Sub Panel, Sub Panel 918B1, with the same solid spine of pillars on one side and a solid coal barrier on outside of the sub panel.

Extraction in the 918 Panel does not occur beneath Temperate Highland Peat Swamps on Sandstone (THPSS) shrub and hanging swamps (with the exception of Paddy's Creek Hanging Swamp which is located partly above the proposed 918B2 sub-panel).

The proposed void width (unsupported span) of sub panels of 918 Panel is 75m for Sub Panel 918A and Sub Panel 918B2 (southern, two sub panels) and is 83m for Sub Panel 918B1 (northern, single sub panel).

The depth of cover with respect to the Extraction Plan for 918 Panel is 174 to 329m. Further detail of the mine plan is specified in the Extraction Plan and in Subsidence, Geotechnical and Caving Assessment (SCT, 2026) and the Subsidence Assessment (MSEC, 2026).

This Surface Water Assessment (this report) is supported by an update to the Swamp Water Balance Model (JBS&G, 2025). That model includes all surface water catchments in the region and encompasses all historical and existing mining in the Western Coalfields, as well as input from the numerical groundwater model (JBS&G, 2026). The Surface Water Assessment also included analysis of other surface water-related matters.

The assessment (this report) indicates:

Site Water and Salt Balance

The change to mine dewatering rate with implementation of the Extraction Plan for 918 Panel is insignificant, therefore the Extraction Plan will have an insignificant impact on the Site Water and Salt Balance.

The implication is that there will be no impact to site water management infrastructure due to the implementation of the Extraction Plan.

Erosion and Sediment Control

The Extraction Plan does not require change to erosion and sediment control infrastructure at Clarence Colliery, and therefore there will be an insignificant impact on this aspect.

Regional Surface Water Flow and Quality

Output from the Swamp Water Balance Model indicates that:

- Insignificant change to surface water flow in Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and the unnamed tributary that leads into Paddys Creek, referred to as Paddys Creek Tributary, due to the Proposed Case compared to the Approved Case
- Insignificant change to water quality (salinity) in Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and Paddys Creek Tributary due to the Proposed Case compared to the Approved Case

- Insignificant change to duration, frequency and average flow of dry periods in Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and Paddys Creek Tributary due to the Proposed Case compared to the Approved Case.

Geomorphology

Subsidence prediction profiles along the thalweg of watercourses in the vicinity of 918 Panel are presented in MSEC (2026). These indicate no adverse change in bedslope due to implementation of the Extraction Plan for 918 Panel. A standalone assessment of geomorphology is presented in GHD (2026) and also concludes that the impact of the implementation of Extraction Plan will be insignificant.

Output from the Swamp Water Balance also indicates no change to streamflow (median) and therefore increase in potential erosivity due to the implementation of the Extraction Plan. There will also be a negligible increase in mine dewatering rate due to implementation of the Extraction Plan, and therefore insignificant impact to mine water discharge (after treatment) to the Wollangambee River via EPL LDP002.

Flooding and Drainage

The Extraction Plan will have an insignificant impact to drainage.

The Extraction Plan will have an insignificant impact to flooding.

Water Availability

Implementation of the Extraction Plan for 918 Panel will have an insignificant impact on water availability.

Aquatic Ecological Environment

The Extraction Plan will have an insignificant impact to the aquatic ecological environment since the modelled change to the duration of dry periods is negligible.

Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the Scope of Work provided by the Client only, and has been based in part on information obtained from the Client and other parties. The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental impact assessment, before being used for any other purpose.

JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client, or amended in any way without prior approval by JBS&G, and should not be relied upon by other parties, who should make their own enquires.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown issues, JBS&G reserves the right to review the report in the context of the additional information.

This report, and environmental modelling associated therein, has been prepared to the standard typical of that undertaken by consultants in preparing an environmental impact assessment.

Glossary (Model Specific)

Approved Case – development (1st workings) and extraction (2nd workings, PPPE using a continuous miner and shortwall supports) of Panel 918 does not proceed.

AWBM – Australian Water Balance Model; a rainfall/runoff model.

CTH IESC – Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development within the Department of Climate Change, Energy, the Environment and Water, Commonwealth of Australia.

Deterministic – 'single' prediction simulation (Proposed and Approved Case) based upon calibrated parameter values.

Development – construction of initial roadways, access pathways and infrastructure through the coal seam, prior to extraction, also known as 1st workings.

Extraction – process of removing coal from the coal seam using methods such as Panel and Pillar Partial Extraction (PPPE), Partial Extraction or Total Extraction, also known as 2nd workings.

FAO56 – an abbreviation for a standard method of calculating evapotranspiration based on the Penman-Monteith equation. The method is described in the Food and Agriculture Organisation of the United Nations Irrigation and Drainage Paper No. 56 (UN, 2006).

Goaf – a mine-subsidence related term describing post-roof collapse area in a mine (following total extraction, including longwall mining). Goafing affects the mined seam, coal is removed and void becomes filled with rubble, and several overlays geologic/hydrogeologic units.

GoldSIM – an industry standard modelling platform used predominantly in hydrological (surface water flow) modelling.

km – kilometres, where a kilometre is 1,000 metres.

ML/d – Megalitres per day, where a megalitre is 1,000,000 litres.

NARCliM – New South Wales and Australian Capital Territory Regional Climate Modelling Project.

Panel and Pillar Partial Extraction (PPPE) – A new partial extraction technique to be deployed at Clarence Colliery. Implemented via continuous miners and shortwall supports, with extraction to around 60% of coal. Designed to be a 'low' subsidence mining method with limited goafing.

Partial Extraction – a form of bord and pillar mining where a system of pillar panels is formed up during the development stage and then a limited percentage of the pillar coal is extracted on the retreat, to ensure the remaining pillars are still able to provide regional support to the overburden and restrict surface subsidence by minimising extraction widths, usually without inducing significant caving (CTH IESC, 2023b).

Proposed Case – as per the Approved Case, however, includes development (1st workings) and extraction (2nd workings, PPPE using a continuous miner and shortwall supports) of 918 Panel.

R10 – acronym to describe 10th percentile ranked model output.

R90 – acronym to describe 90th percentile ranked model output.

Thalweg – line of lowest elevation along a watercourse

Total Extraction – A term used in bord and pillar extraction where the intention is to extract the maximum percentage of the pillar coal formed up during development, in a safe and effective manner, with caving and goaf formation as part of the extraction mining process. Recovery rates within total extraction bord and pillar panels can reach 70% or greater but do not achieve the 95%-100% levels possible with longwall mining. The term can also be applied to longwall mining panels (CTH IESC, 2023b).

SILO Climatic Dataset – a dataset maintained by the Queensland Department of Environment, Tourism, Science and Innovation (QLD DETSI). The rainfall and evapotranspiration data of the SILO climatic dataset is used in this report.

SP - an abbreviation for Stress Period; a Stress Period is set in MODFLOW, usually months or quarters, where boundary conditions are constant for that period.

Stochastic – 'ensemble' of model simulations (Approved (APR) Case and Proposed (PRO) Case) (groundwater model) based upon 300 sets of randomised parameter values

THPSS – Temperate Highland Peat Swamps on Sandstone.

WAL – Water Access Licence.

wy – water year. A water year runs from 1 July through to 30 June of the following year.

1. Introduction

This chapter presents the context, objective and layout of the report.

1.1 Extraction Plan Context

Clarence Colliery has operated since 1979 utilising a range of extraction methods that result in either partial extraction (i.e. limited extraction ratio from the coal seam) and/or total extraction (i.e. higher extraction ratio from the coal seam).

To provide clarity around the differences between partial and total extraction, the following definitions are provided in CTH IESC (2023b):

*"**Partial Extraction** is a form of bord and pillar mining where a system of pillar panels is formed up during the development stage and then a limited percentage of the pillar coal is extracted on the retreat. This is to ensure the remaining pillars can still provide regional support to the overburden and restrict surface subsidence, usually without inducing any significant caving, by minimising extraction widths. Recovery rates using this system vary considerably but are typically in the range of 45%–65%, depending on local geotechnical conditions and surface subsidence constraints."*

*"**Total extraction** is a form of bord and pillar extraction where the intention is to extract the maximum percentage of the pillar coal formed up during development, in a safe and effective manner, with caving and goaf formation as an inherent and essential part of the extraction mining process. Recovery rates within total extraction bord and pillar panels can reach 70% or greater but do not achieve the 95%–100% rates possible with longwall mining. (The term total extraction can also be applied to longwall mining panels.)"*

Clarence Colliery holding includes Consolidated Coal Lease (CCL) CCL 705 and Mining Leases (ML) ML 1353, ML 1354, ML 1583 and ML 1721 (Clarence, 2025a).

Clarence has approval to extract up to 3 million tonnes of coal per annum which is sold both domestically and exported internationally. 918 Panel is the next panel to be extracted under Consolidated Consent DA 504-00-Mod-10.

Mining of the 918 Panel, which is covered by the Extraction Plan, will be undertaken using panel and pillar partial extraction (PPPE) employing continuous miners and shortwall supports. The PPPE method constitutes a partial extraction mining method, as it restricts the proportion of coal extracted to around 60%. This type of mining has been designed to be a 'low' subsidence mining method with limited goafing, suitable for the in-situ geotechnical conditions at Clarence Colliery. A geotechnical, subsidence and caving assessment for 918 Panel was undertaken by SCT Operations Pty Limited (SCT, 2026).

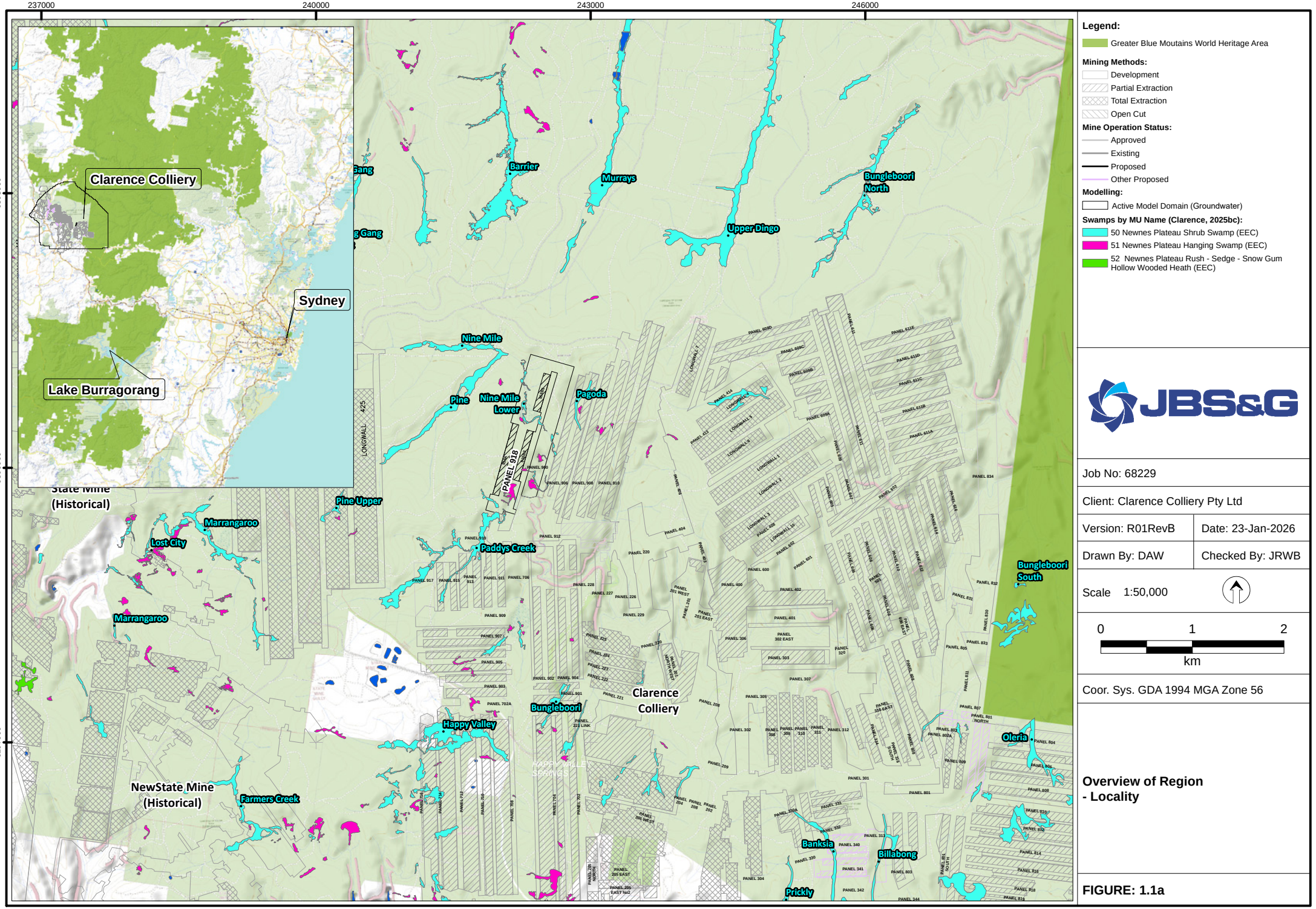
Figure 1.1a and **Figure 1.1b** presents an overview of the region (after Figure 1.1ab of JBS&G, 2026), including the location of historical and existing mine workings as well as regional topography.

1.2 Extraction Plan Overview

Clarence currently operates under Consolidated Consent DA 504-00, as modified. The last modification to consent was Modification 10 and this was approved in May 2024, as DA 504-00-Mod-10 (NSW DPH&I, 2024).

Mining of 918 Panel, which is covered by the Extraction Plan, will involve:

- Development (1st workings) of 918 Panel
- Extraction (2nd workings, PPPE using a continuous miner and shortwall supports) of 918 Panel.
    - Void width (unsupported span) is 75m for Sub Panel 918A and Sub Panel 918B2 (southern, two sub panels) and is 83m for Sub Panel 918B1 (northern, single sub panel).



Legend:

- Greater Blue Moutains World Heritage Area

Mining Methods:

- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:

- Approved
- Existing
- Proposed
- Other Proposed

Modelling:

- Active Model Domain (Groundwater)

Swamps by MU Name (Clarence, 2025bc):

- 50 Newnes Plateau Shrub Swamp (EEC)
- 51 Newnes Plateau Hanging Swamp (EEC)
- 52 Newnes Plateau Rush - Sedge - Snow Gum Hollow Wooded Heath (EEC)

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Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R01RevB	Date: 23-Jan-2026
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Scale 1:50,000

0 1 2
km

Coor. Sys. GDA 1994 MGA Zone 56

Overview of Region - Locality

FIGURE: 1.1a

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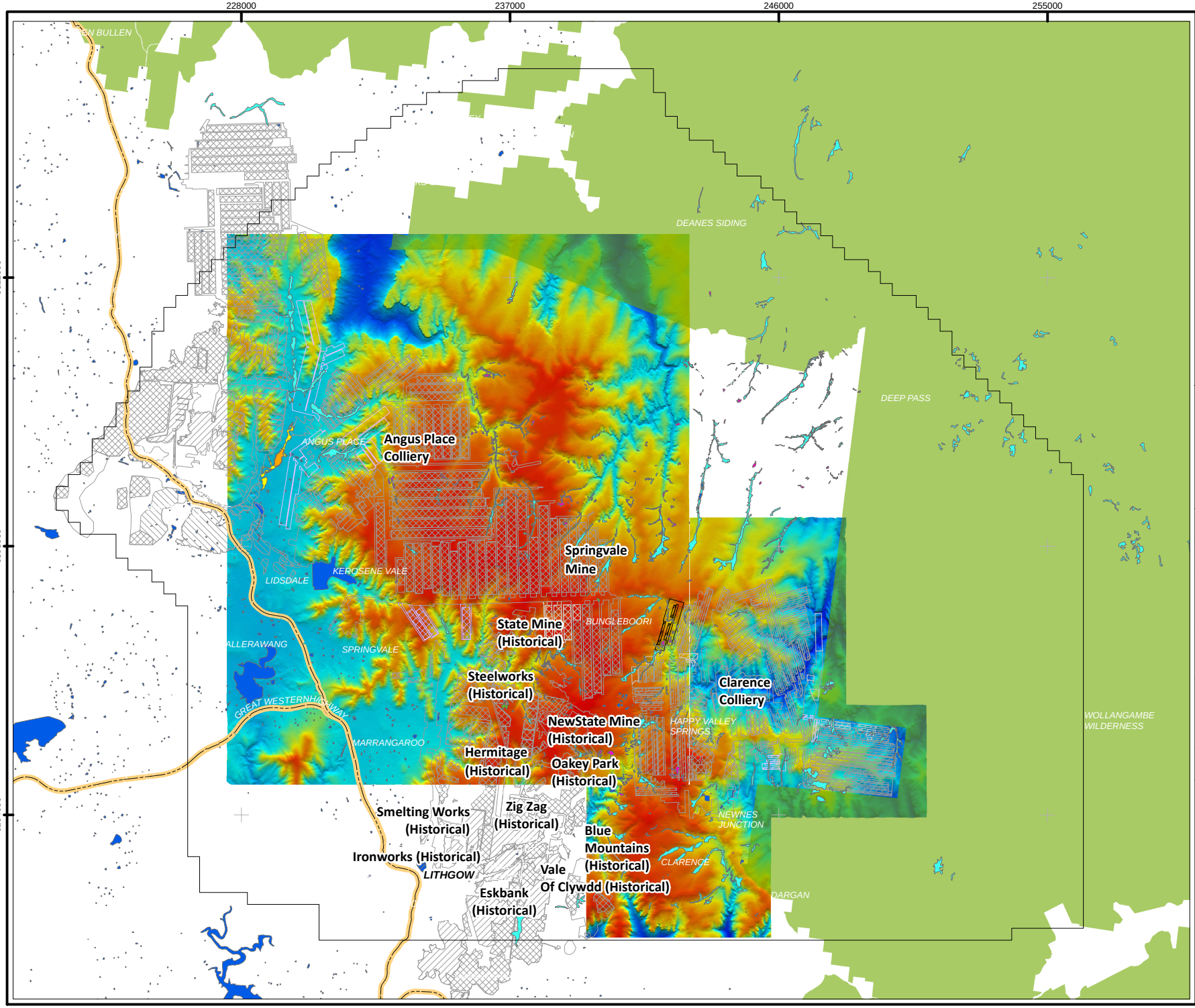

Legend:

- Highway
- Greater Blue Moutains World Heritage Area

Mining Methods:

- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:

- Approved
- Existing
- Proposed
- Other Proposed

Modelling:

- Active Model Domain (Groundwater)

Swamps by MU Name (Clarence, 2025bc):

- 50 Newnes Plateau Shrub Swamp (EEC)
- 51 Newnes Plateau Hanging Swamp (EEC)
- 52 Newnes Plateau Rush - Sedge - Snow Gum Hollow Wooded Heath (EEC)

Swamps by MU Name (RPS, 2018):

- 53 Mountain Hollow Grassy Fen (EEC)
- Typha orientalis Wetland

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Scale 1:170,000

0 3 6
km

Coor. Sys. GDA 1994 MGA Zone 56

Overview Of Region
- Regional Topography

FIGURE: 1.1b

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918 Panel is located at the northwestern edge of the Clarence Colliery holdings, adjacent to 906 Panel.

Figure 1.2 presents the location of 918 Panel at Clarence Colliery (after Figure 1.2ab of JBS&G, 2026).

For the purpose of modelling, it was assumed that development (1st workings) commenced on 1 January 2025 (Start of SP142) and is completed by 30 June 2027 (End of SP151). Extraction (2nd workings) was assumed to commence on 1 October 2026 (Start of SP149) and be completed by 31 December 2027 (End of SP153).

It is emphasised that assumptions presented below with respect to the Swamp Water Balance Model are relevant to its intent, which is to calculate modelled change to surface water flow and water quality (salinity) in watercourses in the vicinity of 918 Panel. As such, some assumptions may be more conservative, such as timing of various project elements, than that presented in the Extraction Plan for 918 Panel.

1.3 Purpose and Objective of the Report

This technical report has been prepared to present an evaluation of surface water impact of implementation of the Extraction Plan for 918 Panel.

The report presents the surface water context (environmental setting and conceptual hydrological model), describes the numerical Swamp Water Balance Model that has been developed for the Western Coalfields over many years, including recent updates, and presents an analysis of other surface water-related aspects such as flooding and drainage and availability of surface water.

The report presents an assessment of impact of changes to surface water flow, water quality (salinity), flooding and drainage behaviour, as well as other surface water-related aspects, in the vicinity of the 918 Panel, and comparison to relevant guidelines, policies and regulation.

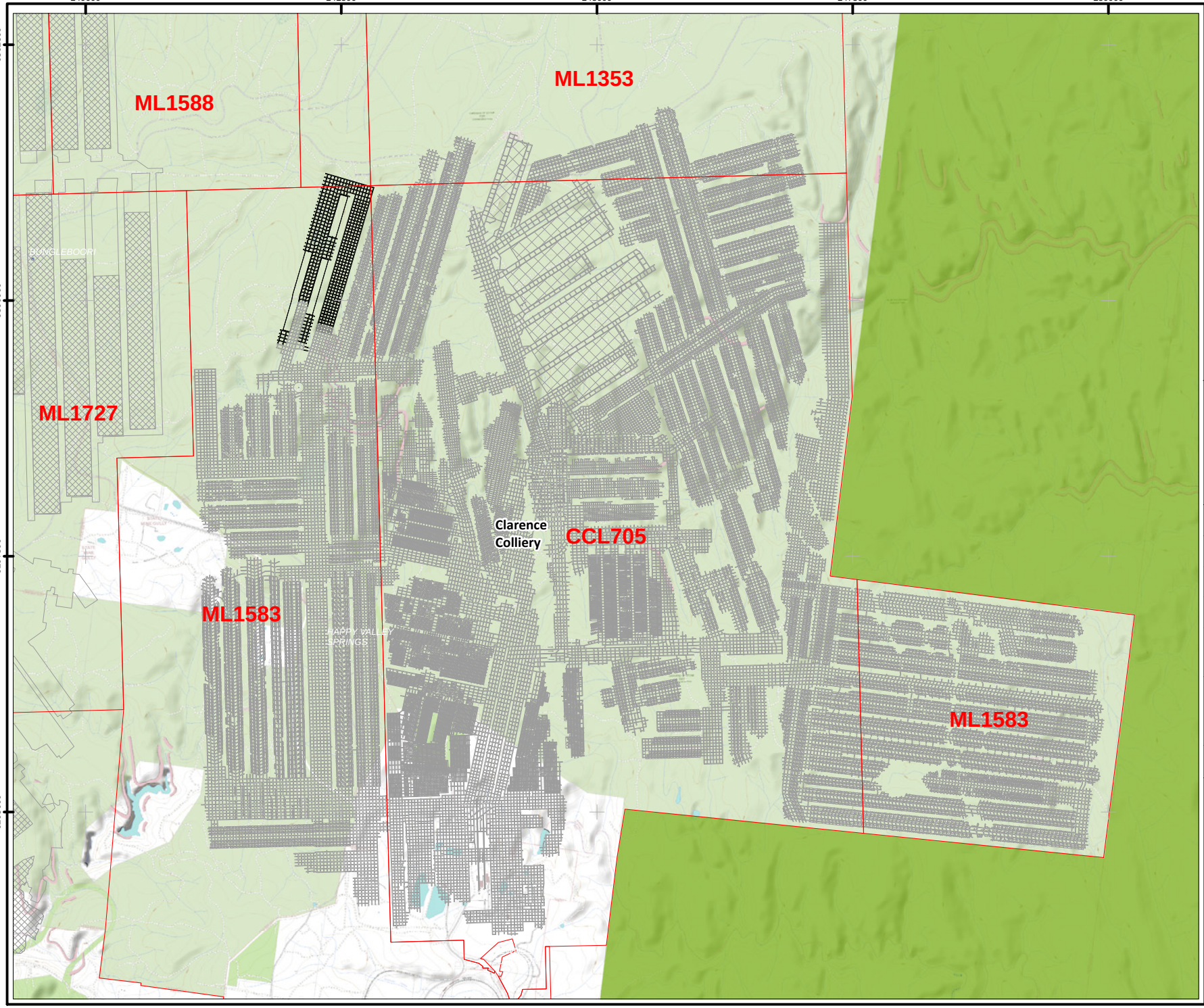
The report also presents the expected change to licensing, management, monitoring and mitigation.

Outcomes of this report will provide input to the Water Management Plan (WMP) (Clarence, 2026) of the Extraction Plan for 918 Panel.

1.4 Layout of the Report

The layout of this report is as follows:

- Chapter 1 – presents the objective of this report and the layout of the report
- Chapter 2 – presents the legislation, regulation and policy framework of the assessment
- Chapter 3 – presents a brief summary of the hydrological and environmental setting
- Chapter 4 – presents the hydrological analysis undertaken for the Extraction Plan
- Chapter 5 – presents the impact assessment, including a compliance assessment
- Chapter 6 – presents the implication of model findings on licensing, management, monitoring and mitigation
- Chapter 7 – provides conclusions from the analysis
- Chapter 8 – discusses limitations of the current version of the model and approach
- Chapter 9 – presents model recommendations
- Chapter 10 – presents relevant references.



Legend:

Greater Blue Moutains World Heritage Area

Mining:

- Mining Lease
- Clarence Existing Mine Layout
- Clarence Existing Total Extraction
- Clarence Proposed Mine Layout

JBS&G

Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R01RevA	Date: 03-Nov-2025
Drawn By: DAW	Checked By: JRWB

Scale 1:50,000

0 1 2
km

Coor. Sys. GDA 1994 MGA Zone 56

Detailed Mine Plan
- Clarence Colliery

FIGURE: 1.2a

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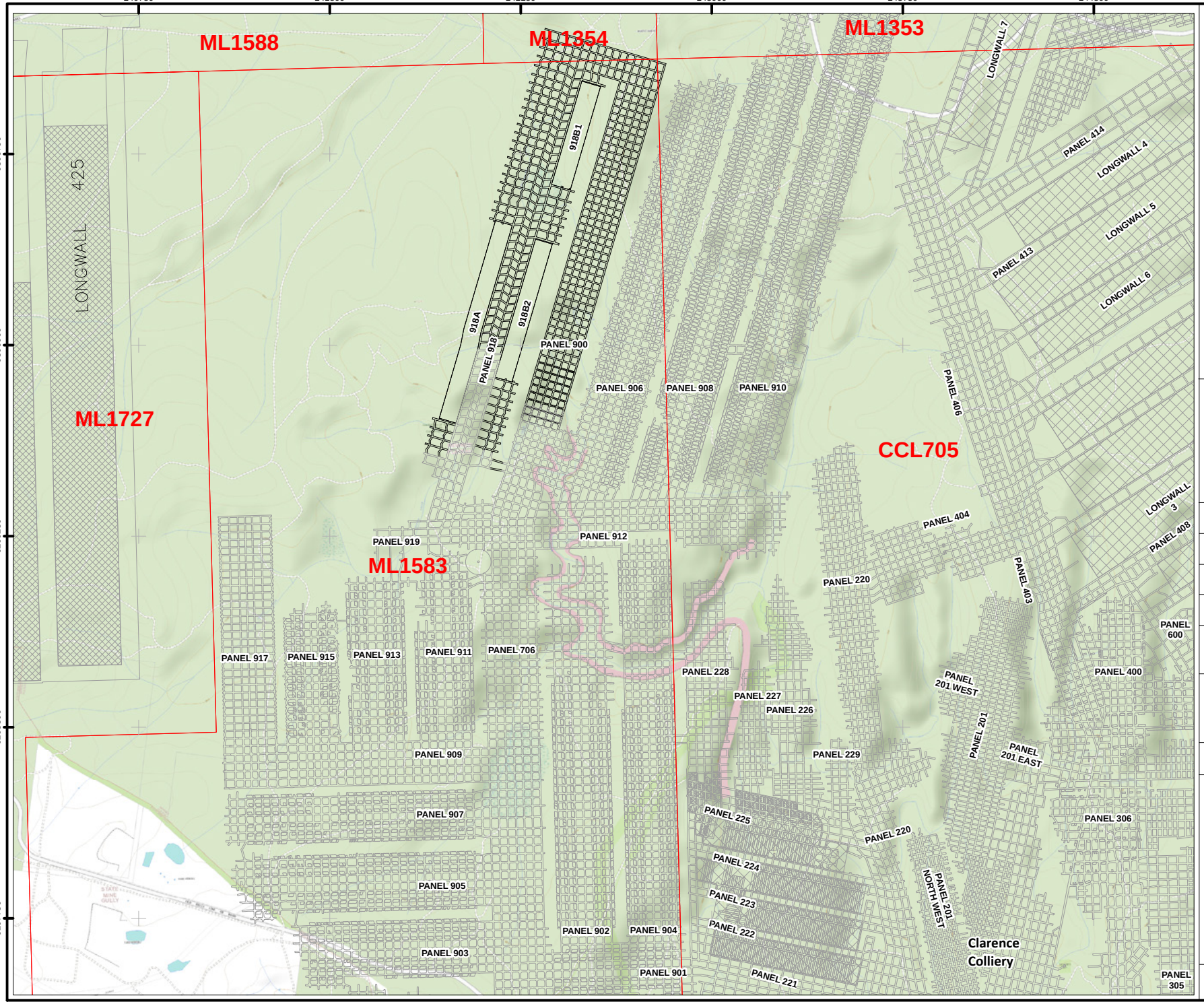

Legend:

Mining:

- Mining Lease
- Clarence Existing Mine Layout
- Clarence Existing Total Extraction
- Clarence Proposed Mine Layout

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Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R01RevA	Date: 04-Nov-2025
Drawn By: DAW	Checked By: JRWB

Scale 1:20,000

0 250 500

Meters

Coor. Sys. GDA 1994 MGA Zone 56

Detailed Mine Plan
- 900 Area

FIGURE: 1.2b

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2. Legislation, Regulation and Policy

This chapter presents the governing legislation, regulations, statutory instruments, guidance documents and policies relevant to the assessment.

2.1 Commonwealth Legislation

2.1.1 Environment Protection and Biodiversity Conservation Act 1999 (Cth)

The *Environment Protection and Biodiversity Conservation Act* 1999 (Cth) is the main Commonwealth environmental legislation that provides the legal framework to protect and manage Matters of National Environmental Significance (MNES). Those matters include:

- World Heritage Areas
- National Heritage Places
- Wetlands of International Importance (listed under the Ramsar Convention)
- Listed Threatened Species and Ecological Communities
- Listed Migratory Species (protected under international agreements)
- Commonwealth Marine Areas
- Great Barrier Reef Marine Park
- Nuclear Actions (including uranium mines)
- Water Resources (that relate to coal seam gas development and large coal mining development).

The following matters were listed as endangered ecological communities (EECs) under the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth) (via a Protected Matters Search (https://pmst.awe.gov.au/)) and are understood to be present and/or in the vicinity of the Site:

- Temperate Highland Peat Swamps on Sandstone (may occur)
- Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (may occur)
- Natural Temperate Grassland of the South Eastern Highlands (may occur)
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (may occur)

None of the endangered ecological communities are listed as being 'likely to occur'.

Water resources are also an MNES and the Extraction Plan is assessed in this report against the *Significant Impact Guidelines for Coal Seam Gas and Large Coal Mining Developments – Impacts on Water Resources*, which is published by the Commonwealth Department of Climate Change, Energy, the Environment and Water (CTH DCCEEW, 2022), and is presented in **Section 2.2.1** below.

It is noted that a Groundwater Assessment has been prepared, as an accompaniment to this report (JBS&G, 2026). That report modelled changes to groundwater contribution to surface water, which are then used in the Swamp Water Balance Model presented in this report. Those changes are relevant, since THPSS are groundwater dependent ecosystems and are listed as MNES; hence are a primary consideration.

Review of the expected impact of the Extraction Plan on EECs, under the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth), is presented in **Section 5.3.1.1**.

2.2 Commonwealth Guidelines and Policy

Guidelines and policies relevant to the Surface Water Assessment are presented below.

2.2.1 Significant Impact Guidelines

CTH DCCEEW (2022) presents guidance on the assessment of impact on hydrological characteristics by an action under the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth) by coal seam gas and large coal mining developments with respect to water resources.

Section 4.2 of CTH DCCEEW (2022) states that consideration of these guidelines is required when an action (underground coal mining; however, it is noted that this report pertains to an Extraction Plan (for 918 Panel) within an existing consent (Consolidated Consent DA 504-00-Mod-10), and is not a modification to consent for Clarence Colliery) may result in a direct or indirect change to:

- the hydrology of a water resource
- the water quality of a water resource.

With respect to water quantity, Section 4.3 of CTH DCCEEW (2022) states the following:

"*A significant impact on the hydrological characteristics of a water resource may occur where there are, as a result of the action:*

- *changes in the water quantity, including the timing of variations in water quantity*
- *changes in the integrity of hydrological or hydrogeological connections, including structural damage (for example, large scale subsidence)*
- *changes in the area or extent of a water resource.*

where these changes are of sufficient scale or intensity as to significantly reduce the current or future utility of the water resource for third party users, including environmental and other public benefit outcomes.

The following aspects may need to be considered when assessing changes in hydrological characteristics:

- *flow regimes (volume, timing, duration and frequency of surface water flows)*
- *recharge rates to groundwater*
- *aquifer pressure or pressure relationships between aquifers*
- *groundwater table and potentiometric surface levels*
- *groundwater-surface water interactions*
- *river-floodplain connectivity*
- *inter-aquifer connectivity*
- *coastal processes including changes to sediment movement or accretion, water circulation patterns, permanent alterations in tidal patterns, or substantial changes to water flows or water quality in estuaries.*

Unless the proponent can establish otherwise, the department will assume that there is a connection between surface water and groundwater. The proponent should also consider the potential impact of drilling, excavating or hydraulic stimulation on connectivity between surface water and groundwater, and whether this is likely to impact on the hydrology of the system beyond the life of the proposed action.".

[Section 4.3 of CTH DCCEEW (2022)]

Furthermore, Section 4.3.1 of CTH DCCEEW (2022) notes:

"*…*

A proponent may obtain entitlements to extract water under a state water plan which has been prepared in accordance with the requirements of the NWI [National Water Initiative].

If a proponent can demonstrate that all of the water used by a proposed action is authorised through such entitlements, the action is less likely to require a referral due to significant impacts on the hydrological characteristics of a water resource.

However, there may be situations where the water used by the proponent in a particular location at a given time exceeds the environmentally sustainable level of extraction for that location, or for another hydrologically connected location. In these cases, the action is more likely to have a significant impact on a water resource.

… .".

[Section 4.3.1 of CTH DCCEEW (2022)]

Take from surface water sources is administered through Water Sharing Plans established through the *Water Management Act* 2000 (NSW). In accordance with NSW DCCEEW (2022), a reduction in groundwater contribution to surface water is to be assigned as a groundwater licensable take.

With respect to water quality, Section 4.4 of CTH DCCEEW (2022) states the following:

"*A significant impact on a water resource may occur where, as a result of the action:*

- *there is a risk that the ability to achieve relevant local or regional water quality objectives would be materially compromised, and as a result the action:*
    - *creates risks to human or animal health or to the condition of the natural environment as a result of the change in water quality*
    - *substantially reduces the amount of water available for human consumptive uses or for other uses, including environmental uses, which are dependent on water of the appropriate quality*
    - *causes persistent organic chemicals, heavy metals, salt or other potentially harmful substances to accumulate in the environment*
    - *seriously affects the habitat or lifecycle of a native species dependent on a water resource, or*
    - *causes the establishment of an invasive species (or the spread of an existing invasive species) that is harmful to the ecosystem function of the water resource, or*
- *there is a significant worsening of local water quality (where current local water quality is superior to local or regional water quality objectives), or*
- *high quality water is released into an ecosystem which is adapted to a lower quality of water.*

For water-dependent ecosystems, a significant impact is likely if the predicted change in water quality is greater than that required for 'moderately to slightly disturbed' systems as described in the relevant local or regional water quality objectives (typically the 80% to 95% ecosystem protection guideline values listed in the Australian Water Quality Guidelines). Note that other thresholds may apply where changes in water quality may impact on other matters of national environmental significance, such as threatened species or ecological communities.

…".

[Section 4.4 of CTH DCCEEW (2022)]

An assessment of the Extraction Plan against the abovementioned guidelines is presented in **Section 5.3.2.1**.

2.2.2 Information Guideline Explanatory Notes

There are several Explanatory Notes issued by CTH IESC.

- Assessing groundwater-dependent ecosystems (CTH IESC, 2019a)
- Deriving site-specific guideline values for physico-chemical parameters and toxicants (CTH IESC, 2019b)

- Characterisation and modelling of geological fault zones (CTH IESC, 2021)
- Uncertainty analysis for groundwater modelling (CTH IESC, 2023a)
- Subsidence associated with underground coal mining (CTH IESC, 2023b)
- Using impact pathway diagrams based on ecohydrological conceptualisation in environmental impact assessment (CTH IESC, 2024)

The Explanatory Notes informed the approach to development of both the numerical groundwater model (presented in JBS&G (2026)) and the numerical surface water model (presented in this report).

An assessment of the Extraction Plan against the Explanatory Notes is presented in **Section 5.3.2.2**.

2.2.3 Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018

Management of water quality in Australia is undertaken using the National Water Quality Management Framework (CTH WQA, 2025). That framework comprises the following steps:

- "*Examine current understanding*
- *Define community values and management goals*
- *Define relevant indicators*
- *Determine water/sediment quality guidelines values*
- *Define draft water/sediment quality objectives*
- *Assess if draft water/sediment quality objectives are met*
- *Consider additional indicators or refine water/sediment quality objectives*
- *Consider alternative management strategies*
- *Assess if water/sediment quality objectives are achievable*
- *Implement agreed management strategy.*"

[https://www.waterquality.gov.au/anz-guidelines/framework]

Typical community values include:

- "*aquatic ecosystems — the health or integrity of the waterway's ecosystem(s)*
- *cultural and spiritual values — water is particularly important for indigenous peoples*
- *drinking water — water is suitable for human consumption*
- *industrial water — water is suitable for use by industry, for example mining, manufacturing, cooling and electricity generation*
- *primary industries — water is suitable for irrigation, livestock drinking water, aquaculture and human consumers of aquatic foods*
- *recreational water and aesthetics — recreation can be undertaken without risk of sickness or disease or loss of aesthetic appeal.*"

[https://www.waterquality.gov.au/anz-guidelines/resources/key-concepts/community-values]

The National Water Quality Management Framework also helped inform the NSW approach. The selected water quality (surface water) and river flow (surface water) objectives for Clarence Colliery and the Extraction Plan for 918 Panel are presented in **Section 2.4.1**. Those objectives are relevant to both the CTH approach and the NSW approach.

As noted by CTH WQA (https://www.waterquality.gov.au/anz-guidelines/guideline-values), site-specific guideline values should be used in preference to default guideline values and for Clarence, these are documented in Clarence (2026).

As JBS&G understands it, these values were developed in accordance with CTH WQA (2024), insofar comparison to a reference to a control site. Further detail on the development of site-specific guideline values and an evaluation of consistency with CTH IESC (2019b) is presented in Clarence (2026).

An assessment against the water quality objectives (NSW) is presented in **Section 5.3.4.1**.

2.2.4 Australian Drinking Water Guidelines 6 – 2011

The guidelines are published by the National Health and Medical Research Council of the Australian Government (CTH NHMRC, 2022) and are:

"*…intended to provide a framework for good management of drinking water supplies that, if implemented, will assure safety at point of use. The Guidelines have been developed after consideration of the best available scientific evidence. They are designed to provide an authoritative reference on what defines safe, good quality water, how it can be achieved and how it can be assured. They are concerned both with safety from a health point of view and with aesthetic quality.*

The Guidelines are not mandatory standards; however, they provide a basis for determining the quality of water to be supplied to consumers in all parts of Australia. These determinations need to consider the diverse array of regional or local factors, and take into account economic, political and cultural issues, including customer expectations and willingness and ability to pay.

The Guidelines are intended for use by the Australian community and all agencies with responsibilities associated with the supply of drinking water, including catchment and water resource managers, drinking water suppliers, water regulators and health authorities."

[Page 2 of CTH NHMRC (2022)]

918 Panel does not lie within the contributing catchment to Lake Burragorang (Warragamba Dam), the primary drinking water supply dam for the Sydney metropolitan area. 918 Panel is also not within the contributing catchment to Farmers Creek Dam (Dam #2), which is a local water supply dam of Lithgow City Council.

Notwithstanding, an assessment of the change to surface water quality due to implementation of the Extraction Plan for 918 Panel was undertaken because there may be incidental take from surface water by recreational users (hiking).

An assessment of the Extraction Plan against water quality objectives (NSW) is presented in **Section 5.3.4.1**.

2.3 NSW Legislation

2.3.1 Environmental Planning and Assessment Act 1979

Extraction of 918 Panel is administered under DA 504-00 (State Significant Development). DA 504-00 has been modified eight times, with DA 504-00-Mod-10, approved on 17 May 2024, being the current version of the Consolidated Consent (NSW DPH&I, 2024).

In accordance with Schedule 3, Condition 2 Extraction Plan, Clarence Colliery is required to prepare an Extraction Plan for all second workings (extraction) not covered by an existing approved Subsidence Management Plan, to the satisfaction of the Secretary.

Schedule 3, Condition 5 presents the Water Resources Impact Assessment Criteria from NSW DPH&I (2024):

"*The Applicant must ensure that the development does not result in any:*

a) significant inflows to mine workings;

b) reduction in pumping yield in private-owned groundwater bores;

c) reduction in surface flows and ground baseflow to upload swamps (Newnes Plateau Shrub Swamps) and wetlands; and

d) reduction in surface flows and groundwater baseflow to waterbodies including Marrangaroo Creek, Farmers Creek, Dargans Creek, Wolgan River, Dumbano Creek, Bungleboori Creek, and Wollangambee River (excluding reduction in flows associated with the proposed water transfer scheme),

to the satisfaction of the Planning Secretary."

[Schedule 3 Condition 5 of NSW DPH&I (2024)]

An assessment of the Extraction Plan against the Water Resources Impact Assessment Criteria of DA 504-00-Mod-10 is presented in **Section 5.3.3.1**.

State Environmental Planning Policy (Biodiversity and Conservation) 2021

The *State Environmental Planning Policy (Biodiversity and Conservation)* 2021 (NSW) is an environmental planning instrument under the *Environmental Planning and Assessment Act* 1979 (NSW).

918 Panel is not located within the Sydney Drinking Water Catchment, declared under the *State Environmental Planning Policy (Biodiversity and Conservation)* 2021 (NSW), nor is LDP002 at Clarence Colliery (refer to **Section 2.3.2** for further details on Clarence's Environment Protection Licence (EPL 726)).

Implementation of the Extraction Plan for 918 Panel does not require confirmation of neutral or beneficial effect on water quality; however, notwithstanding, consideration of water quality outcomes are encompassed in **Section 2.4**.

2.3.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act* 1997 (NSW) is administered by the NSW Environment Protection Authority (NSW EPA), which is an agency of NSW DCCEEW.

Relevant features of this legislation include:

- protection of the environment policies (PEPs)
- integrated environment protection licensing
- regulation of scheduled and non-scheduled activities.

The NSW EPA is the regulatory authority for scheduled activities (activities declared under Schedule 1 of the *Protection of the Environment Operations Act* 1997 (NSW)). The NSW EPA is also the regulatory authority for non-scheduled activities, where activities are undertaken by a public authority.

Clarence Colliery has been granted an EPL for mining of coal and associated works (EPL 726). The EPL covers the mining operation and surface water facilities at Clarence Colliery. The provisions of EPL 726 prescribe water quality and volumetric discharge limits of various surface water pollutants to designated Licensed Discharge Points (LDPs). The locations of Clarence Colliery LDP002, LDP003 and LDP004 under EPL 726 (latest revision, 20 March 2023) is presented in **Figure 2.1** and details and limits to quality and volumetric discharge are summarised in **Table 2-1**.

It is noted that LDP002 discharges into the Wollangambe River, which is a declared Wild River under the *National Parks and Wildlife Act* 1974 (NSW).

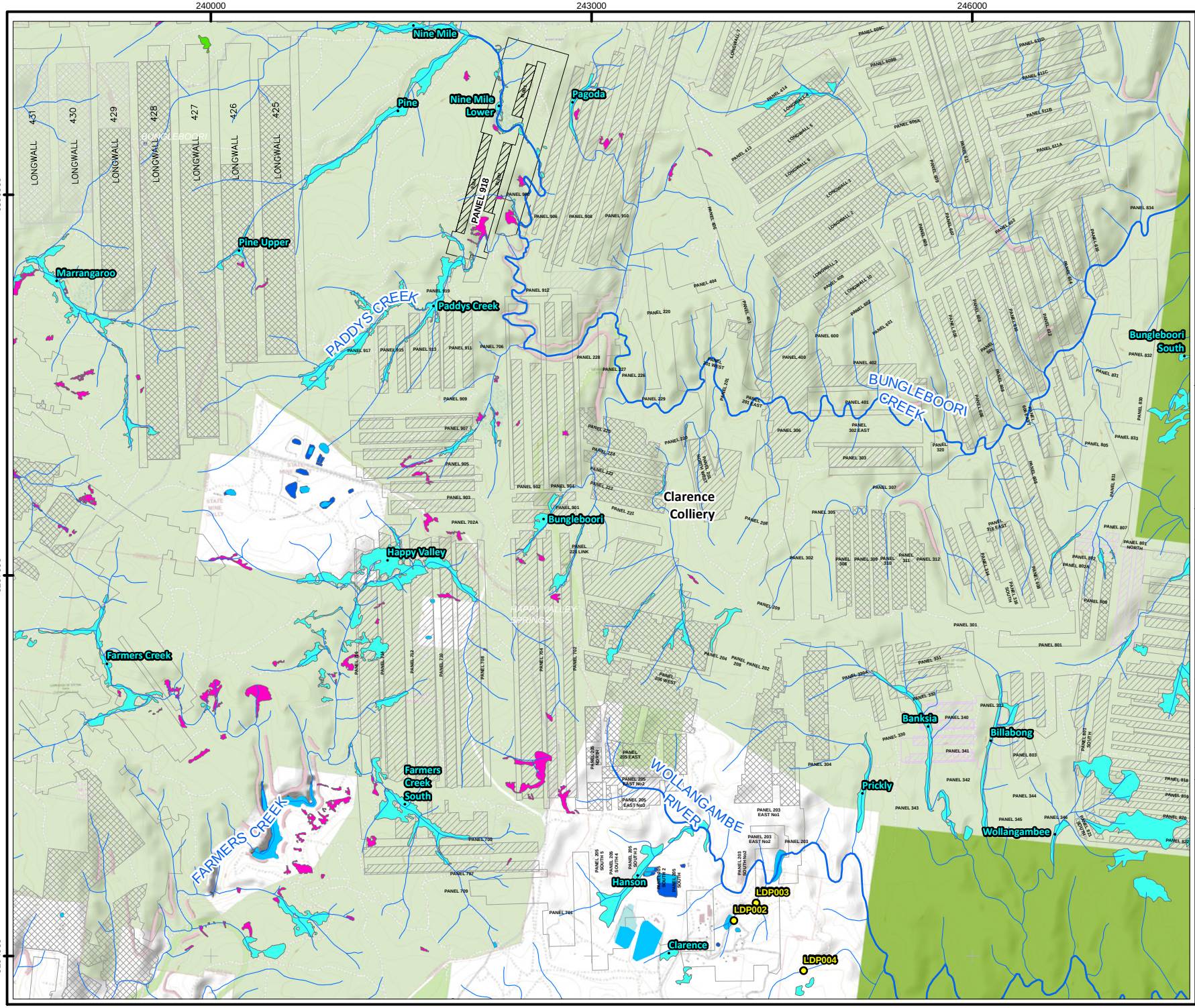
The limits presented in **Table 2-1** do not apply to LDP003 and LDP004 when the five consecutive day total rainfall exceeds 56mm (refer to L2.5 of EPL 726). The total volume discharged from LDP002 may exceed 25000kL/day on any day where greater than 10mm of rainfall is recorded at the premises, for that day.

An assessment of the Extraction Plan on EPL 726 is presented in **Section 10345021.0.10344960.0**.

Table 2-1: Licensed Discharge Point Conditions - Current (EPL 726)

Discharge Point[1]	LDP002, LDP003, LDP004
Function	Discharge and monitoring point
Limit of discharge (kL/d)	25000 for LDP002
Oil & Grease (mg/L)	10
pH	6-8.5
TSS (mg/L)	30
Conductivity (µS/cm)	n/a
Arsenic (dissolved) (mg/L)	0.013
Boron (mg/L)	0.1
Cadmium (dissolved) (mg/L)	0.0002
Chloride (mg/L)	25
Cobalt (dissolved) (mg/L)	0.0025
Copper (dissolved) (mg/L)	0.0014
Filterable iron (mg/L)	0.3
Fluoride (mg/L)	1
Lead (dissolved) (mg/L)	0.0034
Lithium (dissolved) (mg/L)	0.100
Manganese (dissolved) (mg/L)	0.5
Mercury (dissolved) (mg/L)	0.00006
Nickel (dissolved) (mg/L)	0.011
Nitrogen (total) (mg/L)	0.25
Phosphorus (total) (mg/L)	0.02
Selenium (total) (mg/L)	0.005
Silver (dissolved) (mg/L)	0.00005
Sulfate (mg/L)	250
Zinc (dissolved) (mg/L)	0.008

Notes: 1) 100% concentration limit.



Legend:

- Greater Blue Moutains World Heritage Area

Mining Methods:

- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:

- Approved
- Existing
- Proposed
- Other Proposed

Swamps by MU Name (Clarence, 2025bc):

- 50 Newnes Plateau Shrub Swamp (EEC)
- 51 Newnes Plateau Hanging Swamp (EEC)
- 52 Newnes Plateau Rush - Sedge - Snow Gum Hollow Wooded Heath (EEC)

Hydrology:

- Waterbody
- Watercourse
- Licenced Discharge Points

JBS&G

Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevA	Date: 05-Dec-2025
Drawn By: DAW	Checked By: JRWB

Scale 1:40,000

0 0.5 1
km

Coor. Sys. GDA 1994 MGA Zone 56

Licenced Discharge Points

FIGURE: 2.1

File Name: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\GIS\Maps\68229_R02RevA_D017_LDP.mxd

2.3.3 Water Management Act 2000

The *Water Management Act* 2000 (NSW) presents the framework for sustainable and integrated water management in NSW and its objectives are as follows:

- "*to apply the principles of ecologically sustainable development, and*
- *to protect, enhance and restore water sources, their associated ecosystems, ecological processes and biological diversity and their water quality, and*
- *to recognise and foster the significant social and economic benefits to the State that result from the sustainable and efficient use of water, including:*
    - *benefits to the environment, and*
    - *benefits to urban communities, agriculture, fisheries, industry and recreation, and*
    - *benefits to culture and heritage, and*
    - *benefits to the Aboriginal people in relation to their spiritual, social, customary and economic use of land and water,*
- *to recognise the role of the community, as a partner with government, in resolving issues relating to the management of water sources,*
- *to provide for the orderly, efficient and equitable sharing of water from water sources,*
- *to integrate the management of water sources with the management of other aspects of the environment, including the land, its soil, its native vegetation and its native fauna,*
- *to encourage the sharing of responsibility for the sustainable and efficient use of water between the Government and water users,*
- *to encourage best practice in the management and use of water.*"

[Chapter 1, Section 3 of the *Water Management Act* 2000 (NSW)]

The primary instruments applied in NSW to achieve these objectives are Water Sharing Plans.

Water Sharing Plans

Water Sharing Plans provide the basis for equitable sharing of surface water and groundwater between water users, including the environment, and are regulations under the *Water Management Act* 2000 (NSW).

All of NSW is covered by Water Sharing Plans. If an activity leads to a take from a groundwater or surface water source covered by a Water Sharing Plan (excluding Basic Landholder Rights), then an approval and/or licence is required.

In general, the *Water Management Act* 2000 (NSW) requires:

- a water access licence to take water
- a water supply works approval to construct a work
- a water use approval to use the water.

Figure 3.2, presented further below, presents the boundaries of the water sources within the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Sources* 2023 (NSW).

From **Figure 3.2**, the Site is located within the Colo River Water Source.

Table 2-2 presents a summary of the various water share classes of the Colo River Water Source in the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources* 2023 (NSW).

Table 2-2: Summary of Water Share Classes of the Colo River Water Source (ML/wy)

Class/Subclass	Quantity (ML/wy)
Part 3, Division 1: Requirements for water to satisfy basic landholder rights:[1]	
Clause 12 Domestic and Stock Rights	912.5ML/wy
Clause 13 Native Title Rights	n/a
Clause 14 Harvestable Rights	3242.5ML/wy
Part 3, Division 2: Requirements for water for extraction under access licences	
Clause 15 Share components of access licences in the water sources:	
Subclause 1 Domestic and Stock	67.5ML/wy
Subclause 2 Local Water Utility Access Licences	1293ML/wy
Subclause 3 Unregulated River Access Licences	2066.5ML/wy

Notes: 1) Part 3, Division 1 of *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources* 2023 (NSW).; 2) Part 3, Division 2 of the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources* 2023 (NSW).

Transfer trading of water access licences is made possible under Section 71M of the Water Management Act 2000.

A summary of trading of water access licences in the Colo River Water Source of the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources* 2023 (NSW) is presented in **Table 2-3**.

Table 2-3: Summary of Trading in the Colo River Water Source

WAL	Category	Transferred	Share (Units or ML)	Price Paid '$ per Unit'
26606	Unregulated River	22/04/2014	8	$0.00
26627	Domestic And Stock	30/05/2014	1	$0.00
35809	Unregulated River	28/08/2014	15	$0.00
25948	Unregulated River	18/12/2014	29	$0.00
26228	Unregulated River	23/12/2014	44	$0.00
25884	Unregulated River	11/05/2015	22	$0.00
26707	Domestic And Stock	20/11/2015	1	$0.00
26029	Unregulated River	20/03/2017	180	$0.00
26561	Unregulated River	15/11/2017	26	$0.00
26228	Unregulated River	03/07/2018	44	$0.00
26416	Unregulated River	06/09/2018	5	$0.00
26396	Domestic And Stock	17/09/2018	1	$0.00
26702	Domestic And Stock	09/10/2018	1	$0.00
26396	Domestic And Stock	15/10/2018	1	$0.00
25896	Unregulated River	18/03/2019	35	$0.00
26630	Unregulated River	24/06/2019	76	$0.00
26126	Domestic And Stock	10/09/2019	7	$0.00
26127	Unregulated River	10/09/2019	5	$0.00
35770	Unregulated River	12/09/2019	27	$0.04
26228	Unregulated River	03/10/2019	44	$0.00
26430	Unregulated River	26/02/2020	6	$0.00

WAL	Category	Transferred	Share (Units or ML)	Price Paid '$ per Unit'
26500	Unregulated River	22/06/2020	0	$0.00
26430	Unregulated River	28/10/2020	6	$0.00
26718	Unregulated River	02/12/2020	20	$0.00
26461	Domestic And Stock	02/12/2020	5.5	$0.00
35783	Unregulated River	30/12/2020	7	$0.00
26620	Unregulated River	11/02/2021	14	$0.00
25884	Unregulated River	04/05/2021	22	$0.00
26655	Unregulated River	17/08/2021	4	$0.00
25948	Unregulated River	02/11/2021	29	$0.00
26235	Unregulated River	13/12/2021	16	$0.00
26488	Unregulated River	25/10/2022	35	$0.00
26500	Unregulated River	13/12/2022	10	$0.00
26230	Domestic And Stock	06/01/2023	7.5	$0.00
26231	Unregulated River	06/01/2023	4	$0.00
26228	Unregulated River	07/02/2024	44	$454.55
26649	Unregulated River	05/11/2024	26	$0.00
26392	Unregulated River	21/06/2025	28	$0.00

The distribution of WALs in each of the relevant water sources is summarised in **Table 2-4** below.

Table 2-4: Distribution of Water Access Licences (WALs) in Colo River Water Source

Access Licence Category	No. of WALs[1]	Total Share Component[2]	Reported Usage (ML/wy)[3]
Colo River Water Source			
Stock and Domestic	5	47	0
Stock and Domestic (Domestic)	16	15	0
Stock and Domestic (Stock)	1	5.5	0
Local Water Utility	1	1293	0
Unregulated River	71	2066.5	0

Notes 1. Water Access Licence (WAL).; 2. Available Water Determination (AWD) is, generally, 100% of share component. i.e. 1 share equates to 1ML/wy, if AWD = 100%; 3) for Water Year (wy) = 2024/25.

An assessment of the Extraction Plan against rules for granting licences, managing access licences, water supply works approvals and access licence dealings is presented in **Section 5.3.3.3**.

Controlled Activity Approvals

Development within 40m of waterfront land requires a controlled activity approval under the *Water Management Act* 2000 (NSW). The *Water Management Act* 2000 (NSW) defines waterfront land as the bed of any river, lake or estuary and any land within 40 metres of the river banks, lake shore or estuary mean high water mark.

"*waterfront land means:*

(a) the bed of any river, together with any land lying between the bed of the river and a line drawn parallel to, and the prescribed distance inland of, the highest bank of the river, or

(a1) the bed of any lake, together with any land lying between the bed of the lake and a line drawn parallel to, and the prescribed distance inland of, the shore of the lake, or

(a2) the bed of any estuary, together with any land lying between the bed of the estuary and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the estuary, or

(b) if the regulations so provide, the bed of the coastal waters of the State, and any land lying between the shoreline of the coastal waters and a line drawn parallel to, and the prescribed distance inland of, the mean high water mark of the coastal waters,

where the prescribed distance is 40 metres or (if the regulations prescribe a lesser distance, either generally or in relation to a particular location or class of locations) that lesser distance. Land that falls into 2 or more of the categories referred to in paragraphs (a), (a1) and (a2) may be waterfront land by virtue of any of the paragraphs relevant to that land."

[Dictionary, *Water Management Act* 2000 (NSW)]

There is no change to infrastructure with the implementation of the Extraction Plan for 918 Panel, therefore a controlled activity approval is not required.

Harvestable Rights

Harvestable rights are a basic landholder right under the *Water Management Act* 2000 (NSW).

Licences are not required for harvestable rights dams built on minor streams that capture 10 per cent of the average regional rainfall runoff on land in the Central and Eastern Divisions of New South Wales.

Under the *Water Management (General) Regulation* 2025 (NSW),

"…minor stream means—

(a) a stream for which the location is specified in the hydro line spatial data and that has the following characteristics—

(i) is identified as a first or second order stream under the Strahler system,

(ii) does not maintain a visible flow occurring on a continuous basis, or that would occur if there were no artificial extractions of water or obstruction, of flow upstream,

(iii) does not carry flows emanating from a third or higher order stream under the Strahler system, or

(b) a stream for which the location is not specified in the hydro line spatial data.

(2) A stream is specified in the hydro line spatial data if the stream is identified as a watercourse, however described, in accordance with the legend or terms of the hydro line spatial data.

(3) The method of determining the stream order of a minor stream is the Strahler system."

[Part 1, Section 3 of *Water Management (General) Regulation* 2025 (NSW)]

For Clarence Colliery, there are no harvestable rights dams and implementation of the Extraction Plan for 918 Panel will not change lead to change in this state.

Surface water dams at Clarence Colliery pertain to erosion and sediment control, and the capacity of those dams are exempt from consideration of maximum harvestable rights capacity considerations, since water retained in those dams can not be used for any other purpose.

2.3.4 Biodiversity Conservation Act 2016

Biodiversity Conservation Act 2016 (NSW) is NSW state legislation that is intended to maintain a healthy, productive and resilient environment for the greater well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development.

In the vicinity of Clarence Colliery and 918 Panel, following are listed as Critically Endangered Ecological Communities under Schedule 2, Part 1 of the Act:

- "Natural Temperate Grassland of the South Eastern Highlands"
- "White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland"
- In the vicinity of Clarence Colliery and the Extraction Plan, following are listed as Endangered Ecological Communities under Schedule 2, Part 1 of the Act:
- "Temperate Highland Peat Swamps on Sandstone"
- "Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion"

The Temperate Highland Peat Swamps on Sandstone (THPSS) comprise of Newnes Plateau Shrub Swamps (Mapping Unit MU50, NSW DCCEEW (2006)) and Hanging Swamps (Mapping Unit MU51, NSW DCCEEW (2006)) listed under the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth) as Endangered Ecological Communities (EECs) reside on the Newnes Plateau.

The Natural Temperate Grassland of the South Eastern Highlands, White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland and Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion ecological communities are not designated as groundwater dependent ecosystems.

The Ecological Communities in the vicinity of the Site are classified as 'may occur' and are not 'likely to occur'.

The only relevant critically endangered ecological communities to this groundwater assessment are the THPSS.

An assessment of the impact of the Extraction Plan on groundwater dependent ecosystems, from a surface water flow and quality perspective, is presented in **Section 5.3.3.4**.

2.4 NSW Guidelines and Policy

2.4.1 NSW Water Quality and River Flow Objectives 2006

Environmental values have been identified for various catchments within NSW (NSW DCCEEW, 2006).

There are no specific environmental values set for the Hawkesbury-Nepean river catchment due to the transition at that time from the Healthy Rivers Commission to the Natural Resources Commission.

However, catchments in the vicinity have identified water quality and river flow objectives that are appropriate for the purpose of presenting the impact of the Extraction Plan. These are presented below.

It is noted that the environmental values identified in the NSW Water Quality and River Flow Objectives are consistent with the National Water Quality Management Framework presented in CTH WQA (2025).

Table 2-5 presents the adopted Water Quality and River Flow Objectives for the various water sources.

Table 2-5: NSW Water Quality and River Flow Objectives – Clarence Colliery

Objective Type	Objective

Water Quality	• Aquatic ecosystems
	• Visual amenity
	• Drinking water at point of supply – Disinfection only (n/a)
	  ○ Incidental take from recreational users only, as Extraction Plan for 918 Panel is outside of drinking water supply catchments.
	• Drinking water at point of supply – Clarification and disinfection only (n/a)
	  ○ Incidental take from recreational users only, as Extraction Plan for 918 Panel is outside of drinking water supply catchments.
	• Aquatic foods (cooked) (n/a)

Objective Type	Objective
	• Industrial water supply (not listed, but relevant to Clarence Colliery)
River Flow	• Protect natural pools in dry times • Protect natural low flows • Maintain wetland and floodplain inundation (not listed, but relevant to Clarence Colliery) • Maintain natural flow variability (not listed, but relevant to Clarence Colliery) • Minimise effects of weirs and other structures • Maintain groundwater for ecosystems (not listed, but relevant to Clarence Colliery)

An assessment of the impact of the Extraction Plan against the NSW Water Quality and River Flow Objectives is presented in **Section 5.3.4.1**.

2.4.2 Managing Urban Stormwater 2004 & 2008

Erosion and sediment control of projects in NSW is guided by the 'Blue Book', Volume 1 of which was prepared by Landcom (2004). The 'Blue Book' was extended by NSW DPH&I (2008) for use in other areas in Volume 2, including mines and quarries.

There is no change to erosion and sediment control infrastructure due to implementation of the Extraction Plan for 918 Panel.

Assessment of the Extraction Plan against these guidelines is discussed in **Section 5.3.4.2**.

3. Environmental Setting

This chapter describes the environmental and hydrological setting relevant to assessing potential surface water impacts associated with the implementation of the Extraction Plan for 918 Panel. The focus of this chapter is on catchment characteristics, drainage pathways, sensitive ecological features and landscape context that influence surface water flow, water quality and hydrologic function.

3.1 Overview

Clarence Colliery is located in the Western Coalfields of NSW, 2km northeast of the township of Clarence and 15km east of Lithgow.

The mining lease exists below the Newnes Plateau. The Newnes Plateau is a topographically high sandstone feature (1200mAHD) that divides the surface water catchments into the Coxs River (west, southwest), Wolgan River (north) and Bungleboori Creek (east).

The Wolgan Valley lies to the north of the Newnes Plateau, where surface elevation is 690mAHD. The Wolgan River, within the Wolgan Valley, flows in a northerly and then easterly direction.

The Newnes Plateau hosts the Gardens of Stone State Conservation Area (GoS SCA) and a range of endangered ecological communities (EEC) including the Newnes Plateau Shrub Swamps and the Newnes Plateau Hanging Swamps. These communities form part of the federally and state listed Temperate Highland Peat Swamps on Sandstone (THPSS).

3.2 Climate Data

The Western Coalfields receive a temperate climate, with warm summers, cool winters and fairly uniform rainfall throughout the year.

Rainfall and evaporation for the Swamp Water Balance Model (and the numerical groundwater model which provides groundwater contribution to surface water; it uses evapotranspiration (FAO56) (UN, 2006)) was obtained from the SILO climate dataset of the Queensland Department of Environment, Tourism, Science and Innovation (QLD DETSI).

Monthly average rainfall and evaporation above Panel 918 at Clarence Colliery is presented in **Table 3-1** as well as annual average rainfall and evapotranspiration.

Table 3-1: Climatic Summary at Clarence Colliery (150.25°, -33.40°; Grid I8)

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Ave. Daily Temperature (Minimum)	13.0	12.7	10.9	7.9	5.0	2.8	1.8	2.4	4.6	6.9	9.2	11.2	-
Ave. Daily Temperature (Maximum)	24.8	23.6	21.2	17.7	13.8	10.5	9.9	11.6	15.1	18.1	20.8	23.4	-
Average Rainfall (mm)	109	112	111	74.1	65.8	65.7	61.8	71.6	59.3	70.7	101	90.6	991
Average Evaporation (mm)	170	131	111	70.0	41.6	25.8	32.4	53.4	84.2	117	136	167	1140

Gridded data from the SILO dataset (0.05 degree) was used in the numerical models. Daily data was extracted from the SILO database from 1 January 1979 through 31 May 2025.

For future predictions using the numerical models, data from the New South Wales and Australian Capital Territory Regional Climate Modelling Project (NARCliM) was accessed (NSW DCCEEW, 2025).

Of the climate models available, after adaptation to the SILO grid presented above, historical climate data was amended to reflect long-term trends. It noted that NARCliM Version 1.0 was used for this assessment:

- 'Average' Climate conditions were represented by the ECHAM5_R3 model.

It is noted that the evaporation outcomes were derived based on mean near-surface temperature derived from NARCliM and all climate model outputs were found to be similar. The largest divergence between climate models was with respect to cumulative rainfall, with the adopted average climate model being halfway between the lowest and highest.

As noted in the documentation issued in support of NARCliM, the selection of climate model to use needs to take into account the context of use, with respect to risk. For this study, that is the potential reduction in groundwater recharge (given that groundwater contribution to surface water is important for periods of low surface water flows), hence the focus on cumulative rainfall and evapotranspiration (via consideration of mean near-surface temperature). Furthermore, extraction of climate model output needs to be internally consistent, which means that output from different climate models should not be used, rather pick one of the climate models and use that one, single climate model.

3.3 Hydrology

The Newnes Plateau largely influences the hydrology of the Western Coalfields. It divides surface flow into three major directions. The topographic divide between the main catchments is orientated in a generally northwest-southeast direction.

Clarence Colliery spans across two water sources of the *Water Sharing Plan for the Greater Metropolitan Unregulated River Water Sources* 2023 (NSW):

- Wywandy Water Source
- Colo River Water Source.

The northern portion of Clarence sits within the Hawkesbury / Lower Nepean surface water catchment (Colo River Water Source), whereas the southern portion of Clarence falls within the Upper Nepean / Upstream Warragamba (Wywandy Water Source) surface water catchment.

- 918 Panel lies within the Hawkesbury / Lower Nepean surface water catchment (Colo River Water Source).

The major surface water feature in the vicinity of the 918 Panel is Bungleboori Creek, which drains from west to east through 918 Panel. Paddys Creek is located immediately southwest of 918 Panel and leads into Bungleboori Creek. Located north of 918 Panel is Dingo Creek, which drains from west to east into Bungleboori Creek.

Figure 3.1 presents relevant hydrological features in the vicinity of Clarence Colliery.

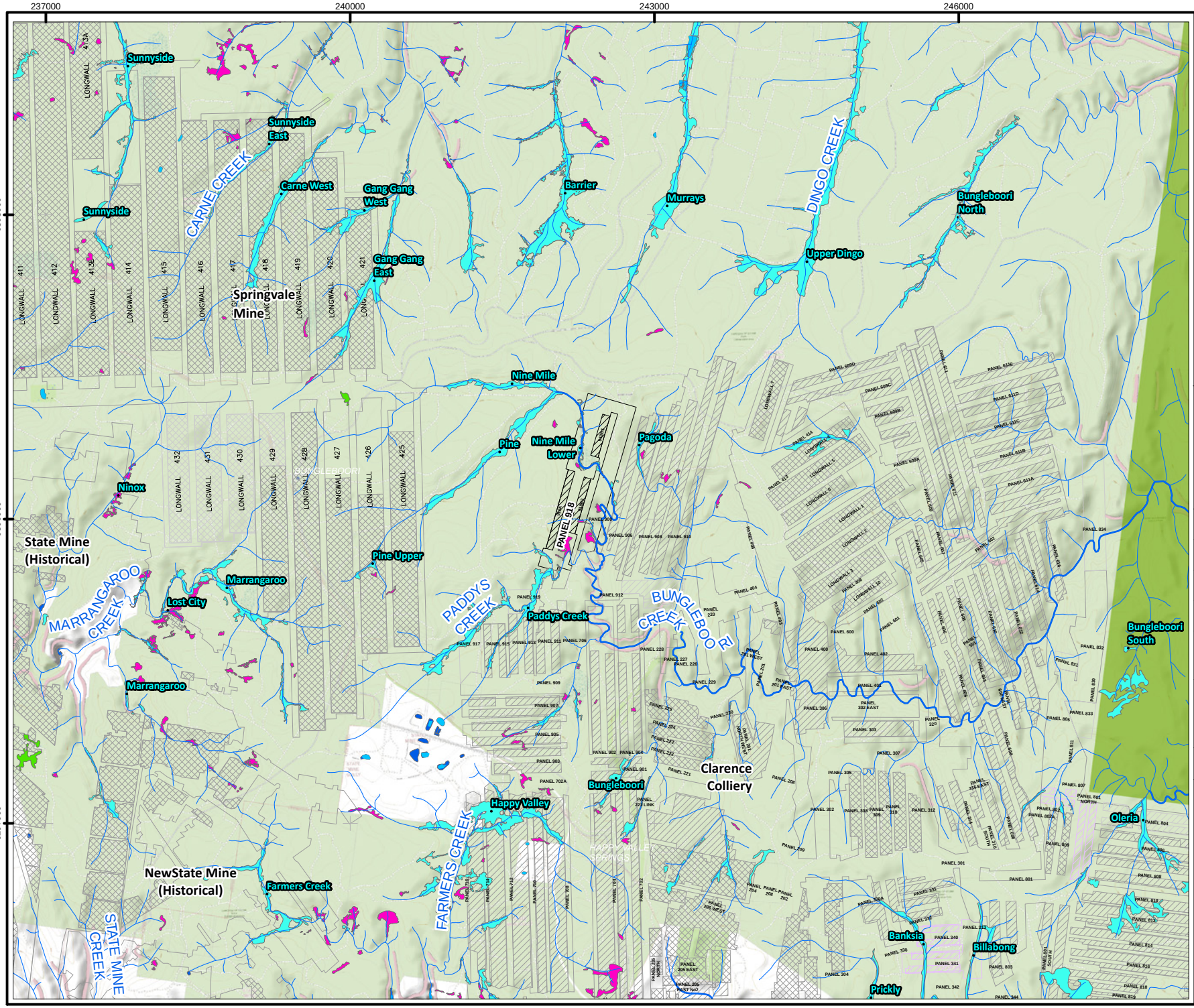
Figure 3.2 presents the boundaries of the respective water sources in the Water Sharing Plan (Surface Water).

3.3.1 Surface Water Use at Site

There is no direct extraction of surface water at Clarence Colliery.

Indirect take of surface water can occur through aquifer interference activity.

Groundwater ingress into mine workings is collected and treated via the Water Treatment Plant and discharged via LDP002, upstream of Main Dam. As presented in the WMP (Clarence, 2026), almost all inflow into underground workings is discharged, after treatment, with very little consumed by colliery activities.



Legend:

Greater Blue Moutains World Heritage Area

Mining Methods:
- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:
- Approved
- Existing
- Proposed
- Other Proposed

Swamps by MU Name (Clarence, 2025bc):
- 50 Newnes Plateau Shrub Swamp (EEC)
- 51 Newnes Plateau Hanging Swamp (EEC)
- 52 Newnes Plateau Rush - Sedge - Snow Gum Hollow Wooded Heath (EEC)

Hydrology:
- Waterbody
- Watercourse

JBS&G

Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R01RevA	Date: 04-Nov-2025
Drawn By: DAW	Checked By: JRWB

Scale 1:50,000

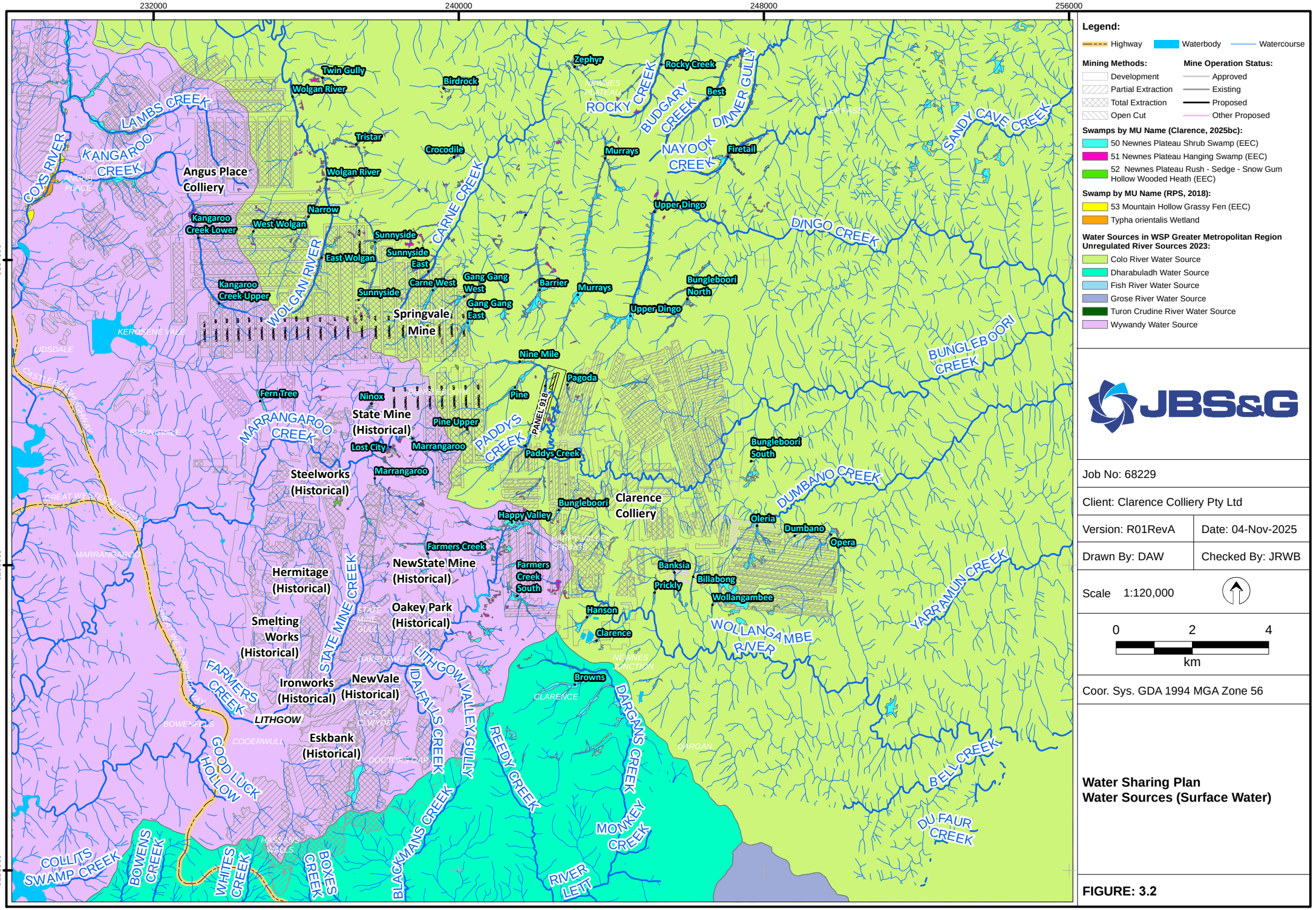
0 1 2
km

Coor. Sys. GDA 1994 MGA Zone 56

Surface Water Features

FIGURE: 3.1

File Name: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\GIS\Maps\68229_R01RevA_D035_SurfaceWaterFeatures.mxd



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3.3.2 Groundwater Dependent Ecosystems

The Newnes Plateau Shrub Swamps and the Newnes Plateau Hanging Shrub Swamps are groundwater dependent ecosystems and form part of the Temperate Highland Peat Swamp on Sandstone (THPSS). The THPSS are listed under the federal *Environment Protection and Biodiversity Conservation Act* 1999 (Cth) and the state *Biodiversity Conservation Act* 2016 (NSW).

THPSS are also listed as high priority groundwater dependent ecosystems in the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources* 2023 (NSW). Newnes Plateau Shrub Swamps primarily occur in narrow eroded valleys in the Burralow Formation or Banks Wall Sandstone.

Newnes Plateau Hanging Shrub Swamps tend to occur on side slopes of valleys and are reliant on seepage from geologic contacts of the Burralow Formation or within the Banks Wall Sandstone.

Newnes Plateau Shrub Swamps of relevance to 918 Panel include:

- Nine Mile Lower Shrub Swamp
- Paddys Creek Shrub Swamp.

Newnes Plateau Hanging Swamps of relevance to 918 Panel include:

- Nine Mile Lower Hanging Swamp
- Paddys Creek Hanging Swamp.

The location of Newnes Plateau Shrub Swamps and Newnes Plateau Hanging Swamps with respect to 918 Panel are presented in **Figure 3.1**. It is noted that there is no extraction proposed directly beneath Bungleboori Creek and Paddys Creek watercourses, which contain Newnes Plateau Hanging and Shrub Swamps.

Nine Mile Swamp, Pine Swamp and the upstream portion of Paddys Creek Swamp are located above the perched groundwater system contained within the Burralow Formation. The mid and lower portion of Paddys Creek Swamp and Lower Nine Mile Swamp are located above the shallow groundwater system which exists within the Banks Wall Sandstone, maintained by the Mount York Claystone.

The mapped extent of THPSS is based on Clarence (2025bc). The mapped extent of THPSS has been progressively updated from the initial desktop mapping undertaken by NSW DCCEEW (2006).

3.4 Surrounding Land-Uses

Land-use above Clarence Colliery is predominantly the Garden of Stone Reserves, which is managed by the NSW National Parks and Wildlife Service. In the past, the Forestry Corporation of NSW (formerly NSW State Forests) operated the Newnes State Forest, for timber production. JBS&G understands that the Newnes State Forest is in the process of being transferred into the Garden of Stone Reserves. Surrounding Clarence Colliery to the north, east and south is the Greater Blue Mountains World Heritage Area.

There are multiple mines, both historical and existing (these extract or have extracted from the Lithgow Seam), in the vicinity of Clarence Colliery (extracts from the Katoomba Seam). These include:

- Springvale Mine is located directly west and northwest of Clarence, Springvale is currently operating and extraction is via the longwall mining method (which is a Total Extraction Method)
- Historical mines (New State Mine and Oakey Park) border the westernmost panels of Clarence Colliery Oakey Park Colliery was established in 1888 and was operational until 1941
- New State Mine was assumed to operate between 1928 and 1941
- Angus Place Colliery to the north and northwest of Springvale Mine
- Other historical mines.
    - State Mine

- Steelworks Colliery
- New State Mine
- Fernbrook Colliery
- Hermitage Colliery
- Oakey Park Colliery
- Smelting Works Colliery
- Zig Zag Colliery.

The location of current and historical works in the vicinity of Clarence Colliery is presented in **Figure 1.1a** and **Figure 1.1b**.

3.5 Surface Water Users

The NSW Water Register (https://waterregister.waternsw.com.au/water-register-frame) was reviewed and Water Access Licences (WAL) in Colo River Water Source were identified.

There are no surface water users located in a 5km radius of 918 Panel.

3.6 Hydrological Investigation

3.6.1 Surface Water Monitoring Network

Surface water monitoring undertaken at Clarence Colliery comprises of flow gauging as well as water quality monitoring.

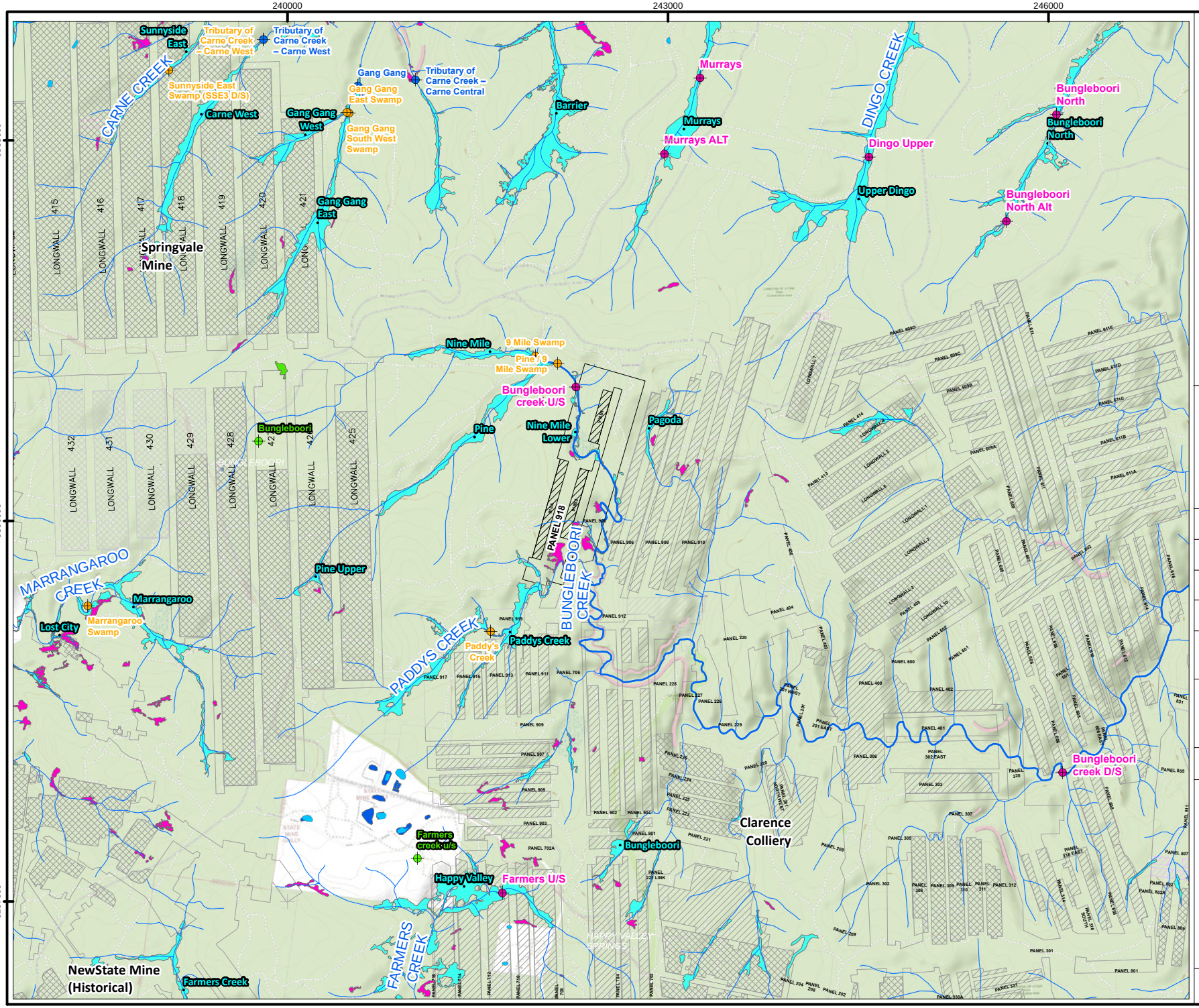
Figure 3.3 presents the surface water monitoring locations at Clarence Colliery.

Table 3-2 presents a summary of details of the surface water monitoring network of relevance at Clarence Colliery.

Relevant surface water monitoring locations for stream flow and water quality (salinity), that are in the vicinity of the 918 Panel include:

- Pine / Nine Mile Swamp (9 Mile Swamp and Pine / 9 Mile Swamp)
- Bungleboori Creek Upstream (Bungleboori Creek US)
- Bungleboori Creek Downstream (Bungleboori Creek DS)
- Bungleboori North #2
- Paddys Creek
- Upper Dingo Swamp.

Surface water flow rates and electrical conductivity (EC) for these surface water monitoring locations are presented in the calibration results in **Section 4.3.4.2**.



Legend:

Mining Methods:
- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:
- Approved
- Existing
- Proposed
- Other Proposed

Clarence Surface Water Monitoring Network:
- Clarence Surface Water Monitoring

Springvale Surface Water Monitoring Network:
- Creeks (Springvale Coal, 2022a)
- Swamps (Springvale Coal, 2022b)
- UCRAMP (Springvale Coal, 2025)

Swamps by MU Name (Clarence, 2025bc):
- 50 Newnes Plateau Shrub Swamp (EEC)
- 51 Newnes Plateau Hanging Swamp (EEC)
- 52 Newnes Plateau Rush - Sedge - Snow Gum Hollow Wooded Heath (EEC)

Hydrology:
- Waterbody
- Watercourse

JBS&G

Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevA	Date: 05-Dec-2025
Drawn By: DAW	Checked By: JRWB

Scale 1:40,000

0 0.5 1
km

Coor. Sys. GDA 1994 MGA Zone 56

Surface Water Monitoring Network

FIGURE: 3.3

File Name: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\GIS\Maps\68229_R02RevA_D016_SurfaceWaterMonitoringNetwork.mxd

Table 3-2: Summary of Surface Water Monitoring Network

Name	Easting (mMGA)[1]	Northing (mMGA)[1]	Description of Location	Model Name	Catchment Node Number	Aliases
Pine / Nine Mile Swamp	242129	6301241	Confluence of Pine Swamp and Nine Mile Swamp immediately west of 918 Panel	Pine / Nine Mile Swamp	Node 696	Pine / 9 Mile Swamp
Bungleboori Creek Upstream	242273	6301057	Located immediately downstream of Pine / Nine Mile Swamp immediately west of 918 Panel	Bungleboori Creek Upstream	Node 696	BUNGLEBOORI_CK_US; Bungleboori Creek US
Bungleboori Creek Downstream	246112	6298018	Located approximately 5km downstream of the 918 Panel	Bungleboori Creek Downstream	Node 857	BUNGLEBOORI_CK_DS; Bungleboori Creek DS
Bungleboori North #2	246063	6303204	Located approximately 4km northeast of the 918 Panel. Bungleboori Creek North leads into Dingo Creek which leads into Bungleboori Creek approximately 16km downstream of 918 Panel	Bungleboori Creek North	Node 673	BUNGLEBOORI NTH; Bungleboori North
Upper Dingo Swamp	244584	6302869	Located approximately 2.5km northeast from 918 Panel and leads into Dingo Creek	Dingo Creek Upper	Node 986	DINGO UPPER
Paddys Creek	241601	6299128	Located within Paddys Creek	Paddys Creek Swamp	Node 712	n/a

Notes: 1) Locations are in Map Grid of Australia 1994 Zone 56;

3.6.1.1 Surface Water Quality

Surface water monitoring is undertaken in accordance with the WMP (Clarence, 2026) and EPL 726 requirements. Additionally, trigger values have been set for surface water quality and are specified in the WMP. As JBS&G understands it, these were developed in accordance with CTH WQA (2025), insofar comparison to a reference to a control site. Further detail on the development of site-specific trigger values and an evaluation of consistency with CTH IESC (2019b) is presented in Clarence (2026).

Table 4.1 of the WMP (Clarence, 2026) specifies the analytical suite and frequency for surface water quality monitoring at Clarence Colliery, an excerpt of which is presented in **Table 3-3**, for the purpose of reference.

Table 3-3: Surface Water Quality Monitoring Program (excerpt from Table 4.1 of Clarence (2026))

Location	Frequency	Parameters
Wollangambe River US Wollangambe River DS*	Monthly	**Physicochemical:** DO, EC, pH, temperature, TDS, TSS, turbidity. **Major ions:** alkalinity (bicarbonate, carbonate, hydroxide, total), calcium, chloride, magnesium, potassium, sodium, sulfate, total hardness. **Nutrients:** ammonia, nitrate, nitrite, nitrate + nitrite, total fluoride, total Kjeldahl nitrogen, total nitrogen, total phosphorous. **Dissolved metals:** aluminium, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, rubidium, selenium, silver, strontium, uranium, vanadium, zinc. **Total metals:** aluminium, arsenic, barium, beryllium, boron, cadmium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, vanadium, zinc. **Other:** oil and grease, dissolved organic carbon.
Farmers Creek US Farmers Creek DS	Quarterly	**Physicochemical:** EC, pH, temperature, TDS, TSS, turbidity. **Major ions:** alkalinity (bicarbonate, carbonate, hydroxide, total), calcium, chloride, magnesium, potassium, sodium, sulfate, total hardness. **Nutrients:** ammonia. **Dissolved metals:** aluminium, barium, cadmium, copper, chromium, cobalt, iron, manganese, nickel, zinc. **Total metals:** aluminium, barium, copper, cadmium, cobalt, iron, manganese, nickel, strontium, zinc. **Other:** total organic carbon, silica (silicon as SiO_2), silicon.
Bungleboori Creek US Bungleboori Creek DS	Monthly	**Physicochemical:** EC, pH, temperature, TDS, TSS, turbidity.
Paddys Creek	Monthly ^	**Physicochemical:** EC, pH, temperature, DO, turbidity.

From **Table 3-3**, the analytical suite for Bungleboori Creek US and Bungleboori Creek DS are field parameters (physio-chemical parameters), plus TDS and TSS, and for Paddys Creek is field parameters.

Discharge volume monitoring and water quality monitoring occur at LDP002, with volume monitoring recorded continuously and water quality monitoring undertaken monthly. It is noted that the Wollangambe River Downstream (Wollangambe River DS) location is monitored in accordance with EPL 726 (known as EPL Point 9).

Table 3-4 presents example surface water quality from samples obtained between 2024 to 2025 at LDP002, Wollangambe River DS, Bungleboori Creek US, Bungleboori Creek DS, Bungleboori North #2 and Upper Dingo Swamp respectively. Surface water quality monitoring frequency and parameters are presented in Table 4.1 of the WMP (Clarence, 2026).

LDP002

From **Table 3-4**, the pH of the sample obtained on 25 March 2025 is 8.8, which is considered slightly alkaline. Discharged water from that sample has an EC of 333µS/cm and Total Dissolved Solids (TDS) of 220mg/L.

The water quality of treated groundwater being discharged at LDP002 is not expected to change due to extraction of 918 Panel.

Wollangambe River DS

From **Table 3-4**, the pH of the sample obtained on 24 June 2025 is 7.2, which is near-neutral. The sample has an EC of 323µS/cm, TDS of 208mg/L and Dissolved Oxygen (DO) is 8.0mg/L.

The surface water quality at Wollangambe Downstream (Wollangambe River DS) is considered fresh, and is not expected to change due to extraction of 918 Panel.

Bungleboori Creek

From **Table 3-4**, the pH of the sample obtained on 27 June 2025 at Bungleboori Creek Upstream (Bungleboori Creek US) is 4.5, which is considered to be slightly acidic. Surface water has an EC of 40µS/cm and Dissolved Oxygen (DO) is 8.0mg/L.

From **Table 3-4**, the pH of the sample obtained on 27 June 2025 at Bungleboori Creek Downstream (Bungleboori Creek DS) is 4.2, which is considered to be slightly acidic. Surface water has an EC of 32µS/cm and Dissolved Oxygen (DO) is 10.4mg/L.

The surface water quality at Bungleboori Creek Upstream (Bungleboori Creek US) and Bungleboori Creek Downstream (Bungleboori Creek DS) is considered to be slightly acidic, and is not expected to change due to extraction of 918 Panel.

Bungleboori North

From **Table 3-4**, the pH of the sample obtained on 13 November 2024 at Bungleboori North #2 is 5.5, which is considered to be slightly acidic. Surface water has an EC of 67µS/cm and Dissolved Oxygen (DO) is 4.1mg/L.

The surface water quality at Bungleboori North #2 is not expected to change due to extraction of 918 Panel.

Upper Dingo Swamp

From **Table 3-4**, the pH of the sample obtained on 13 June 2025 at Upper Dingo Swamp is 5.2, which is considered to be slightly acidic. Surface water has an EC of 35µS/cm and Dissolved Oxygen (DO) is 9.3mg/L.

The surface water quality at Upper Dingo Swamp is not expected to change due to extraction of 918 Panel.

Table 3-4: Example Surface Water Quality – 2024 to 2025

Parameter	Units	LDP002	Wollangambe Downstream	Bungleboori Creek Upstream	Bungleboori Creek Downstream	Bungleboori North #2	Upper Dingo Swamp
Date		*25/03/2025*	*24/06/2025*	*27/06/2025*	*27/06/2025*	*13/11/2024*	*13/06/2025*
Physiochemical							
pH		8.8	7.2	4.5	4.2	5.5	5.2
EC	µS/cm	333	323	40	32	67	35
DO	mg/L	7.2	8.0	12.4	10.4	4.1	9.3
TSS	mg/L	<5	<5	<5	<5	367	n/a
TDS	mg/L	220	208	n/a	n/a	n/a	n/a
Major Ions							
Chloride	mg/L	20	20	n/a	n/a	n/a	n/a
Sulfate as SO4	mg/L	93	64	n/a	n/a	n/a	n/a
Nutrients							
Fluoride	mg/L	<0.1	<0.1	n/a	n/a	n/a	n/a
Total Nitrogen as N	mg/L	0.1	0.7	n/a	n/a	n/a	n/a
Total Phosphorus as P	mg/L	0.01	<0.01	n/a	n/a	n/a	n/a
Dissolved Metals							
Arsenic	mg/L	<0.001	<0.001	n/a	n/a	n/a	n/a
Boron	mg/L	<0.05	<0.05	n/a	n/a	n/a	n/a
Cadmium	mg/L	<0.0001	<0.0001	n/a	n/a	n/a	n/a
Chromium	mg/L	<0.001	<0.001	n/a	n/a	n/a	n/a
Cobalt	mg/L	0.001	0.007	n/a	n/a	n/a	n/a
Copper	mg/L	<0.001	<0.001	n/a	n/a	n/a	n/a
Iron	mg/L	<0.05	<0.05	n/a	n/a	n/a	n/a
Lead	mg/L	<0.001	<0.001	n/a	n/a	n/a	n/a
Lithium	mg/L	0.017	0.016	n/a	n/a	n/a	n/a
Manganese	mg/L	0.018	0.110	n/a	n/a	n/a	n/a
Mercury	mg/L	<0.0001	<0.00004	n/a	n/a	n/a	n/a
Nickel	mg/L	0.004	0.02	n/a	n/a	n/a	n/a
Silver	mg/L	<0.001	<0.001	n/a	n/a	n/a	n/a
Zinc	mg/L	<0.005	0.022	n/a	n/a	n/a	n/a

3.7 Soils

3.7.1 Soil Landscape Units

Soils on the Newnes Plateau influence runoff generation, infiltration, erosion potential and the hydrologic behaviour of upland swamps and drainage lines.

The distribution of soil landscape units in the vicinity of Clarence Colliery was obtained from the NSW Office of Environment and Heritage (NSW OEH) eSPADE database, and is presented in **Figure 3.4**. These units were mapped and reported in the 1:100,000 Scale Soil Landscape Series: 8931 WALLERWANG prepared by the NSW DCCEEW (1993).

The landscape units presented in **Figure 3.4**, are summarised in **Table 3-5**.

From **Figure 3.4** and **Table 3-5**, SubPanel 918A and 918B2 are primarily located beneath the WOLLANGAMBE soil landscape unit (rounded convex crests and moderately to steeply inclined sideslopes on Narrabeen Group sandstones).

From **Figure 3.4** and **Table 3-5**, SubPanel 918B1 is primarily located beneath the WARRAGAMBA soil landscape unit (narrow convex crests and ridges and steep colluvial sideslopes on Narrabeen Group sandstones with minor cliffs and scarps on steeper slopes).

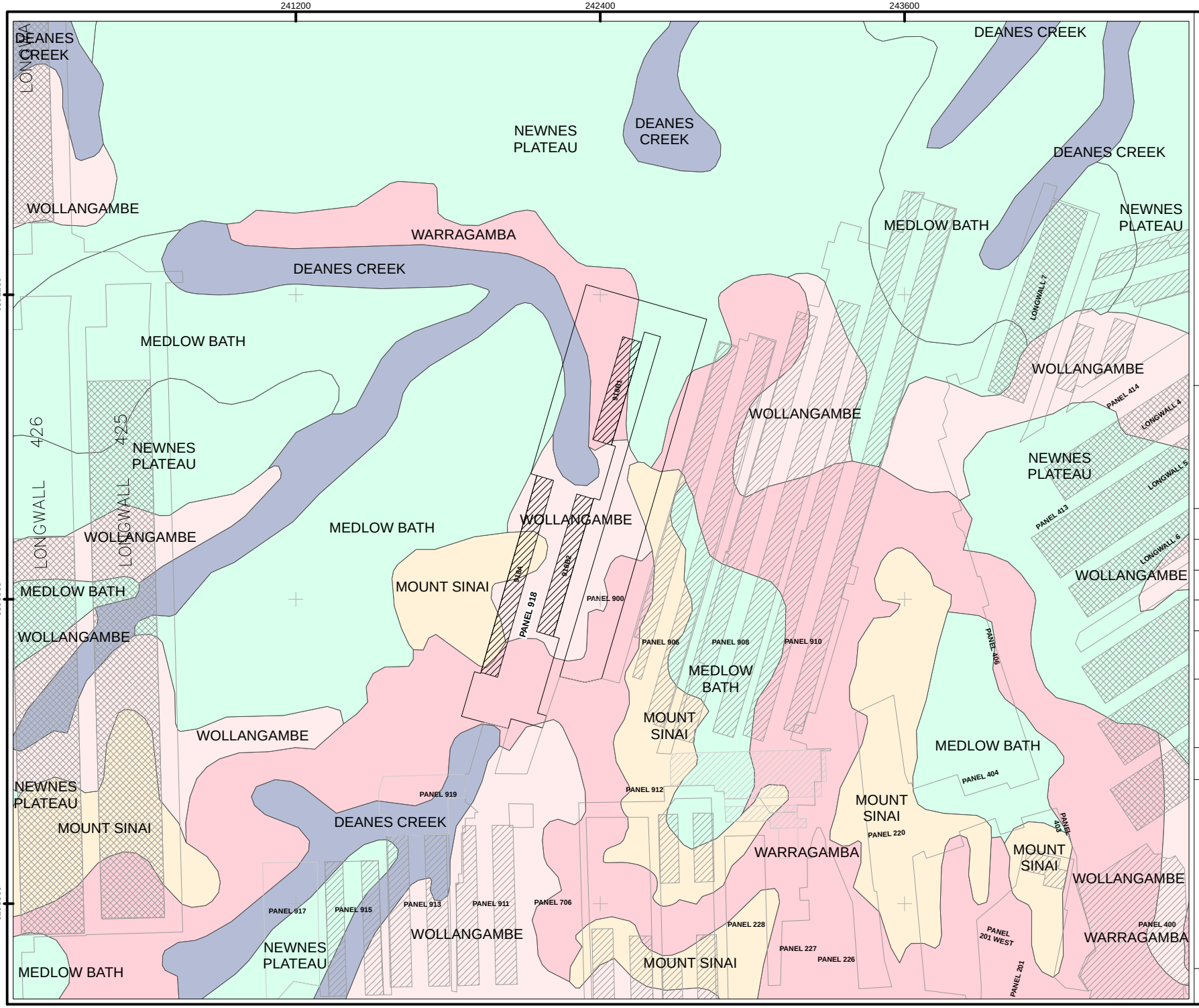
From **Figure 3.4** and **Table 3-5**, the Extraction Plan for 918 Panel is such that the DEANES CREEK soil landscape unit (narrow gently inclined elongated swamps along drainage lines on Narrabeen Group Sandstones on the Newnes Plateau), is not directly undermined.

From **Figure 3.4** and **Table 3-5**, there are a variety of soil landscape units located above the development extent for 918 Panel, including NEWNES PLATEAU, DEANES CREEK, MOUNT SINAI and MEDLOW BATH.

The erosion hazard for each landscape unit is also provided in NSW DCCEEW (1993) and is presented in summary, in **Table 3-6**.

From **Table 3-6**, the erosion potential of concentrated flows is moderate to high for MEDLOW BATH, high to extreme for WOLLANGAMBE, slight to moderate for DEANES CREEK, slight to moderate for NEWNES PLATEAU, high to extreme for MOUNT SINAI, and very high to extreme for WARRAGAMBA.

Implementation of the Extraction Plan for 918 Panel does not involve grazing, cultivation or clearing (urban) of the soil landscape. PPPE (Mining Method 3) is a low-subsidence method, being less than 100mm, by design.



Legend:

Mining Methods:
- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:
- Approved
- Existing
- Proposed
- Other Proposed

Soild Landscape Process:
- COLLUVIAL
- EROSIONAL
- RESIDUAL
- SWAMP
- VESTIGIAL

JBS&G

Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevA | Date: 28-Nov-2025

Drawn By: DAW | Checked By: JRWB

Scale 1:20,000

0 400 800

Meters

Coor. Sys. GDA 1994 MGA Zone 56

Soil Landscape Units

FIGURE: 3.4

File Name: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\GIS\Maps\68229_R02RevA_D008_SoilLandscapeUnits.mxd
Reference: Soil Landscape Units from eSPADE, NSW OEH, 2018 (based on NSW DCCEEW (1993)).

Table 3-5: Soil Landscape Units in the vicinity of the Extraction Plan

Code	Landscape Name	Description	Location	Soil Landscape Process
8931mb	MEDLOW BATH	*"narrow crests and moderately inclined sideslopes on Narrabeen Group sandstone. Local relief to 20 – 50m. Slopes 10 – 20%. Elevation generally >850m. Localised rock outcrop. Partially cleared open-forest and open-woodland.* [Page 30, NSW DCCEEW (1993)]	Immediately west of 918 Panel	Residual
8931wo	WOLLANGAMBE	*"rounded convex crests and moderately to steeply inclined sideslopes on Narrabeen Group sandstones. Local relief to 100 m. Slopes usually <35%. Elevation mostly >600 m. Localised rock outcrop is common including broken scarps and small rock ledges and cliffs (<25 m). Largely uncleared open-woodland and openforest."* [Page 95, NSW DCCEEW (1993)]	Above 918 Panel	Erosional
8931dc	DEANES CREEK	*"narrow gently inclined elongated swamps along drainage lines on Narrabeen Group Sandstones on the Newnes Plateau. Local relief to 30 m, slopes 0 – 5%, elevation mostly >1000 m. Uncleared closed-heath and closed-sedgeland with open-woodland on swamp margins"* [Page 110, NSW DCCEEW (1993)]	Above 918 Panel	Swamp
8931np	NEWNES PLATEAU	*"level to gently undulating wide crests and ridges on plateau surfaces of Triassic Grose Sandstone. Local relief to 20 m. Slopes <10%. Elevation generally >1 000 m. Infrequent rock outcrop. Partially cleared low open forest and woodland and pine plantations."* [Page 35, NSW DCCEEW (1993)]	Immediately north of 918 Panel	Residual
8931ms	MOUNT SINAI	*"narrow, rocky undulating crests and steep sideslopes with many rocky benches and pagoda rock formations on Narrabeen Group sandstones. Local relief to 130 m, slopes generally >30%, elevation approx. 900 – 1 180 m. Abundant rock outcrop. Open-heath with some open-woodland in protected valleys."* [Page 49, NSW DCCEEW (1993)]	Immediately west and east of 918 Panel	Vestigial
8931wb	WARRAGAMBA	*"narrow convex crests and ridges and steep colluvial sideslopes on Narrabeen Group sandstones with minor cliffs and scarps on steeper slopes. Local relief 80 – 130 m, slopes >35%, elevation mostly <700 m. Uncleared tall open-forest."* [Page 69, NSW DCCEEW (1993)]	Above 918 Panel	Colluvial

Table 3-6: Soil Erosion Hazard of Landscape Units in the vicinity of the Extraction Plan

Landscape Unit	Location	Existing Erosion	Soil Erosion Hazard	
			Non-Concentrated Flows	Concentrated Flows
MEDLOW BATH	Immediately west of 918 Panel	*"Moderate track and sheet erosion. Soils are susceptible to erosion when ground cover is disturbed."* [Page 31 of NSW DCCEEW (1993)]	grazing – moderate cultivation – moderate urban – moderate	grazing – moderate cultivation – mod-high urban – mod-high
WOLLANGAMBE	Above 918 Panel	*"Moderate sheet erosion is evident over most of this landscape. The landscape is particularly susceptible to sheet erosion following bushfire or clearing. Severe rill erosion and sheet erosion are commonplace along poorly designed access tracks."* [Page 95 of NSW DCCEEW (1993)]	grazing – high cultivation – extreme urban – high	grazing – extreme cultivation – extreme urban – extreme
DEANES CREEK	Above 918 Panel	*"Dense sedge and swamp vegetation largely restricts erosion and promotes the retention of any sediments delivered to the swamp from adjacent hillslopes. Minor sheet erosion occurs on the less protected swamp margins."* [Page 111 of NSW DCCEEW (1993)]	grazing – slight cultivation – moderate urban – slight	grazing – slight cultivation – moderate urban – slight
NEWNES PLATEAU	Immediately north of 918 Panel	"*Minor sheet erosion and track erosion are present. The landscape is particularly susceptible to erosion following bushfire or logging.*" [Page 36 of NSW DCCEEW (1993)]	grazing – slight cultivation – moderate urban – slight	grazing – slight cultivation – moderate urban – moderate
MOUNT SINAI	Immediately west and east of 918 Panel	"*Moderate to severe sheet erosion often occurs particularly following bushfires. Owing to the exposed nature of this landscape and shallow, frequently dry soils, it is also highly susceptible to wind erosion when the ground cover is disturbed."* [Page 50 of NSW DCCEEW (1993)]	grazing – high cultivation – extreme urban – extreme	grazing – high cultivation – extreme urban – extreme
WARRAGAMBA	Above 918 Panel	*"Moderate sheet erosion on steep hillslopes. Landslip and rock fall are widespread and evident on steep slopes with wet, unstable and disturbed soils."* [Page 69 of NSW DCCEEW (1993)]	grazing – very high cultivation – extreme urban – extreme	grazing – very high cultivation – extreme urban – extreme

3.8 Ecology

3.8.1 Temperate Highland Peat Swamps on Sandstone

THPSS comprising Newnes Plateau Shrub Swamps (Mapping Unit MU50, NSW DCCEEW (2006)) and Hanging Swamps (Mapping Unit MU51, NSW DCCEEW (2006)) listed under the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth) as Endangered Ecological Communities (EECs) reside on the Newnes Plateau located above and in the vicinity of Clarence Colliery. The Newnes Plateau shrub swamps are also listed as an EEC under the *Biodiversity Conservation Act* 2016 (NSW). There are MU50 – Newnes Plateau Shrub Swamps mapped in the vicinity of 918 Panel, including Pine Swamp, Lower Nine Mile Swamp and Paddys Creek Swamp.

3.9 Geomorphology

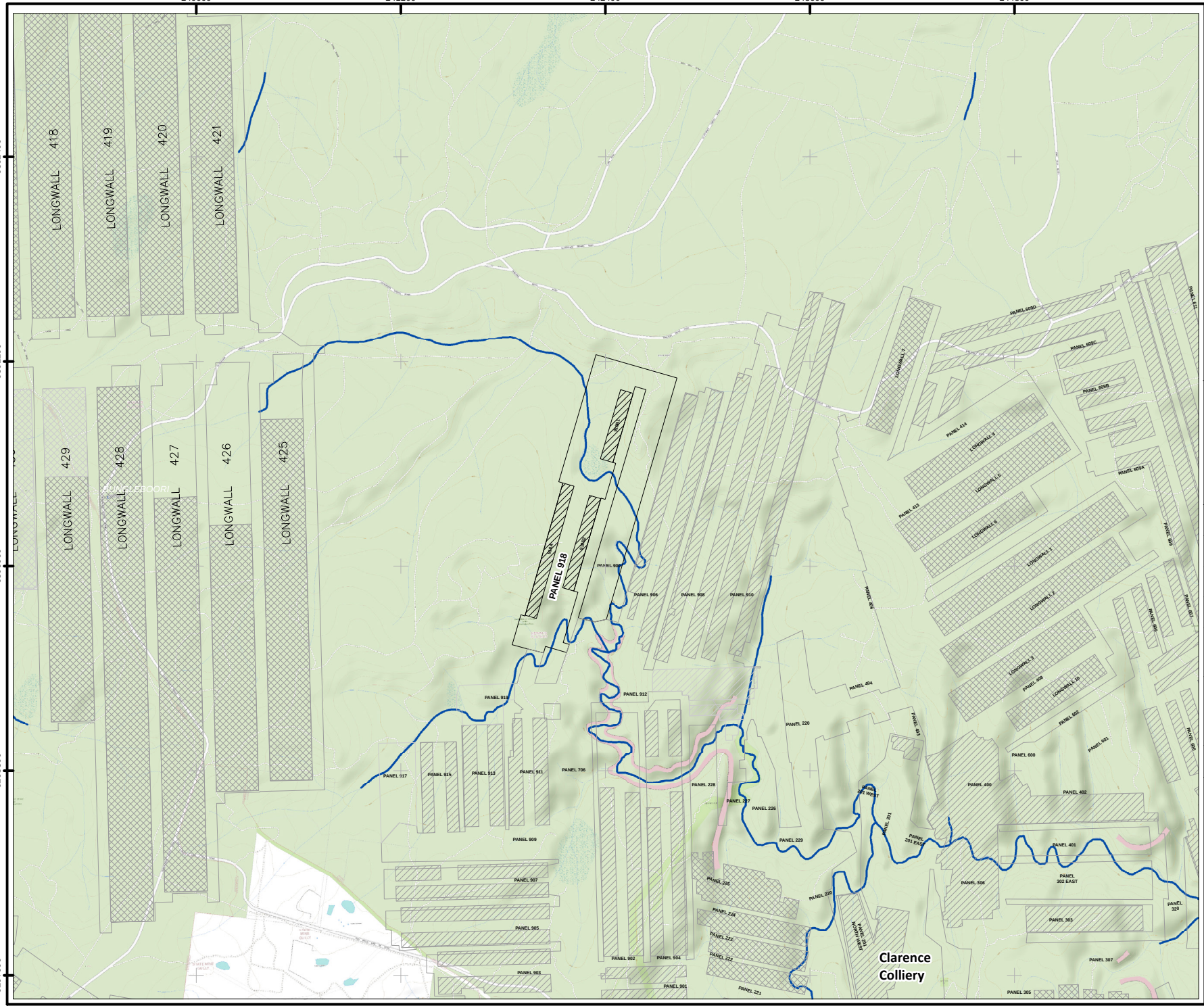
The River Styles Framework (developed at Macquarie University) is a method of classifying the river geomorphology. **Figure 3.5** details the geomorphic stream condition for the Bungleboori Creek catchment and **Figure 3.6** details the potential for recovery from current conditions.

Figure 3.7 presents the Strahler Order provided by the Water NSW map service.

Located between SubPanel 918B1 and SubPanel 918B2 is the Bungleboori Creek, with a river style described as “laterally unconfined, discontinuous channel, valley fill and sand”. The geomorphic stream condition is described as good and the recovery potential is described as intact. The Strahler Order of Bungleboori Creek above 918 Panel is 3, prior to the downstream confluence with Paddys Creek, where the Strahler Order of Bungleboori Creek increases to 4.

Located south of Panel 918 is Paddys Creek which flows into Bungleboori Creek. Paddys Creek has a river style described as laterally unconfined, discontinuous channel, valley fill and sand. The geomorphic stream condition is described as good and the recovery potential is described as intact.

An assessment of the impact of subsidence-related change to geomorphology is presented in GHD (2026).



Legend:

Mining Methods:
- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:
- Approved
- Existing
- Proposed
- Other Proposed

Geomorphic Stream Condition:
- Good
- Moderate
- Poor
- Not assessed

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Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevA	Date: 08-Dec-2025
Drawn By: DAW	Checked By: JRWB

Scale 1:30,000

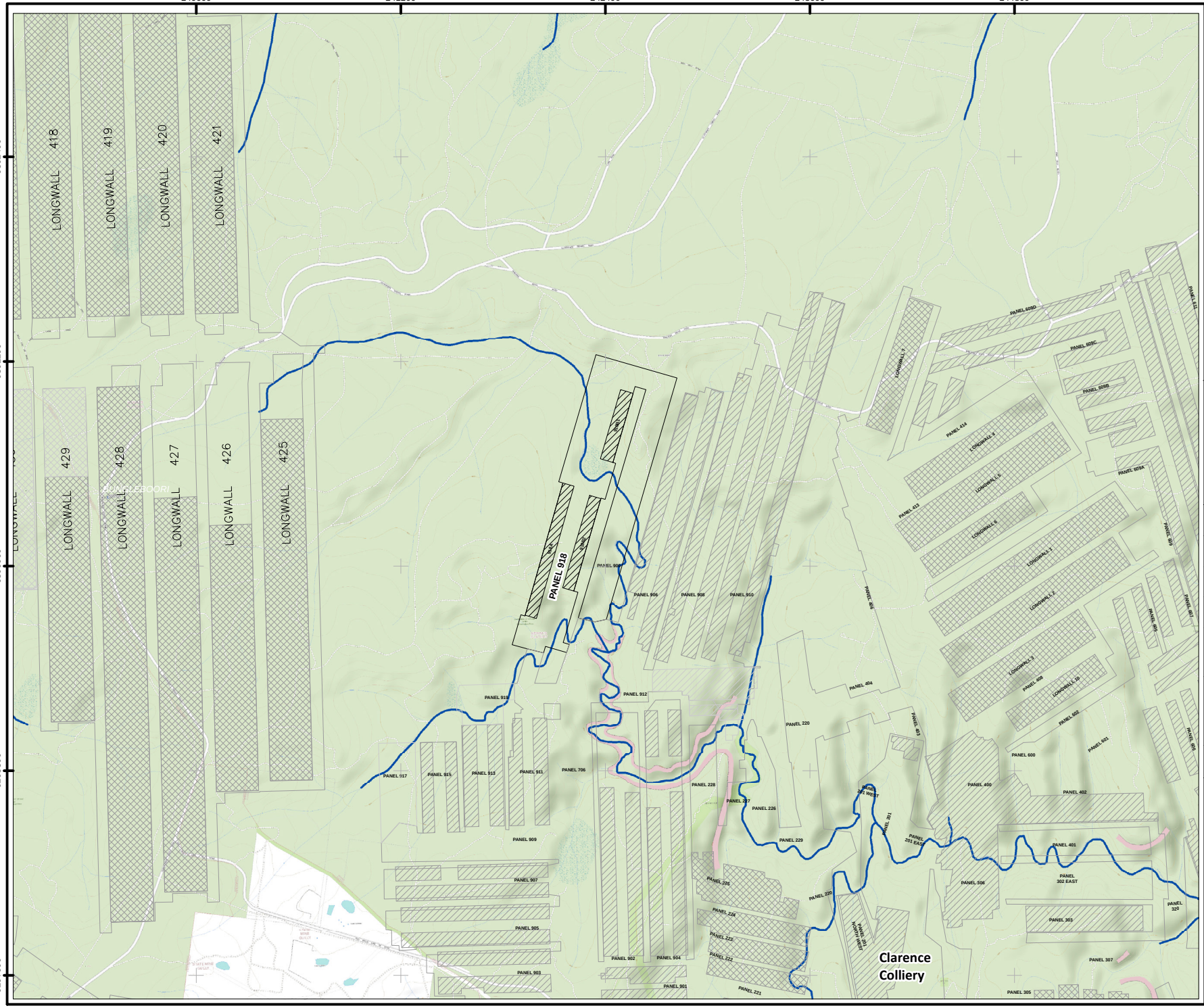
0 0.5 1
Kilometers

Coor. Sys. GDA 1994 MGA Zone 56

River Styles:
Geomorphic Stream Condition

FIGURE: 3.5

File Name: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\GIS\Maps\68229_R02RevA_D009_RiverStyles.mxd
Reference: NSW River Styles provided by NSW DCCEEW (2023).



Legend:

Mining Methods:
- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:
- Approved
- Existing
- Proposed
- Other Proposed

Recovery Potential:
- Intact
- High recovery potential
- Moderate recovery potential
- Low recovery potential
- Previously strategic - To be assessed
- Not assessed

JBS&G

Job No: 68229	
Client: Clarence Colliery Pty Ltd	
Version: R02RevA	Date: 08-Dec-2025
Drawn By: DAW	Checked By: JRWB

Scale 1:30,000

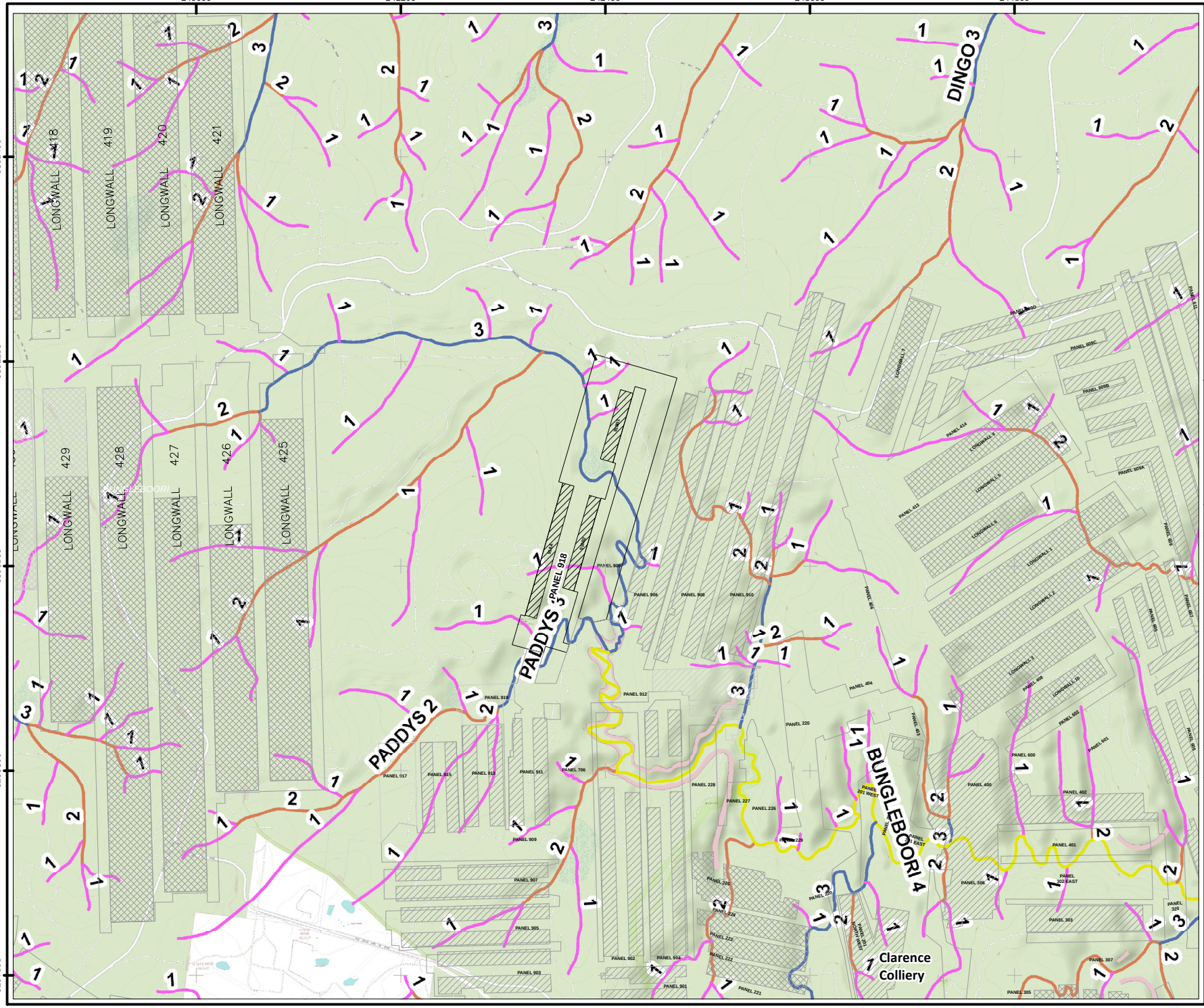
0 0.5 1
Kilometers

Coor. Sys. GDA 1994 MGA Zone 56

River Styles:
Potential to recover from current conditions

FIGURE: 3.6

File Name: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\GIS\Maps\68229_R02RevA_D010_RiverStyles_Recovery.mxd
Reference: NSW River Styles provided by NSW DCCEEW (2023).



Legend:

Mining Methods:
- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:
- Approved
- Existing
- Proposed
- Other Proposed

Strahler Order:
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

JBS&G

Job No: 68229	
Client: Clarence Colliery Pty Ltd	
Version: R02RevA	Date: 08-Dec-2025
Drawn By: DAW	Checked By: JRWB

Scale 1:30,000

0 0.5 1
Kilometers

Coor. Sys. GDA 1994 MGA Zone 56

River Styles:
Strahler Order

FIGURE: 3.7

File Name: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\GIS\Maps\68229_R02RevA_D011_Strahler.mxd
Reference: WaterNSW Strahler Order provided by Water NSW, downloaded on 28/11/2025.

3.10 Conceptual Model

The conceptual model for surface water in the vicinity of 918 Panel is as follows:

- Rainfall is received to ground surface on the Newnes Plateau, above Clarence's mine workings, and either becomes surface water runoff or percolates vertically downward into the groundwater system
- Groundwater contribution to surface water occurs directly to watercourses and via seepage faces
- Surface water flow behaviour often shifts depending on seasonality, with wet and dry periods occurring
- THPSS shrub and hanging swamps, including Lower Nine Mile Swamp, Pine Swamp and Paddys Creek Swamp, retain moisture from rainfall/runoff processes, as well as receive groundwater contribution to surface water
- At THPSS shrub and hanging swamps, surface and baseflow 'stores' decrease during dry periods
- Groundwater contribution to surface water is complex, where:
    - changes to the values of hydraulic properties due to subsidence-induced changes can lead to an increase in seepage flux
    - local and regional depressurisation of groundwater elevation can lower the elevation of the uppermost water table and reduce groundwater contribution to surface water
    - disruption to ground surface, upon extraction, can lead to relative higher recharge (described as 'enhanced recharge' in JBS&G (2026))
    - the magnitude of these changes are dependent on the magnitude of disruption to the hydrogeological environment, with high-subsidence mining methods, such as Total Extraction and Longwall (JBS&G, 2026), being much more significant than low-subsidence mining methods such as PPPE, which is proposed to be used for 918 Panel.
- Changes to 'Catchment Surface' due to extraction
    - changes include increase in soil storage capacity, increase diversion of rainfall excess to baseflow store, losses from soil storage, baseflow store and surface runoff store
    - these changes reduce over time, but retain a small, permanent change to represent long term effects
    - change to 'Catchment Surface' is consistent with observed changes to swamp water level and streamflow at significant distance from location of current mining activity (extraction), and is consistent with correlation of current mining activity (extraction) and the presence of geological lineaments, as THPSS reside on watercourses which coincide with the location of lineaments
    - change to 'Catchment Surface' is also consistent with observed change to hydrologic regime from steady continuous streamflow to sporadic streamflow, in some locations
    - again, the magnitude of these changes are dependent on the magnitude of disruption to the hydrogeological environment, with high-subsidence mining methods, such as Total Extraction and Longwall (JBS&G, 2026), being much more significant than low-subsidence mining methods such as PPPE, which is proposed to be used for 918 Panel.
- Salinity (EC) is naturally low, dominated by rainfall, with relatively higher salinity (although still low) occurring following prolonged dry periods. Groundwater contribution to surface water is important and groundwater quality is fresh.

3.11 Impact Pathway Diagram

In accordance with CTH IESC (2024), the ecohydrological model summaries the pathway of change to potential impact, in this case on TPHSS, which are groundwater dependent ecosystems, by definition.

The magnitude of changes are dependent on the magnitude of disruption to the surface water environment, with high-subsidence mining methods, such as Total Extraction and Longwall (JBS&G, 2026), being much more significant than low-subsidence mining methods such as PPPE, which is proposed to be used for 918 Panel.

Figure XX presents the distribution of categories of magnitude of change to surface water in the Swamp Water Balance Model described further below.

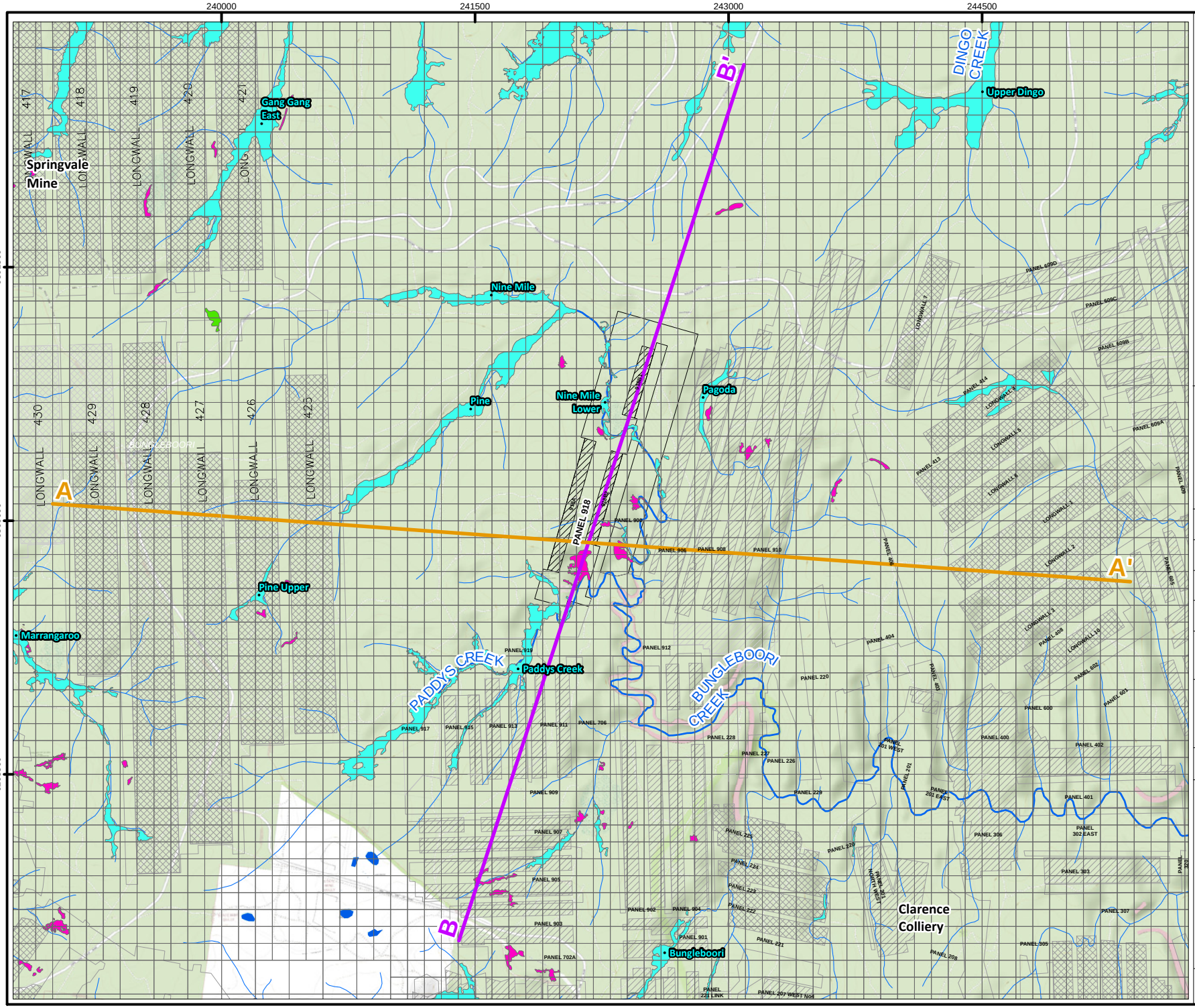
Relevant changes are:

- subsidence-induced disturbance near ground surface (limited), that may change near surface groundwater quality due to increased groundwater/rock interaction
    - negligible due to being a low subsidence mining method.
- decline in elevation of uppermost water table along watercourses in which THPSS (shrub) exist
    - negligible within THPSS.
- increase in groundwater contribution to surface water through seepage faces, due to dilation of horizontal piles under topographic ridgelines
    - negligible due to use of a low subsidence mining method for 918 Panel.
- reduction in groundwater contribution to surface water along watercourses, due to changes to groundwater elevation of perched and shallow groundwater system
    - negligible.
- increase in tortuosity of flowpath of runoff from seepage faces to THPSS
    - negligible due to use of a low subsidence mining method for 918 Panel.

The location of two cross-sections used to present the Impact Pathway Diagrams for 918 Panel is presented in **Figure 3.8**. The Impact Pathway Diagrams are presented in **Figure 3.9**.

From **Figure 3.9**, the impact pathway pertains to:

- changes to swamp water level
    - negligible within THPSS.
- changes to groundwater contribution to surface water.
    - negligible.



Legend:

Modelling:
- Cross Section A
- Cross Section B
- Model Grid (Groundwater)

Mining Methods:
- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:
- Approved
- Existing
- Proposed
- Other Proposed

Swamps by MU Name (Clarence, 2025bc):
- 50 Newnes Plateau Shrub Swamp (EEC)
- 51 Newnes Plateau Hanging Swamp (EEC)
- 52 Newnes Plateau Rush - Sedge - Snow Gum Hollow Wooded Heath (EEC)

Hydrology:
- Watercourse
- Waterbody

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Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R01RevA	Date: 03-Nov-2025
Drawn By: DAW	Checked By: JRWB

Scale 1:30,000

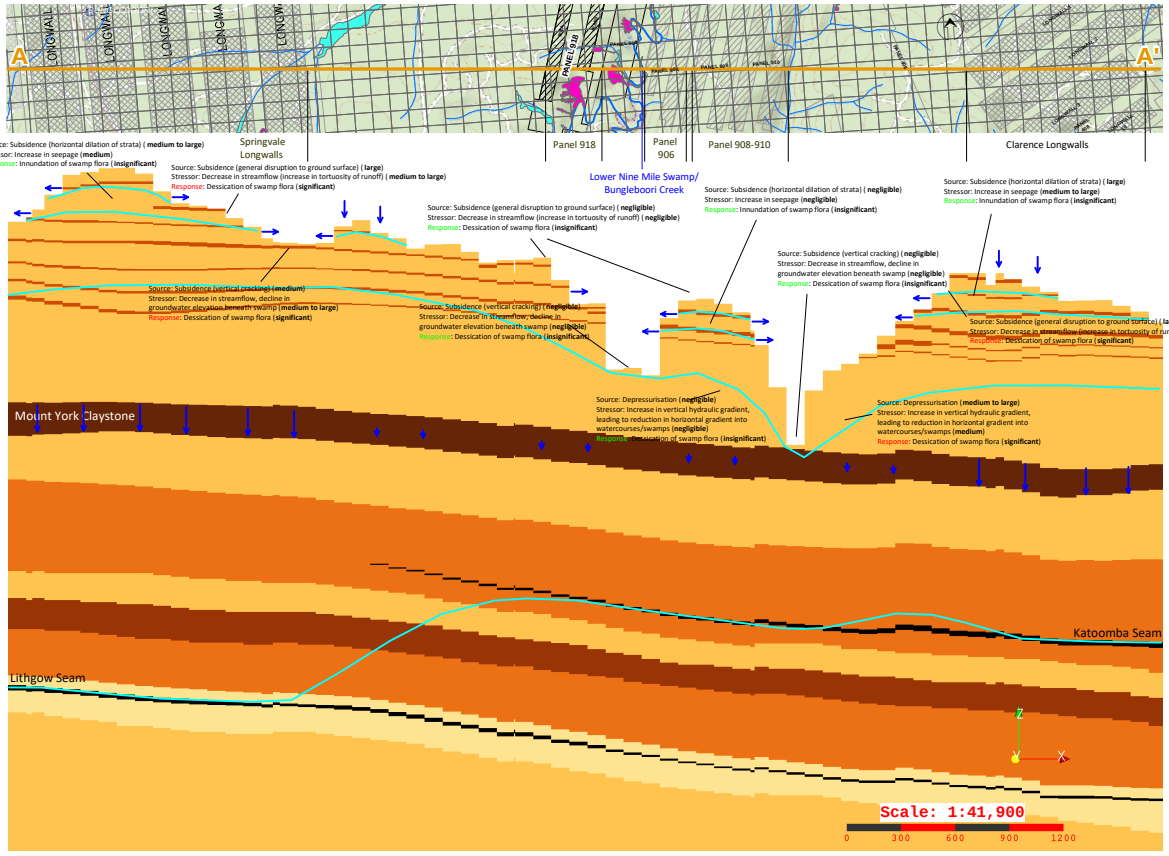
0 0.5 1
Kilometers

Coor. Sys. GDA 1994 MGA Zone 56

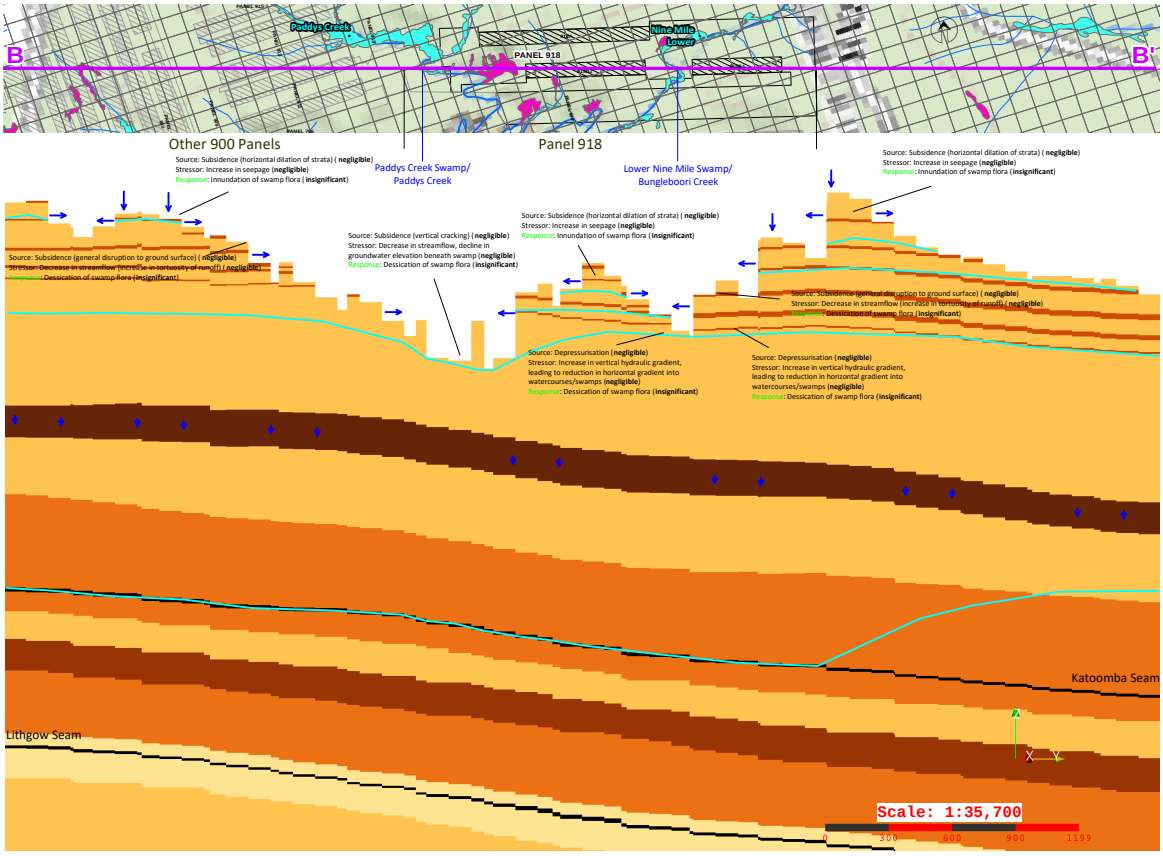
Location of Cross-Sections

FIGURE: 3.8

File Name: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\GIS\Maps\68229_R01RevA_D021_ModelGrid_Transect.mxd



Section A - A' (End of Mining):



Section B-B' (End of Mining):

Legend

Hydrogeological Interpretation:

- Water Flow
- Water Table

Geological Units:

- Sandstone (Regolith at Ground Surface)
- Shale (Regolith at Ground Surface)
- Claystone/Shale
- Siltstone
- Coal
- Mudstone
- Conglomerate
- Cryst'ne_W'd-F'd

Job No.: 68229		Impact Pathway Diagram (Section A - A' and B - B')	
Client: Clarence Colliery Pty Ltd			
Version: R01RevD	Date: 12/02/2026		
Drawn By: JRWB	Checked By: JRWB	**Figure 3.9**	JBS&G

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EPI\Figures\Grapher\68229_R01RevD_D002_IPD\68229_R01RevD_D002_IPD.grf

Reference: 68229_R01RevA_APR_03c

4. Hydrological Analysis

4.1 Site Water and Salt Balance

JBS&G understands that Site Water and Salt Balance has been developed by others to quantify water transfers within Clarence Colliery and with respect to discharge via LDP002 under EPL726.

As presented in the Groundwater Assessment (JBS&G, 2026), the modelled change in mine dewatering rate is an increase to 0.9ML/d, for 6 months, at peak, then declines to an increase of 0.5ML/d in the next 12 months and then declines further towards an increase of 0.2ML/d.

As there is negligible change to mine dewatering rate due to implementation of the Extraction Plan for 918 Panel, there will be an insignificant effect on the Site Water and Salt Balance.

4.2 Erosion and Sediment Control

Implementation of the Extraction Plan for 918 Panel is a continuation of current, consented activity at Clarence Colliery. There will be no change to the configuration of erosion and sediment control infrastructure due to development and extraction of 918 Panel.

Accordingly, there will be an insignificant impact on Erosion and Sediment Control due to the Extraction Plan.

4.3 Regional Surface Water Flow and Quality Modelling

This chapter presents the model objectives, model setup, model calibration and model results incorporating predictive uncertainty. It is noted that the Regional Surface Water Flow and Quality Modelling used in this assessment refers to the Swamp Water Balance Model (JBS&G, 2021, 2025).

4.3.1 Model History

The Swamp Water Balance Model is based on the Australian Water Balance Model (AWBM) (Boughton, 2010) and commenced development in 2016 (Jacobs, 2016), in response to requirements of the Development Consent for the Springvale Mine Extension Project (SSD 5594). That study also confirmed that there are large losses between groundwater emanating from seepage faces in the valleys surrounding THPSS. This was expected.

The Swamp Water Balance Model was upgraded in 2021 (JBS&G, 2021), to incorporate new surface water processes, namely time-series changes (losses) to the AWBM storages. The increase in tortuosity of flowpath of groundwater emanating from seepage faces was also subject to time-series changes (additional losses).

The Swamp Water Balance Model was again upgraded in 2025 (JBS&G, 2025), to allow external modification of input values through use of the External element in GoldSIM, reducing the complexity of future updates of the model. Other changes made in JBS&G (2025), included improved translation of output from the numerical groundwater model, to allow different adjustment factors (loss rates) to be applied to different boundary conditions (seepage faces, ephemeral watercourses, surface overland flow and rivers (minor)).

The current version of the Swamp Water Balance Model, used in this report, uses the same methodology as that developed in JBS&G (2025); however, has been upgraded to include better representation of time-series changes (losses) with a recession constant rather than a pre-defined unit loss factor. A recession constant applied to the storages (three surface storages, intra-bank storage and runoff storage) amends an issue where low-flows would lead to storage instantly reducing to zero. Additionally, the time-series change categories that are assigned on a subcatchment-by-subcatchment basis, now reflect not only the areal extent of extraction, but also subsidence informed by the width to height ratio.

4.3.2 Model Objectives

The objectives of the Swamp Water Balance Model were as follows (as per JBS&G, 2021, 2025):

- prepare water balance for swamp areas which account for daily time-series change to climatic inputs
- incorporate groundwater contribution derived from the numerical groundwater model to resolve the disparity between surface water-only and groundwater-only model approaches
- consider time-series change (losses) to the AWBM storages as well as other parameters.

Groundwater contribution to surface water (stochastic output) was obtained from the Groundwater Assessment prepared for the Extraction Plan for 918 Panel (JBS&G, 2026) and used as input to the Swamp Water Balance Model.

4.3.3 Model Approach and Code

The Swamp Water Balance Model was prepared in GoldSIM (GTG, 2018), Version 12.1.3, and is based on the AWBM (Boughton, 2010).

Each subcatchment in the Swamp Water Balance Model is represented as a separate container and receives relevant climate input, with parameterisation of the AWBM dependent on land-use.

Land-use types include:

- Channel
- Disturbed
- Natural
- Pasture
- Urban
- Wilderness.

Figure 4.1 presents the layout of the subcatchments in the Swamp Water Balance Model (after JBS&G, 2021).

From **Figure 4.1**, there are three regions:

- Western Region
- Southeast Region
- Northeast Region.

Of the relevant to this report in the Southeast Region, which drains in a generally an easterly direction, along the Bungleboori Creek and Wollangambe River.

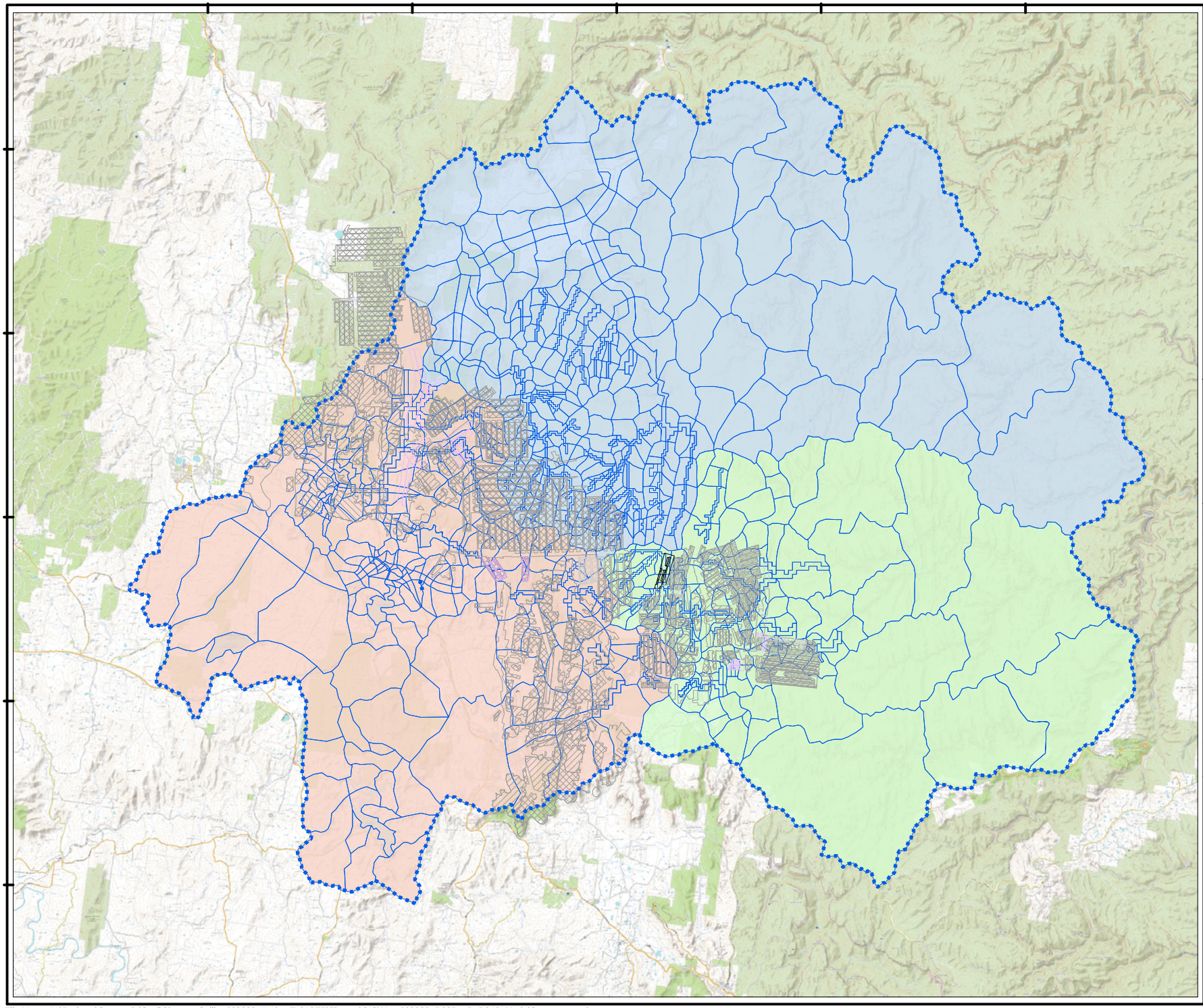
As noted in **Section 4.3.1**, time-series change (losses) to the AWBM storages as well as groundwater contribution to surface water were incorporated into the model.

4.3.3.1 Changes to Structure of the AWBM

Figure 4.2 presents the layout of the AWBM, together with the relevant changes to the structure of the AWBM (after JBS&G, 2021).

The changes implemented in the AWBM compromise:

- transient change to soil storage capacity
    - increase in soil storage due to effect of subsidence.
- transient loss from soil storage
    - due to enhanced vertically downward hydraulic gradient.
- transient change to the fraction of rainfall excess that is diverted to ‘baseflow’ store (BFI)



Legend:

SAPSWBM Model Boundary

Mining Methods:

- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:

- Approved
- Existing
- Proposed
- Other Proposed

Model Catchments:

- Northeast Region - Wolgan River Catchments
- Southeast Region - Bungleboori River Catchments
- Western Region - Coxs River Catchments

JBS&G

Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevB	Date: 23-Jan-2026
Drawn By: DAW	Checked By: JRWB

Scale 1:250,000

0 5 10

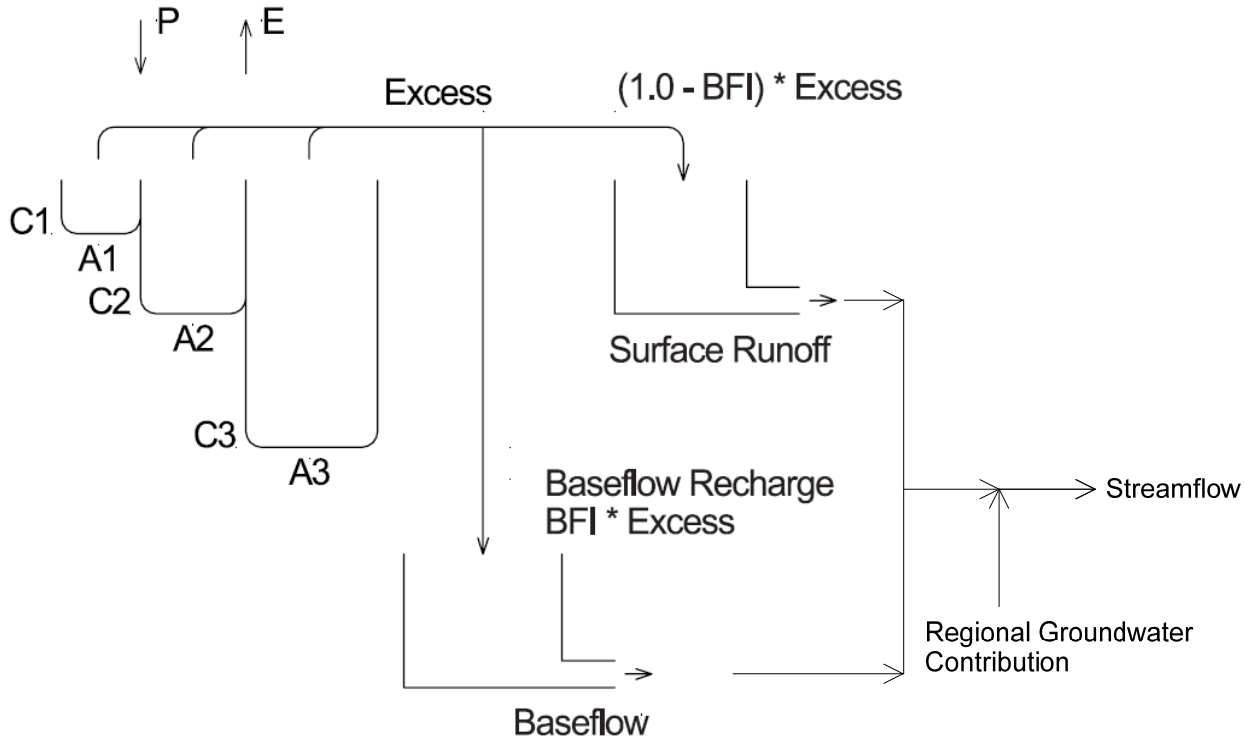
km

Coor. Sys. GDA 1994 MGA Zone 56

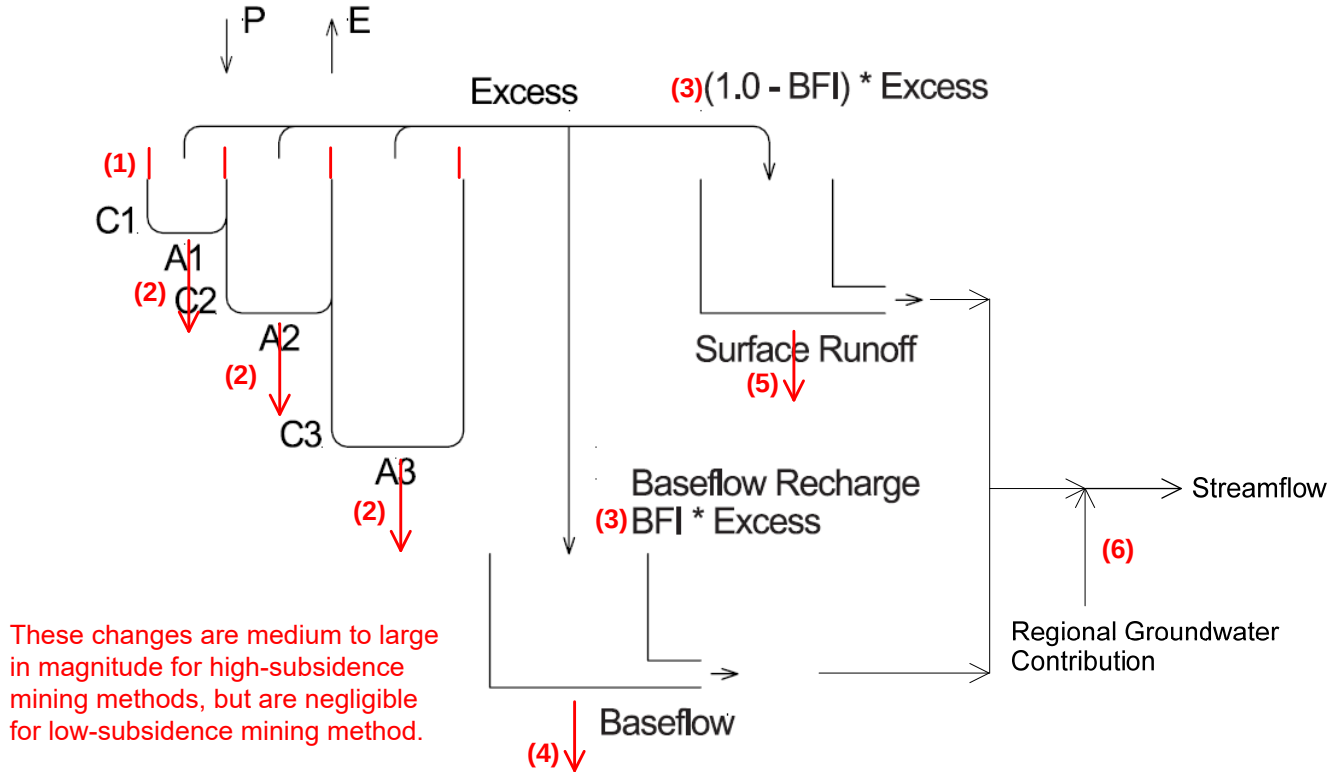
Swamp Water Balance Model Extent

FIGURE: 4.1

File Name: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\GIS\Maps\68229_R02RevB_D019_ModelGeometry.mxd



AWBM Layout - Default:



AWBM Layout: Modified

Legend

Summary of Changes to AWBM Layout:

(1): increase in Soil Storage Capacity (due to surface disturbance)

(2): add loss from Soil Storage (due to enhanced vertical hydraulic gradient near surface)

(3): change to fraction of rainfall excess diverted to baseflow (BFI)

(4): add loss from Baseflow Store (enhanced diversion due to surface cracking)

(5): add loss from Surface Runoff Store (enhanced diversion due to surface cracking)

(6): additional loss (due to increased tortuosity of flowpath).

Job No.: 60679		**Structure of the AWBM**
Client: Springvale Coal Pty Limited		
Version: R01Rev0	Date: 03/08/2021	
Drawn By: SRG	Checked By: JRB	**Figure 4.2**

File Path: n:\Projects\CentennialCoal\SpringvaleMine\60679_6MonthlyUpdateOfGroundwaterModel\Figures\Grapher\60679_R01Rev0_D001_AWBM.grf

Reference: n/a

- ‘baseflow’ being surface water baseflow, namely near surface, short term, storage of rainfall excess (‘excess’ being excess with respect to soil storage capacity)
- due to near surface disturbance leading to diversion of surface runoff ‘below surface’.

- transient loss from ‘baseflow’ store
  - due to near surface disturbance, the ‘baseflow’ store loses additional water over time
- transient loss from ‘surface recession’ store.
  - this is a minor store in the AWBM
  - again, due to near-surface disturbance, additional loss from the store over time.

The time-series changes to AWBM were implemented in a categorical manner.

For 918 Panel, the time-series changes are negligible throughout, due to the adoption of a low-subsidence mining method, by design.

The approach to time-series changes to AWBM has been updated, since JBS&G (2025), to reflect both the areal extent of extraction and subsidence, informed by the width to height ratio of extraction (refer **Section 4.3.1**). The update was implemented by assigning categories on a subcatchment-by-subcatchment basis, informed by the look-up table presented in **Table 4-1**. The effect of the change did not lead to a significant difference in model outcomes compared to JBS&G (2025), but reduced the potential for a transcription error in model input.

Table 4-1: Transient Change Categories in the Swamp Water Balance Model – Areal Extent

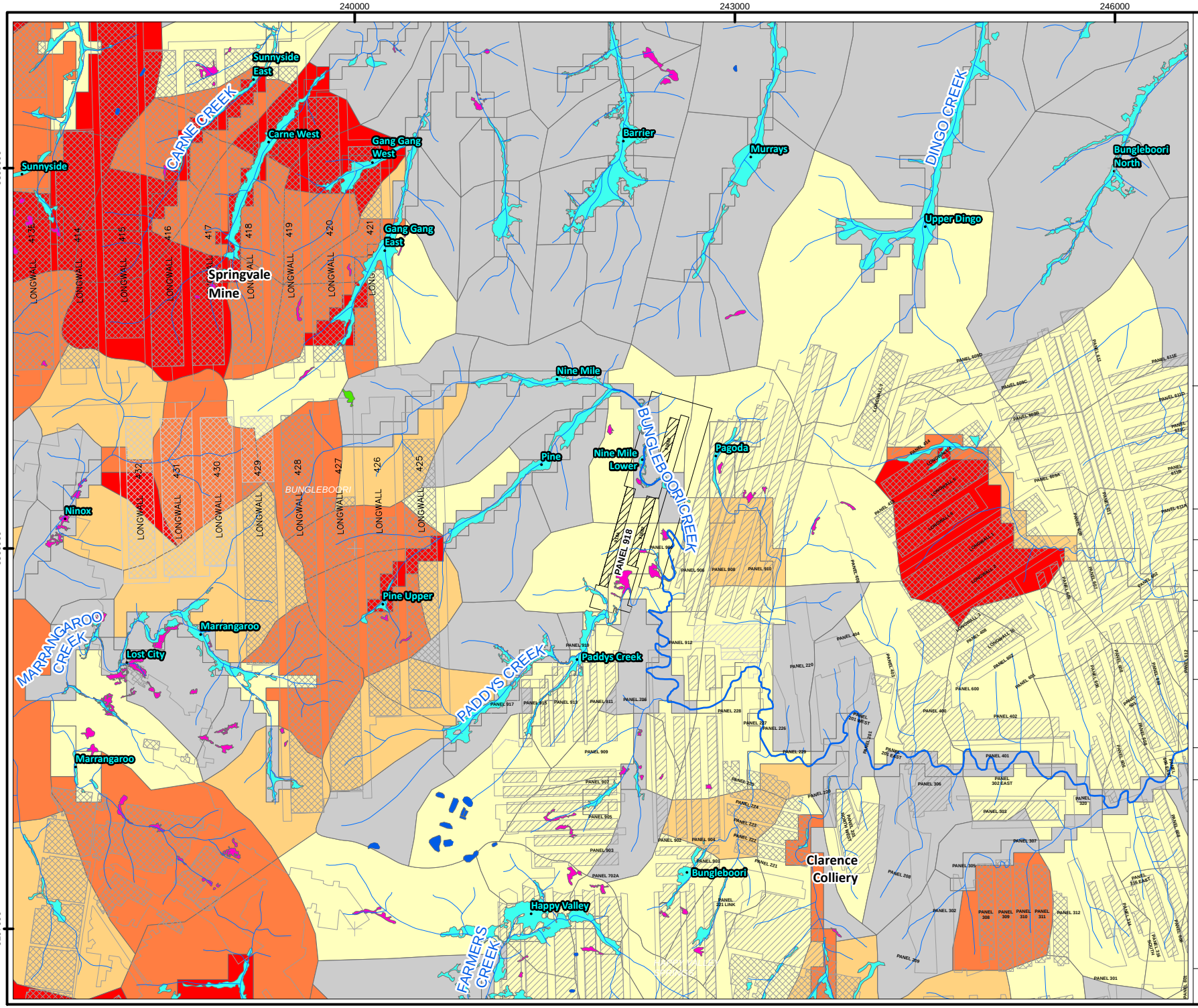
		Width to Height Ratio		
		<40%	**40 to 70%**	**>70%**
Proportion of Area of Subcatchment Affected	**No Change**	Null	Null	Null
	>10%	Null	Null	Negligible
	10 to 30%	Negligible	Negligible	Small
	30 to 60%	Negligible	Small	Medium
	>60%	Small	Medium	Large

Figure 4.3 presents the distribution of transient change categories in the vicinity of 918 Panel.

From **Figure 4.3**, transient change category of subcatchment above 918 Panel, which is a low-subsidence mining method, is negligible. This is consistent with the mine design, namely, to be a low-subsidence mining method.

From **Figure 4.3**, the transient change category of subcatchments overlying high-subsidence mining methods, such as total extraction and longwall mining ming areas, are medium to large (informed by proportion of extraction area within a particular subcatchment, as well as Width to Height Ratio (as per **Table 4-1**)).

The duration of the transient change in the Swamp Water Balance Model is presented in **Table 4-2**.



Legend:

Mining Methods:
- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:
- Approved
- Existing
- Proposed
- Other Proposed

Swamps by MU Name (Clarence, 2025bc):
- 50 Newnes Plateau Shrub Swamp (EEC)
- 51 Newnes Plateau Hanging Swamp (EEC)
- 52 Newnes Plateau Rush - Sedge - Snow Gum Hollow Wooded Heath (EEC)

Hydrology:
- Waterbody
- Watercourse

Transient Change Categories:
- Null
- Negligible
- Small
- Medium
- Large

JBS&G

Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevC	Date: 12-Feb-2026
Drawn By: DAW	Checked By: JRWB

Scale 1:40,000

0 0.5 1
km

Coor. Sys. GDA 1994 MGA Zone 56

Transient Change Categories

FIGURE: 4.3

File Name: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\GIS\Maps\68229_R02RevC_D002a_TransientChangeCategories.mxd

Table 4-2: Duration of Transient Change in the Swamp Water Balance Model

Period	Start Date[1]	End Date[1]	Duration of Change	Magnitude of Change
Pre-Impact	01/01/1994 (start of simulation)	Stress Period of Change from Groundwater Model (SP Start Date)	n/a	No Change
Immediate	SP Start Date	SP Start Date + 24 months (2 years)	24 months (2 years)	Large
Short Term	SP Start Date + 24 months (2 years)	SP Start Date + 60 months (5 years)	36 months (3 years)	Medium
Medium Term	SP Start Date + 60 months (5 years)	SP Start Date + 108 months (9 years)	48 months (4 years)	Small
Residual	SP Start Date + 108 months (9 years)	31/12/2079 (end of simulation)	On-going	Negligible

Notes: 1) SP is Stress Period and pertains to the numerical groundwater model (MODFLOW). It refers to when extraction occurs in the groundwater model. In a particular subcatchment, if there are more than one different extraction SPs, then a representative SP was selected.

The duration of time-series changes in the Swamp Water Balance Model used in this assessment was the same as that adopted in JBS&G (2021, 2025).

4.3.3.2 Groundwater Contribution to Surface Water

Groundwater contribution to surface water was obtained from the numerical groundwater model. From JBS&G (2026), the change to groundwater contribution to surface water was negligible.

As part of this assessment, the contribution from different boundary conditions in the groundwater model were separated, with different adjustment factors applied to each. This is consistent with the approach presented in JBS&G (2025).

The groundwater contribution to surface water boundary conditions in the groundwater model was as follows:

- seepage faces (adjustment factor was 0.2; 80% loss)
- surface overland flow (adjustment factor was 0.6; 40% loss)
- ephemeral watercourses (adjustment factor was 0.8; 20% loss)
- perennial watercourses (adjustment factor was 1.0; 0% loss).

As per the approach presented in JBS&G (2025), there was a time-series change to groundwater contribution, as well as a time-series change (minor) to assumed groundwater salinity. The time-series changes are, however, negligible with respect to the 918 Panel. Furthermore, as presented in JBS&G (2026), the change in groundwater contribution to surface water, due to 918 Panel, is also negligible.

4.3.4 Model Calibration

The Swamp Water Balance Model was calibrated in JBS&G (2021). The calibration has received a minor update in this assessment to account for the new recession parameters outlined in **Section 4.3.4.1**.

4.3.4.1 Calibrated Parameters

As presented in **Section 4.3**, there were multiple land-uses used in the Swamp Water Balance Model.

Table 4-3 presents the calibrated values of the AWBM. These values are the same as those used in JBS&G (2021).

Table 4-3: Calibrated Values of the AWBM

Parameter	Description	Channel	Disturbed	Natural	Pasture	Urban	Wilderness
Cave(mm)[1]	Average surface storage capacity	27	79	168	192	27	192
BFI	Baseflow Index	0.25	0.25	0.25	0.25	0.25	0.25
Kb	Baseflow store recession constant	0.98	0.98	0.98	0.98	0.98	0.98
Ks	Surface store recession constant	0.6	0.3	0.3	0.3	0.6	0.3
BVI	Baseflow Visibility Index	0.98	0.95	0.98	0.98	0.95	0.98

Note 1. The disaggregation of Cave is the default in AWBM, where C1 = 0.075*Cave, C2 = 0.762*Cave and C3 = 1.524*Cave;

Table 4-4 presents the adopted values of water quality (salinity) parameters in the Swamp Water Balance Model. These values are the same as those used in JBS&G (2021).

Table 4-4: Calibrated Values of Water Quality (Salinity)

Parameter	Description	Channel	Disturb'd	Natural	Pasture	Urban	Wild'ess
Western Region:							
Minimum Salinity (mg/L)	Assumed minimum salinity (representing 'flushed' runoff conditions)	190	400	60	120	300	30
Surface Runoff Threshold (mm/d)	Runoff rate below which salinity will start to cumulatively increase	0.001	0.001	0.001	0.001	0.001	0.001
Salinity Multiplier	Factor that previous day's salinity is multiplied by, if surface runoff continues to be below the specified threshold.	1.027	1.040	1.022	1.034	1.037	1.016
Salinity Divider	Factor that previous day's salinity is divided by, if surface runoff exceeds the specified runoff threshold.	0.84	0.91	0.86	0.88	0.93	0.84
Maximum Salinity (mg/L)	Assumed maximum salinity (representing seepage from local groundwater dominating runoff conditions)	500	1100	300	550	800	225
Northeast Region:							
Minimum Salinity (mg/L)	As above	190	400	40	75	250	25
Surface Runoff Threshold (mm/d)	As above	0.001	0.001	0.001	0.001	0.001	0.001
Salinity Multiplier	As above	1.023	1.029	1.018	1.025	1.027	1.013
Salinity Divider	As above	0.84	0.91	0.86	0.88	0.93	0.84

Parameter	Description	Channel	Disturb'd	Natural	Pasture	Urban	Wild'ess
Maximum Salinity (mg/L)	As above	500	1000	300	500	700	200
Southeast Region:							
Minimum Salinity (mg/L)	As above	190	400	40	25	250	25
Surface Runoff Threshold (mm/d)	As above	0.001	0.001	0.001	0.001	0.001	0.001
Salinity Multiplier	As above	1.023	1.029	1.018	1.025	1.027	1.013
Salinity Divider	As above	0.84	0.91	0.86	0.88	0.93	0.84
Maximum Salinity (mg/L)	As above	500	1000	350	500	700	200

The 'Catchment Surface' processes, which are time-series changes, are presented in **Table 4-5** through to **Table 4-10**.

The Surface Storage Loss Rate (mm/d), Baseflow Store Loss Rate (mm/d) and Surface Runoff Storage Loss Rate (mm/d) presented in JBS&G (2021, 2025), have been replaced with the Surface Storage Loss Recession Factor (**Table 4-6**), Baseflow Store Loss Recession Factor (**Table 4-8**) and Surface Runoff Storage Recession Factor (**Table 4-9**), respectively.

Table 4-5: Surface Storage Capacity Factor

Change Factor	Time0	Time1	Time2	Time3	Time4
Null	1	1	1	1	1
Negligible	1	1.015	1.006	1.0024	1.001125
Small	1	1.03	1.012	1.0048	1.00225
Medium	1	1.1	1.04	1.016	1.0075
Large	1	1.2	1.08	1.032	1.015

Table 4-6: Surface Storage Loss Recession Factor (1/d)

Change Factor	Time0	Time1	Time2	Time3	Time4
Null	1	1	1	1	1
Negligible	1	0.9964	0.9982	0.9991	0.9994
Small	1	0.991	0.9955	0.99775	0.9985
Medium	1	0.982	0.991	0.9955	0.997
Large	1	0.97	0.985	0.9925	0.995

Table 4-7: Baseflow Index Factor

Change Factor	Time0	Time1	Time2	Time3	Time4
Null	1	1	1	1	1
Negligible	1	1.02625	1.0105	1.0042	1.001875
Small	1	1.0525	1.021	1.0084	1.00375
Medium	1	1.175	1.07	1.028	1.0125
Large	1	1.35	1.14	1.056	1.025

Table 4-8: Baseflow Store Loss Recession Factor

Change Factor	Time0	Time1	Time2	Time3	Time4
Null	1	1	1	1	1
Negligible	1	0.99745	0.998725	0.999363	0.99955
Small	1	0.9949	0.99745	0.998725	0.9991
Medium	1	0.9898	0.9949	0.99745	0.9982
Large	1	0.983	0.9915	0.99575	0.997

Table 4-9: Surface Runoff Storage Recession Factor

Change Factor	Time0	Time1	Time2	Time3	Time4
Null	1	1	1	1	1
Negligible	1	0.9925	0.99625	0.998125	0.9985
Small	1	0.985	0.9925	0.99625	0.997
Medium	1	0.97	0.985	0.9925	0.994
Large	1	0.95	0.975	0.9875	0.99

Table 4-10: Baseflow Visibility Index Recession Factor

Change Factor	Time0	Time1	Time2	Time3	Time4
Null	1	1	1	1	1
Negligible	1	0.985	0.9925	0.99625	0.9955
Small	1	0.97	0.985	0.9925	0.991
Medium	1	0.94	0.97	0.985	0.982
Large	1	0.9	0.95	0.975	0.97

4.3.4.2 Model Results

The model control files associated with calibration simulations were:

- 68229_R02RevA_W-APR_03c.gsm
- 68229_R02RevA_NE-APR_03c.gsm
- 68229_R02RevA_SE-APR_03c.gsm

For the purpose of demonstrating calibration, model output is presented at various locations.

Bungleboori Creek Catchment

Figure 4.4a presents the subcatchments contributing to the confluence of Pine Swamp and Nine Mile Swamp at upstream Bungleboori Creek (Node 696).

Figure 4.4b presents the observed and modelled surface water flow and water quality (salinity) at the Pine/Nine Mile Swamp location. **Figure 4.4c** presents the observed modelled and surface water flow and water quality (salinity) at Bungleboori Creek Upstream.

From **Figure 4.4b**, the fit between modelled and observed time-series flow at Pine/Nine Mile Swamp is considered to be fair. From **Figure 4.4b**, the fit to time-series water quality (salinity) at this location is considered to be fair.

From **Figure 4.4c**, the fit between modelled and observed time-series flow at Bungleboori Creek Upstream is considered to be fair. From **Figure 4.4c**, the fit to time-series water quality (salinity) at this location is considered to be fair.

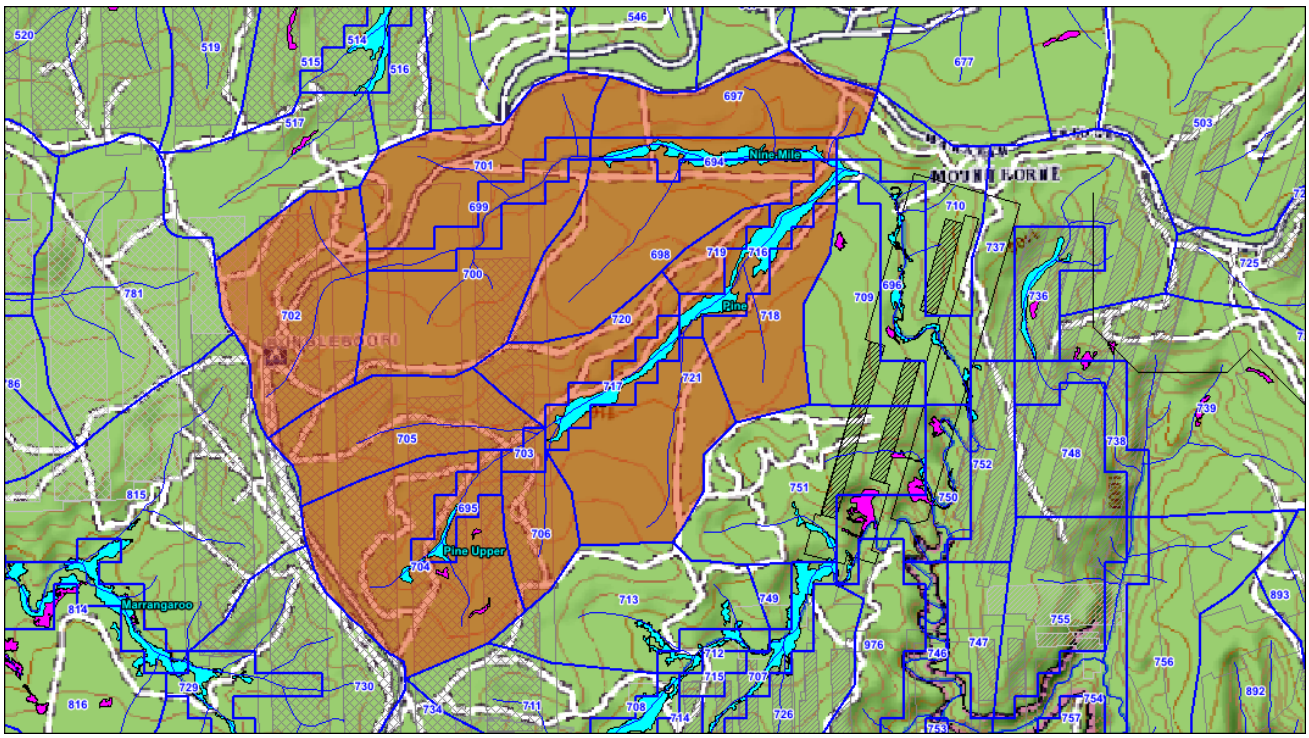
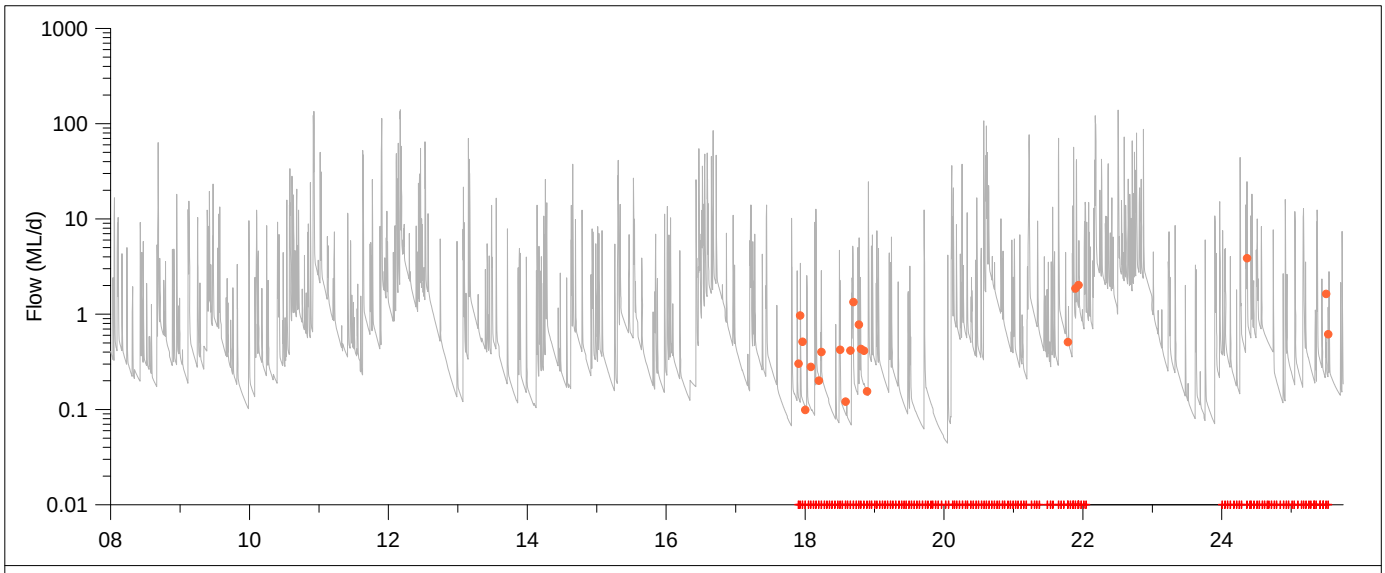
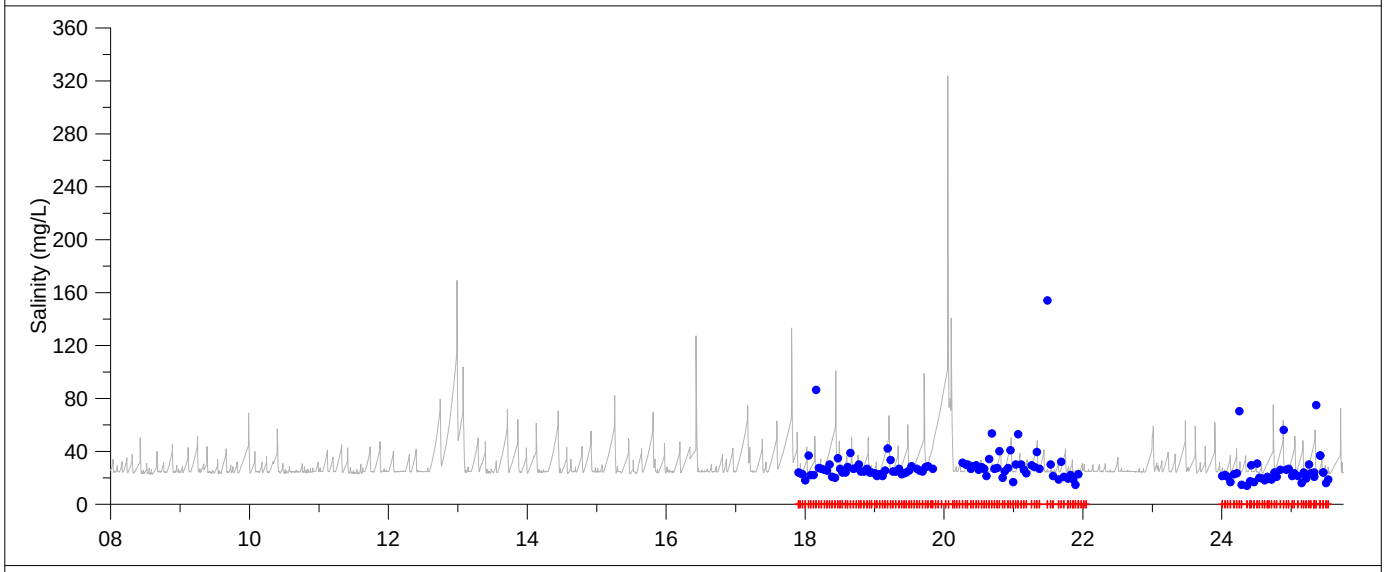


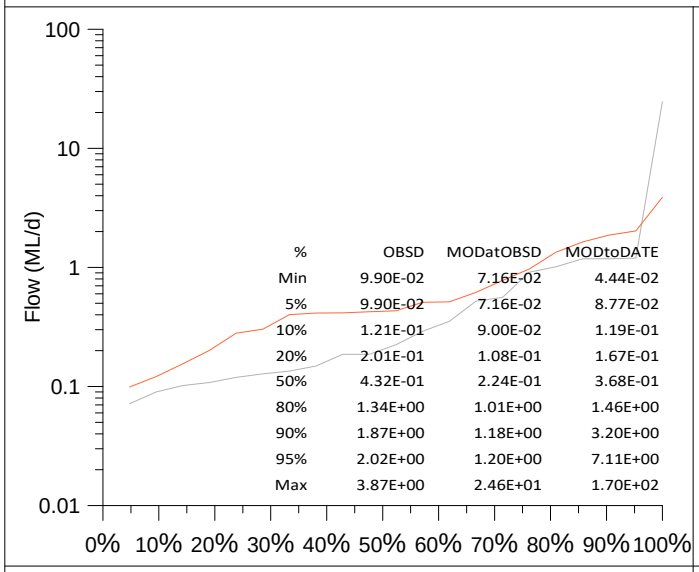
Figure 4.4: Calibration Results – Pine/Nine Mile Swamp (Node 696)



Time Series Model Output (Flow)

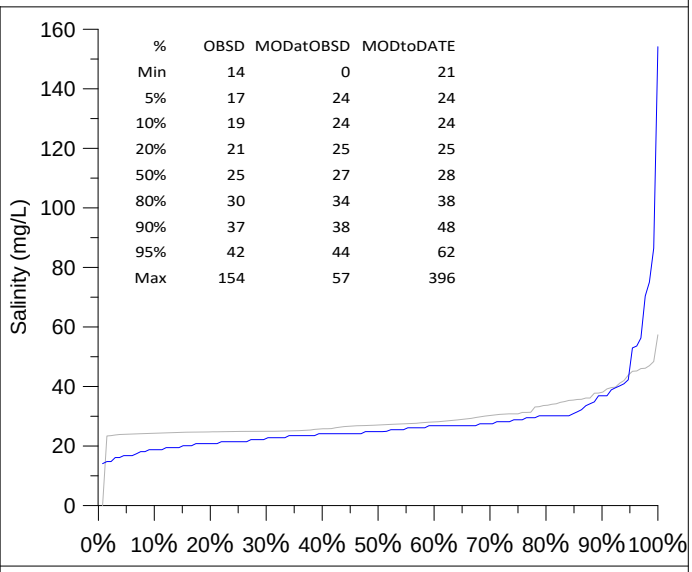


Time Series Model Output (Salinity)



%	OBSD	MODatOBSD	MODtoDATE
Min	9.90E-02	7.16E-02	4.44E-02
5%	9.90E-02	7.16E-02	8.77E-02
10%	1.21E-01	9.00E-02	1.19E-01
20%	2.01E-01	1.08E-01	1.67E-01
50%	4.32E-01	2.24E-01	3.68E-01
80%	1.34E+00	1.01E+00	1.46E+00
90%	1.87E+00	1.18E+00	3.20E+00
95%	2.02E+00	1.20E+00	7.11E+00
Max	3.87E+00	2.46E+01	1.70E+02

Statistical Distribution of Model Output at Observed (Flow)



%	OBSD	MODatOBSD	MODtoDATE
Min	14	0	21
5%	17	24	24
10%	19	24	24
20%	21	25	25
50%	25	27	28
80%	30	34	38
90%	37	38	48
95%	42	44	62
Max	154	57	396

Statistical Distribution of Model Output at Observed (Salinity)

Legend

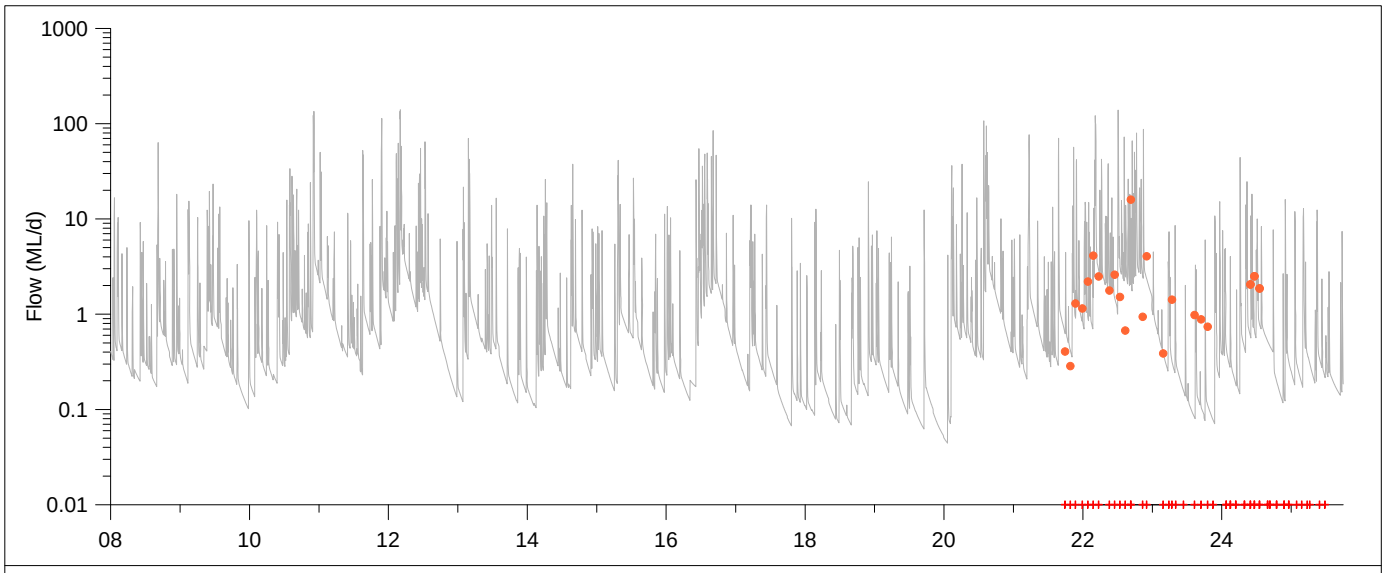
- Model Simulation (Flow, ML/d or Salinity, mg/L)
- Observed Flow (ML/d)
- Observed Salinity (mg/L)
- Sample Event

Notes: 1) The statistical distribution table does not use interpolation and instead the closest model output to the requested k^{th} value (e.g. 95%th) is displayed. As such, when the observation dataset is small, repetition of model output for different k^{th} values may occur.

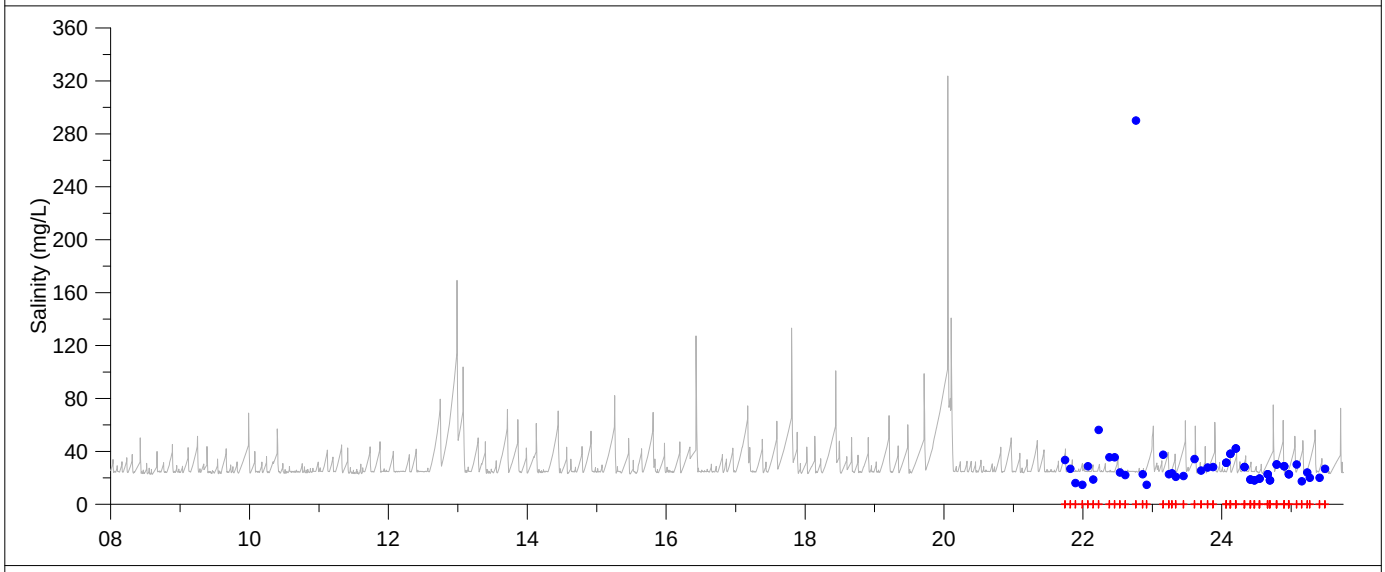
Job No.: 68229		**GoldSIM Model Calibration**
Client: Clarence Colliery Pty Ltd		**Bungleboori Creek:** **- Pine/Nine Mile Swamp** (Node 696)
Version: R02RevA	Date: 06/09/2021	
Drawn By: DAW	Checked By: JRWB	**Figure 4.4b**

File Path: m:\Projects\CentennialCoal\SpringvaleMine\55208_Stage2HydrologicalModellingOfShrubSwamps\Analysis\Hydrology\Results\Working\60679_R01RevA_CAL-Oct20-W_01e\60679_R01Rev1\

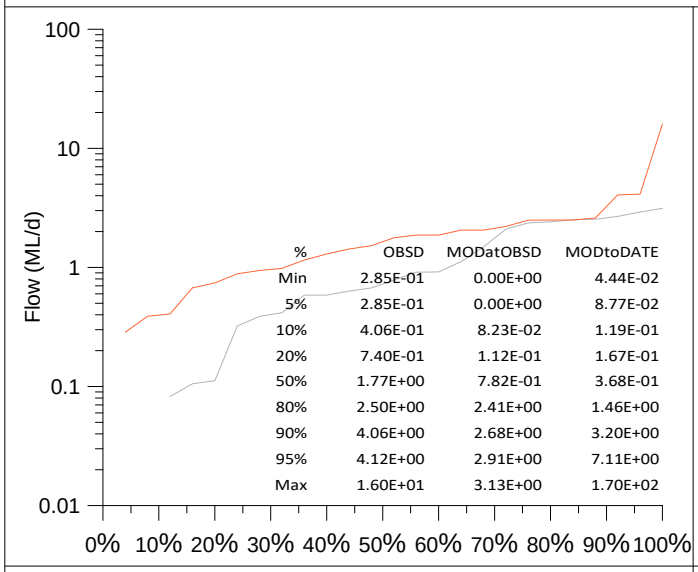
Reference: 68229_R02RevA_SE-APR_03c_SIM0.gsp



Time Series Model Output (Flow)

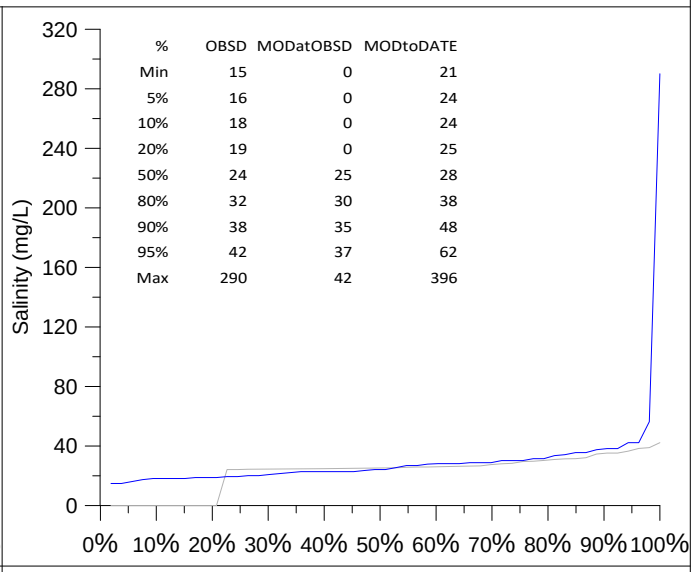


Time Series Model Output (Salinity)



%	OBSD	MODatOBSD	MODtoDATE
Min	2.85E-01	0.00E+00	4.44E-02
5%	2.85E-01	0.00E+00	8.77E-02
10%	4.06E-01	8.23E-02	1.19E-01
20%	7.40E-01	1.12E-01	1.67E-01
50%	1.77E+00	7.82E-01	3.68E-01
80%	2.50E+00	2.41E+00	1.46E+00
90%	4.06E+00	2.68E+00	3.20E+00
95%	4.12E+00	2.91E+00	7.11E+00
Max	1.60E+01	3.13E+00	1.70E+02

Statistical Distribution of Model Output at Observed (Flow)



%	OBSD	MODatOBSD	MODtoDATE
Min	15	0	21
5%	16	0	24
10%	18	0	24
20%	19	0	25
50%	24	25	28
80%	32	30	38
90%	38	35	48
95%	42	37	62
Max	290	42	396

Statistical Distribution of Model Output at Observed (Salinity)

Legend

- Model Simulation (Flow, ML/d or Salinity, mg/L)
- Observed Flow (ML/d)
- Observed Salinity (mg/L)
- Sample Event

Notes: 1) The statistical distribution table does not use interpolation and instead the closest model output to the requested k^{th} value (e.g. 95%th) is displayed. As such, when the observation dataset is small, repetition of model output for different k^{th} values may occur.

Job No.: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevA | Date: 06/09/2021

Drawn By: DAW | Checked By: JRWB

GoldSIM Model Calibration

Bungleboori Creek:
- Bungleboori Upstream (Node 696)

Figure 4.4c

JBS&G

File Path: m:\Projects\CentennialCoal\SpringvaleMine\55208_Stage2HydrologicalModellingOfShrubSwamps\Analysis\Hydrology\Results\Working\60679_R01RevA_CAL-Oct20-W_01e\60679_R01Rev1\

Reference: 68229_R02RevA_SE-APR_03c_SIM0.gsp

Figure 4.5a presents the subcatchments contributing to Bungleboori Creek Dowstream (Node 857). **Figure 4.5b** presents the observed and modelled surface water flow and water quality (salinity) at that location.

From **Figure 4.5b**, the fit between modelled and observed time-series flow at Bungleboori Creek Downstream is considered to be fair. From **Figure 4.5b**, the fit to time-series water quality (salinity) at this location is considered to be reasonable.

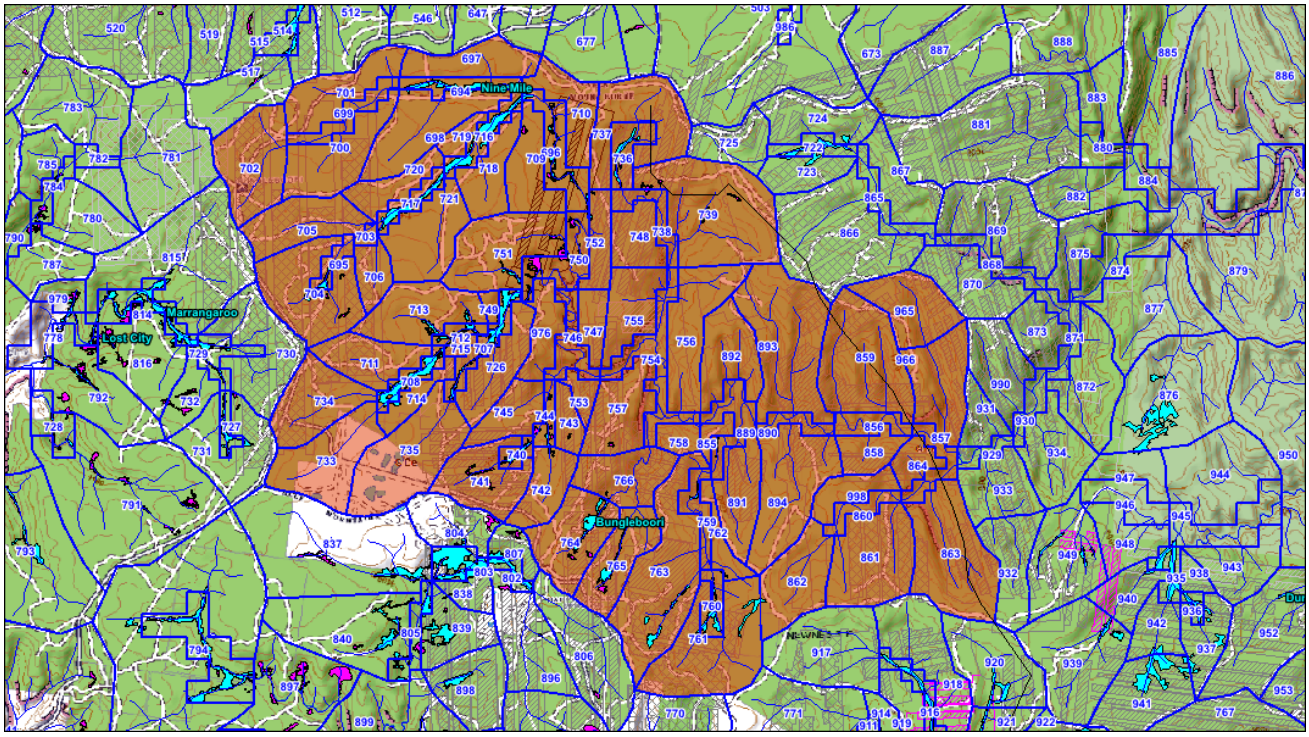
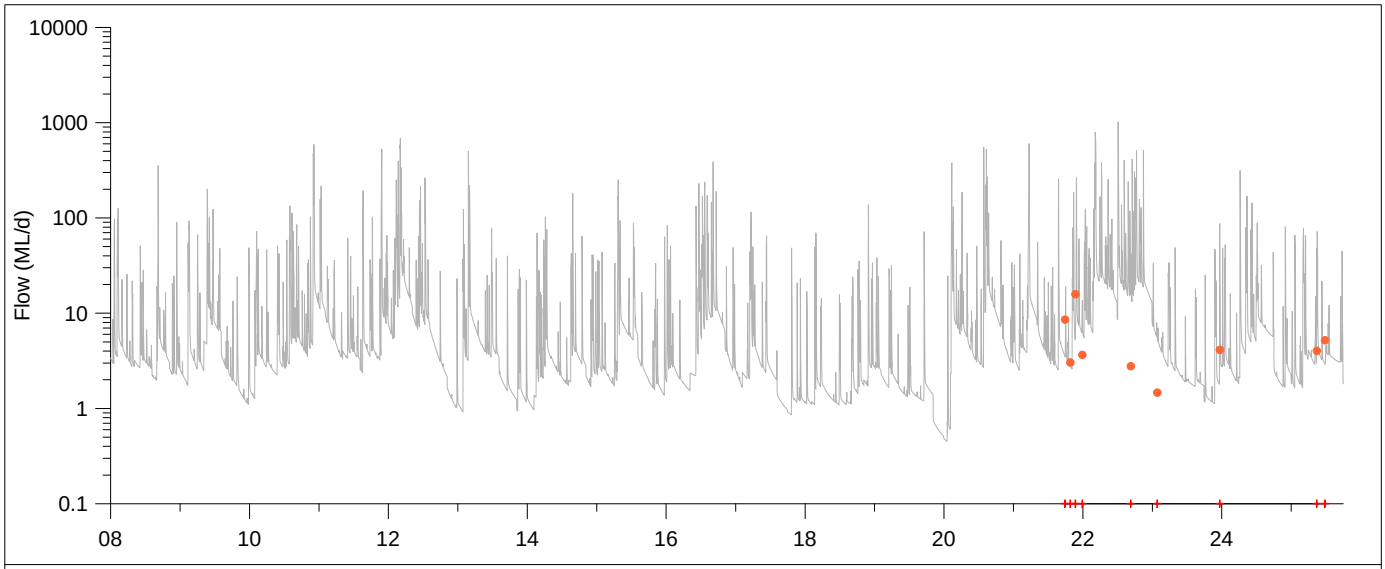
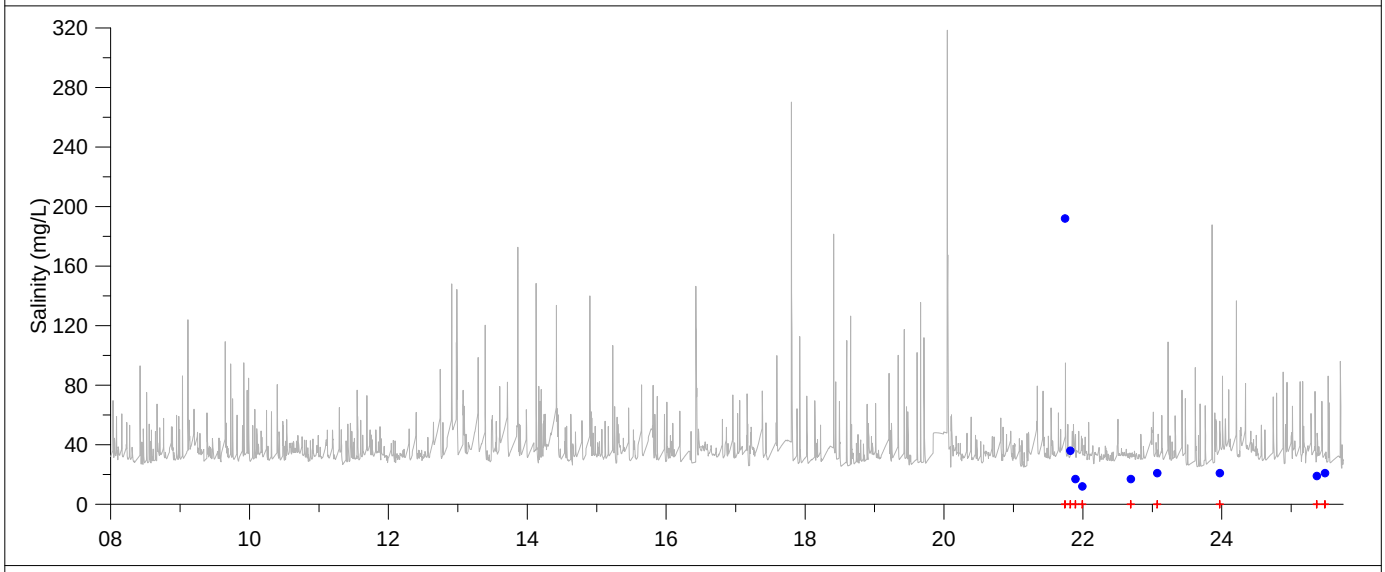


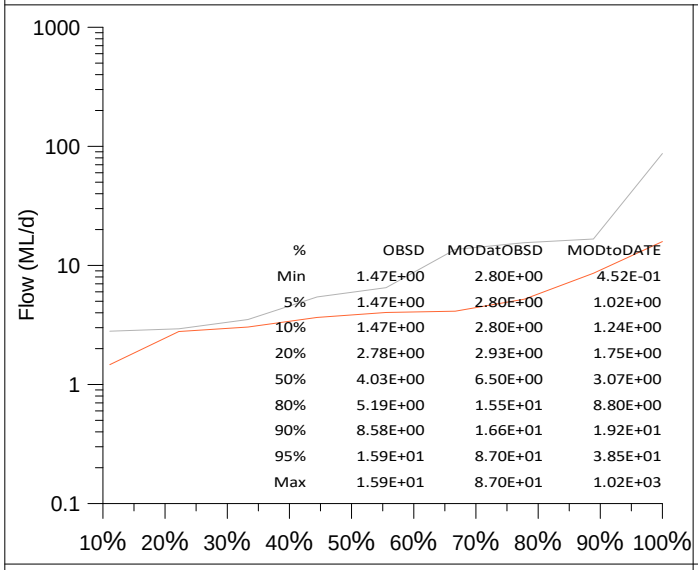
Figure 4.5: Calibration Results – Bungleboori Creek Downstream (Node 857)



Time Series Model Output (Flow)

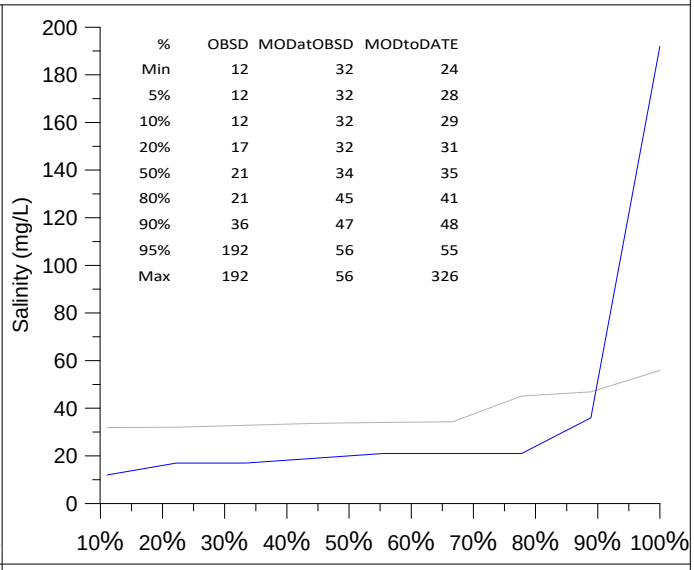


Time Series Model Output (Salinity)



%	OBSD	MODatOBSD	MODtoDATE
Min	1.47E+00	2.80E+00	4.52E-01
5%	1.47E+00	2.80E+00	1.02E+00
10%	1.47E+00	2.80E+00	1.24E+00
20%	2.78E+00	2.93E+00	1.75E+00
50%	4.03E+00	6.50E+00	3.07E+00
80%	5.19E+00	1.55E+01	8.80E+00
90%	8.58E+00	1.66E+01	1.92E+01
95%	1.59E+01	8.70E+01	3.85E+01
Max	1.59E+01	8.70E+01	1.02E+03

Statistical Distribution of Model Output at Observed (Flow)



%	OBSD	MODatOBSD	MODtoDATE
Min	12	32	24
5%	12	32	28
10%	12	32	29
20%	17	32	31
50%	21	34	35
80%	21	45	41
90%	36	47	48
95%	192	56	55
Max	192	56	326

Statistical Distribution of Model Output at Observed (Salinity)

Legend

- Model Simulation (Flow, ML/d or Salinity, mg/L)
- Observed Flow (ML/d)
- Observed Salinity (mg/L)
- Sample Event

Notes: 1) The statistical distribution table does not use interpolation and instead the closest model output to the requested k^{th} value (e.g. 95%th) is displayed. As such, when the observation dataset is small, repetition of model output for different k^{th} values may occur.

Job No.: 68229		**GoldSIM Model Calibration**
Client: Clarence Colliery Pty Ltd		**Bungleboori Creek:** **- Bungleboori Dowstream** (Node 857)
Version: R02RevA	Date: 06/09/2021	
Drawn By: DAW	Checked By: JRWB	**Figure 4.5b**

JBS&G

File Path: m:\Projects\CentennialCoal\SpringvaleMine\55208_Stage2HydrologicalModellingOfShrubSwamps\Analysis\Hydrology\Results\Working\60679_R01RevA_CAL-Oct20-W_01e\60679_R01Rev1\

Reference: 68229_R02RevA_SE-APR_03c_SIM0.gsp

Figure 4.6a presents the subcatchments contributing to Bungleboori Creek North (Node 673). **Figure 4.6b** presents the observed and modelled surface water flow and water quality (salinity) at that location.

From **Figure 4.6b**, the fit between modelled and observed time-series flow at Bungleboori Creek North is considered to be fair. From **Figure 4.6b**, the fit to time-series water quality (salinity) at this location is considered to be fair.

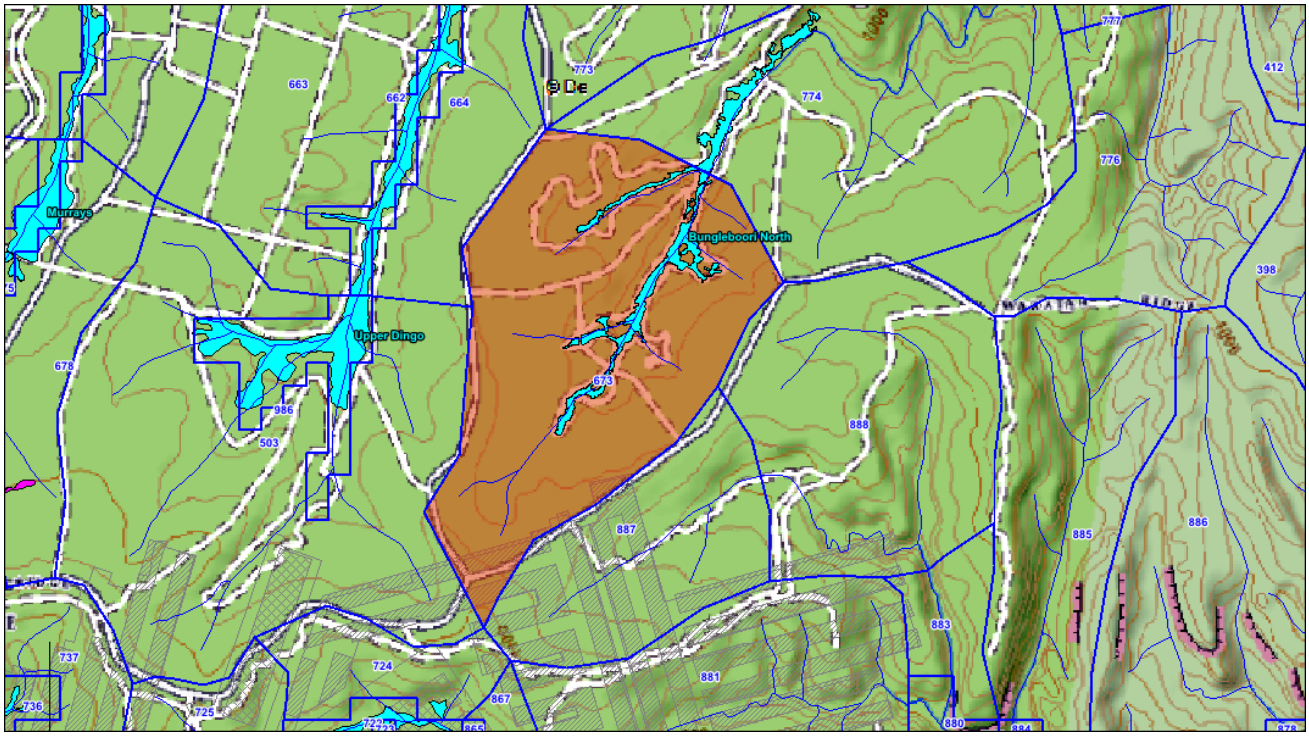
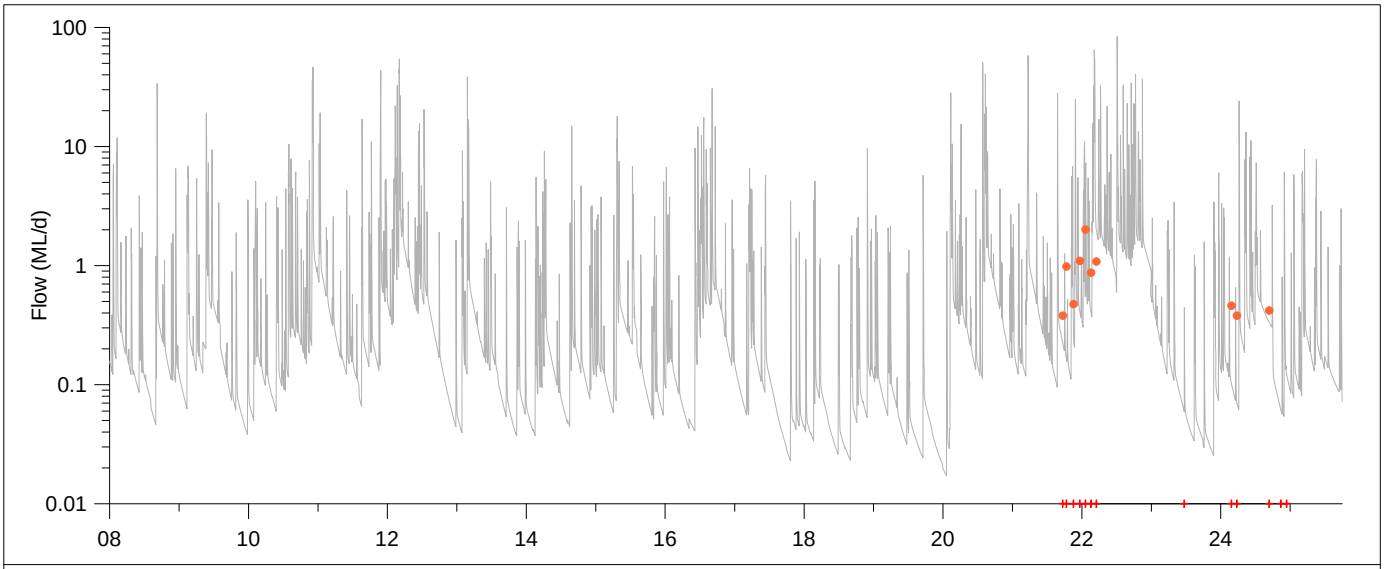
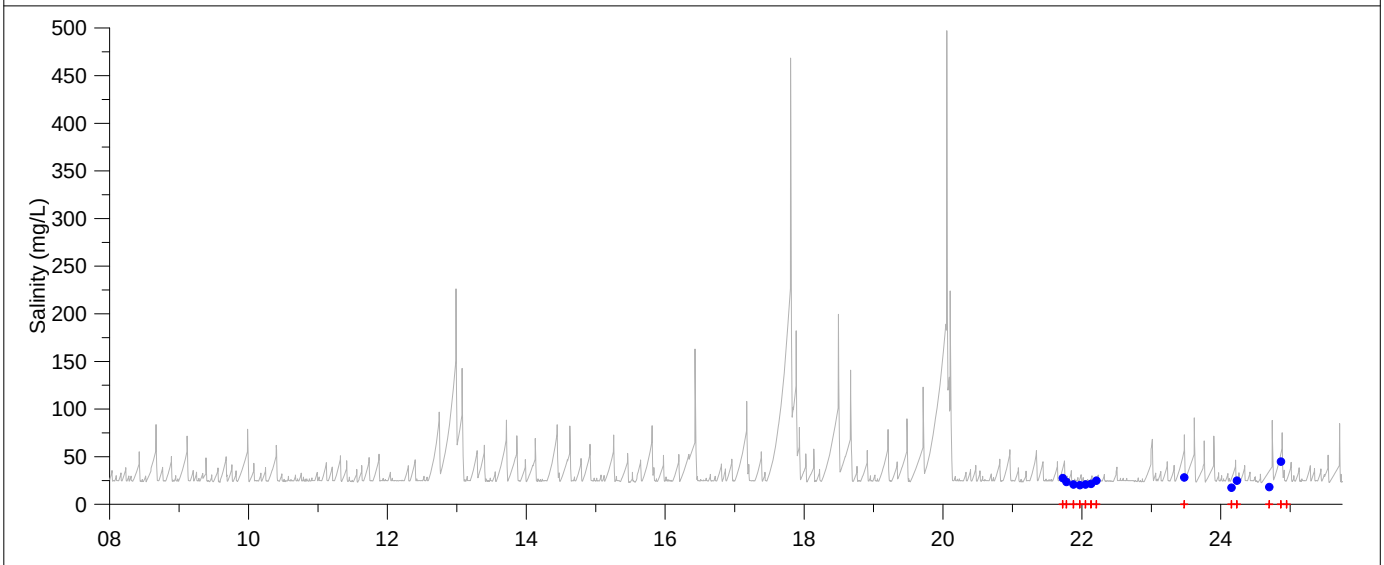


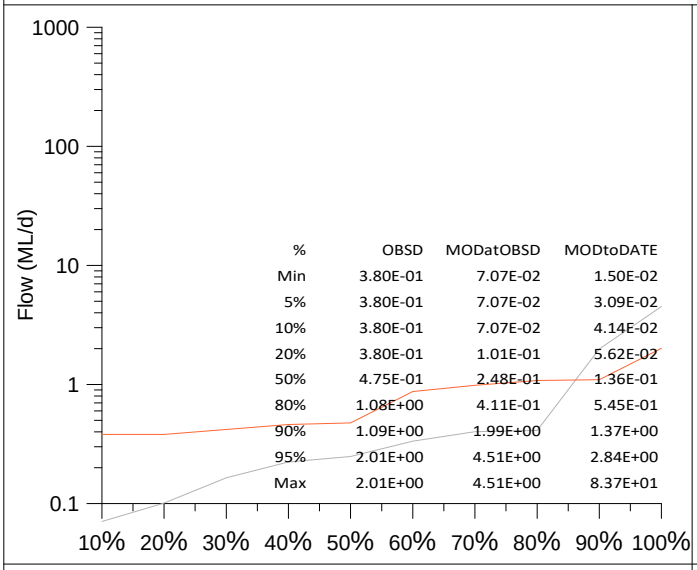
Figure 4.6: Calibration Results – Bungleboori Creek North (Node 673)



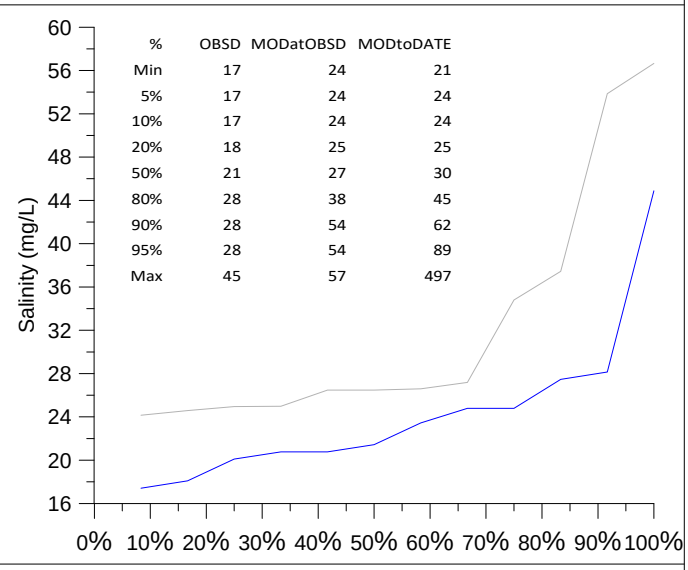
Time Series Model Output (Flow)



Time Series Model Output (Salinity)



Statistical Distribution of Model Output at Observed (Flow)



Statistical Distribution of Model Output at Observed (Salinity)

Legend

- Model Simulation (Flow, ML/d or Salinity, mg/L)
- Observed Flow (ML/d)
- Observed Salinity (mg/L)
- Sample Event

Notes: 1) The statistical distribution table does not use interpolation and instead the closest model output to the requested k^{th} value (e.g. 95%th) is displayed. As such, when the observation dataset is small, repetition of model output for different k^{th} values may occur.

Job No.: 68229		**GoldSIM Model Calibration**
Client: Clarence Colliery Pty Ltd		**Bungleboori Creek: - Bungleboori North** (Node 673)
Version: R02RevA	Date: 06/09/2021	
Drawn By: DAW	Checked By: JRWB	**Figure 4.6b**

JBS&G

File Path: m:\Projects\CentennialCoal\SpringvaleMine\55208_Stage2HydrologicalModellingOfShrubSwamps\Analysis\Hydrology\Results\Working\60679_R01RevA_CAL-Oct20-W_01e\60679_R01Rev1\

Reference: 68229_R02RevA_SE-APR_03c_SIM0.gsp

Figure 4.7a presents the subcatchments contributing to Dingo Creek Upper (Node 986). **Figure 4.7b** presents the observed and modelled surface water flow and water quality (salinity) at that location.

From **Figure 4.7b**, the fit between modelled and observed time-series flow at Dingo Creek Upper is considered to be fair. From **Figure 4.7b**, the fit to time-series water quality (salinity) at this location is considered to be fair.

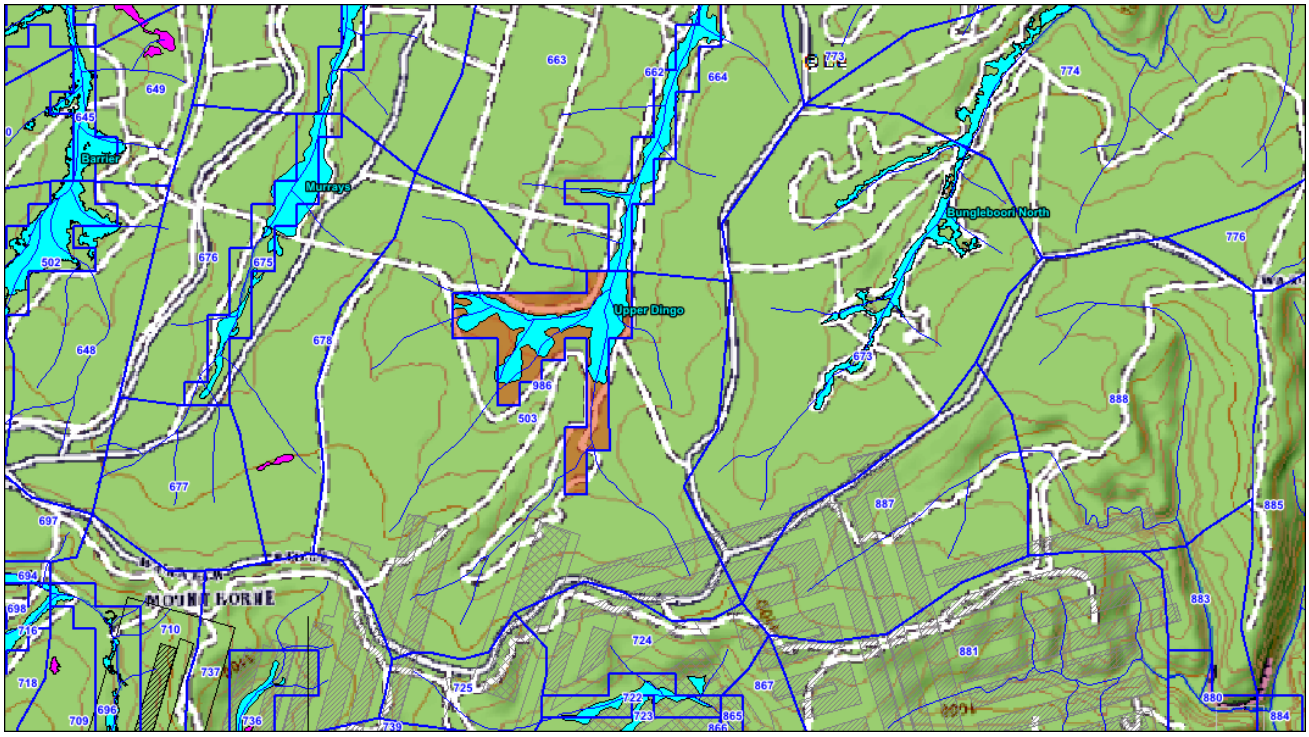
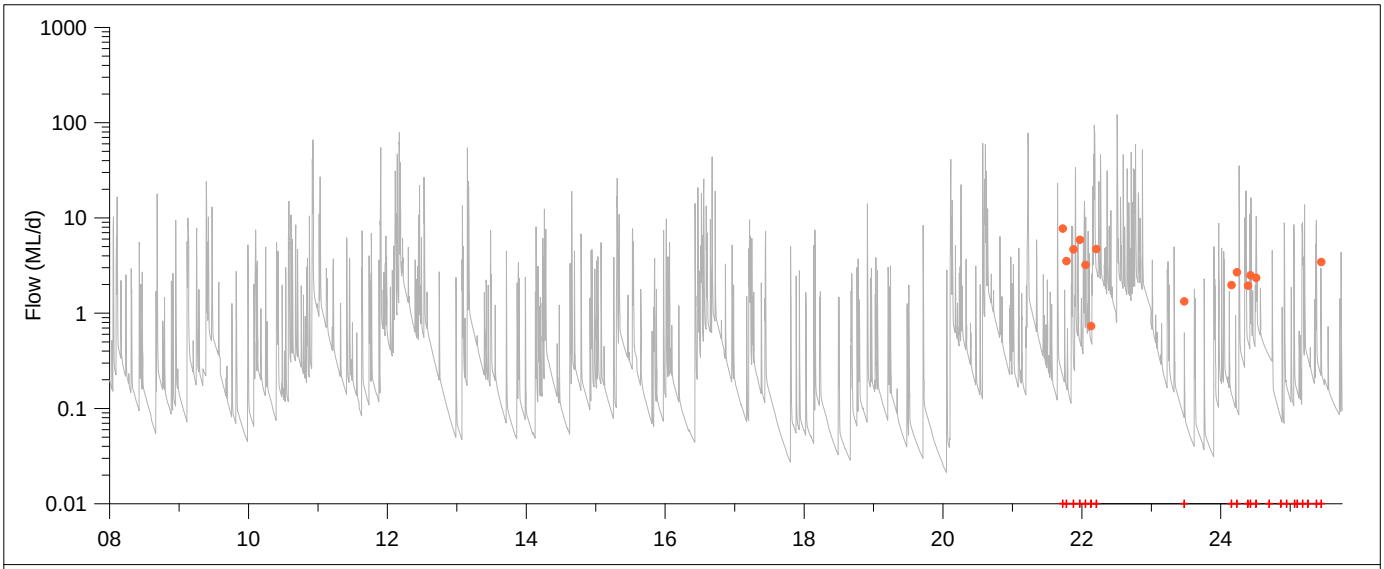
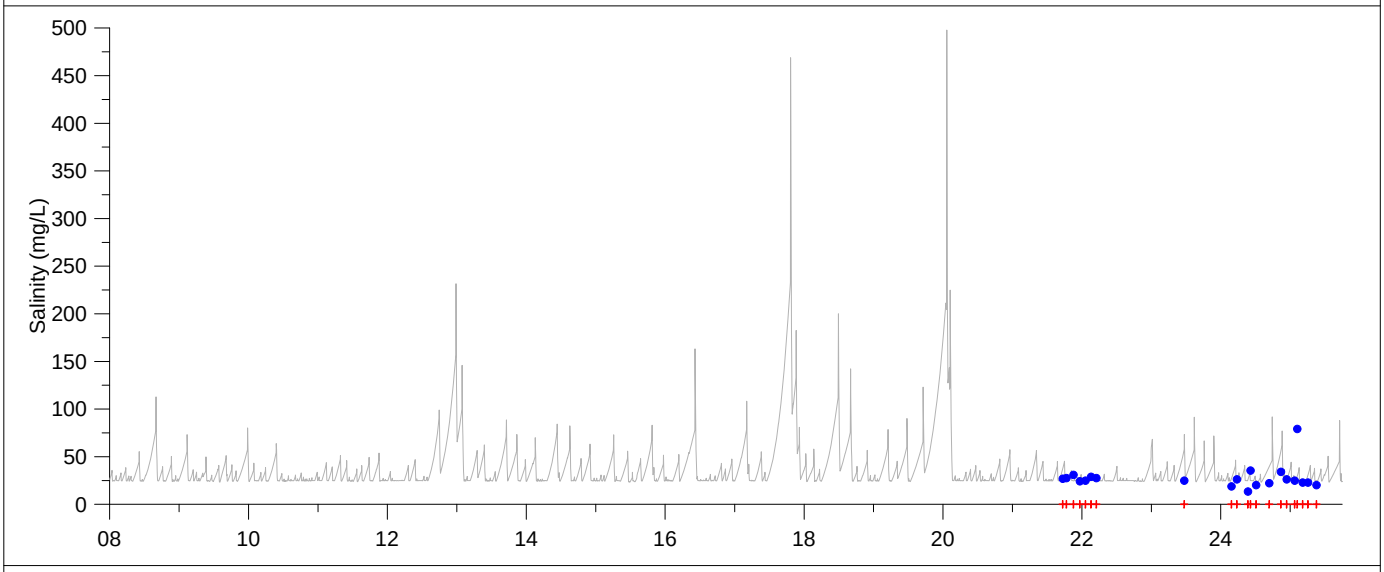


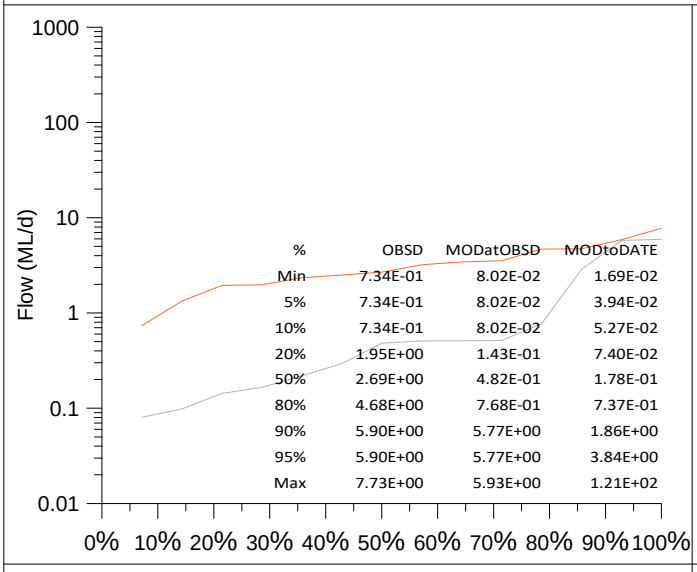
Figure 4.7: Calibration Results – Dingo Creek Upper (Node 986)



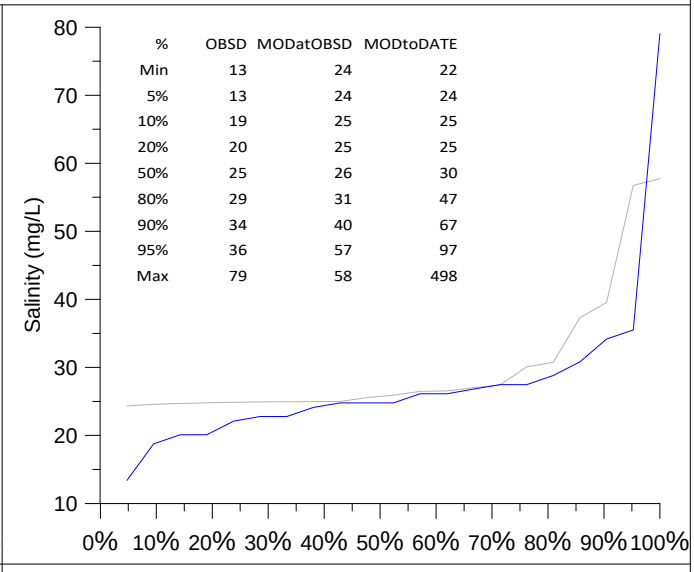
Time Series Model Output (Flow)



Time Series Model Output (Salinity)



Statistical Distribution of Model Output at Observed (Flow)



Statistical Distribution of Model Output at Observed (Salinity)

Legend

- Model Simulation (Flow, ML/d or Salinity, mg/L)
- Observed Flow (ML/d)
- Observed Salinity (mg/L)
- Sample Event

Notes: 1) The statistical distribution table does not use interpolation and instead the closest model output to the requested k^{th} value (e.g. 95%th) is displayed. As such, when the observation dataset is small, repetition of model output for different k^{th} values may occur.

Job No.: 68229		**GoldSIM Model Calibration**
Client: Clarence Colliery Pty Ltd		**Dingo Creek:** **- Dingo Upper** (Node 986)
Version: R02RevA	Date: 06/09/2021	
Drawn By: DAW	Checked By: JRWB	**Figure 4.7b**

JBS&G

File Path: m:\Projects\CentennialCoal\SpringvaleMine\55208_Stage2HydrologicalModellingOfShrubSwamps\Analysis\Hydrology\Results\Working\60679_R01RevA_CAL-Oct20-W_01e\60679_R01Rev1\

Reference: 68229_R02RevA_SE-APR_03c_SIM0.gsp

Coxs River Catchment

Figure 4.8a presents the location of the subcatchment, upstream of Lake Wallace, which is associated with NSW DCCEEW Station No. 212054 (Node 032). The subcatchments contributing to Node 032, in the vicinity of Node 032, are also highlighted in **Figure 4.8a**. It is noted that Upper Coxs River catchment contributing to Node 032 is extensive, but is not all shown in **Figure 4.8a**.

Figure 4.8b presents the modelled and observed time-series flow and water quality (salinity) immediately upstream of Lake Wallace (Node 032).

From **Figure 4.8b**, the fit between modelled and observed time-series is considered to be reasonable.

Figure 4.9a presents the location of the subcatchment immediately downstream of Lake Lyell. That location is associated with NSW DCCEEW Station No. 212011 (Node 147). **Figure 4.9b** presents the modelled and observed time-series flow and water quality (salinity).

From **Figure 4.9b**, the fit between modelled and observed time-series flow and water quality (salinity) is considered reasonable. It is noted that the modelled water quality (salinity) is higher in the later time period. This will be reviewed in the next version of the model.

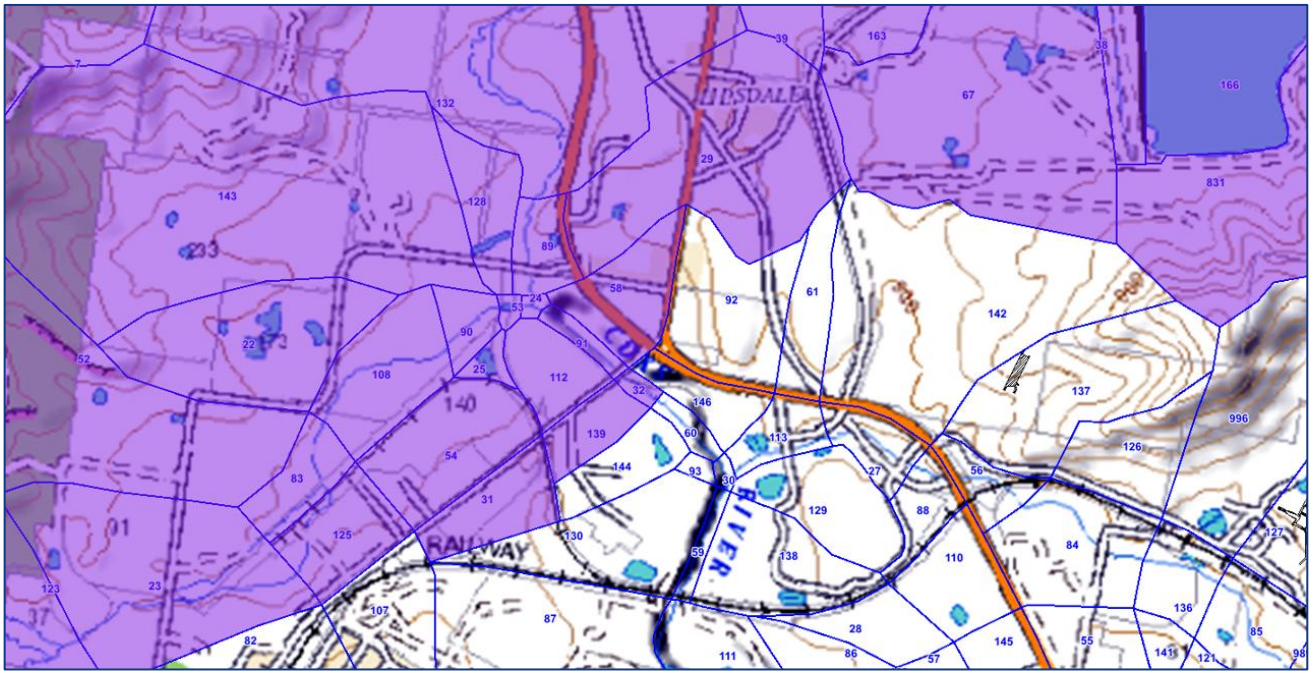


Figure 4.8: Calibration Results - Upstream of Lake Wallace (NSW DCCEEW Station No. 212054; Node 032)

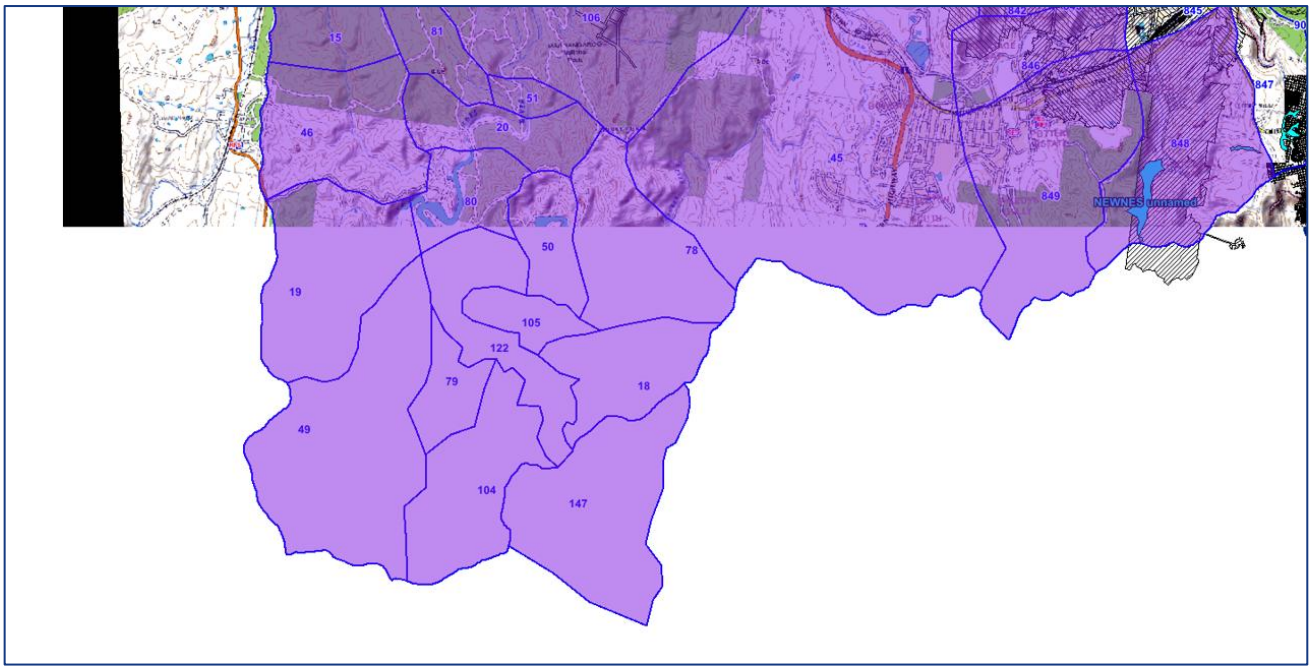
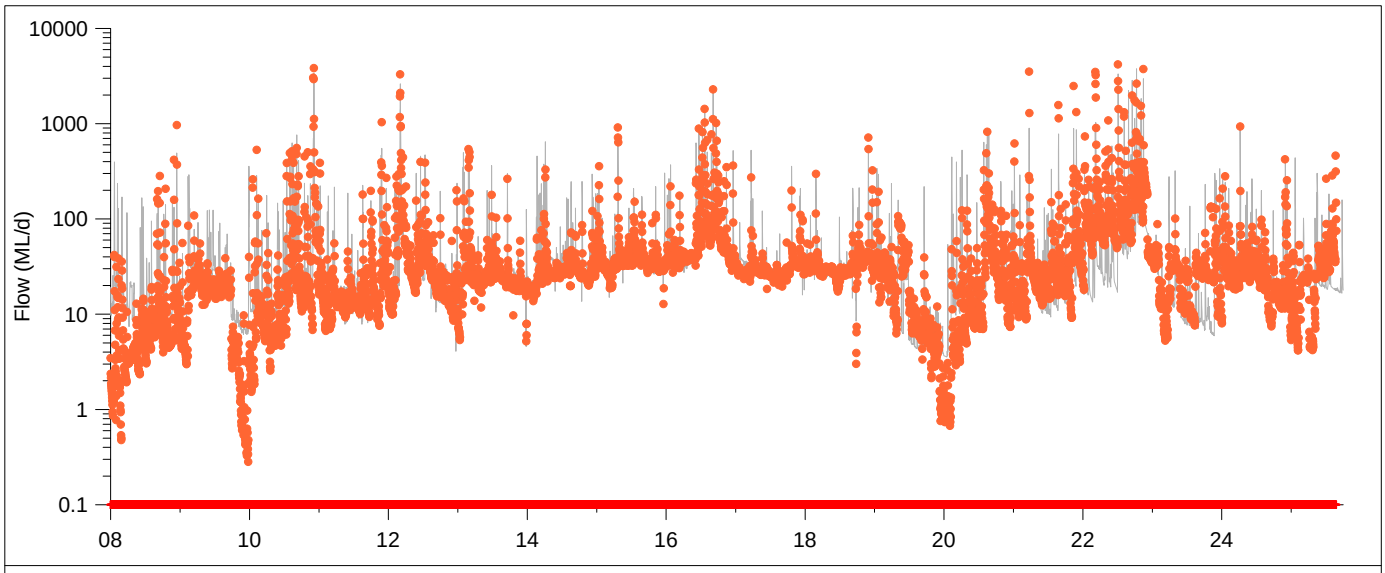
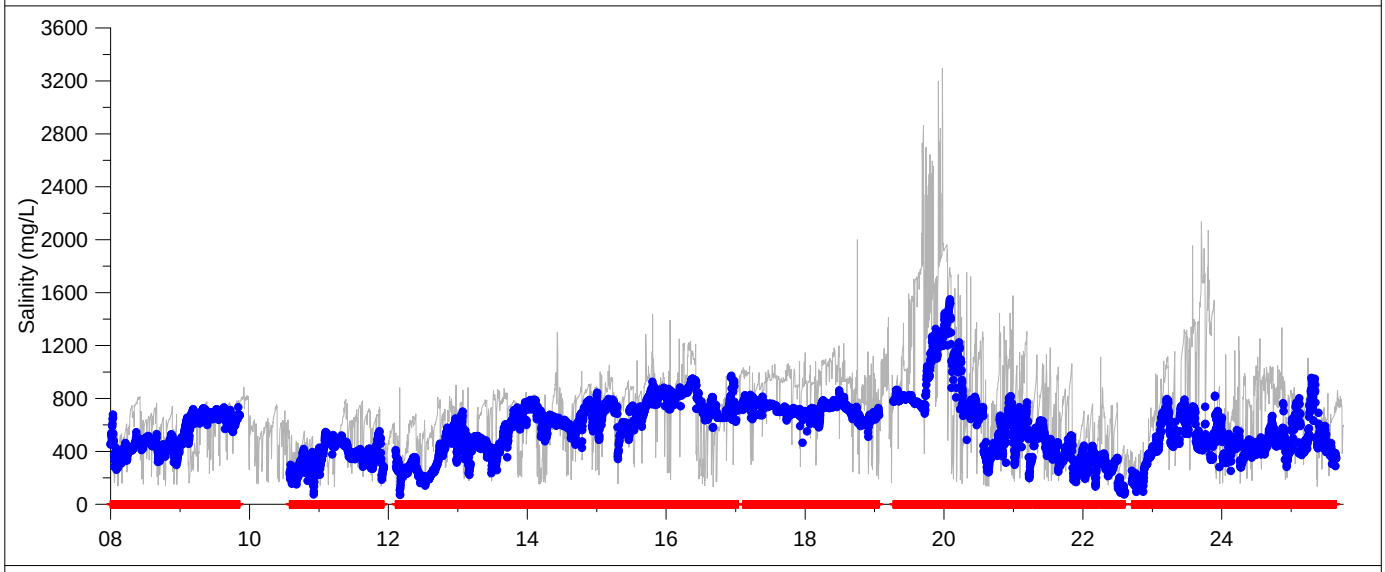


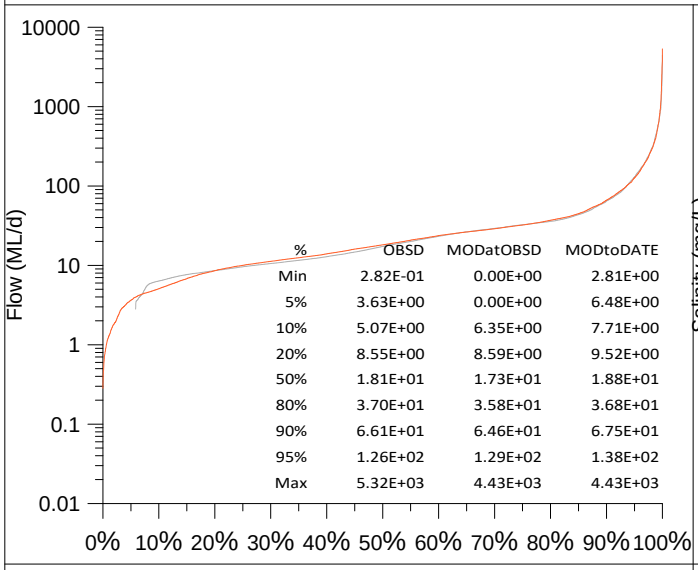
Figure 4.9: Calibration Results - Downstream of Lake Lyell (NSW DCCEEW Station No. 212011; Node 147)



Time Series Model Output (Flow)

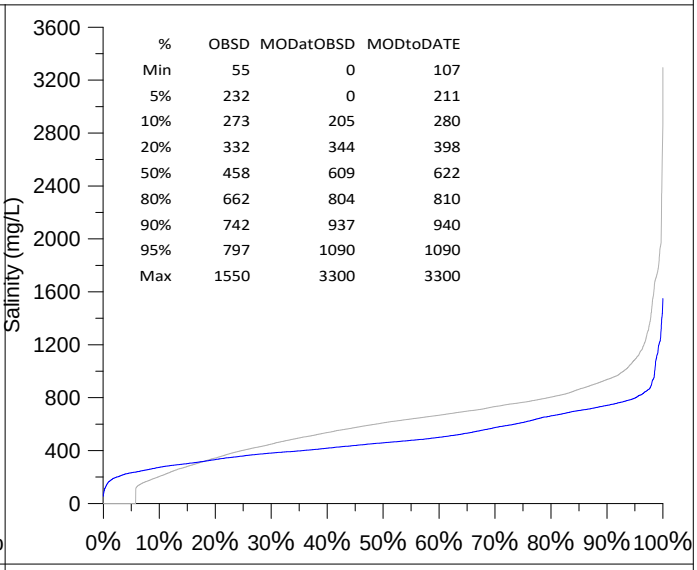


Time Series Model Output (Salinity)



%	OBSD	MODatOBSD	MODtoDATE
Min	2.82E-01	0.00E+00	2.81E+00
5%	3.63E+00	0.00E+00	6.48E+00
10%	5.07E+00	6.35E+00	7.71E+00
20%	8.55E+00	8.59E+00	9.52E+00
50%	1.81E+01	1.73E+01	1.88E+01
80%	3.70E+01	3.58E+01	3.68E+01
90%	6.61E+01	6.46E+01	6.75E+01
95%	1.26E+02	1.29E+02	1.38E+02
Max	5.32E+03	4.43E+03	4.43E+03

Statistical Distribution of Model Output at Observed (Flow)



%	OBSD	MODatOBSD	MODtoDATE
Min	55	0	107
5%	232	0	211
10%	273	205	280
20%	332	344	398
50%	458	609	622
80%	662	804	810
90%	742	937	940
95%	797	1090	1090
Max	1550	3300	3300

Statistical Distribution of Model Output at Observed (Salinity)

Legend

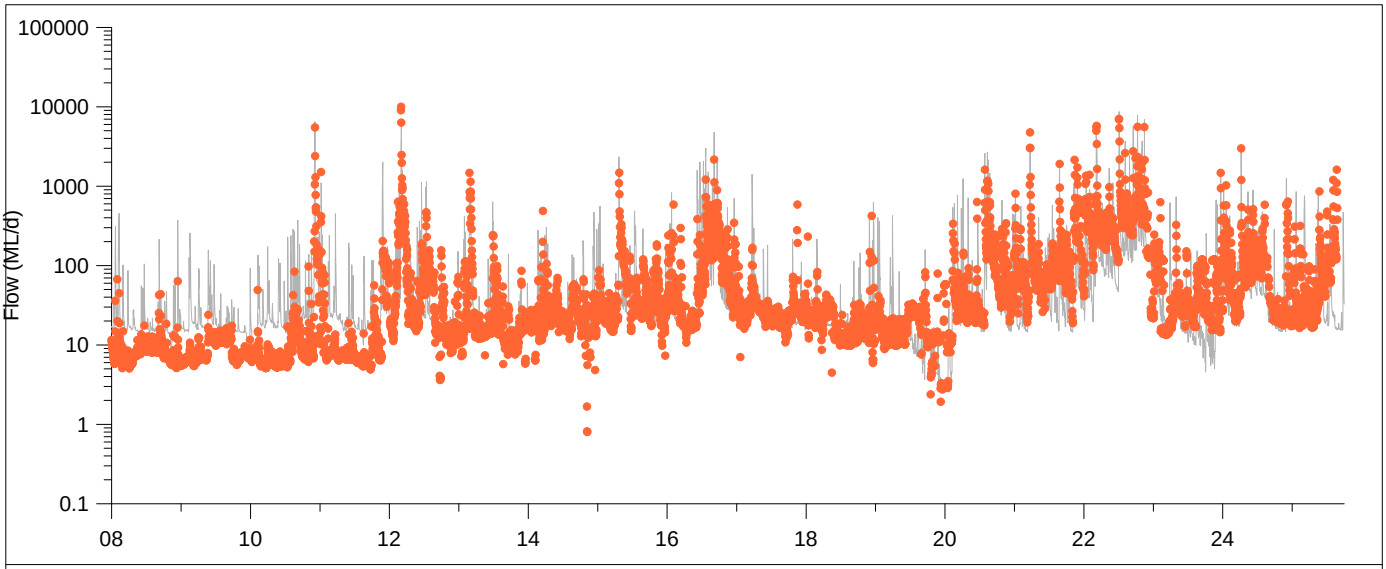
- Model Simulation (Flow, ML/d or Salinity, mg/L)
- Observed Flow (ML/d)
- Observed Salinity (mg/L)
- Sample Event

Notes: 1) The statistical distribution table does not use interpolation and instead the closest model output to the requested k^{th} value (e.g. 95%th) is displayed. As such, when the observation dataset is small, repetition of model output for different k^{th} values may occur.

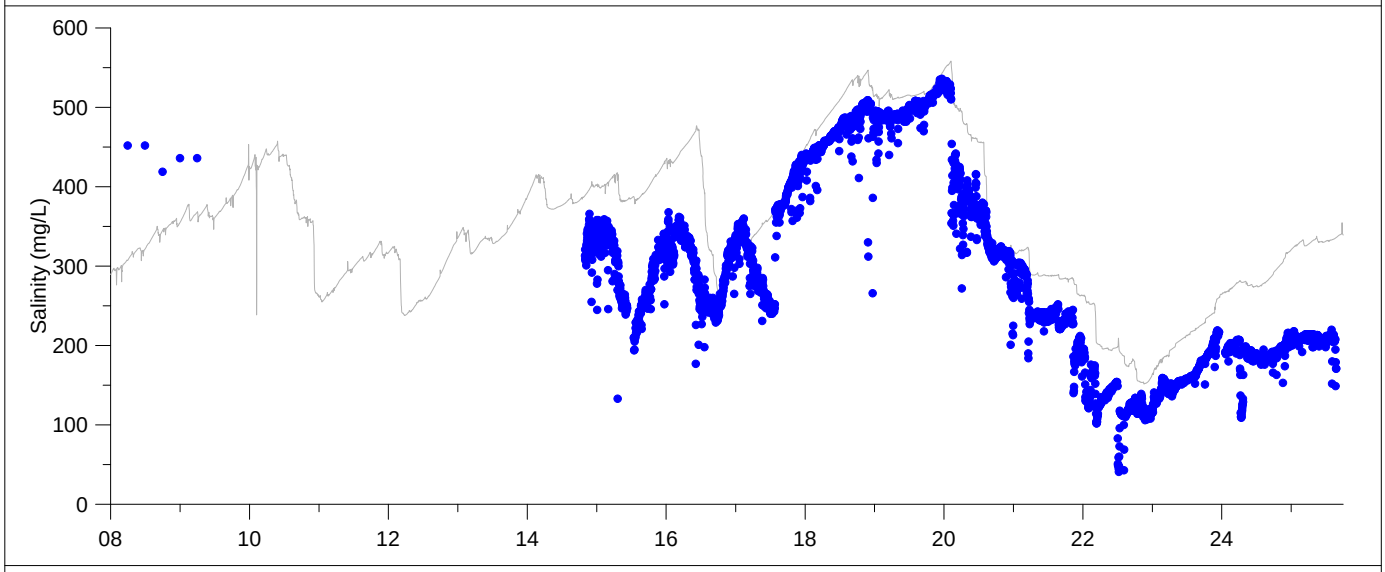
Job No.: 68229		**GoldSIM Model Calibration**
Client: Clarence Colliery Pty Ltd.		**Coxs River:** **- Station 212054** (Node 032)
Version: R02RevA	Date: 06/09/2021	
Drawn By: DAW	Checked By: JRWB	**Figure 4.8b**

File Path: m:\Projects\CentennialCoal\SpringvaleMine\55208_Stage2HydrologicalModellingOfShrubSwamps\Analysis\Hydrology\Results\Working\60679_R01RevA_CAL-Oct20-W_01e\60679_R01Rev1\

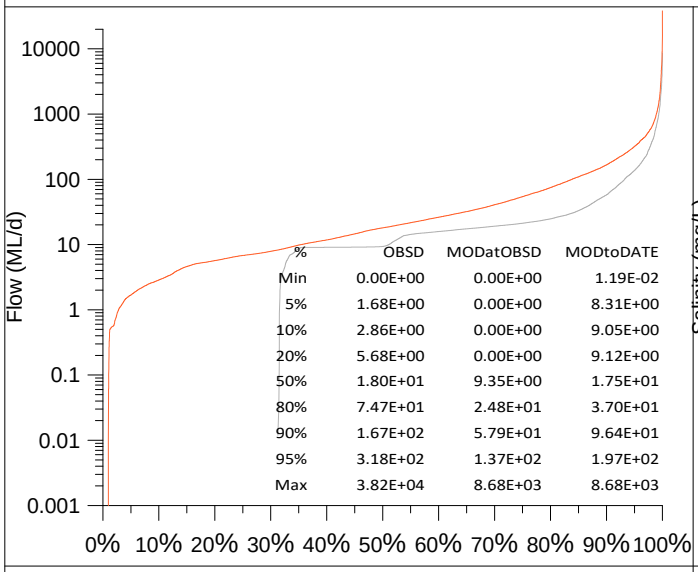
Reference: 68229_R02RevA_W-APR_03c_SIM0.gsp



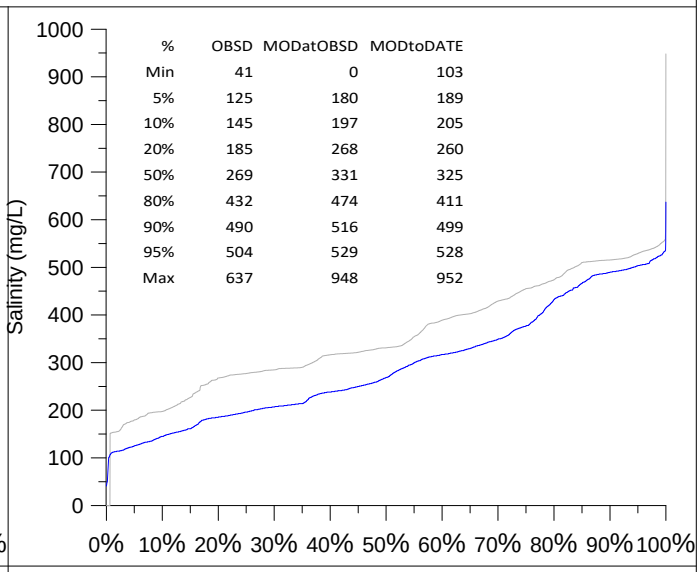
Time Series Model Output (Flow)



Time Series Model Output (Salinity)



Statistical Distribution of Model Output at Observed (Flow)



Statistical Distribution of Model Output at Observed (Salinity)

Legend

- Model Simulation (Flow, ML/d or Salinity, mg/L)
- Observed Flow (ML/d)
- Observed Salinity (mg/L)
- Sample Event

Notes: 1) The statistical distribution table does not use interpolation and instead the closest model output to the requested k^{th} value (e.g. 95%th) is displayed. As such, when the observation dataset is small, repetition of model output for different k^{th} values may occur.

Job No.: 68229		**GoldSIM Model Calibration**
Client: Clarence Colliery Pty Ltd		**Coxs River:** **- Station 212011** (Node 147)
Version: R02RevA	Date: 06/09/2021	
Drawn By: DAW	Checked By: JRWB	**Figure 4.9b**

JBS&G

File Path: m:\Projects\CentennialCoal\SpringvaleMine\55208_Stage2HydrologicalModellingOfShrubSwamps\Analysis\Hydrology\Results\Working\60679_R01RevA_CAL-Oct20-W_01e\60679_R01Rev1\

Reference: 68229_R02RevA_W-APR_03c_SIM0.gsp

4.3.5 Model Results incorporating Predictive Uncertainty

4.3.5.1 Approach to Cumulative Change

The Swamp Water Balance Model incorporates changes induced by all mining operations in the vicinity of Clarence Colliery. That change entails changes to groundwater contribution to surface water as well as change to 'Catchment Surface' via the time-series change to AWBM parameters and other parameters (refer **Section 4.3.3.1**).

4.3.5.2 Approach to Uncertainty Analysis

JBS&G (2026) presents the Groundwater Assessment for the Extraction Plan for 918 Panel. JBS&G (2026) explains that stochastic simulations of the groundwater model were undertaken. The approach to stochastic simulations was consistent with the Explanatory Note on Uncertainty Analysis presented by the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (CTH IESC, 2023a).

Groundwater contribution to surface water with respect to each subcatchment in the Swamp Water Balance Model was reviewed (refer to **Section 4.3.3**, where it is explained that seepage faces, surface overland flow, ephemeral watercourses and rivers (minor)) and extracted separately, with various adjustment factors used to account for losses between point of exit from groundwater model to the environmental receptor.

The extracted groundwater contribution to surface water, separated according to type, were each ranked from smallest to largest. The 10th and 90th ranked were collated and then used the Swamp Water Balance Model. The simulations were referred to as "R10" for the 10th percentile ranked value and "R90" for the 90th percentile ranked value.

The probabilistic simulation option with GoldSIM (GTG, 2018) was not used.

In summary, uncertainty analysis was incorporated into the Swamp Water Balance Model via use of ranked stochastic outputs from the groundwater model with respect to groundwater contribution to surface water (which were then used as input to the Swamp Water Balance Model). AWBM and other parameters with the Swamp Water Balance Model were otherwise kept at the same values as presented in **Section 4.3.4.1**.

4.3.5.3 Model Setup

Two simulations were prepared:

- **Approved (APR) Case** (includes existing mining at Clarence Colliery and surrounding mines)
- **Proposed (PRO) Case** (includes existing mining at Clarence Colliery and surrounding mines, as well as development and extraction of 918 Panel).

Changes to the Swamp Water Balance Model comprised different groundwater contribution to surface water (devised from the groundwater model) and change to 'Catchment Surface'.

4.3.5.4 Prediction Results

The model control files associated with the prediction simulations were:

- Southeastern Region:
    - 68229_R02RevA_SE-APR_03c_R10.gsm
    - 68229_R02RevA_SE-APR_03c_R90.gsm
    - 68229_R02RevA_SE-PRO_02a_R10.gsm
    - 68229_R02RevA_SE-PRO_02a_R90.gsm.

It is noted that the catchments relevant to the Extraction Plan for 918 Panel are located in the Southeastern Region (refer to **Figure 4.1** for the distribution of these regions), however, the Swamp Water Balance Model

in the other regions were also updated, so that the update to the model (comprising the three regions) was consistent.

Bungleboori Creek Catchment

Pine Swamp (Node 716):

Figure 4.10 presents the subcatchments contributing to Pine Swamp.

Figure 4.11a and **Figure 4.11b** presents the modelled time-series flow for the Approved Case and Proposed Case considering the 10th and 90th ranked smallest groundwater contribution to surface water with respect to each subcatchment.

Figure 4.11c and **Figure 4.11d** presents the modelled time-series water quality (salinity) for the Approved Case and Proposed Case considering the 10th and 90th ranked smallest groundwater contribution to surface water with respect to each subcatchment.

From **Figure 4.11a** and **Figure 4.11b**, the difference between modelled Approved Case surface water flows and Proposed Case surface water flows is negligible (change is less than 2%), for both the R10 and R90 scenarios.

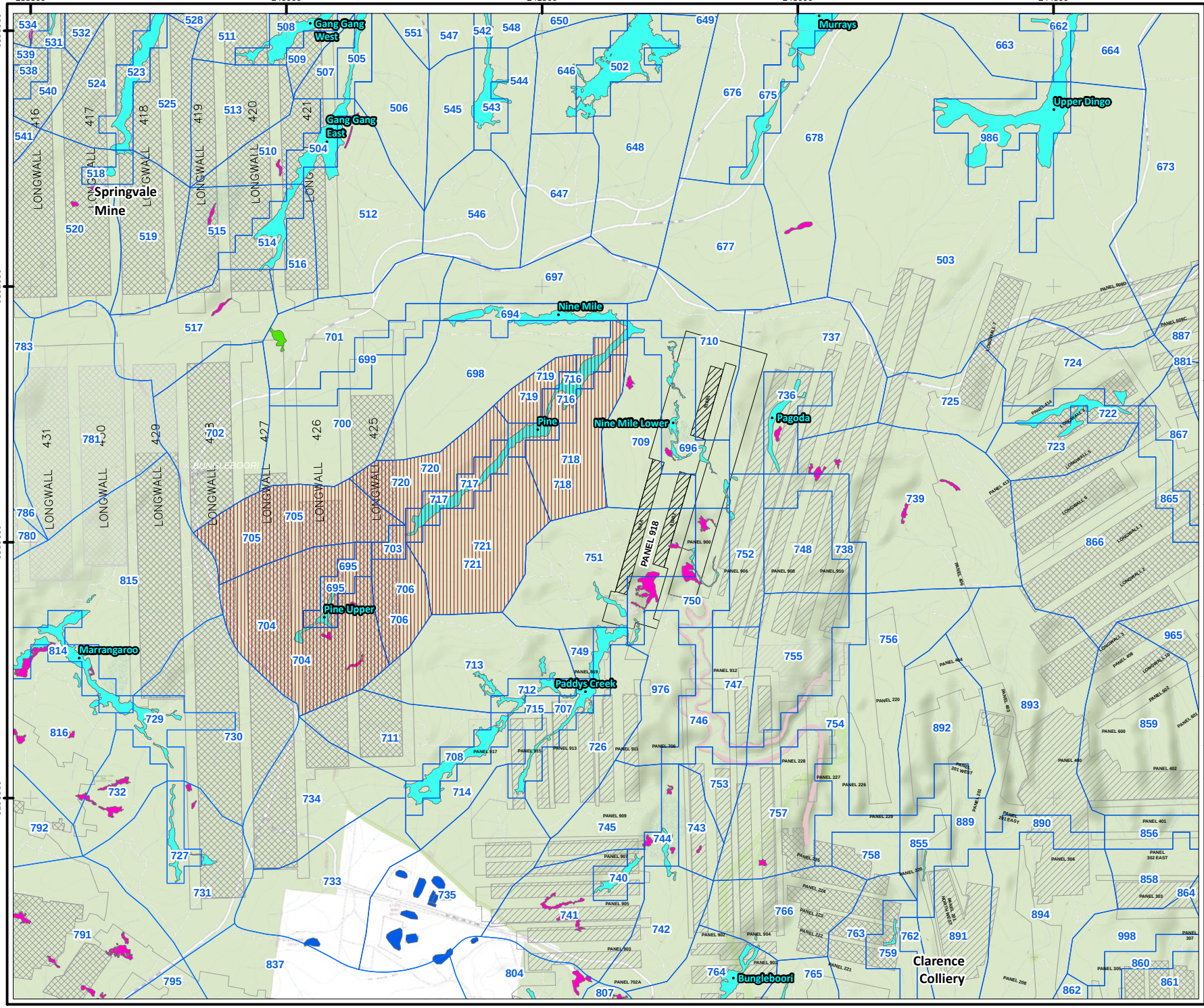
From **Figure 4.11c** and **Figure 4.11d**, the difference between modelled Approved Case water quality (salinity) and Proposed Case water quality (salinity) is negligible (change is less than 2%), for both the R10 and R90 scenarios.

Figure 4.12a and **Figure 4.12b** presents the modelled cumulative days within a dry period for the Approved Case and Proposed Case considering the 10th and 90th ranked smallest groundwater contribution to surface water with respect to each subcatchment.

For the purpose of this assessment, in a conservative approach, a dry period is considered to be the same as a low-flow period, whereby the streamflow is lower than the 10% threshold over the selected time period, calculated from the Approved Case. It is noted that the use of recession curves in the AWBM will prevent streamflow from ever reaching zero.

It is noted that **Figure 4.12a** and **Figure 4.12b** is a new figure type to that presented JBS&G (2025) and involved post-processing model output, without other changes.

From **Figure 4.12a** and **Figure 4.12b**, comparison of the Proposed Case to the Approved Case, indicates there is a negligible change with respect to cumulative days and average (geomean) flow for dry periods.



Legend:

Mining Methods:
- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:
- Approved
- Existing
- Proposed
- Other Proposed

Swamps by MU Name (Clarence, 2025bc):
- 50 Newnes Plateau Shrub Swamp (EEC)
- 51 Newnes Plateau Hanging Swamp (EEC)
- 52 Newnes Plateau Rush - Sedge - Snow Gum Hollow Wooded Heath (EEC)

Modelling:
- Surface Water Catchments
- Selected Catchment

JBS&G

Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R01RevA	Date: 05-Nov-2025
Drawn By: DAW	Checked By: JRWB

Scale 1:30,000

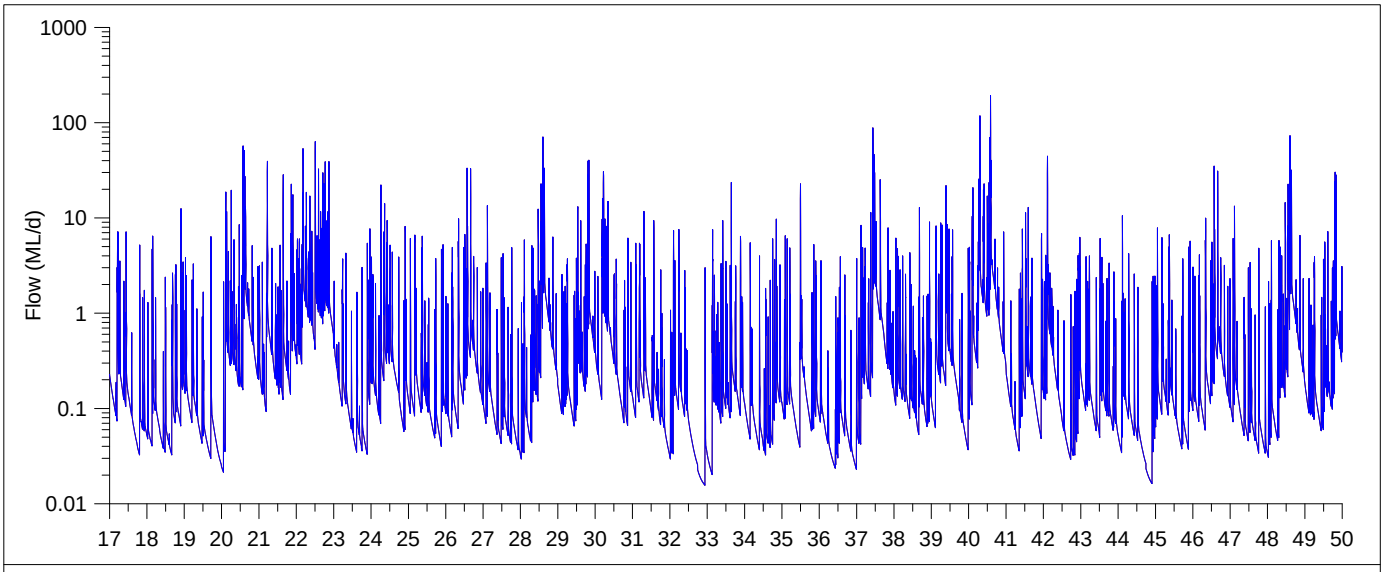
0 0.5 1
km

Coor. Sys. GDA 1994 MGA Zone 56

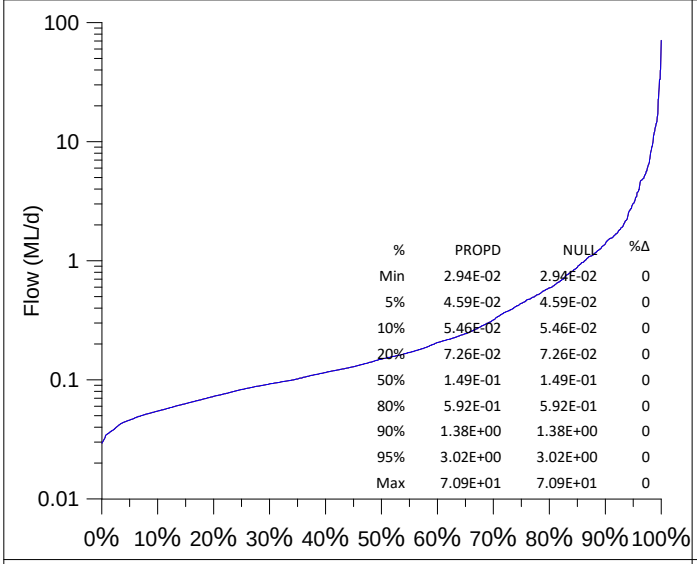
Surface Catchments - Pine Swamp (Node 716)

FIGURE: 4.10

File Name: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\GIS\Maps\68229_R01RevA_D052a_Catchments_Node716.mxd

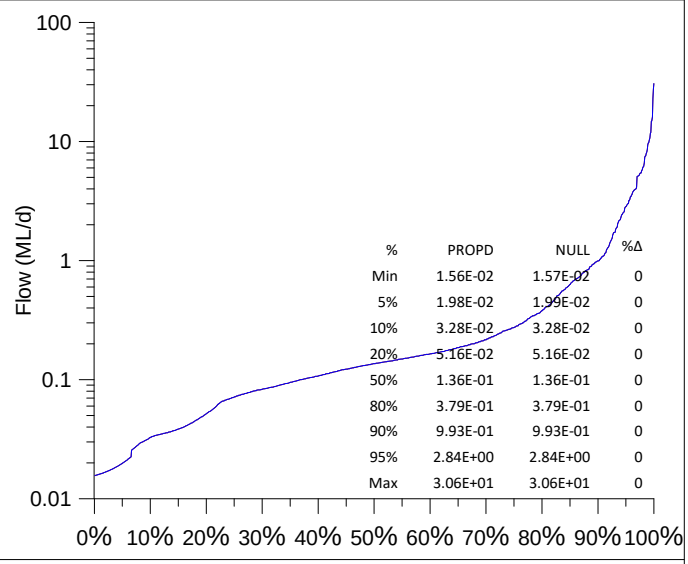


Time Series Model Output:



%	PROPD	NULL	%Δ
Min	2.94E-02	2.94E-02	0
5%	4.59E-02	4.59E-02	0
10%	5.46E-02	5.46E-02	0
20%	7.26E-02	7.26E-02	0
50%	1.49E-01	1.49E-01	0
80%	5.92E-01	5.92E-01	0
90%	1.38E+00	1.38E+00	0
95%	3.02E+00	3.02E+00	0
Max	7.09E+01	7.09E+01	0

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



%	PROPD	NULL	%Δ
Min	1.56E-02	1.57E-02	0
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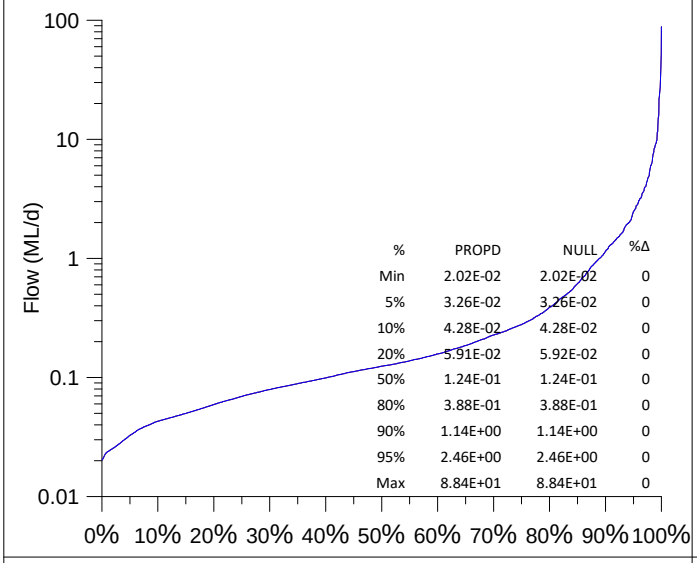
10%	3.28E-02	3.28E-02	0
20%	5.16E-02	5.16E-02	0
50%	1.36E-01	1.36E-01	0
80%	3.79E-01	3.79E-01	0
90%	9.93E-01	9.93E-01	0
95%	2.84E+00	2.84E+00	0
Max	3.06E+01	3.06E+01	0

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



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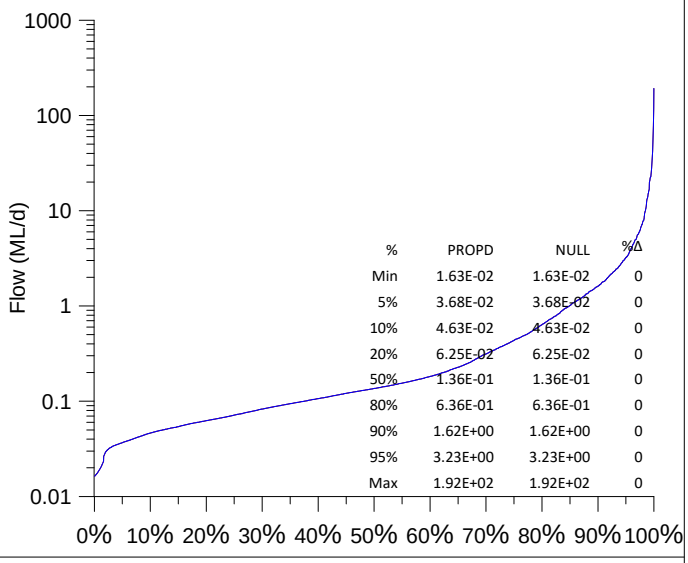
10%	4.28E-02	4.28E-02	0
20%	5.91E-02	5.92E-02	0
50%	1.24E-01	1.24E-01	0
80%	3.88E-01	3.88E-01	0
90%	1.14E+00	1.14E+00	0
95%	2.46E+00	2.46E+00	0
Max	8.84E+01	8.84E+01	0

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
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5%	3.68E-02	3.68E-02	0
10%	4.63E-02	4.63E-02	0
20%	6.25E-02	6.25E-02	0
50%	1.36E-01	1.36E-01	0
80%	6.36E-01	6.36E-01	0
90%	1.62E+00	1.62E+00	0
95%	3.23E+00	3.23E+00	0
Max	1.92E+02	1.92E+02	0

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

- Proposed Case (PRO) Simulation
- Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

Job No.: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevA | Date: 27/11/2025

Drawn By: DAW | Checked By: JRWB

GoldSIM Model Output - Flow (R10)

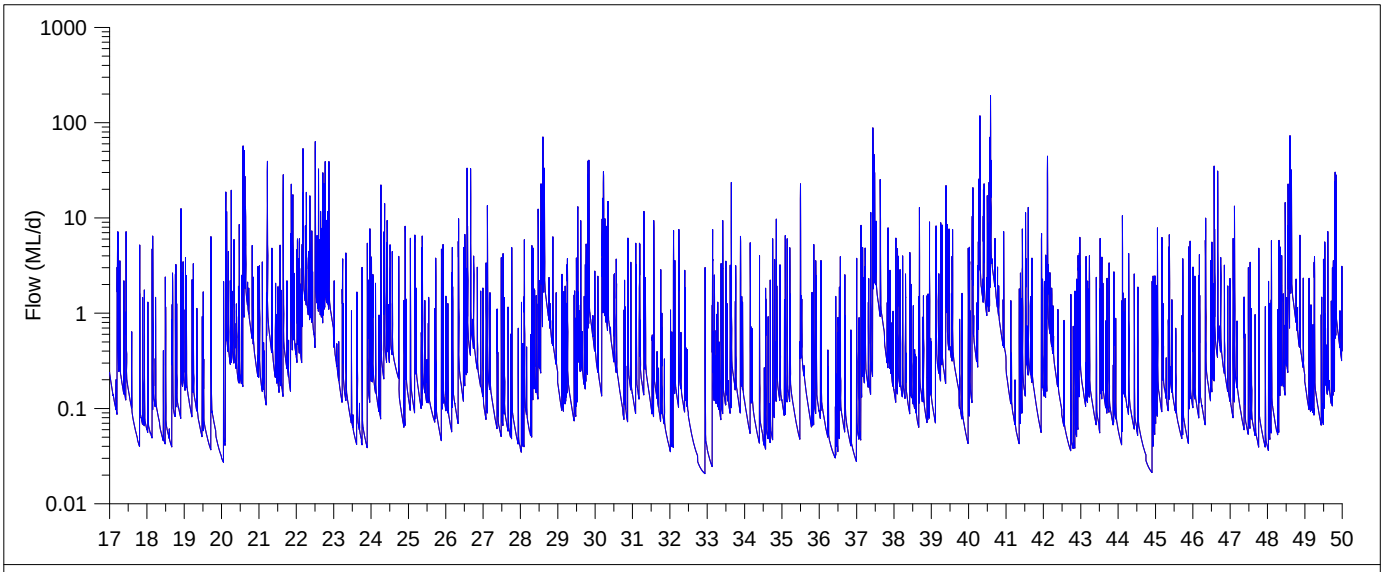
Pine Swamp:
- Pine Swamp
(Node 716)

Figure 4.11a

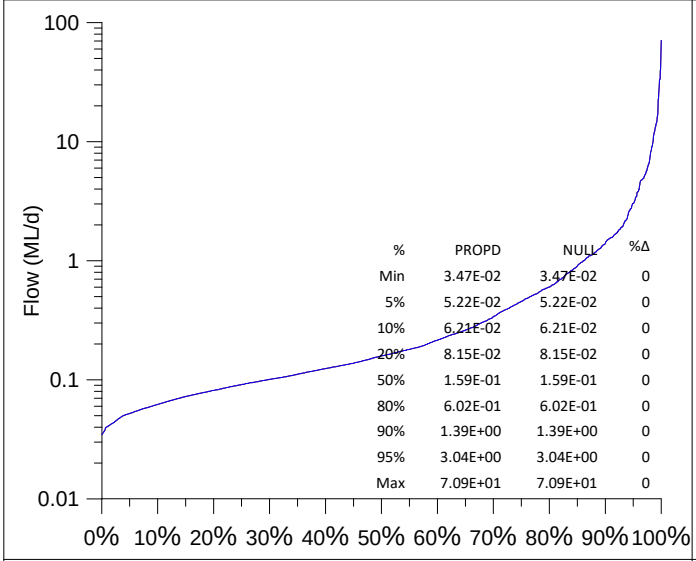
JBS&G

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EPI\Figures\Grapher\68229_R02RevA_D004_Predn_Node716\68229_R02RevA_D004a_PRO_02a_GoldSIMOutput_Flow_R10.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp



Time Series Model Output:



%	PROPD	NULL	%Δ
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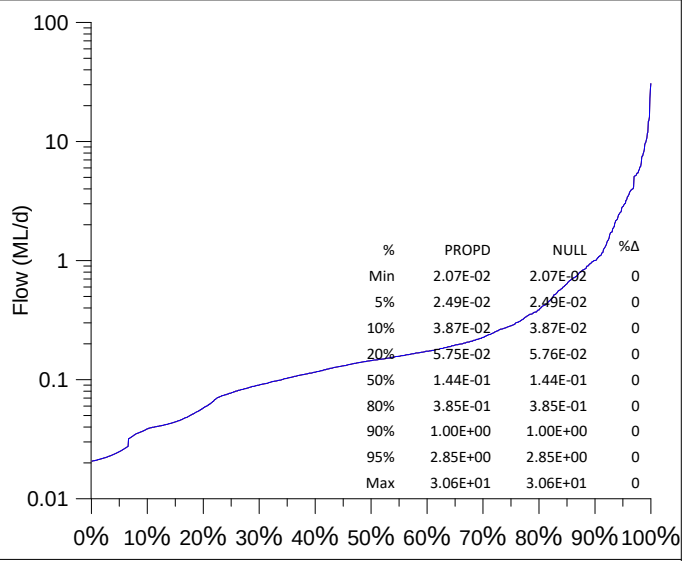
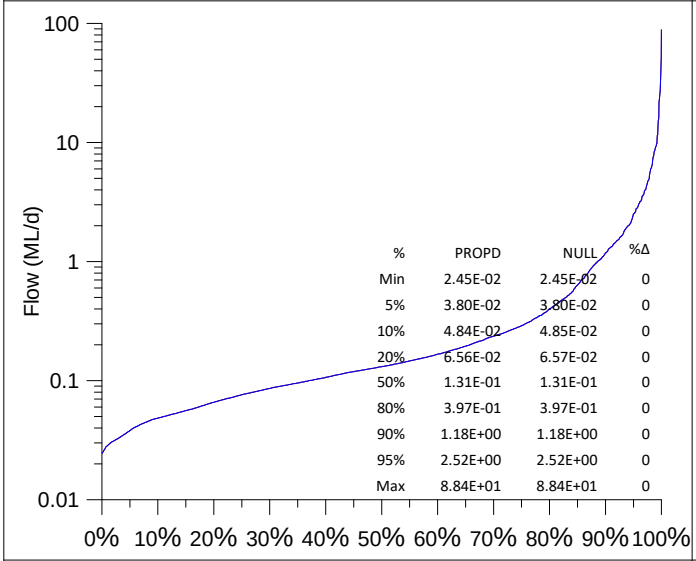
10%	6.21E-02	6.21E-02	0
20%	8.15E-02	8.15E-02	0
50%	1.59E-01	1.59E-01	0
80%	6.02E-01	6.02E-01	0
90%	1.39E+00	1.39E+00	0
95%	3.04E+00	3.04E+00	0
Max	7.09E+01	7.09E+01	0

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



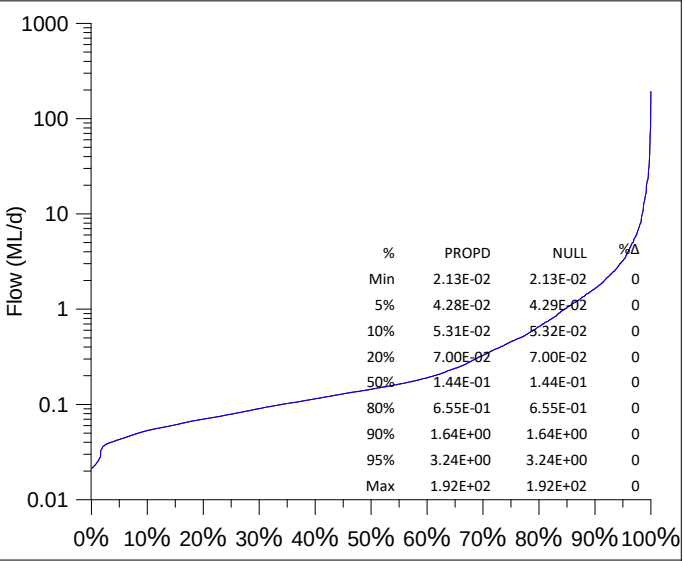
%	PROPD	NULL	%Δ
Min	2.07E-02	2.07E-02	0
5%	2.49E-02	2.49E-02	0
10%	3.87E-02	3.87E-02	0
20%	5.75E-02	5.76E-02	0
50%	1.44E-01	1.44E-01	0
80%	3.85E-01	3.85E-01	0
90%	1.00E+00	1.00E+00	0
95%	2.85E+00	2.85E+00	0
Max	3.06E+01	3.06E+01	0

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



%	PROPD	NULL	%Δ
Min	2.45E-02	2.45E-02	0
5%	3.80E-02	3.80E-02	0
10%	4.84E-02	4.85E-02	0
20%	6.56E-02	6.57E-02	0
50%	1.31E-01	1.31E-01	0
80%	3.97E-01	3.97E-01	0
90%	1.18E+00	1.18E+00	0
95%	2.52E+00	2.52E+00	0
Max	8.84E+01	8.84E+01	0

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
Min	2.13E-02	2.13E-02	0
5%	4.28E-02	4.29E-02	0
10%	5.31E-02	5.32E-02	0
20%	7.00E-02	7.00E-02	0
50%	1.44E-01	1.44E-01	0
80%	6.55E-01	6.55E-01	0
90%	1.64E+00	1.64E+00	0
95%	3.24E+00	3.24E+00	0
Max	1.92E+02	1.92E+02	0

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

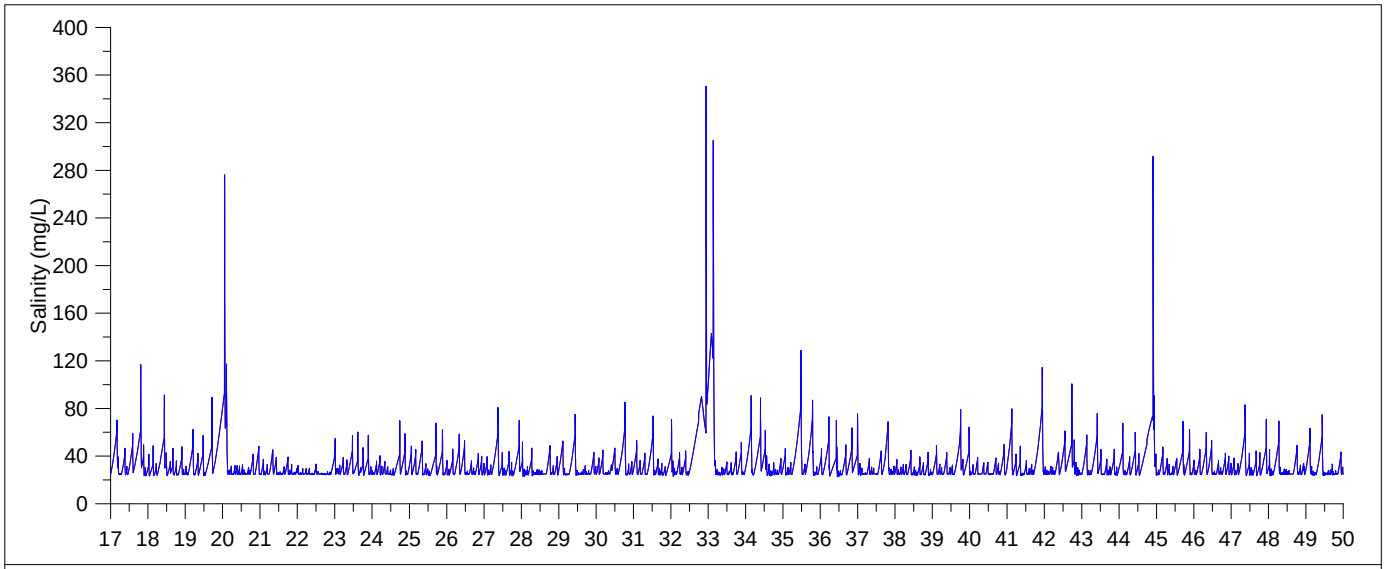
- Proposed Case (PRO) Simulation
- Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

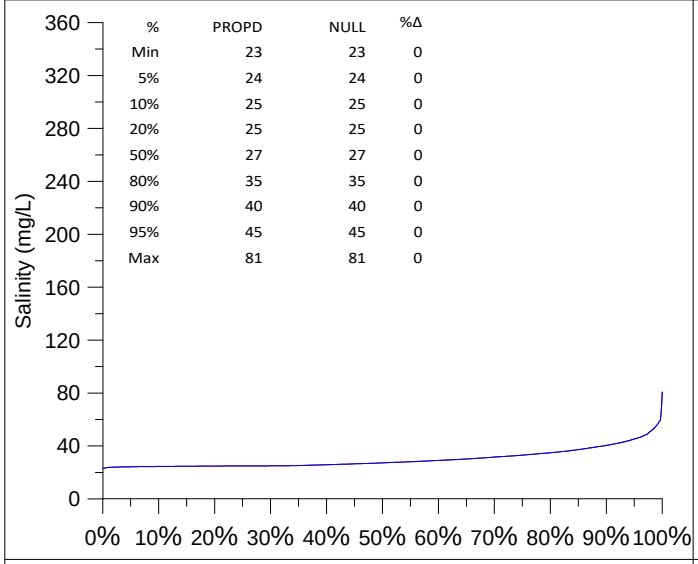
Job No.: 68229		**GoldSIM Model Output - Flow (R90)**
Client: Clarence Colliery Pty Ltd		**Pine Swamp:** - Pine Swamp (Node 716)
Version: R02RevA	Date: 27/11/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.11b**

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EPI\Figures\Grapher\68229_R02RevA_D004_Predn_Node716\68229_R02RevA_D004b_PRO_02a_GoldSIMOutput_Flow_R90.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp

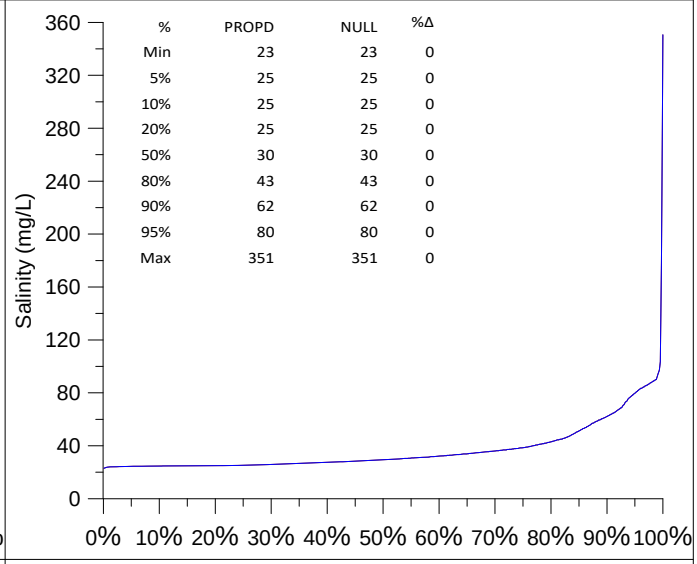


Time Series Model Output:



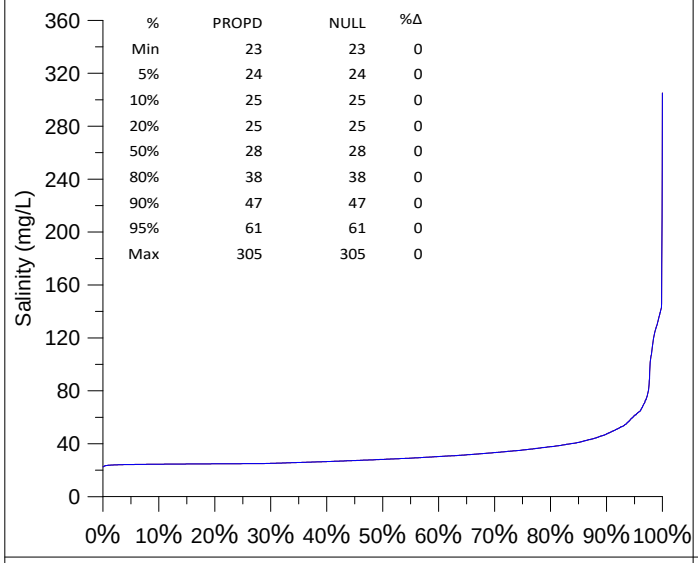
%	PROPD	NULL	%Δ
Min	23	23	0
5%	24	24	0
10%	25	25	0
20%	25	25	0
50%	27	27	0
80%	35	35	0
90%	40	40	0
95%	45	45	0
Max	81	81	0

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



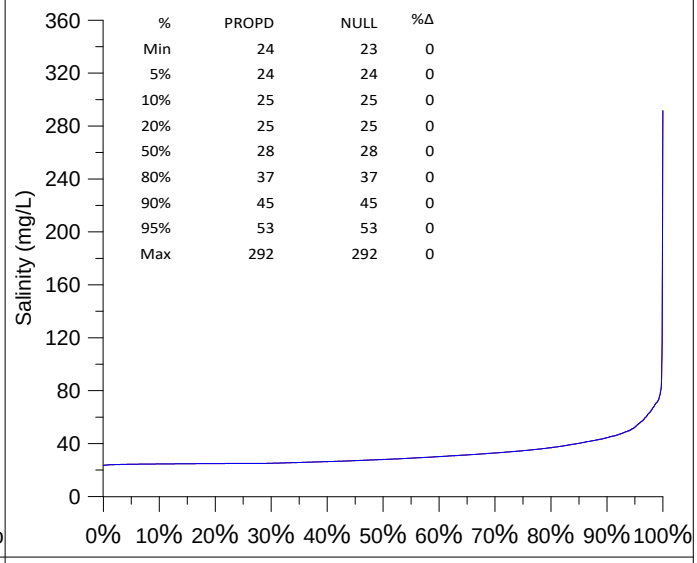
%	PROPD	NULL	%Δ
Min	23	23	0
5%	25	25	0
10%	25	25	0
20%	25	25	0
50%	30	30	0
80%	43	43	0
90%	62	62	0
95%	80	80	0
Max	351	351	0

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



%	PROPD	NULL	%Δ
Min	23	23	0
5%	24	24	0
10%	25	25	0
20%	25	25	0
50%	28	28	0
80%	38	38	0
90%	47	47	0
95%	61	61	0
Max	305	305	0

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
Min	24	23	0
5%	24	24	0
10%	25	25	0
20%	25	25	0
50%	28	28	0
80%	37	37	0
90%	45	45	0
95%	53	53	0
Max	292	292	0

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

Proposed Case (PRO) Simulation

Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

Job No.: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevA | Date: 27/11/2025

Drawn By: DAW | Checked By: JRWB

GoldSIM Model Output - Salinity (R10)

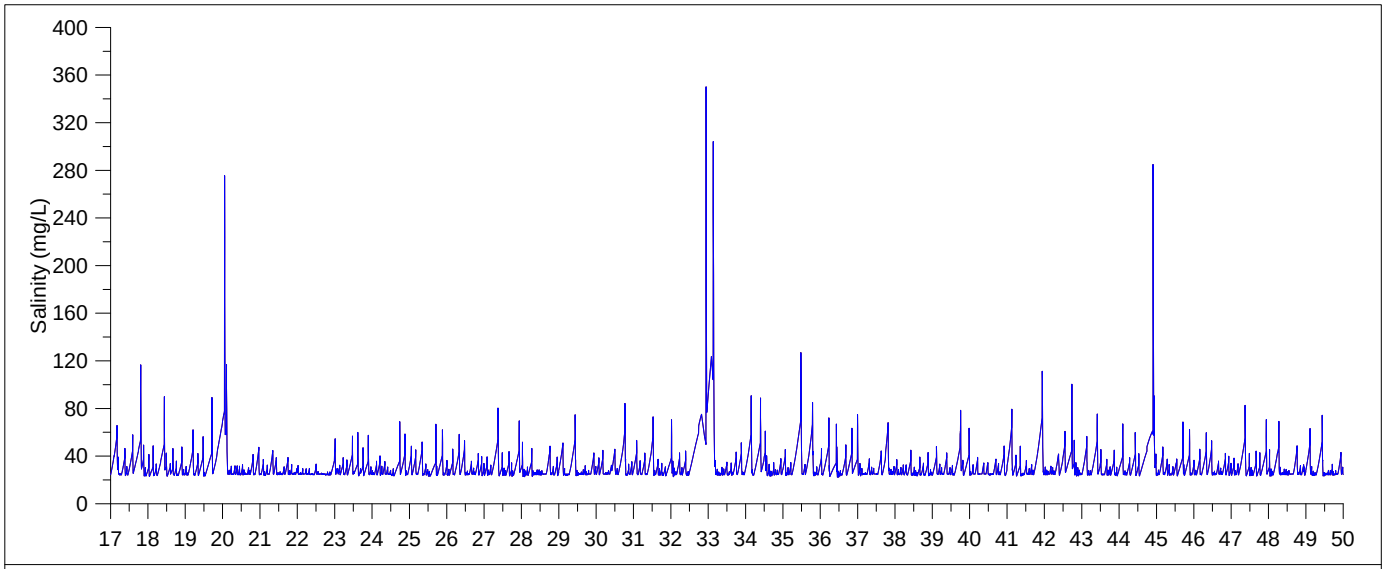
Pine Swamp:
- Pine Swamp
(Node 716)

Figure 4.11c

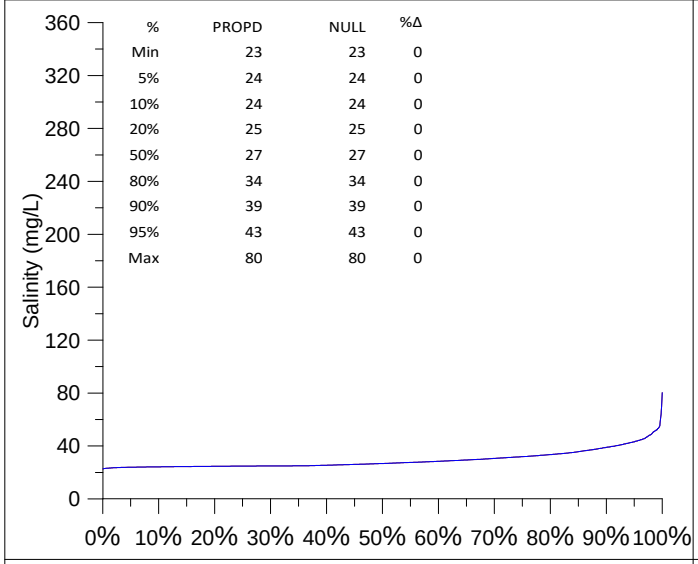
JBS&G

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D004_Predn_Node716\68229_R02RevA_D004c_PRO_02a_GoldSIMOutput_Salinity_R10.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp

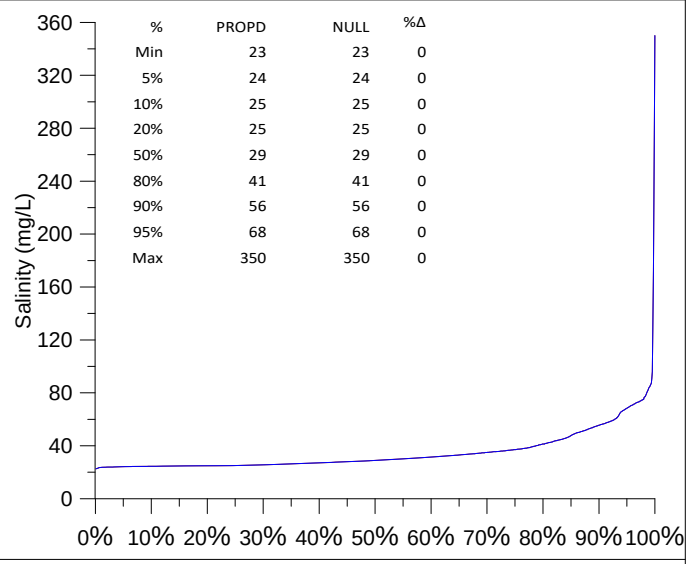


Time Series Model Output:



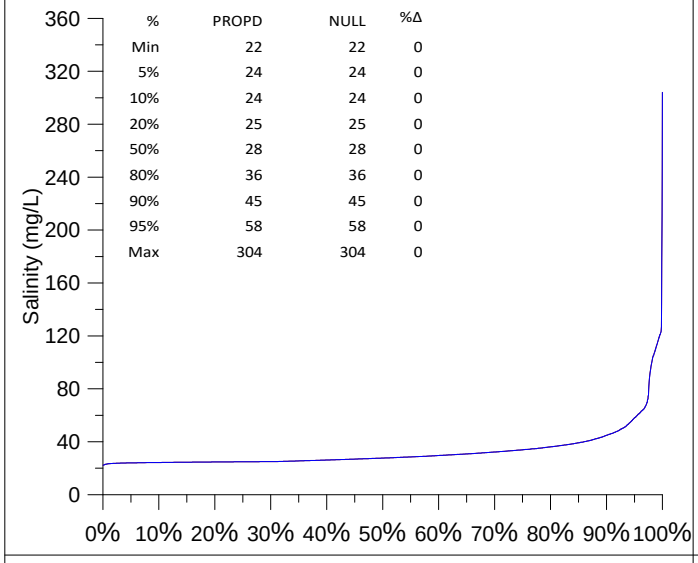
%	PROPD	NULL	%Δ
Min	23	23	0
5%	24	24	0
10%	24	24	0
20%	25	25	0
50%	27	27	0
80%	34	34	0
90%	39	39	0
95%	43	43	0
Max	80	80	0

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



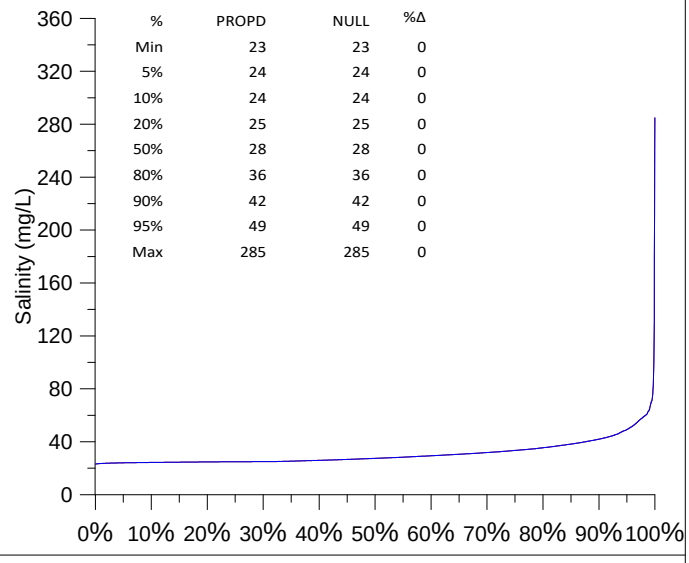
%	PROPD	NULL	%Δ
Min	23	23	0
5%	24	24	0
10%	25	25	0
20%	25	25	0
50%	29	29	0
80%	41	41	0
90%	56	56	0
95%	68	68	0
Max	350	350	0

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



%	PROPD	NULL	%Δ
Min	22	22	0
5%	24	24	0
10%	24	24	0
20%	25	25	0
50%	28	28	0
80%	36	36	0
90%	45	45	0
95%	58	58	0
Max	304	304	0

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
Min	23	23	0
5%	24	24	0
10%	24	24	0
20%	25	25	0
50%	28	28	0
80%	36	36	0
90%	42	42	0
95%	49	49	0
Max	285	285	0

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

Proposed Case (PRO) Simulation

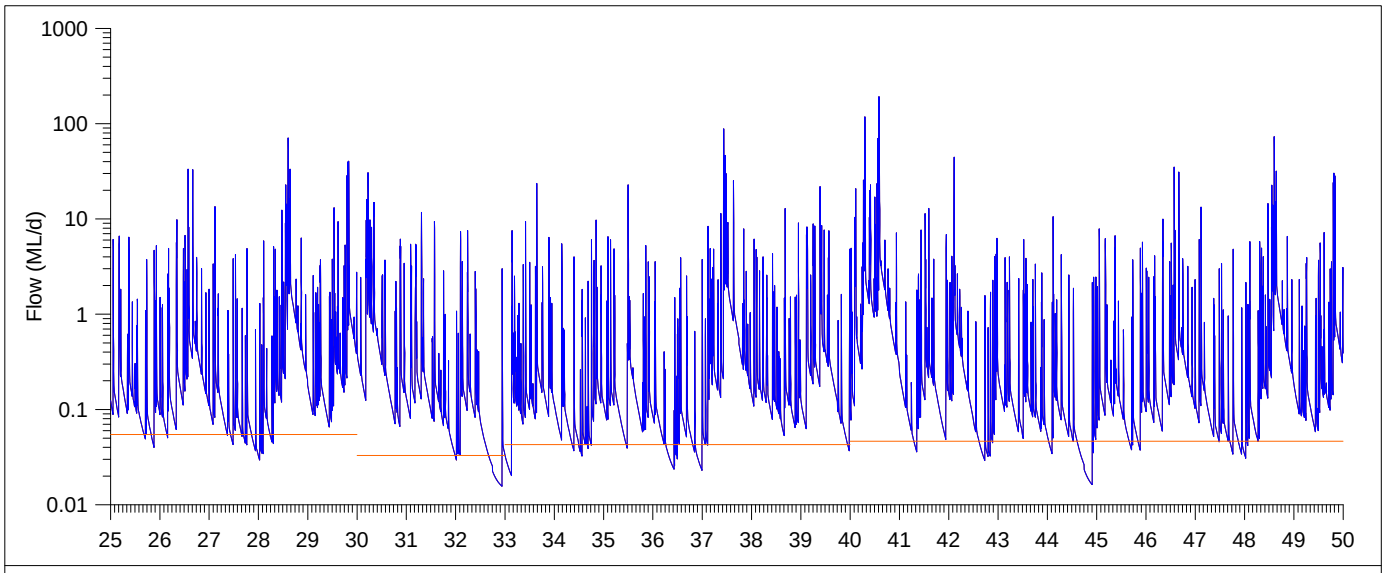
Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

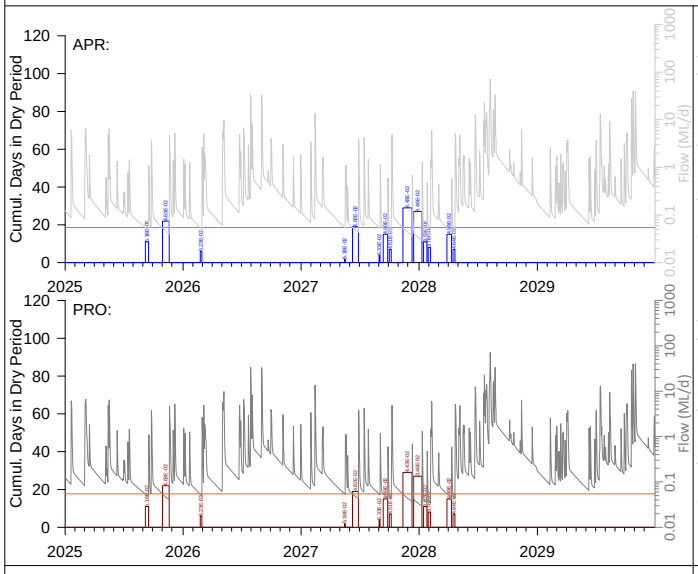
Job No.: 68229		**GoldSIM Model Output - Salinity (R90)**
Client: Clarence Colliery Pty Ltd		**Pine Swamp:** - Pine Swamp (Node 716)
Version: R02RevA	Date: 27/11/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.11d** JBS&G

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D004_Predn_Node716\68229_R02RevA_D004d_PRO_02a_GoldSIMOutput_Salinity_R90.grf

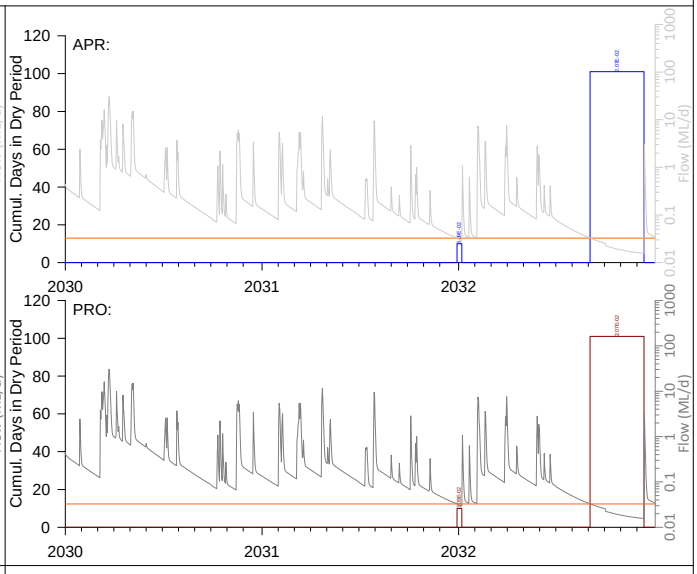
Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp



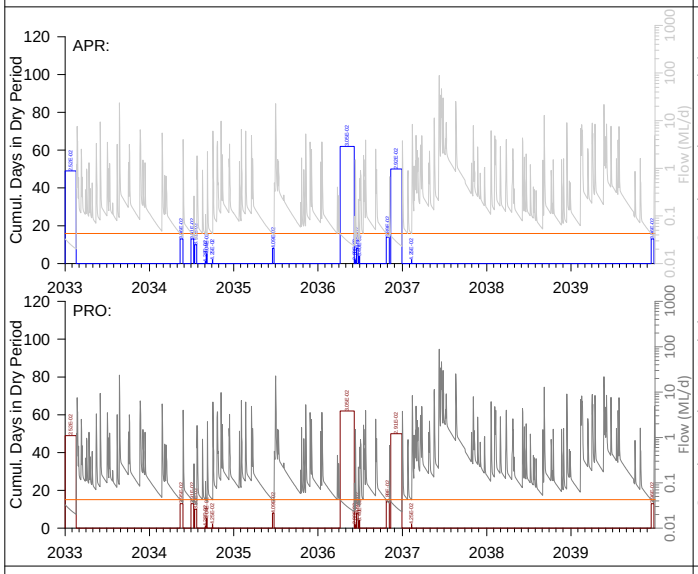
Time Series Model Output:



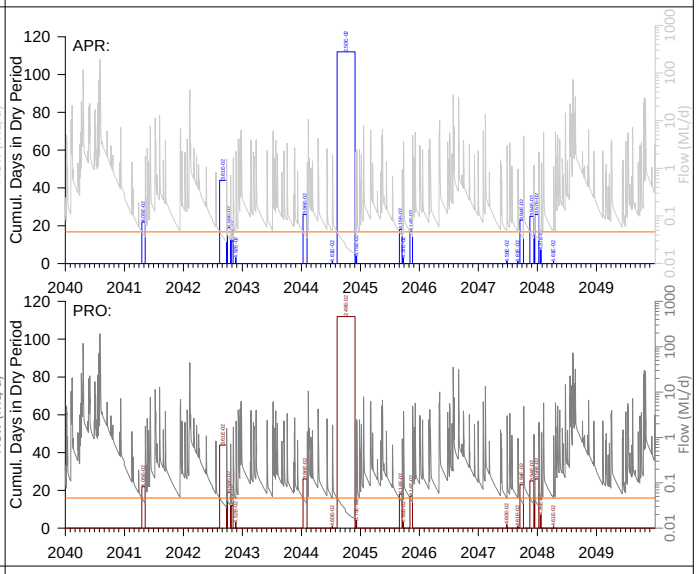
Cumul. Days in Dry Period: Flow at or below 5.46E-02ML/d (10%): 01/01/2025 to 31/12/2029



Cumul. Days in Dry Period: Flow at or below 3.28E-02ML/d (10%): 01/01/2030 to 31/12/2032



Cumul. Days in Dry Period: Flow at or below 4.28E-02ML/d (10%): 01/01/2033 to 31/12/2039



Cumul. Days in Dry Period: Flow at or below 4.63E-02ML/d (10%): 01/01/2040 to 31/12/2049

Legend

Upper Chart:
- Approved Flow (ML/d)
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)

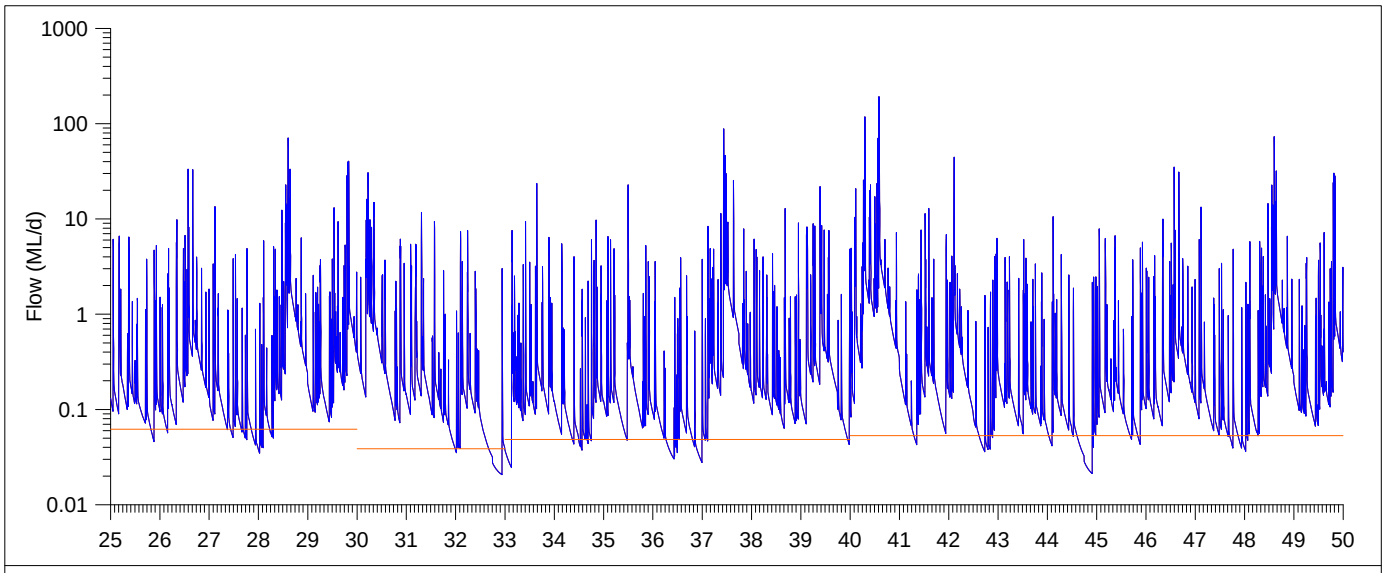
Lower Charts:
- Approved Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Approved
- Cumulative Days in Dry Period - Approved
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Proposed
- Cumulative Days in Dry Period - Proposed

Notes:

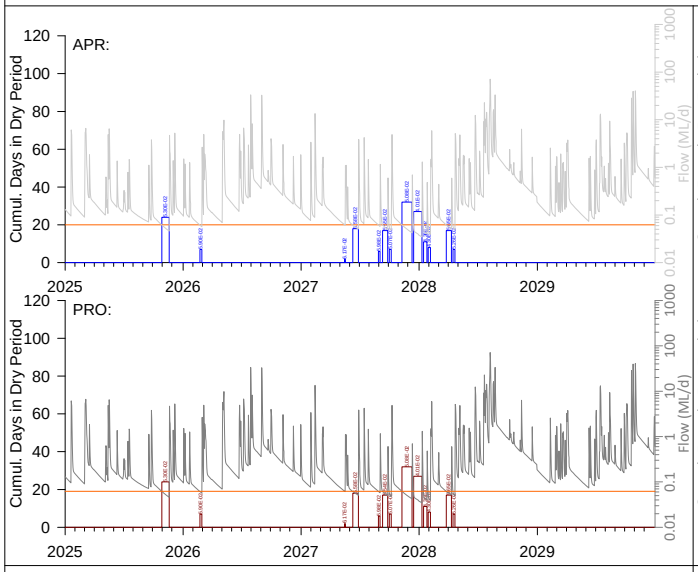
Job No.: 68229		**GoldSIM Model Output - Cumulative Days in Dry Period (R10)**
Client: Clarence Colliery Pty Ltd		**Pine Swamp:** - Pine Swamp (Node 716)
Version: R02RevA	Date: 04/12/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.12a** JBS&G

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D012_DryDays_Node716\68229_R02RevA_D012a\68229_R02RevA_D012a_PRO_02a_GoldSIMOutput_Node716_DryDays_R10.grf

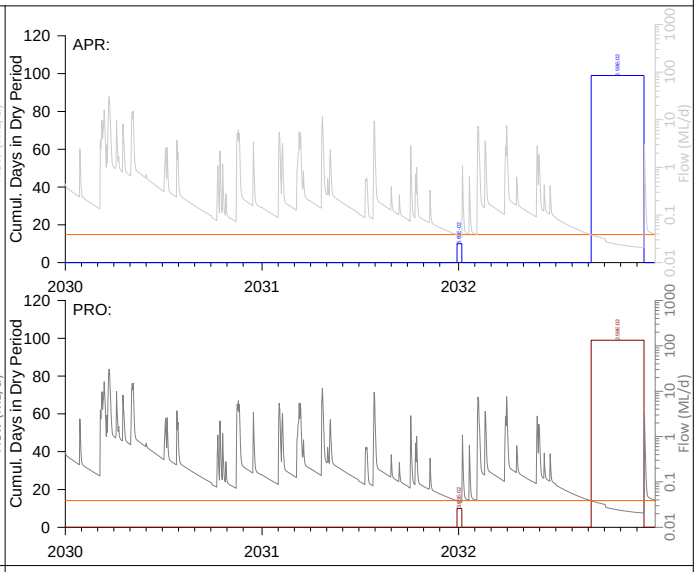
Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp



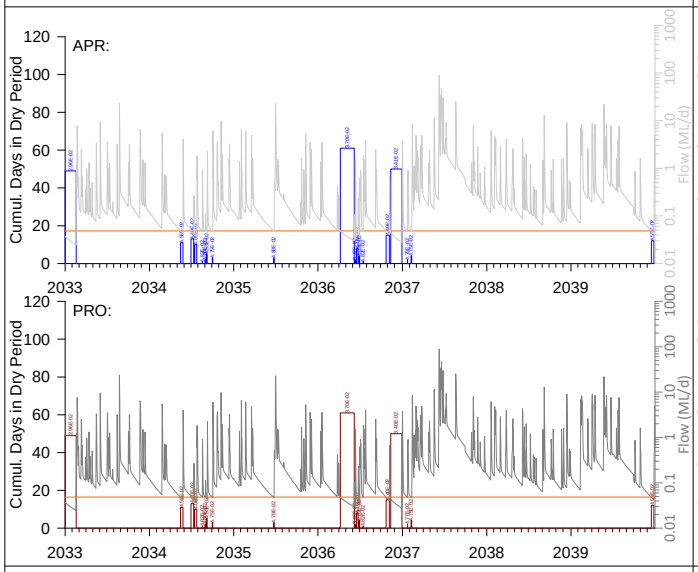
Time Series Model Output:



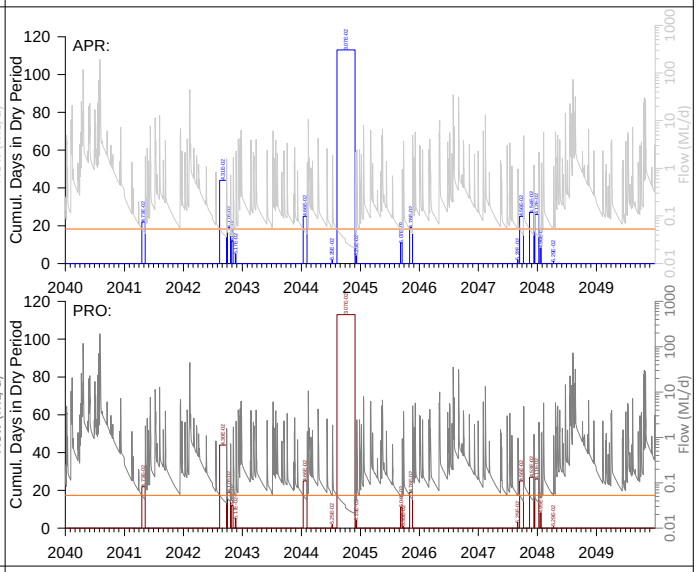
Cumul. Days in Dry Period: Flow at or below 6.21E-02ML/d (10%): 01/01/2025 to 31/12/2029



Cumul. Days in Dry Period: Flow at or below 3.87E-02ML/d (10%): 01/01/2030 to 31/12/2032



Cumul. Days in Dry Period: Flow at or below 4.85E-02ML/d (10%): 01/01/2033 to 31/12/2039



Cumul. Days in Dry Period: Flow at or below 5.32E-02ML/d (10%): 01/01/2040 to 31/12/2049

Legend

Upper Chart:
- Approved Flow (ML/d)
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)

Lower Charts:
- Approved Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Approved
- Cumulative Days in Dry Period - Approved
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Proposed
- Cumulative Days in Dry Period - Proposed

Notes:

Job No.: 68229		**GoldSIM Model Output - Cumulative Days in Dry Period (R90)**
Client: Clarence Colliery Pty Ltd		**Pine Swamp:** - Pine Swamp (Node 716)
Version: R02RevA	Date: 04/12/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.12b**

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D012_DryDays_Node716\68229_R02RevA_D012b\68229_R02RevA_D012b_PRO_02a_GoldSIMOutput_Node716_DryDays_R90.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp

Paddys Creek Swamp (Node 712):

Figure 4.13 presents the subcatchments contributing to Paddys Creek Swamp.

Figure 4.14a and **Figure 4.14b** presents the modelled time-series flow for the Approved Case and Proposed Case considering the 10th and 90th ranked smallest groundwater contribution to surface water with respect to each subcatchment.

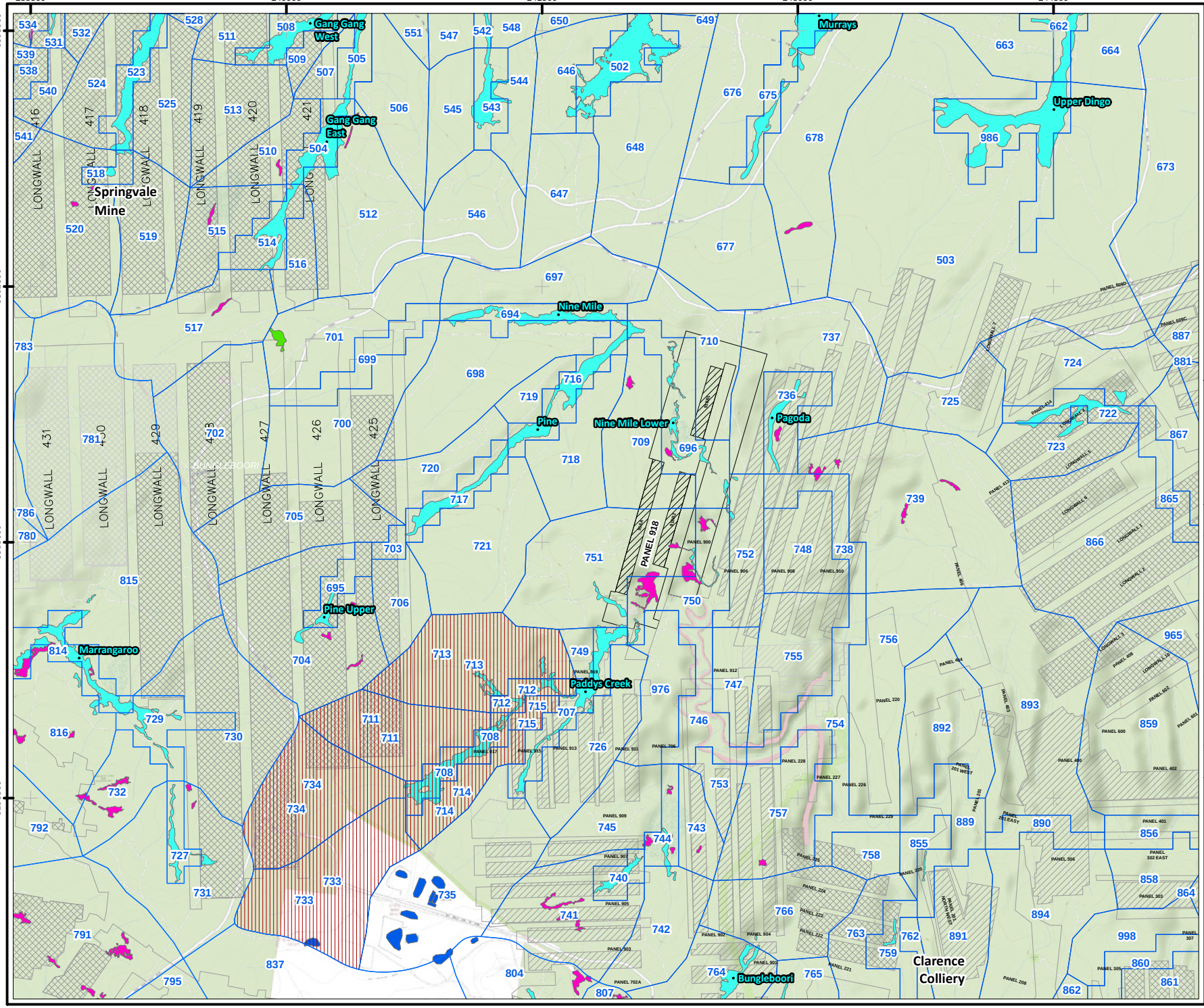
Figure 4.14c and **Figure 4.14d** presents the modelled time-series water quality (salinity) for the Approved Case and Proposed Case considering the 10th and 90th ranked smallest groundwater contribution to surface water with respect to each subcatchment.

From **Figure 4.14a** and **Figure 4.14b**, the difference between modelled Approved Case surface water flows and Proposed Case surface water flows is negligible (change is less than 2%), for both the R10 and R90 scenarios.

From **Figure 4.14c** and **Figure 4.14d**, the difference between modelled Approved Case water quality (salinity) and Proposed Case water quality (salinity) is negligible (change is less than 2%), for both the R10 and R90 scenarios.

Figure 4.15a and **Figure 4.15b** presents the modelled cumulative days within a dry period for the Approved Case and Proposed Case considering the 10th and 90th ranked smallest groundwater contribution to surface water with respect to each subcatchment.

From **Figure 4.15a** and **Figure 4.15b**, comparison of the Proposed Case to the Approved Case, indicates there is a negligible change with respect to cumulative days and average (geomean) flow for dry periods.



Legend:

Mining Methods:
- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:
- Approved
- Existing
- Proposed
- Other Proposed

Swamps by MU Name (Clarence, 2025bc):
- 50 Newnes Plateau Shrub Swamp (EEC)
- 51 Newnes Plateau Hanging Swamp (EEC)
- 52 Newnes Plateau Rush - Sedge - Snow Gum Hollow Wooded Heath (EEC)

Modelling:
- Surface Water Catchments
- Selected Catchment

JBS&G

Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R01RevA	Date: 05-Nov-2025
Drawn By: DAW	Checked By: JRWB

Scale 1:30,000

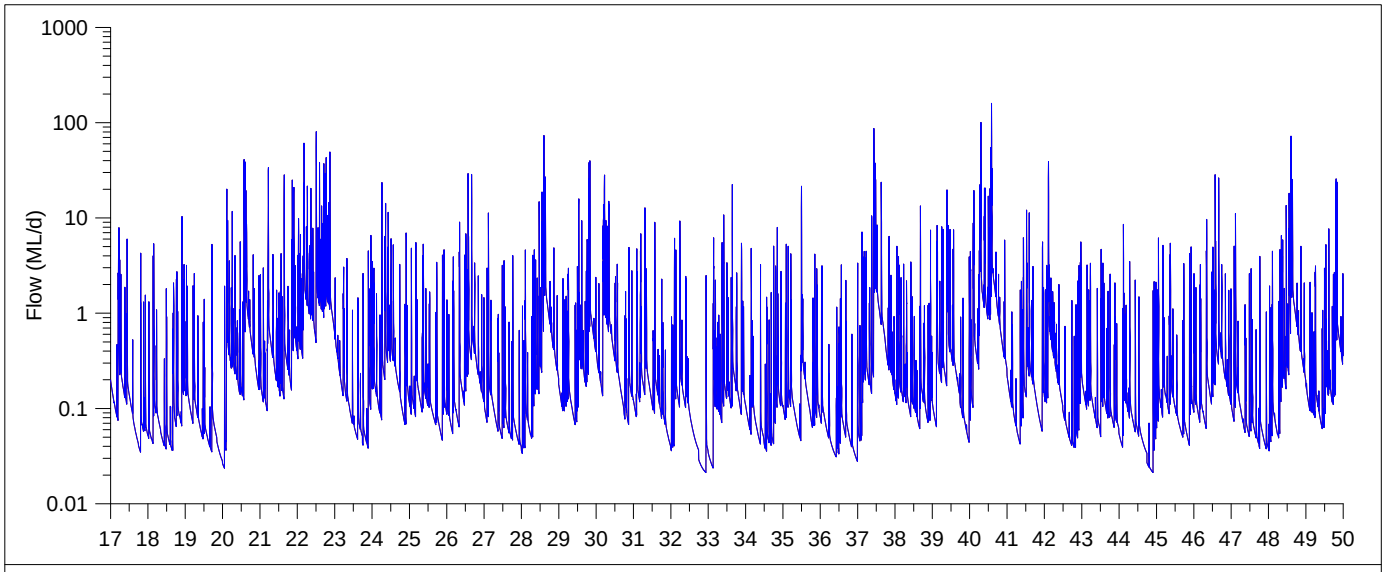
0 0.5 1
km

Coor. Sys. GDA 1994 MGA Zone 56

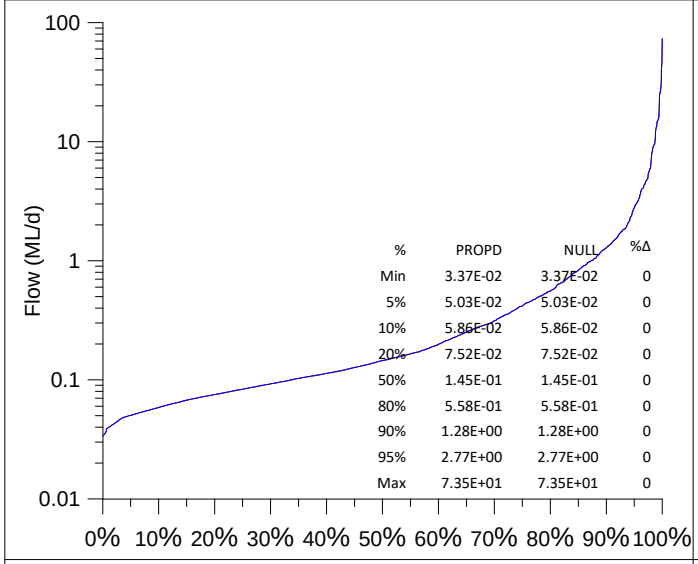
Surface Catchments
- Paddys Creek Swamp (Node 712)

FIGURE: 4.13

File Name: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\GIS\Maps\68229_R01RevA_D052b_Catchments_Node712.mxd

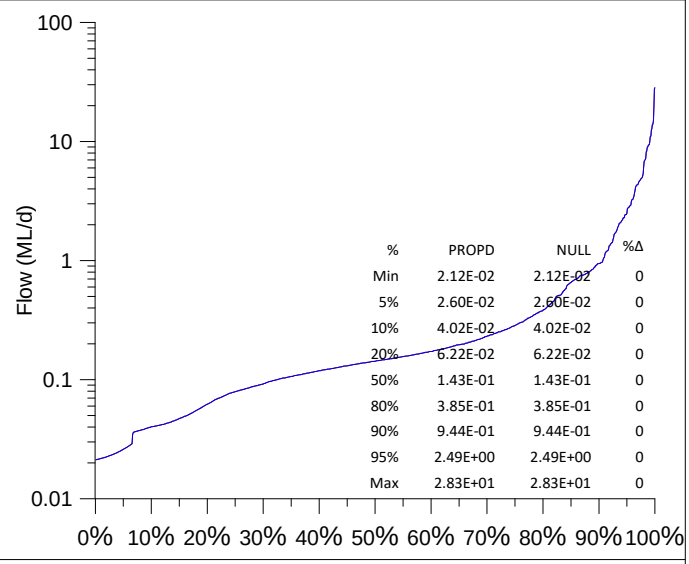


Time Series Model Output:



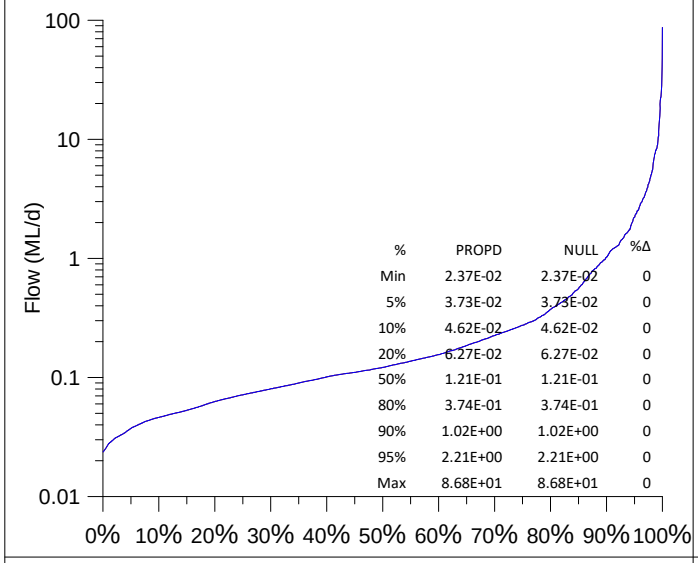
%	PROPD	NULL	%Δ
Min	3.37E-02	3.37E-02	0
5%	5.03E-02	5.03E-02	0
10%	5.86E-02	5.86E-02	0
20%	7.52E-02	7.52E-02	0
50%	1.45E-01	1.45E-01	0
80%	5.58E-01	5.58E-01	0
90%	1.28E+00	1.28E+00	0
95%	2.77E+00	2.77E+00	0
Max	7.35E+01	7.35E+01	0

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



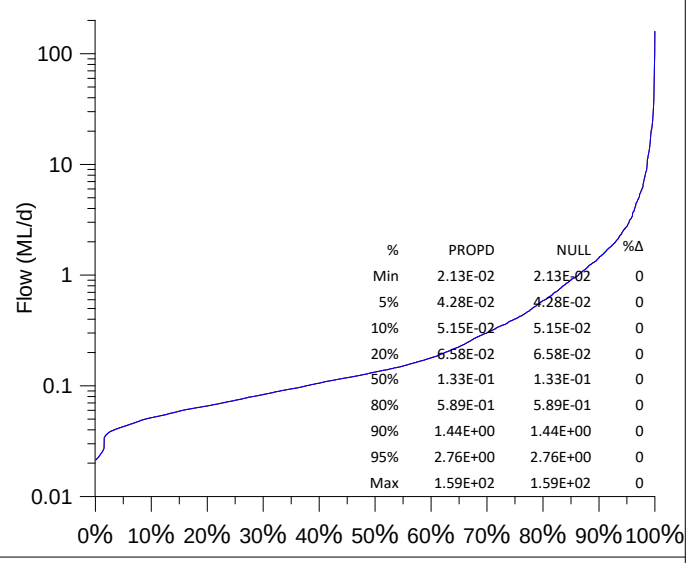
%	PROPD	NULL	%Δ
Min	2.12E-02	2.12E-02	0
5%	2.60E-02	2.60E-02	0
10%	4.02E-02	4.02E-02	0
20%	6.22E-02	6.22E-02	0
50%	1.43E-01	1.43E-01	0
80%	3.85E-01	3.85E-01	0
90%	9.44E-01	9.44E-01	0
95%	2.49E+00	2.49E+00	0
Max	2.83E+01	2.83E+01	0

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



%	PROPD	NULL	%Δ
Min	2.37E-02	2.37E-02	0
5%	3.73E-02	3.73E-02	0
10%	4.62E-02	4.62E-02	0
20%	6.27E-02	6.27E-02	0
50%	1.21E-01	1.21E-01	0
80%	3.74E-01	3.74E-01	0
90%	1.02E+00	1.02E+00	0
95%	2.21E+00	2.21E+00	0
Max	8.68E+01	8.68E+01	0

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
Min	2.13E-02	2.13E-02	0
5%	4.28E-02	4.28E-02	0
10%	5.15E-02	5.15E-02	0
20%	6.58E-02	6.58E-02	0
50%	1.33E-01	1.33E-01	0
80%	5.89E-01	5.89E-01	0
90%	1.44E+00	1.44E+00	0
95%	2.76E+00	2.76E+00	0
Max	1.59E+02	1.59E+02	0

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

Proposed Case (PRO) Simulation

Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

Job No.: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevA | Date: 27/11/2025

Drawn By: DAW | Checked By: JRWB

GoldSIM Model Output - Flow (R10)

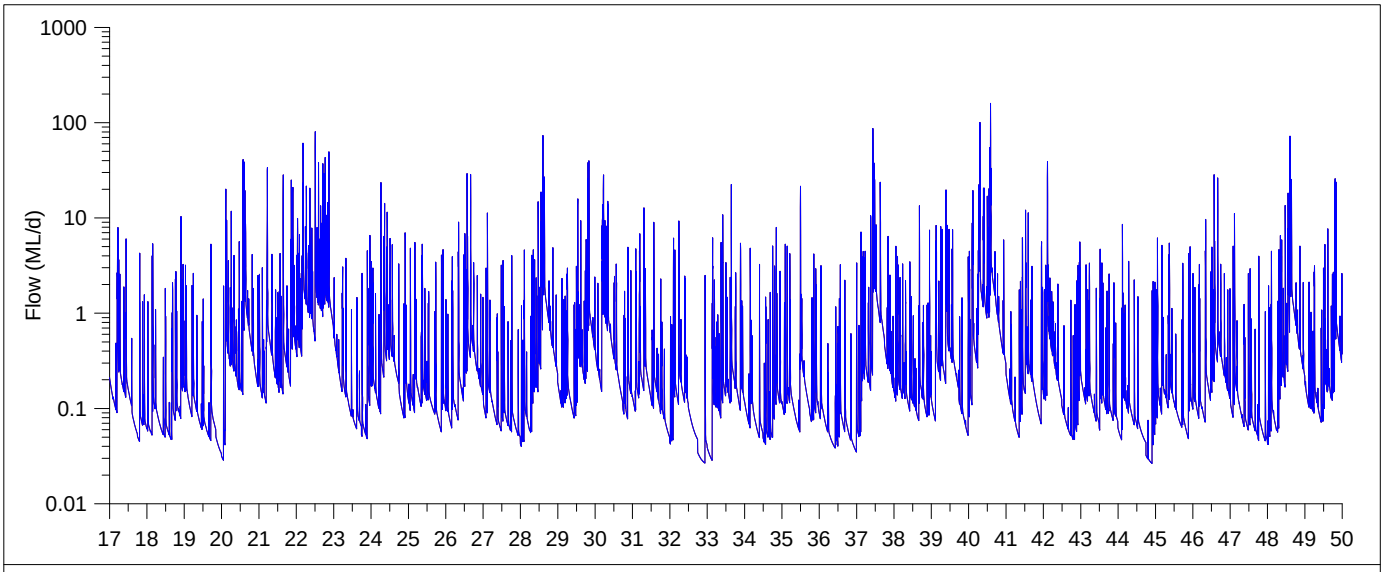
Paddys Creek Swamp:
- Paddys Creek Swamp
(Node 712)

Figure 4.14a

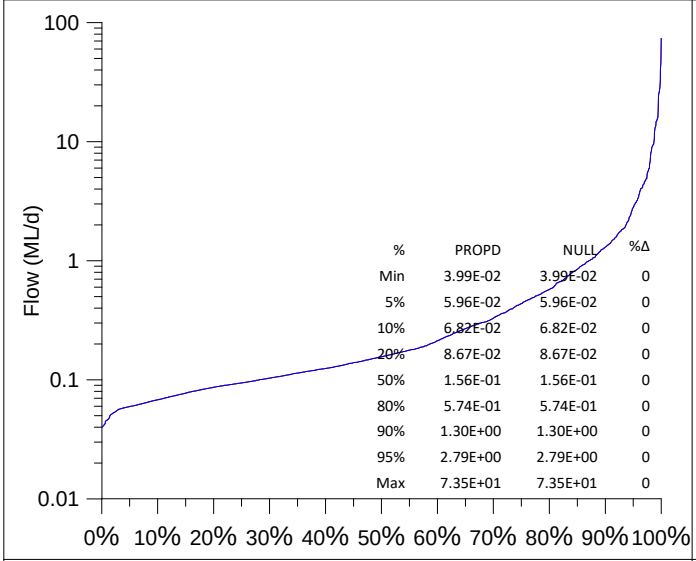
JBS&G

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EPI\Figures\Grapher\68229_R02RevA_D005_Predn_Node712\68229_R02RevA_D005a_PRO_02a_GoldSIMOutput_Flow_R10.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp

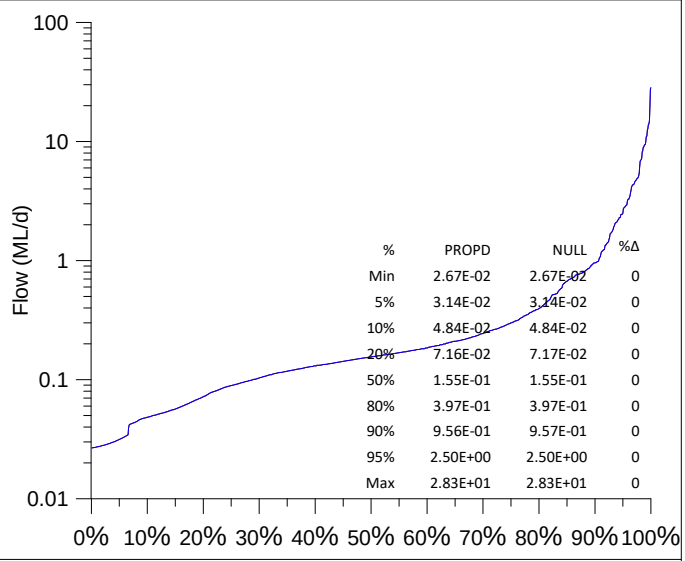


Time Series Model Output:



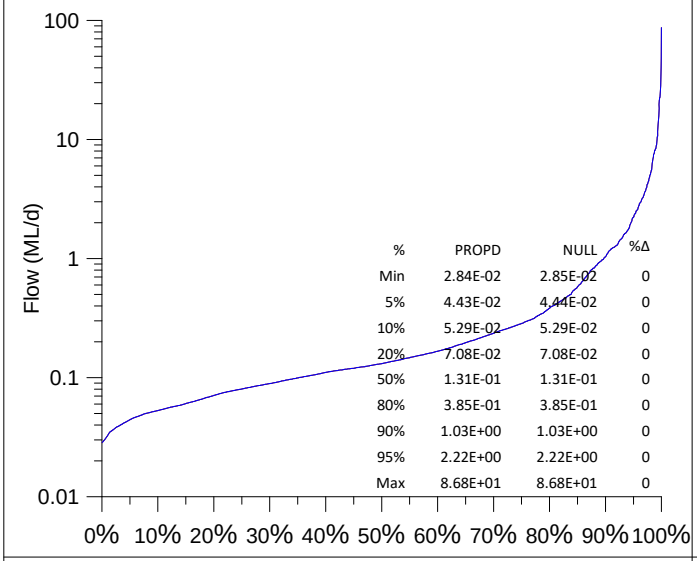
%	PROPD	NULL	%Δ
Min	3.99E-02	3.99E-02	0
5%	5.96E-02	5.96E-02	0
10%	6.82E-02	6.82E-02	0
20%	8.67E-02	8.67E-02	0
50%	1.56E-01	1.56E-01	0
80%	5.74E-01	5.74E-01	0
90%	1.30E+00	1.30E+00	0
95%	2.79E+00	2.79E+00	0
Max	7.35E+01	7.35E+01	0

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



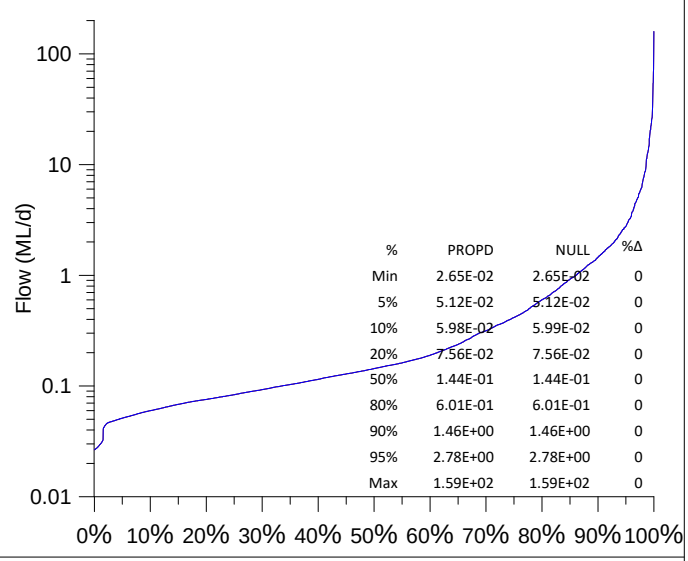
%	PROPD	NULL	%Δ
Min	2.67E-02	2.67E-02	0
5%	3.14E-02	3.14E-02	0
10%	4.84E-02	4.84E-02	0
20%	7.16E-02	7.17E-02	0
50%	1.55E-01	1.55E-01	0
80%	3.97E-01	3.97E-01	0
90%	9.56E-01	9.57E-01	0
95%	2.50E+00	2.50E+00	0
Max	2.83E+01	2.83E+01	0

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



%	PROPD	NULL	%Δ
Min	2.84E-02	2.85E-02	0
5%	4.43E-02	4.44E-02	0
10%	5.29E-02	5.29E-02	0
20%	7.08E-02	7.08E-02	0
50%	1.31E-01	1.31E-01	0
80%	3.85E-01	3.85E-01	0
90%	1.03E+00	1.03E+00	0
95%	2.22E+00	2.22E+00	0
Max	8.68E+01	8.68E+01	0

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
Min	2.65E-02	2.65E-02	0
5%	5.12E-02	5.12E-02	0
10%	5.98E-02	5.99E-02	0
20%	7.56E-02	7.56E-02	0
50%	1.44E-01	1.44E-01	0
80%	6.01E-01	6.01E-01	0
90%	1.46E+00	1.46E+00	0
95%	2.78E+00	2.78E+00	0
Max	1.59E+02	1.59E+02	0

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

- Proposed Case (PRO) Simulation
- Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

Job No.: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevA | Date: 27/11/2025

Drawn By: DAW | Checked By: JRWB

GoldSIM Model Output - Flow (R90)

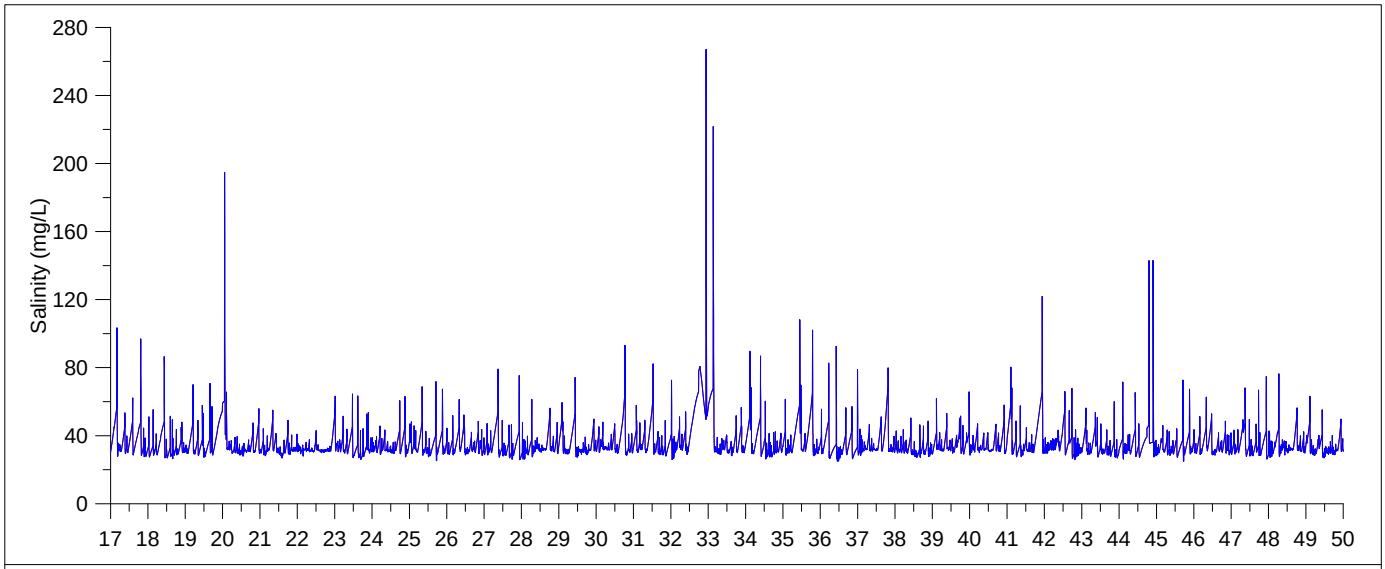
Paddys Creek Swamp:
- Paddys Creek Swamp
(Node 712)

Figure 4.14b

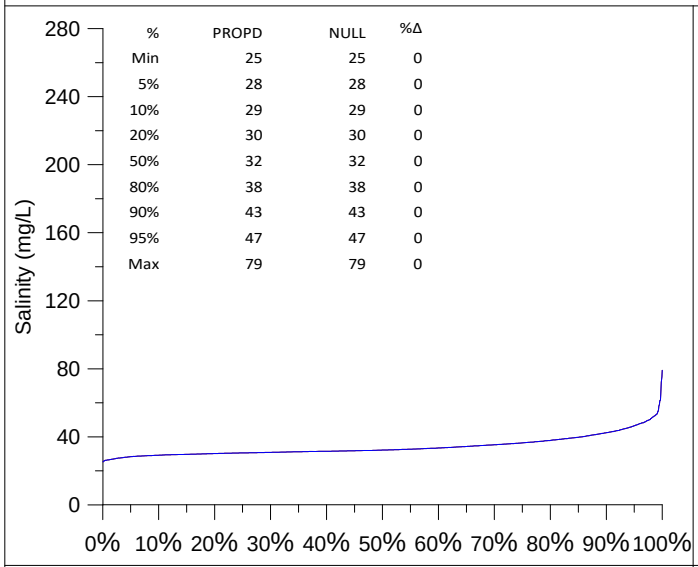
JBS&G

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EPI\Figures\Grapher\68229_R02RevA_D005_Predn_Node712\68229_R02RevA_D005b_PRO_02a_GoldSIMOutput_Flow_R90.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp

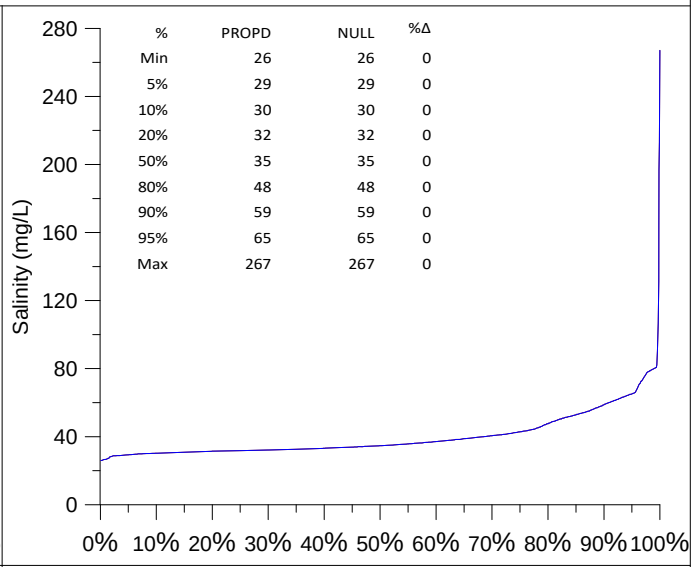


Time Series Model Output:



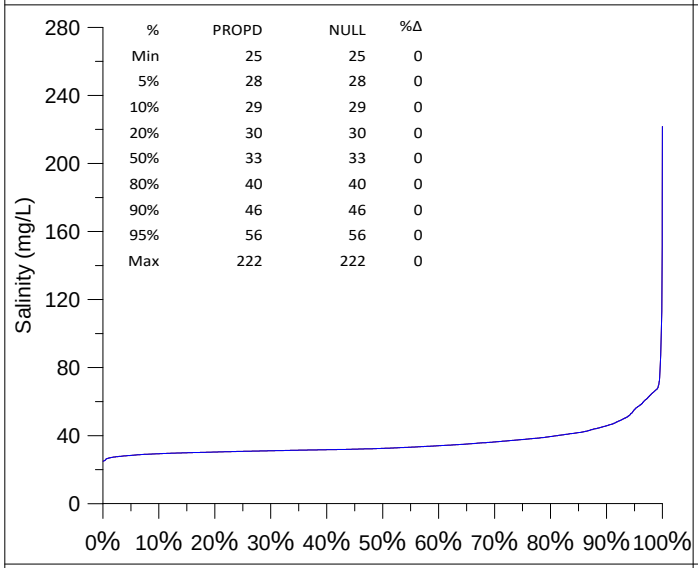
%	PROPD	NULL	%Δ
Min	25	25	0
5%	28	28	0
10%	29	29	0
20%	30	30	0
50%	32	32	0
80%	38	38	0
90%	43	43	0
95%	47	47	0
Max	79	79	0

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



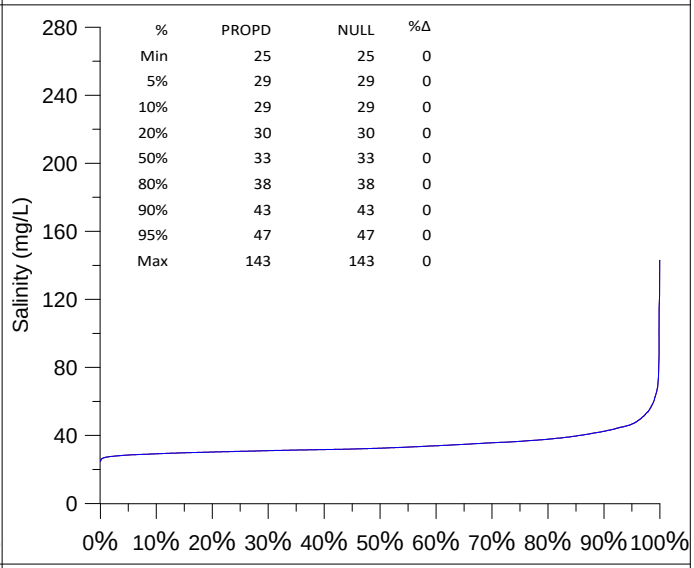
%	PROPD	NULL	%Δ
Min	26	26	0
5%	29	29	0
10%	30	30	0
20%	32	32	0
50%	35	35	0
80%	48	48	0
90%	59	59	0
95%	65	65	0
Max	267	267	0

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



%	PROPD	NULL	%Δ
Min	25	25	0
5%	28	28	0
10%	29	29	0
20%	30	30	0
50%	33	33	0
80%	40	40	0
90%	46	46	0
95%	56	56	0
Max	222	222	0

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
Min	25	25	0
5%	29	29	0
10%	29	29	0
20%	30	30	0
50%	33	33	0
80%	38	38	0
90%	43	43	0
95%	47	47	0
Max	143	143	0

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

- Proposed Case (PRO) Simulation
- Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

Job No.: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevA | Date: 27/11/2025

Drawn By: DAW | Checked By: JRWB

GoldSIM Model Output - Salinity (R10)

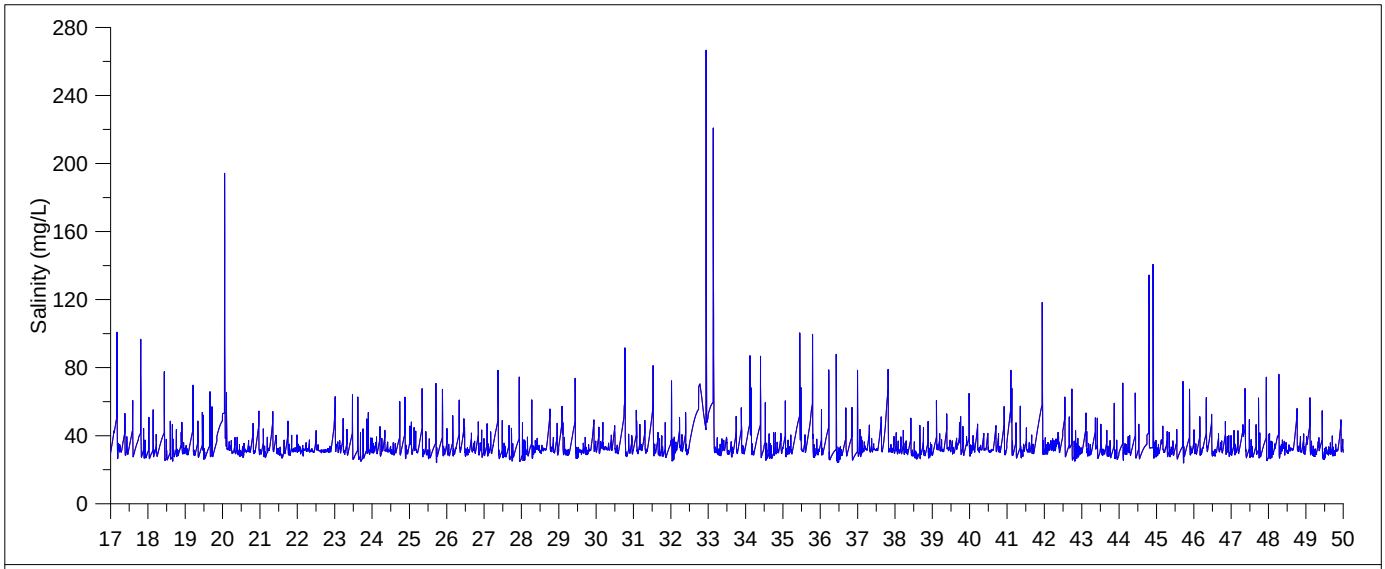
Paddys Creek Swamp:
- Paddys Creek Swamp
(Node 712)

Figure 4.14c

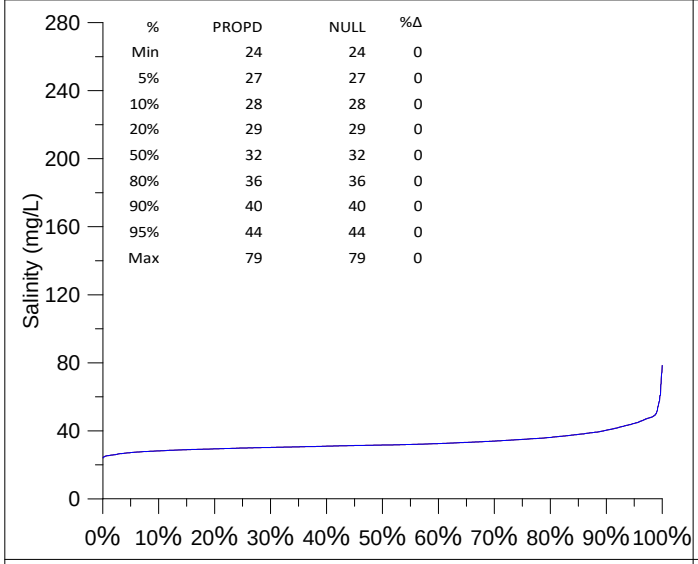
JBS&G

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D005_Predn_Node712\68229_R02RevA_D005c_PRO_02a_GoldSIMOutput_Salinity_R10.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp

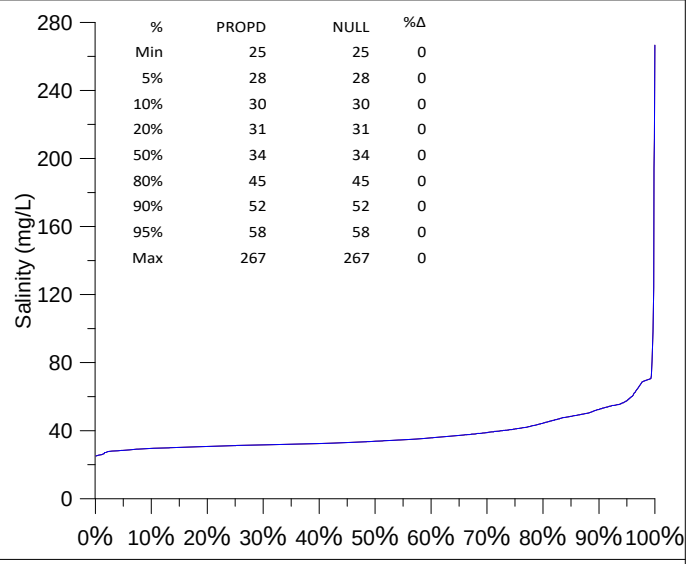


Time Series Model Output:



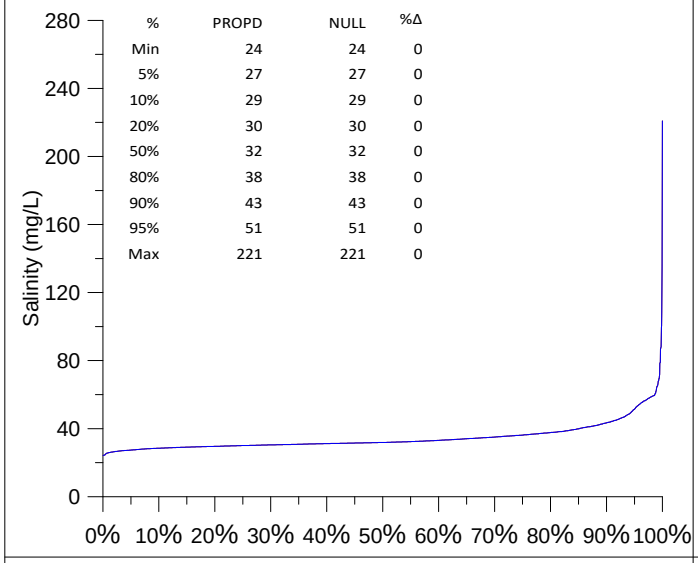
%	PROPD	NULL	%Δ
Min	24	24	0
5%	27	27	0
10%	28	28	0
20%	29	29	0
50%	32	32	0
80%	36	36	0
90%	40	40	0
95%	44	44	0
Max	79	79	0

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



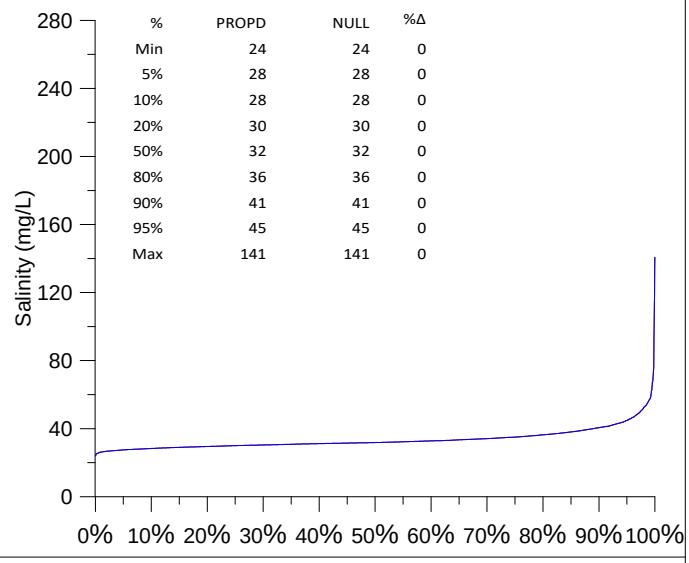
%	PROPD	NULL	%Δ
Min	25	25	0
5%	28	28	0
10%	30	30	0
20%	31	31	0
50%	34	34	0
80%	45	45	0
90%	52	52	0
95%	58	58	0
Max	267	267	0

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



%	PROPD	NULL	%Δ
Min	24	24	0
5%	27	27	0
10%	29	29	0
20%	30	30	0
50%	32	32	0
80%	38	38	0
90%	43	43	0
95%	51	51	0
Max	221	221	0

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
Min	24	24	0
5%	28	28	0
10%	28	28	0
20%	30	30	0
50%	32	32	0
80%	36	36	0
90%	41	41	0
95%	45	45	0
Max	141	141	0

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

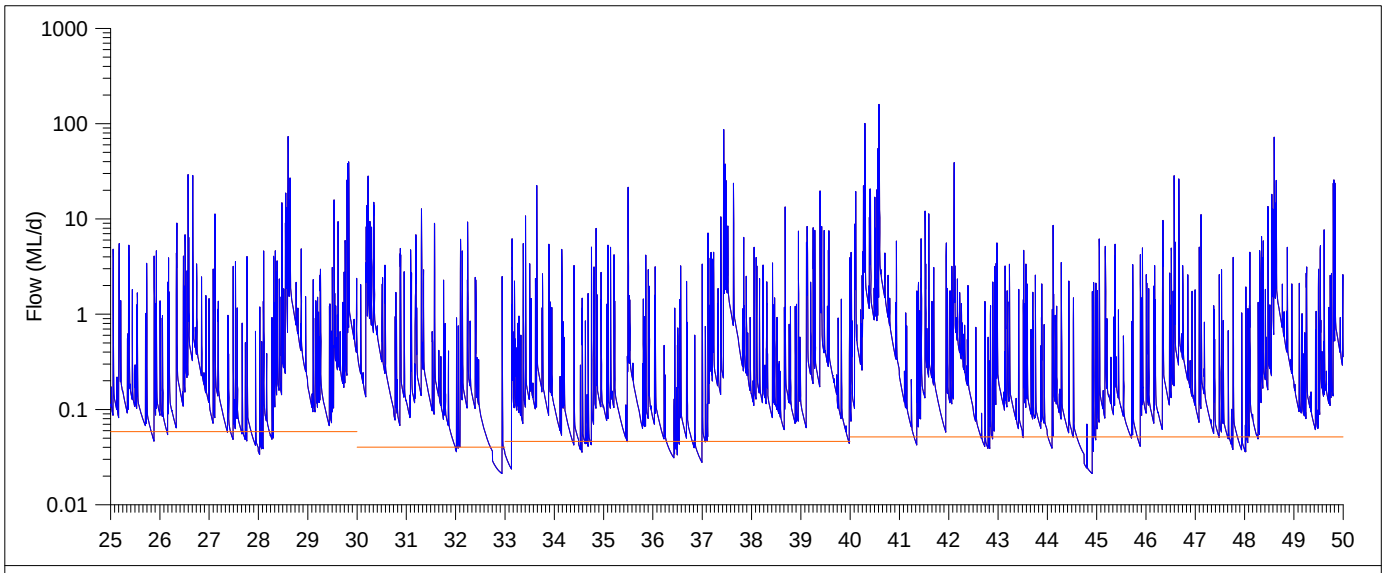
- Proposed Case (PRO) Simulation
- Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

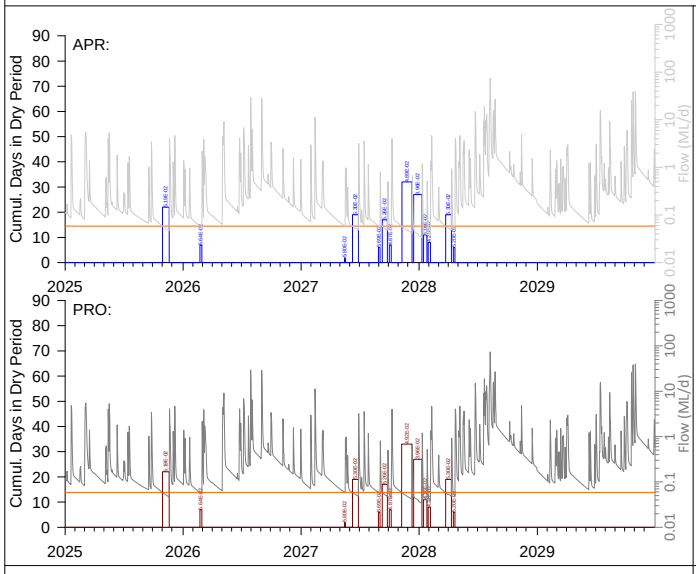
Job No.: 68229		**GoldSIM Model Output - Salinity (R90)**
Client: Clarence Colliery Pty Ltd		**Paddys Creek Swamp:** - Paddys Creek Swamp (Node 712)
Version: R02RevA	Date: 27/11/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.14d**

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D005_Predn_Node712\68229_R02RevA_D005d_PRO_02a_GoldSIMOutput_Salinity_R90.grf

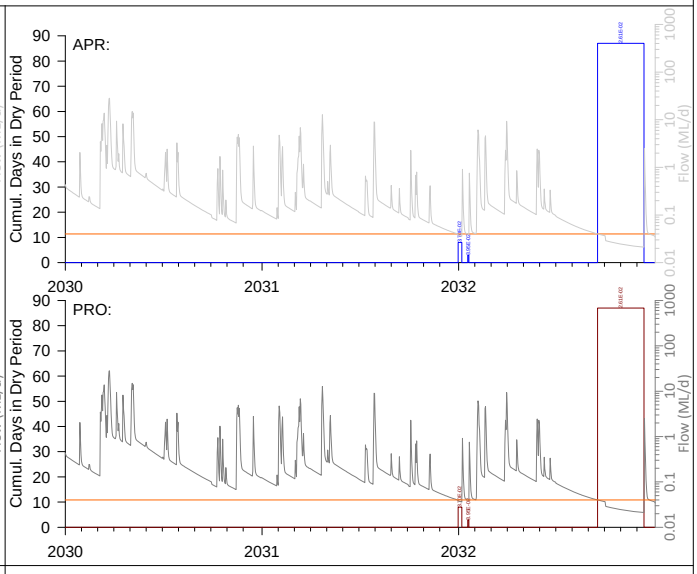
Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp



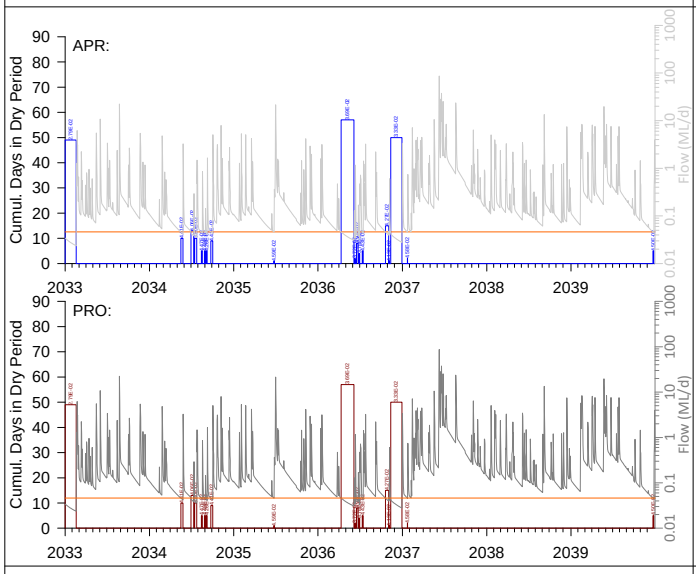
Time Series Model Output:



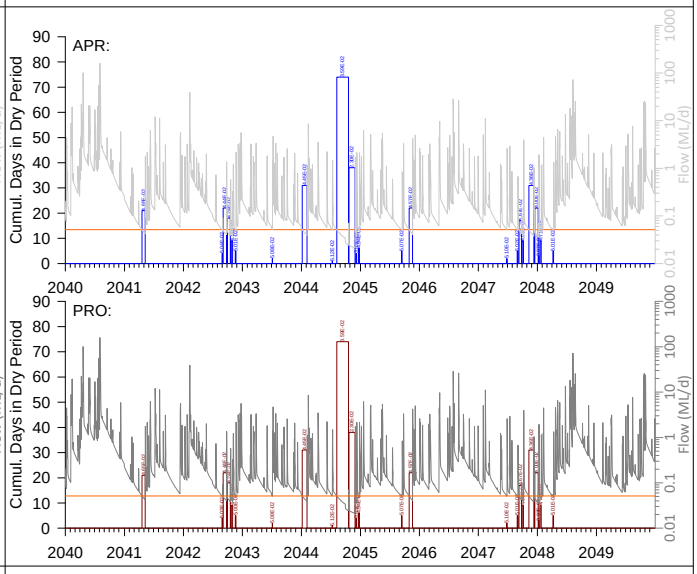
Cumul. Days in Dry Period: Flow at or below 5.86E-02ML/d (10%): 01/01/2025 to 31/12/2029



Cumul. Days in Dry Period: Flow at or below 4.02E-02ML/d (10%): 01/01/2030 to 31/12/2032



Cumul. Days in Dry Period: Flow at or below 4.62E-02ML/d (10%): 01/01/2033 to 31/12/2039



Cumul. Days in Dry Period: Flow at or below 5.15E-02ML/d (10%): 01/01/2040 to 31/12/2049

Legend

Upper Chart:
- Approved Flow (ML/d)
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)

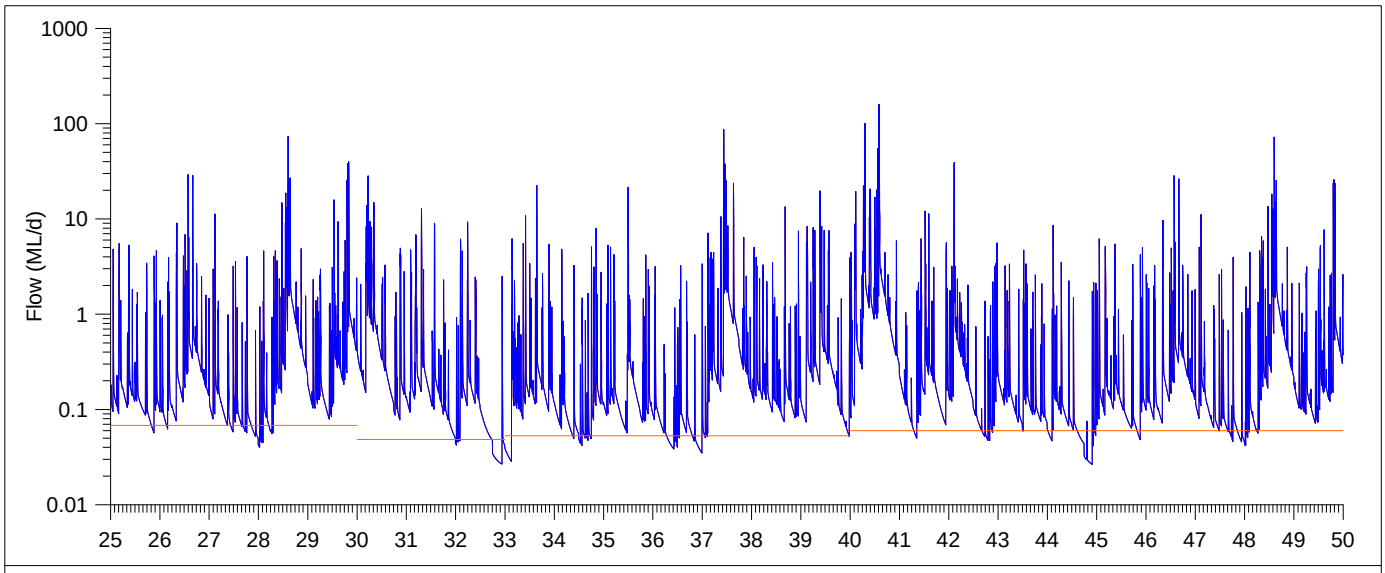
Lower Charts:
- Approved Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Approved
- Cumulative Days in Dry Period - Approved
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Proposed
- Cumulative Days in Dry Period - Proposed

Notes:

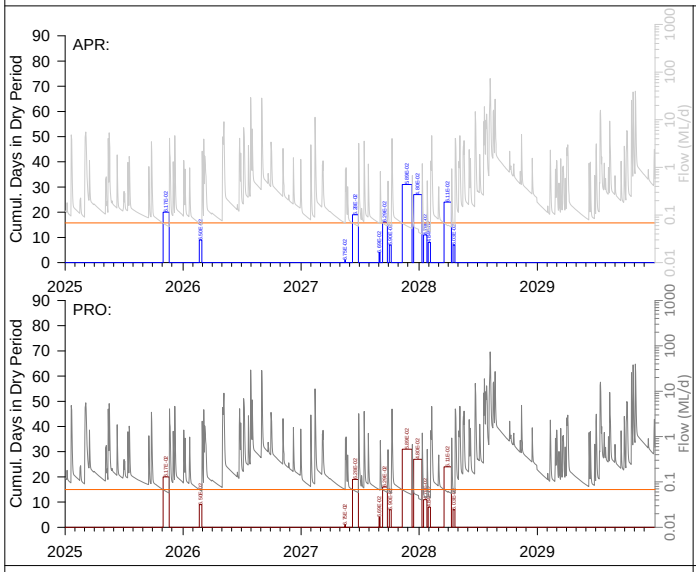
Job No.: 68229		**GoldSIM Model Output - Cumulative Days in Dry Period (R10)**
Client: Clarence Colliery Pty Ltd		**Paddys Creek Swamp:** - Paddys Creek Swamp (Node 712)
Version: R02RevA	Date: 04/12/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.15a**

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D013_DryDays_Node712\68229_R02RevA_D013a\68229_R02RevA_D013a_PRO_02a_GoldSIMOutput_Node712_DryDays_R10.grf

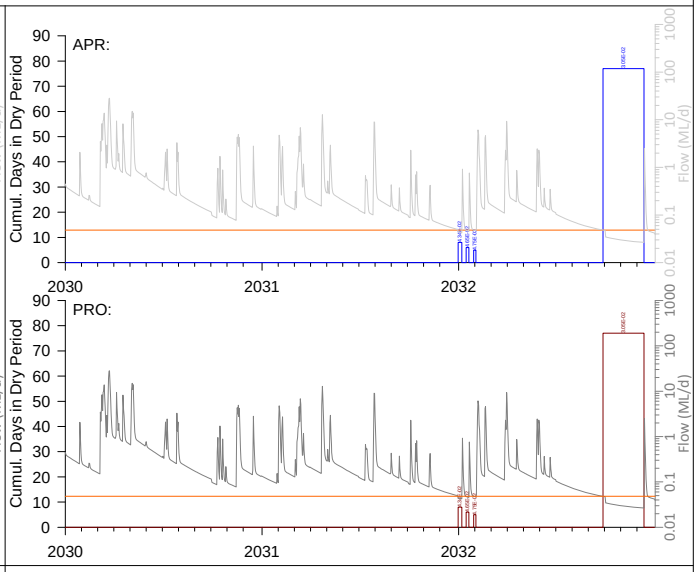
Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp



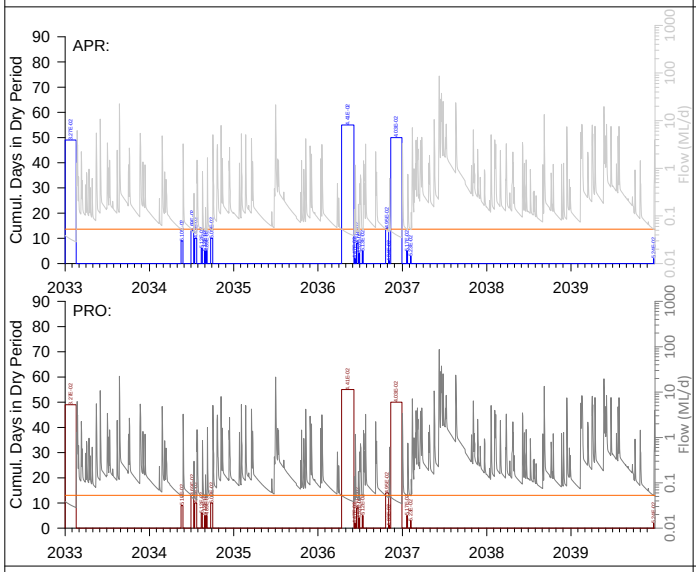
Time Series Model Output:



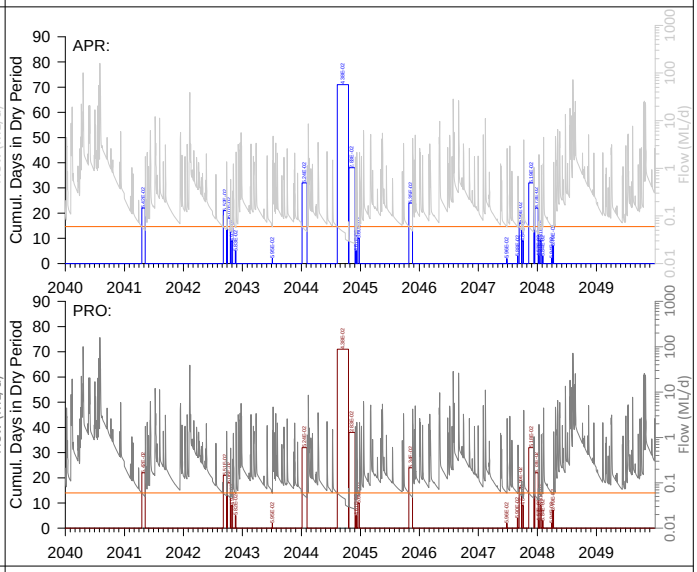
Cumul. Days in Dry Period: Flow at or below 6.82E-02ML/d (10%): 01/01/2025 to 31/12/2029



Cumul. Days in Dry Period: Flow at or below 4.84E-02ML/d (10%): 01/01/2030 to 31/12/2032



Cumul. Days in Dry Period: Flow at or below 5.29E-02ML/d (10%): 01/01/2033 to 31/12/2039



Cumul. Days in Dry Period: Flow at or below 5.99E-02ML/d (10%): 01/01/2040 to 31/12/2049

Legend

Upper Chart:
- Approved Flow (ML/d)
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)

Lower Charts:
- Approved Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Approved
- Cumulative Days in Dry Period - Approved
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Proposed
- Cumulative Days in Dry Period - Proposed

Notes:

Job No.: 68229		**GoldSIM Model Output - Cumulative Days in Dry Period (R90)**
Client: Clarence Colliery Pty Ltd		**Paddys Creek Swamp:** - Paddys Creek Swamp (Node 712)
Version: R02RevA	Date: 04/12/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.15b**

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D013_DryDays_Node712\68229_R02RevA_D013b\68229_R02RevA_D013b_PRO_02a_GoldSIMOutput_Node712_DryDays_R90.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp

Bungleboori Creek (Node 746):

Figure 4.16 presents the subcatchments contributing to Bungleboori Creek.

Figure 4.17a and **Figure 4.17b** presents the modelled time-series flow for the Approved Case and Proposed Case considering the 10th and 90th ranked smallest groundwater contribution to surface water with respect to each subcatchment.

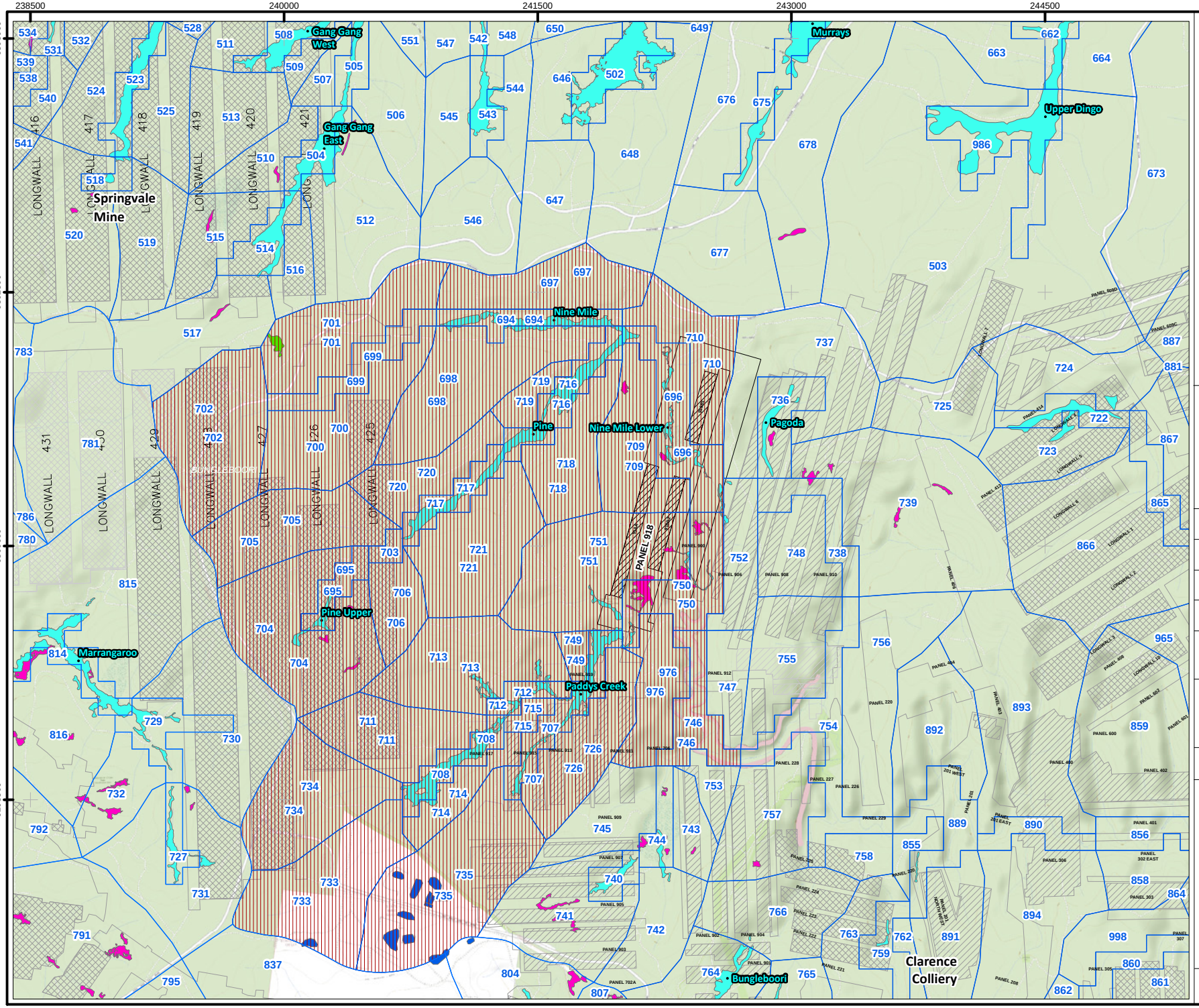
Figure 4.17c and **Figure 4.17d** presents the modelled time-series water quality (salinity) for the Approved Case and Proposed Case considering the 10th and 90th ranked smallest groundwater contribution to surface water with respect to each subcatchment.

From **Figure 4.17a** and **Figure 4.17b**, comparison of the Proposed Case to the Approved Case, for both the R10 and R90 scenarios, indicates there is a negligible (change is less than 2%) increase in daily surface water flows, between 0% to 1% (R10 and R90), for the 10% percentile level (cumulative distribution) across the selected model output intervals. From **Figure 4.17a** and **Figure 4.17b**, comparison of the Proposed Case to the Approved Case, for both the R10 and R90 scenarios, indicates there is a negligible (change is less than 2%) decrease in daily surface water flows, between -1% to 0% (R10 and R90), for the 50% percentile level (cumulative distribution) across the selected model output intervals.

From **Figure 4.17c** and **Figure 4.17d**, comparison of the Proposed Case to the Approved Case, for both the R10 and R90 scenarios, indicates there is a negligible (change is less than 2%) change to predicted salinity, of 0% (R10 and R90), for the 90% percentile level (cumulative distribution) across the selected model output intervals. From **Figure 4.17c** and **Figure 4.17d**, comparison of the Proposed Case to the Approved Case, for both the R10 and R90 scenarios, indicates there is a negligible (change is less than 2%) change to predicted salinity, of 0% (R10 and R90), for the 50% percentile level (cumulative distribution) across the selected model output intervals.

Figure 4.18a and **Figure 4.18b** presents the modelled cumulative days within a dry period for the Approved Case and Proposed Case considering the 10th and 90th ranked smallest groundwater contribution to surface water with respect to each subcatchment.

From **Figure 4.18a** and **Figure 4.18b**, comparison of the Proposed Case to the Approved Case, indicates there is a negligible change with respect to cumulative days and average (geomean) flow for dry periods.



Legend:

Mining Methods:
- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:
- Approved
- Existing
- Proposed
- Other Proposed

Swamps by MU Name (Clarence, 2025bc):
- 50 Newnes Plateau Shrub Swamp (EEC)
- 51 Newnes Plateau Hanging Swamp (EEC)
- 52 Newnes Plateau Rush - Sedge - Snow Gum Hollow Wooded Heath (EEC)

Modelling:
- Surface Water Catchments
- Selected Catchment

JBS&G

Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R01RevA	Date: 05-Nov-2025
Drawn By: DAW	Checked By: JRWB

Scale 1:30,000

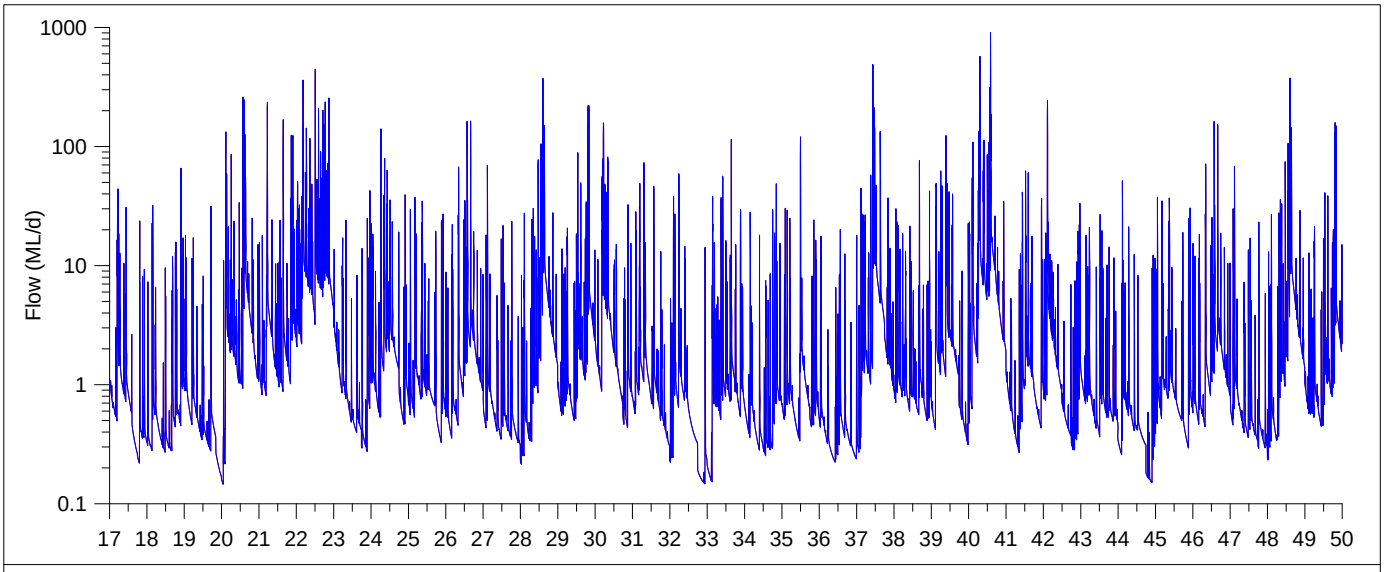
0 0.5 1
km

Coor. Sys. GDA 1994 MGA Zone 56

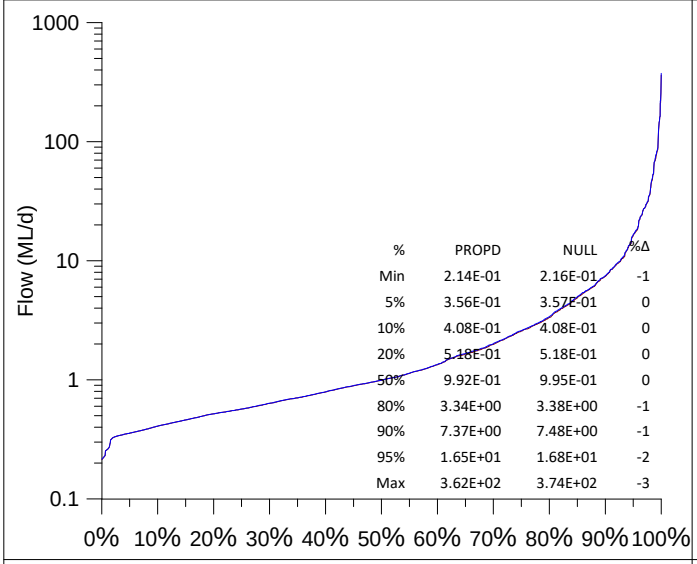
Surface Catchments
- Bungleboori Creek (Node 746)

FIGURE: 4.16

File Name: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\GIS\Maps\68229_R01RevA_D052c_Catchments_Node746.mxd

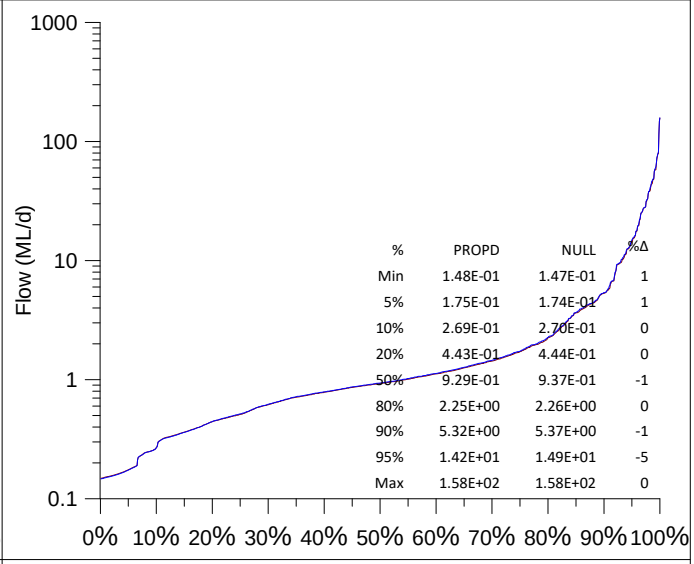


Time Series Model Output:



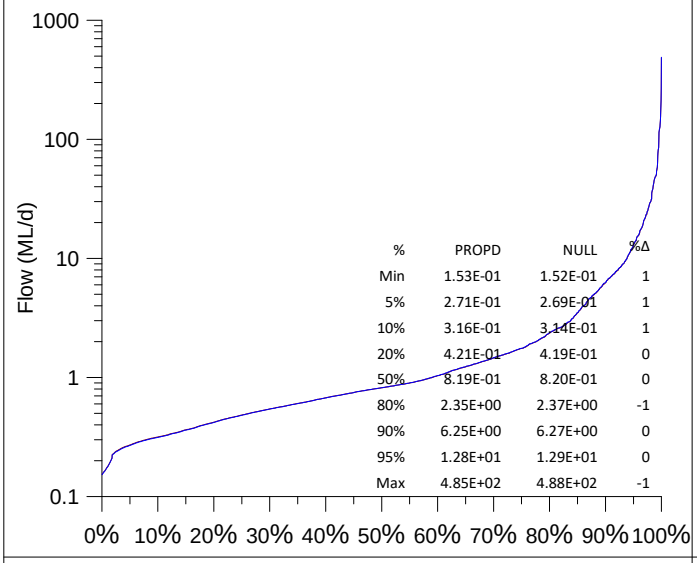
%	PROPD	NULL	%Δ
Min	2.14E-01	2.16E-01	-1
5%	3.56E-01	3.57E-01	0
10%	4.08E-01	4.08E-01	0
20%	5.18E-01	5.18E-01	0
50%	9.92E-01	9.95E-01	0
80%	3.34E+00	3.38E+00	-1
90%	7.37E+00	7.48E+00	-1
95%	1.65E+01	1.68E+01	-2
Max	3.62E+02	3.74E+02	-3

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



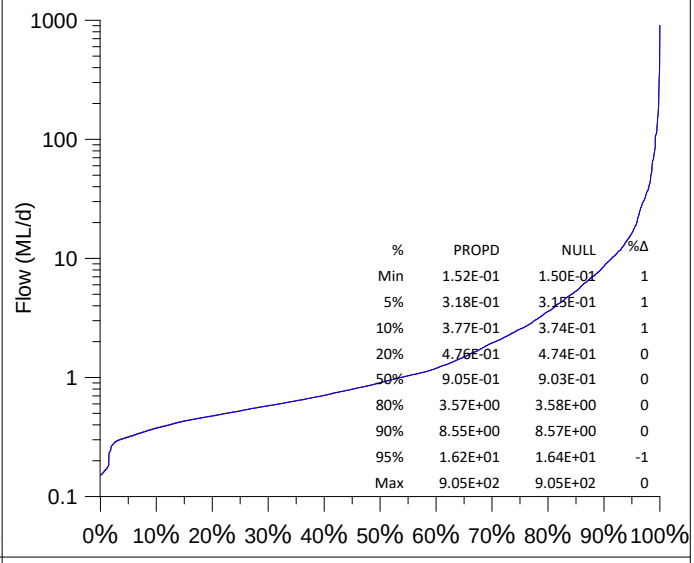
%	PROPD	NULL	%Δ
Min	1.48E-01	1.47E-01	1
5%	1.75E-01	1.74E-01	1
10%	2.69E-01	2.70E-01	0
20%	4.43E-01	4.44E-01	0
50%	9.29E-01	9.37E-01	-1
80%	2.25E+00	2.26E+00	0
90%	5.32E+00	5.37E+00	-1
95%	1.42E+01	1.49E+01	-5
Max	1.58E+02	1.58E+02	0

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



%	PROPD	NULL	%Δ
Min	1.53E-01	1.52E-01	1
5%	2.71E-01	2.69E-01	1
10%	3.16E-01	3.14E-01	1
20%	4.21E-01	4.19E-01	0
50%	8.19E-01	8.20E-01	0
80%	2.35E+00	2.37E+00	-1
90%	6.25E+00	6.27E+00	0
95%	1.28E+01	1.29E+01	0
Max	4.85E+02	4.88E+02	-1

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
Min	1.52E-01	1.50E-01	1
5%	3.18E-01	3.15E-01	1
10%	3.77E-01	3.74E-01	1
20%	4.76E-01	4.74E-01	0
50%	9.05E-01	9.03E-01	0
80%	3.57E+00	3.58E+00	0
90%	8.55E+00	8.57E+00	0
95%	1.62E+01	1.64E+01	-1
Max	9.05E+02	9.05E+02	0

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

Proposed Case (PRO) Simulation

Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

Job No.: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevA | Date: 27/11/2025

Drawn By: DAW | Checked By: JRWB

GoldSIM Model Output - Flow (R10)

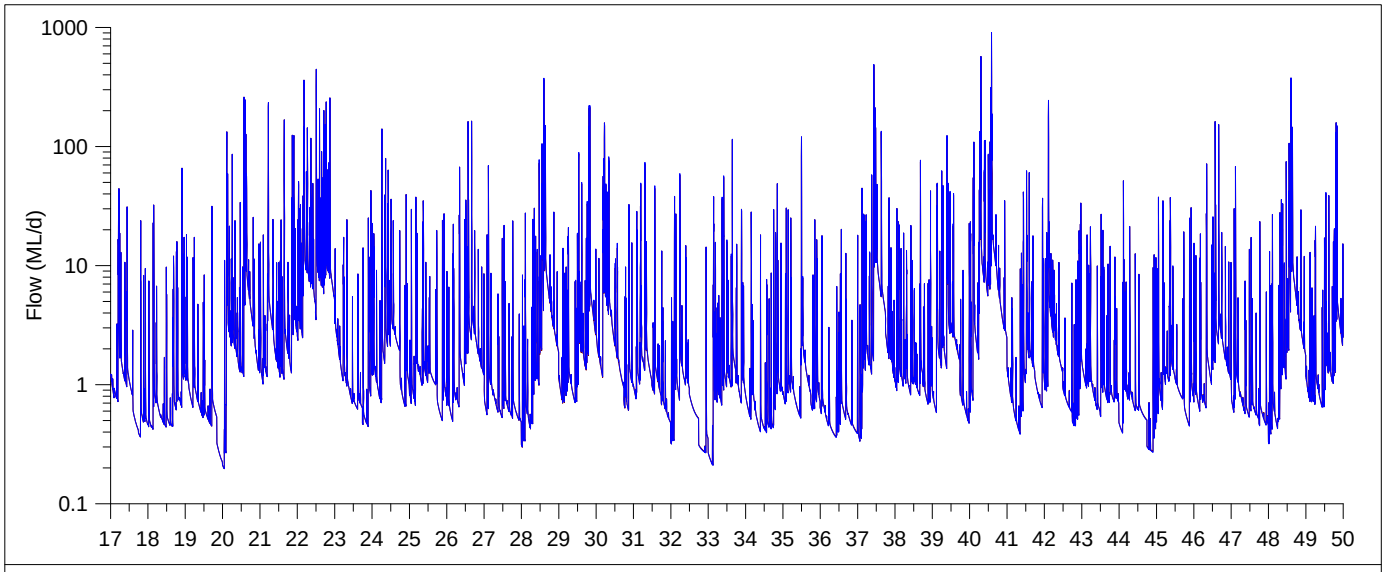
Bungleboori Creek:
- Below junction of Swamps (Node 746)

Figure 4.17a

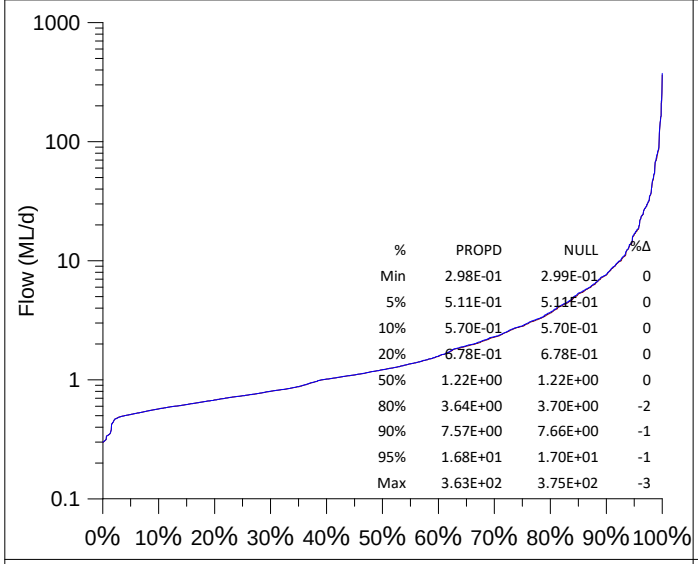
JBS&G

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EPI\Figures\Grapher\68229_R02RevA_D006_Predn_Node746\68229_R02RevA_D006a_PRO_02a_GoldSIMOutput_Flow_R10.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp

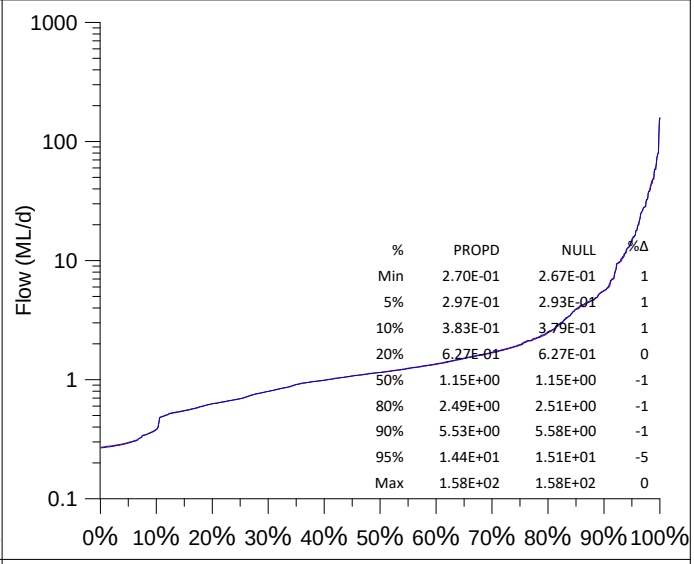


Time Series Model Output:



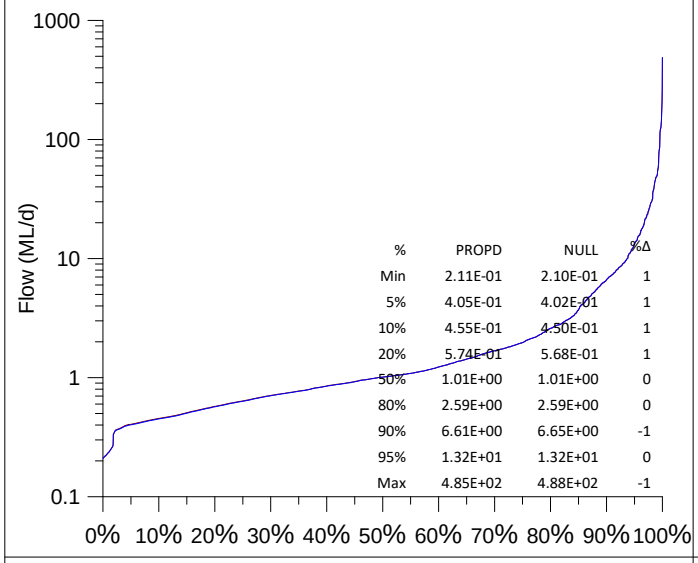
%	PROPD	NULL	%Δ
Min	2.98E-01	2.99E-01	0
5%	5.11E-01	5.11E-01	0
10%	5.70E-01	5.70E-01	0
20%	6.78E-01	6.78E-01	0
50%	1.22E+00	1.22E+00	0
80%	3.64E+00	3.70E+00	-2
90%	7.57E+00	7.66E+00	-1
95%	1.68E+01	1.70E+01	-1
Max	3.63E+02	3.75E+02	-3

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



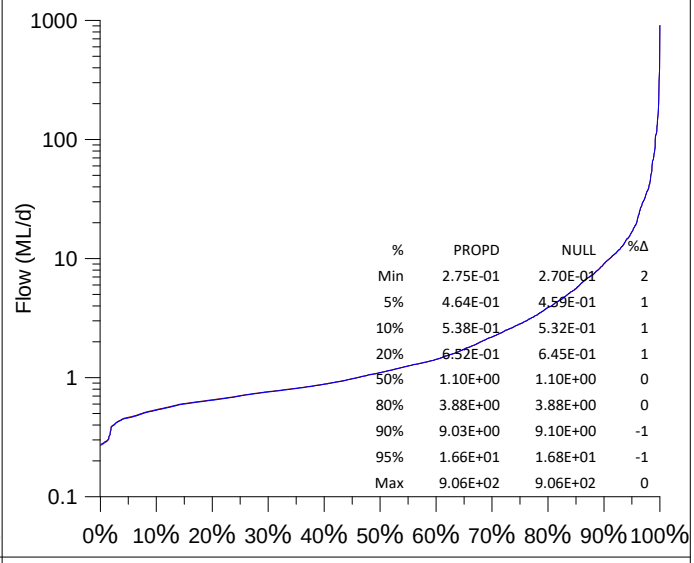
%	PROPD	NULL	%Δ
Min	2.70E-01	2.67E-01	1
5%	2.97E-01	2.93E-01	1
10%	3.83E-01	3.79E-01	1
20%	6.27E-01	6.27E-01	0
50%	1.15E+00	1.15E+00	-1
80%	2.49E+00	2.51E+00	-1
90%	5.53E+00	5.58E+00	-1
95%	1.44E+01	1.51E+01	-5
Max	1.58E+02	1.58E+02	0

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



%	PROPD	NULL	%Δ
Min	2.11E-01	2.10E-01	1
5%	4.05E-01	4.02E-01	1
10%	4.55E-01	4.50E-01	1
20%	5.74E-01	5.68E-01	1
50%	1.01E+00	1.01E+00	0
80%	2.59E+00	2.59E+00	0
90%	6.61E+00	6.65E+00	-1
95%	1.32E+01	1.32E+01	0
Max	4.85E+02	4.88E+02	-1

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
Min	2.75E-01	2.70E-01	2
5%	4.64E-01	4.59E-01	1
10%	5.38E-01	5.32E-01	1
20%	6.52E-01	6.45E-01	1
50%	1.10E+00	1.10E+00	0
80%	3.88E+00	3.88E+00	0
90%	9.03E+00	9.10E+00	-1
95%	1.66E+01	1.68E+01	-1
Max	9.06E+02	9.06E+02	0

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

- Proposed Case (PRO) Simulation
- Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

Job No.: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevA | Date: 27/11/2025

Drawn By: DAW | Checked By: JRWB

GoldSIM Model Output - Flow (R90)

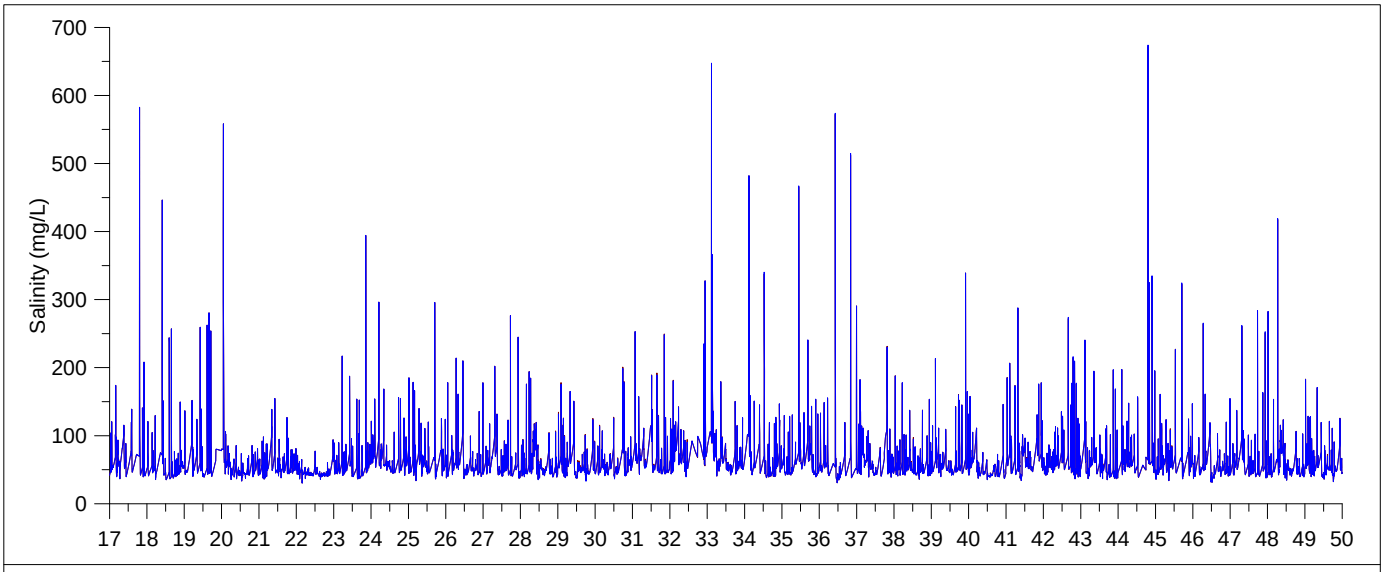
Bungleboori Creek:
- Below junction of Swamps
(Node 746)

Figure 4.17b

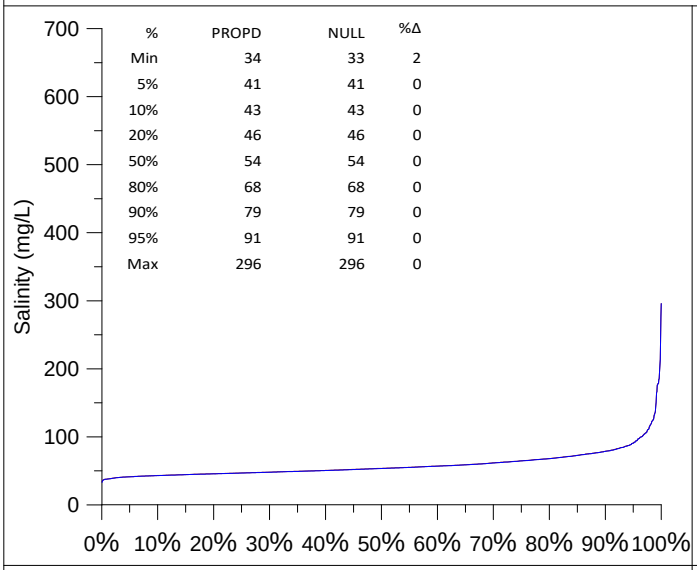
JBS&G

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EPI\Figures\Grapher\68229_R02RevA_D006_Predn_Node746\68229_R02RevA_D006b_PRO_02a_GoldSIMOutput_Flow_R90.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp

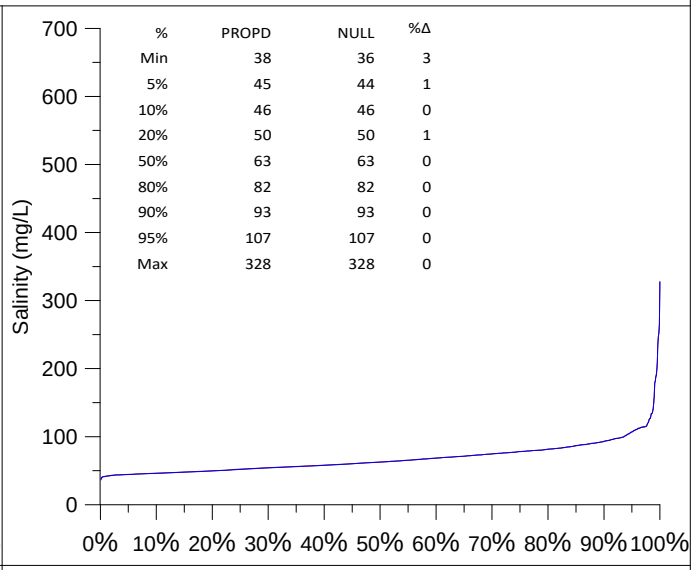


Time Series Model Output:



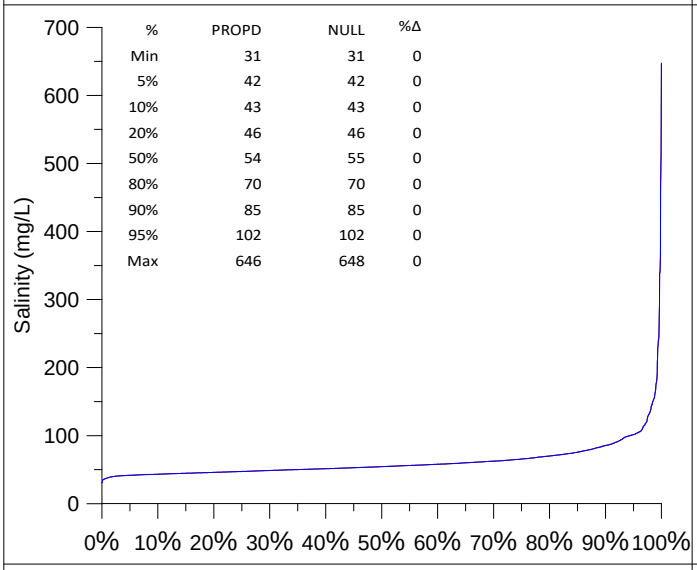
%	PROPD	NULL	%Δ
Min	34	33	2
5%	41	41	0
10%	43	43	0
20%	46	46	0
50%	54	54	0
80%	68	68	0
90%	79	79	0
95%	91	91	0
Max	296	296	0

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



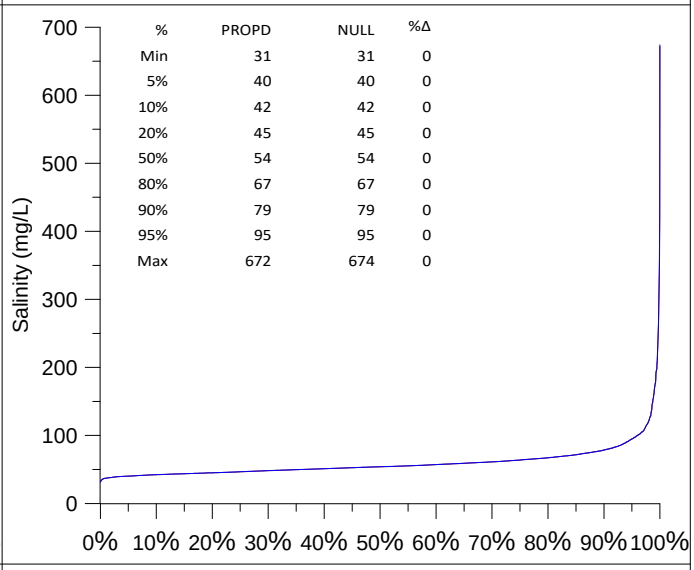
%	PROPD	NULL	%Δ
Min	38	36	3
5%	45	44	1
10%	46	46	0
20%	50	50	1
50%	63	63	0
80%	82	82	0
90%	93	93	0
95%	107	107	0
Max	328	328	0

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



%	PROPD	NULL	%Δ
Min	31	31	0
5%	42	42	0
10%	43	43	0
20%	46	46	0
50%	54	55	0
80%	70	70	0
90%	85	85	0
95%	102	102	0
Max	646	648	0

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
Min	31	31	0
5%	40	40	0
10%	42	42	0
20%	45	45	0
50%	54	54	0
80%	67	67	0
90%	79	79	0
95%	95	95	0
Max	672	674	0

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

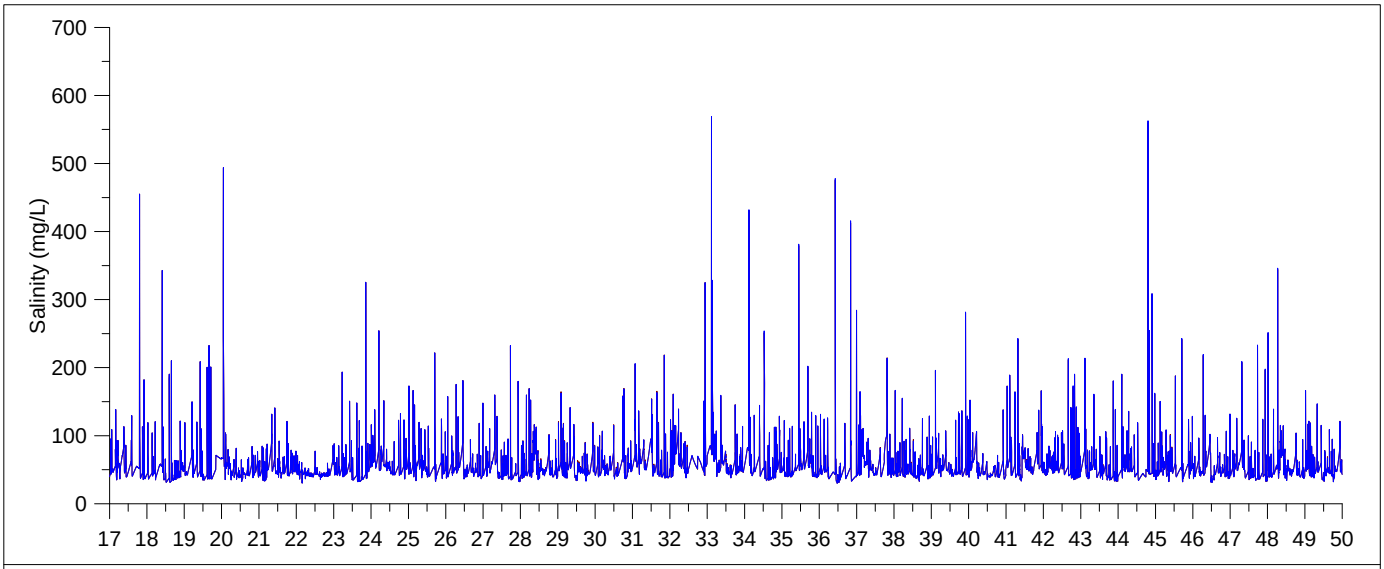
- Proposed Case (PRO) Simulation
- Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

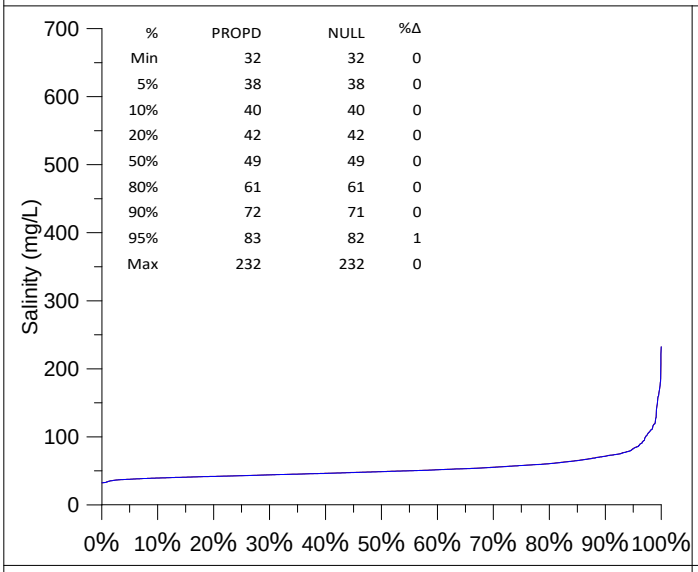
Job No.: 68229		**GoldSIM Model Output - Salinity (R10)**
Client: Clarence Colliery Pty Ltd		**Bungleboori Creek:** - Below junction of Swamps (Node 746)
Version: R02RevA	Date: 27/11/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.17c**

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D006_Predn_Node746\68229_R02RevA_D006c_PRO_02a_GoldSIMOutput_Salinity_R10.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp

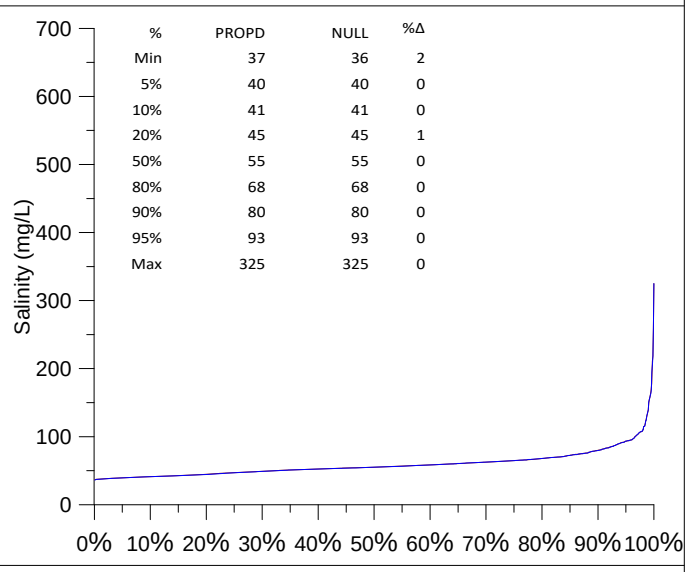


Time Series Model Output:



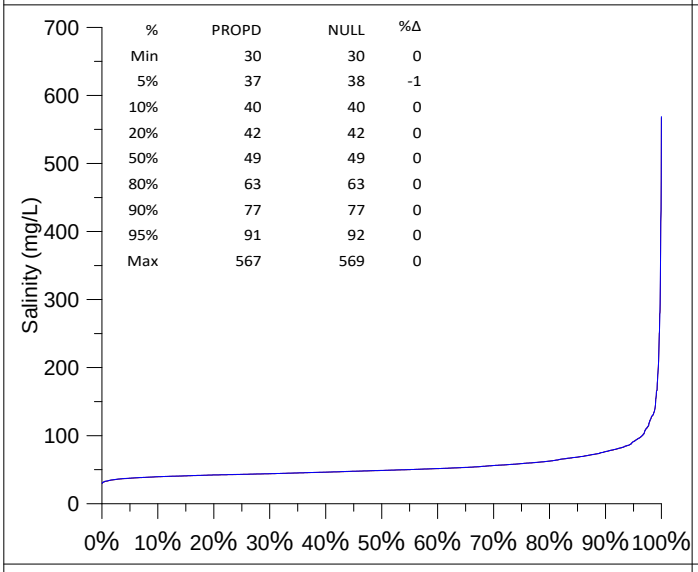
%	PROPD	NULL	%Δ
Min	32	32	0
5%	38	38	0
10%	40	40	0
20%	42	42	0
50%	49	49	0
80%	61	61	0
90%	72	71	0
95%	83	82	1
Max	232	232	0

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



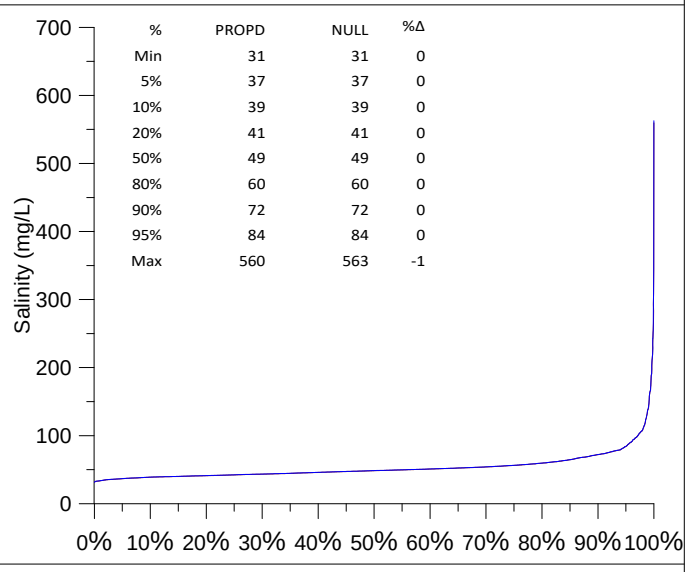
%	PROPD	NULL	%Δ
Min	37	36	2
5%	40	40	0
10%	41	41	0
20%	45	45	1
50%	55	55	0
80%	68	68	0
90%	80	80	0
95%	93	93	0
Max	325	325	0

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



%	PROPD	NULL	%Δ
Min	30	30	0
5%	37	38	-1
10%	40	40	0
20%	42	42	0
50%	49	49	0
80%	63	63	0
90%	77	77	0
95%	91	92	0
Max	567	569	0

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
Min	31	31	0
5%	37	37	0
10%	39	39	0
20%	41	41	0
50%	49	49	0
80%	60	60	0
90%	72	72	0
95%	84	84	0
Max	560	563	-1

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

Proposed Case (PRO) Simulation

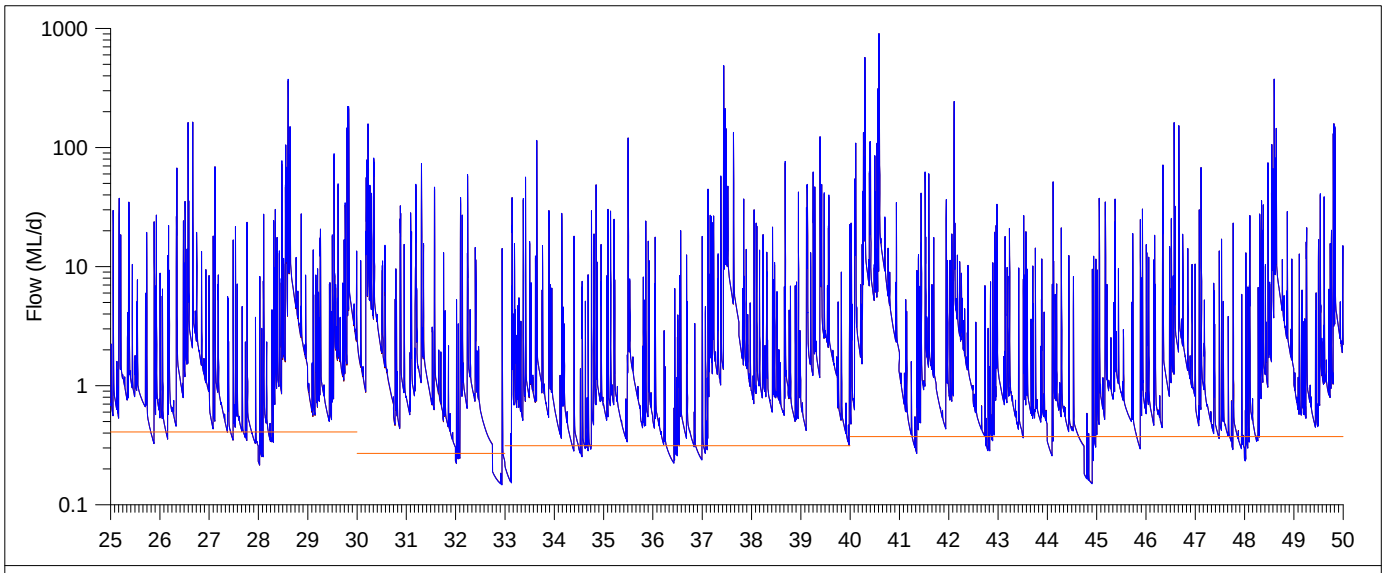
Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

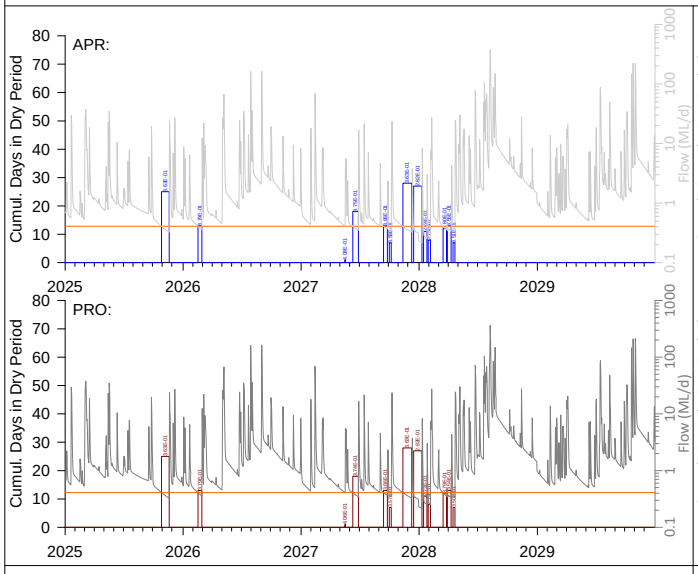
Job No.: 68229		**GoldSIM Model Output - Salinity (R90)**
Client: Clarence Colliery Pty Ltd		**Bungleboori Creek:** - Below junction of Swamps (Node 746)
Version: R02RevA	Date: 27/11/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.17d**

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D006_Predn_Node746\68229_R02RevA_D006d_PRO_02a_GoldSIMOutput_Salinity_R90.grf

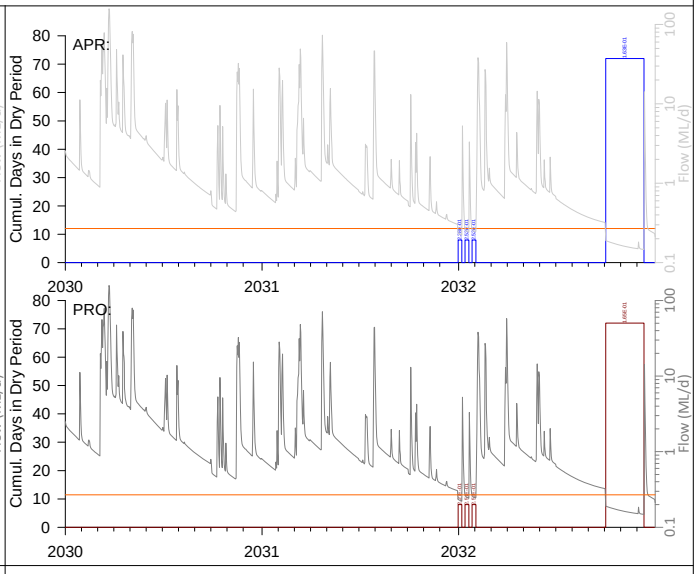
Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp



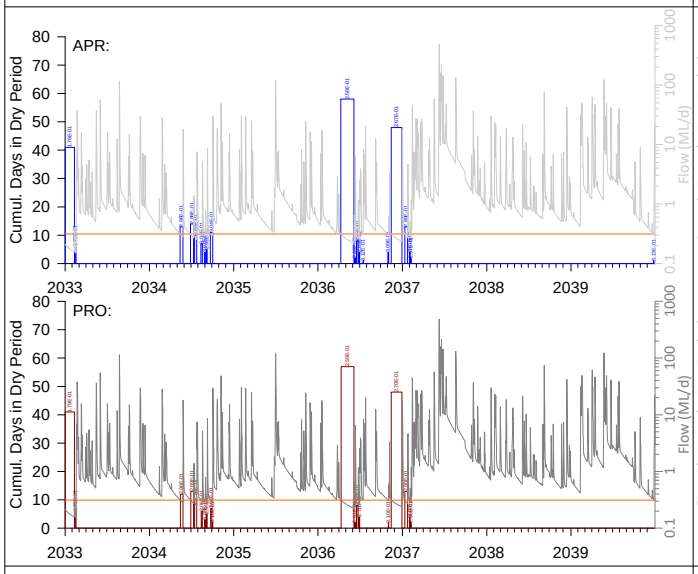
Time Series Model Output:



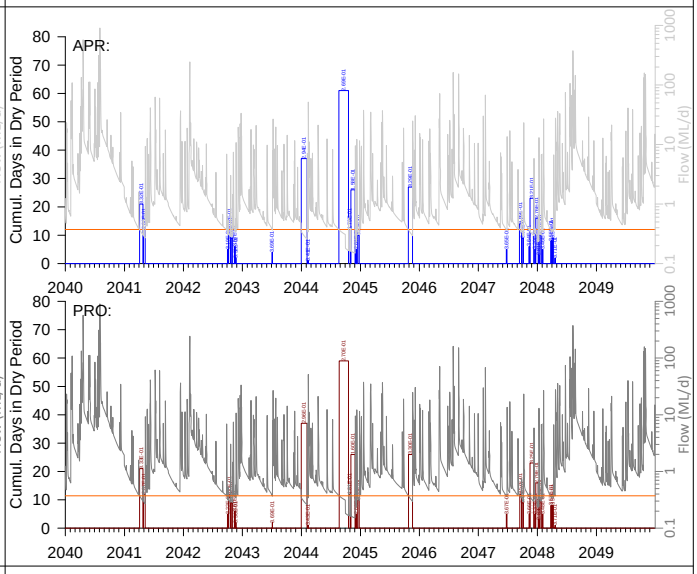
Cumul. Days in Dry Period: Flow at or below 4.08E-01ML/d (10%): 01/01/2025 to 31/12/2029



Cumul. Days in Dry Period: Flow at or below 2.70E-01ML/d (10%): 01/01/2030 to 31/12/2032



Cumul. Days in Dry Period: Flow at or below 3.14E-01ML/d (10%): 01/01/2033 to 31/12/2039



Cumul. Days in Dry Period: Flow at or below 3.74E-01ML/d (10%): 01/01/2040 to 31/12/2049

Legend

Upper Chart:
- Approved Flow (ML/d)
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)

Lower Charts:
- Approved Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Approved
- Cumulative Days in Dry Period - Approved
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Proposed
- Cumulative Days in Dry Period - Proposed

Notes:

Job No.: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevA | Date: 04/12/2025

Drawn By: DAW | Checked By: JRWB

GoldSIM Model Output - Cumulative Days in Dry Period (R10)

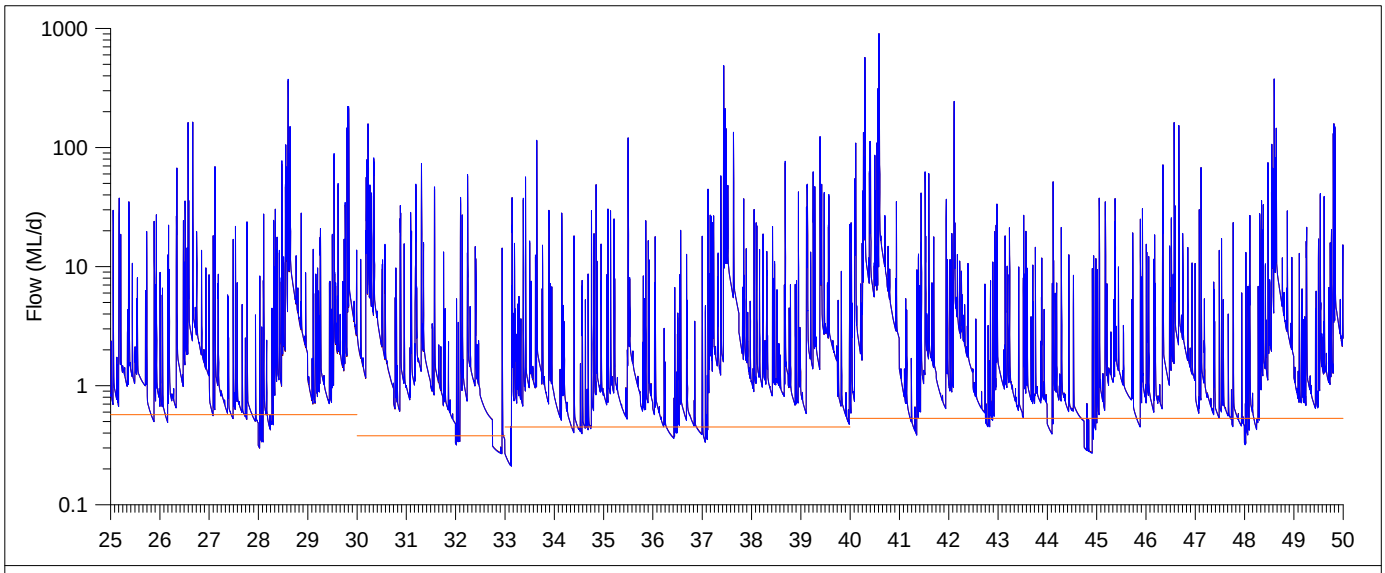
Bungleboori Creek:
- Below junction of Swamps (Node 746)

Figure 4.18a

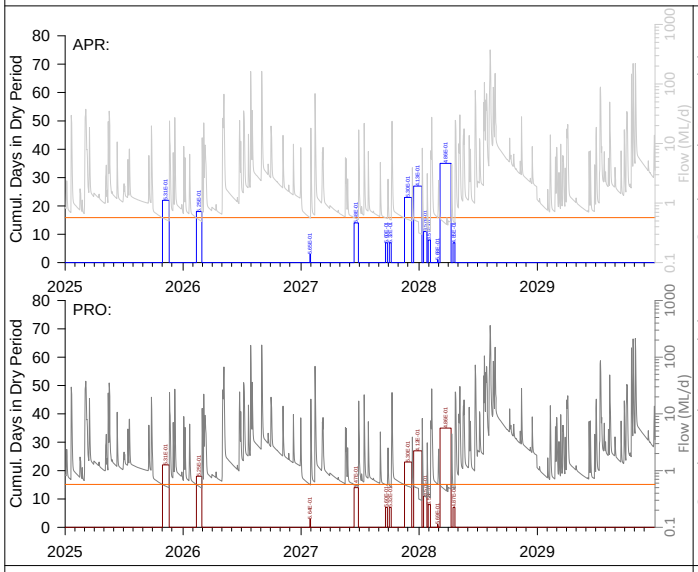
JBS&G

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D014_DryDays_Node746\68229_R02RevA_D014a\68229_R02RevA_D014a_PRO_02a_GoldSIMOutput_Node746_DryDays_R10.grf

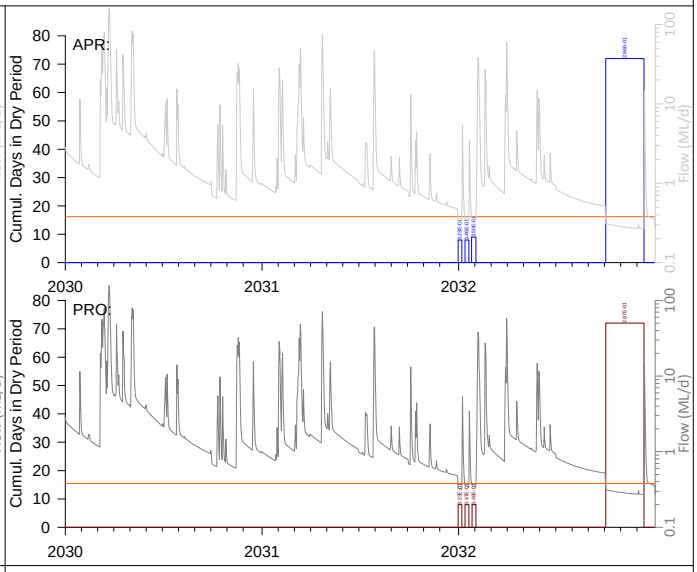
Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp



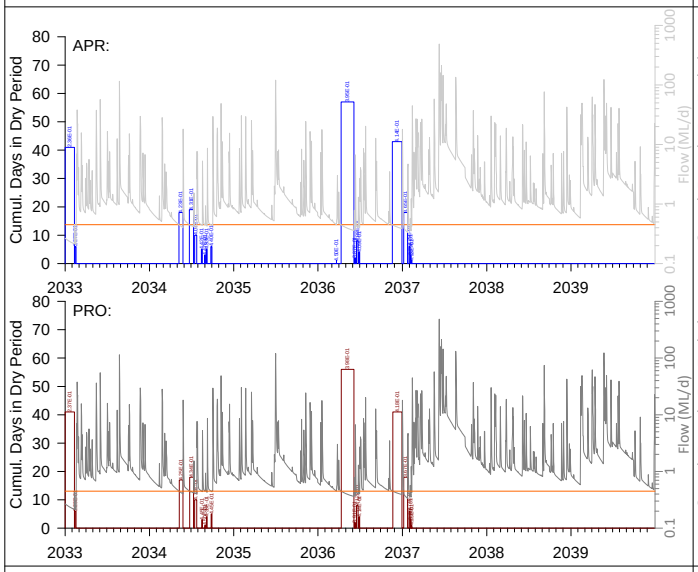
Time Series Model Output:



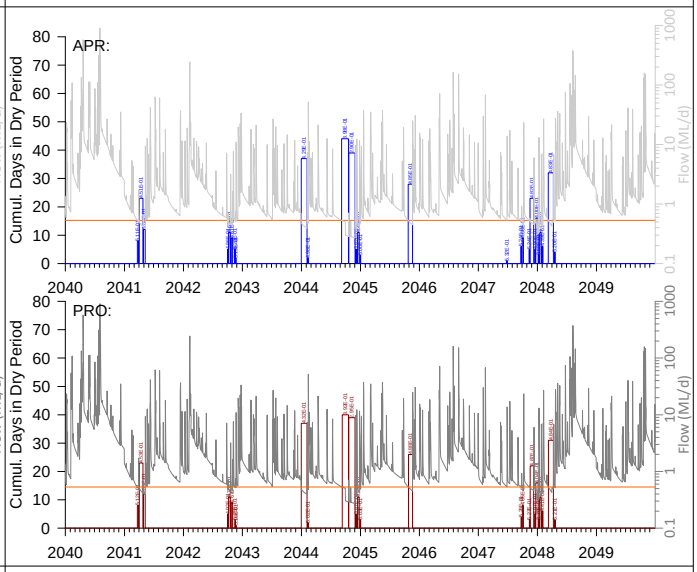
Cumul. Days in Dry Period: Flow at or below 5.70E-01ML/d (10%): 01/01/2025 to 31/12/2029



Cumul. Days in Dry Period: Flow at or below 3.79E-01ML/d (10%): 01/01/2030 to 31/12/2032



Cumul. Days in Dry Period: Flow at or below 4.50E-01ML/d (10%): 01/01/2033 to 31/12/2039



Cumul. Days in Dry Period: Flow at or below 5.32E-01ML/d (10%): 01/01/2040 to 31/12/2049

Legend

Upper Chart:
- Approved Flow (ML/d)
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)

Lower Charts:
- Approved Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Approved
- Cumulative Days in Dry Period - Approved
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Proposed
- Cumulative Days in Dry Period - Proposed

Notes:

Job No.: 68229		**GoldSIM Model Output - Cumulative Days in Dry Period (R10)**
Client: Clarence Colliery Pty Ltd		**Bungleboori Creek:** - Below junction of Swamps (Node 746)
Version: R02RevA	Date: 04/12/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.18b**

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D014_DryDays_Node746\68229_R02RevA_D014b\68229_R02RevA_D014b_PRO_02a_GoldSIMOutput_Node746_DryDays_R90.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp

Paddys Creek Tributary (Node 751):

Figure 4.19 presents the subcatchments contributing to Paddys Creek Tributary.

Figure 4.20a and **Figure 4.20b** presents the modelled time-series flow for the Approved Case and Proposed Case considering the 10th and 90th ranked smallest groundwater contribution to surface water with respect to each subcatchment.

Figure 4.20c and **Figure 4.20d** presents the modelled time-series water quality (salinity) for the Approved Case and Proposed Case considering the 10th and 90th ranked smallest groundwater contribution to surface water with respect to each subcatchment.

From **Figure 4.20a** and **Figure 4.20b**, comparison of the Proposed Case to the Approved Case, for both the R10 and R90 scenarios, indicates there is a negligible (change is less than 2%) change in daily surface water flows, between -2% (R10) to 1% (R90), for the 10% percentile level (cumulative distribution) of selected model output between January 2030 to December 2032. From **Figure 4.20a** and **Figure 4.20b**, comparison of the Proposed Case to the Approved Case, for both the R10 and R90 scenarios, indicates there is a medium (change is 5 to 15%) decrease in daily surface water flows, between -11% (R10) to -9% (R90), for the 50% percentile level (cumulative distribution) of selected model output between January 2030 to December 2032.

From **Figure 4.20a** and **Figure 4.20b**, comparison of the Proposed Case to the Approved Case, for both the R10 and R90 scenarios, indicates there is a small (change is 2 to 5%) increase in daily surface water flows, between 4% (R10) to 5% (R90), for the 10% percentile level (cumulative distribution) of selected model output between January 2040 to December 2049. From **Figure 4.20a** and **Figure 4.20b**, comparison of the Proposed Case to the Approved Case, for both the R10 and R90 scenarios, indicates there is a negligible (change is less than 2%) increase in daily surface water flows, of 1% (R10 and R90), for the 50% percentile level (cumulative distribution) of selected model output between January 2040 to December 2049.

In summary, from **Figure 4.20a** and **Figure 4.20b**, the change in daily surface water flows during low-flow days, represented by the 10% percentile level (cumulative distribution) is negligible (change is less than 2%) change during early time, and has a small (change is 2 to 5%) increase in the long-term, interpreted as being due to the increased tortuosity of the flowpath from the change to catchment surface. For median flows, represented by the 50% percentile level (cumulative distribution), there is a medium (change is 5 to 15%) decrease in daily surface water flows in early time that ameliorates to be a negligible (change is less than 2%) increase in the long-term.

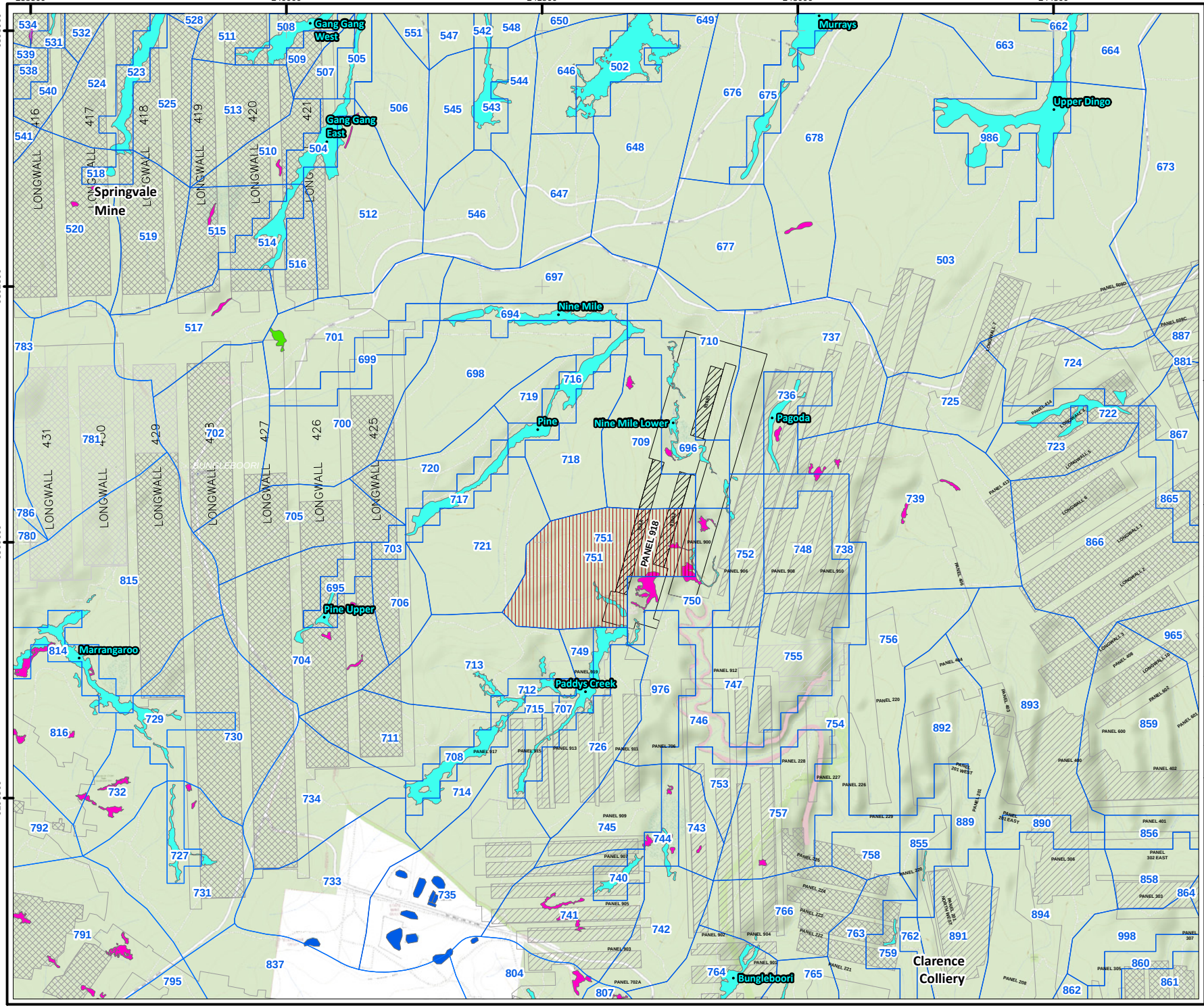
As presented in **Figure 4.3**, the magnitude of transient change category is negligible for 918 Panel, due to use of a low-subsidence mining method, and the modelled disruption to ground surface is likely to be conservative.

From **Figure 4.20c** and **Figure 4.20d**, comparison of the Proposed Case to the Approved Case, for both the R10 and R90 scenarios, indicates there is a medium (change is 5 to 15%) decrease to predicted salinity, between -7% (R10) and -6% (R90), for the 90% percentile level (cumulative distribution) of selected model output between January 2030 to December 2032. From **Figure 4.20c** and **Figure 4.20d**, comparison of the Proposed Case to the Approved Case, for both the R10 and R90 scenarios, indicates there is a negligible (change is less than 2%) change to predicted salinity, between -2% (R10) and -1% (R90), for the 50% percentile level (cumulative distribution) of selected model output between January 2030 to December 2032.

From **Figure 4.20c** and **Figure 4.20d**, comparison of the Proposed Case to the Approved Case, for both the R10 and R90 scenarios, indicates there is a negligible (change is 5 to 15%) decrease to predicted salinity, of -1% (R10 and R90), for the 90% percentile level (cumulative distribution) of selected model output between January 2040 to December 2049. From **Figure 4.20c** and **Figure 4.20d**, comparison of the Proposed Case to the Approved Case, for both the R10 and R90 scenarios, indicates there is a negligible (change is less than 2%) change to predicted salinity, of 0% (R10 and R90), for the 50% percentile level (cumulative distribution) of selected model output between January 2040 to December 2049.

Figure 4.21a and **Figure 4.21b** presents the modelled cumulative days within a dry period for the Approved Case and Proposed Case considering the 10th and 90th ranked smallest groundwater contribution to surface water with respect to each subcatchment.

From **Figure 4.21a** and **Figure 4.21b**, comparison of the Proposed Case to the Approved Case, indicates there is a negligible change with respect to cumulative days and average (geomean) flow for dry periods. From **Figure 4.21a** and **Figure 4.21b**, modelling indicates that during November 2027 to December 2027, there is a 32 (R90) and 33 (R10) day dry period in the Approved Case that extends to a 34 (R90) and 35 (R10) day dry period in the Proposed Case. However, during that dry period, the average (geomean) flow is 0.00253ML/d (R90) and 0.0196ML/d (R10) in the Approved Case and 0.00249ML/d (R90) and 0.0192ML/d (R10) in the Proposed Case, which is a negligible decrease of approximately 2%.



Legend:

Mining Methods:
- Development
- Partial Extraction
- Total Extraction
- Open Cut

Mine Operation Status:
- Approved
- Existing
- Proposed
- Other Proposed

Swamps by MU Name (Clarence, 2025bc):
- 50 Newnes Plateau Shrub Swamp (EEC)
- 51 Newnes Plateau Hanging Swamp (EEC)
- 52 Newnes Plateau Rush - Sedge - Snow Gum Hollow Wooded Heath (EEC)

Modelling:
- Surface Water Catchments
- Selected Catchment

JBS&G

Job No: 68229

Client: Clarence Colliery Pty Ltd

Version: R01RevA	Date: 05-Nov-2025
Drawn By: DAW	Checked By: JRWB

Scale 1:30,000

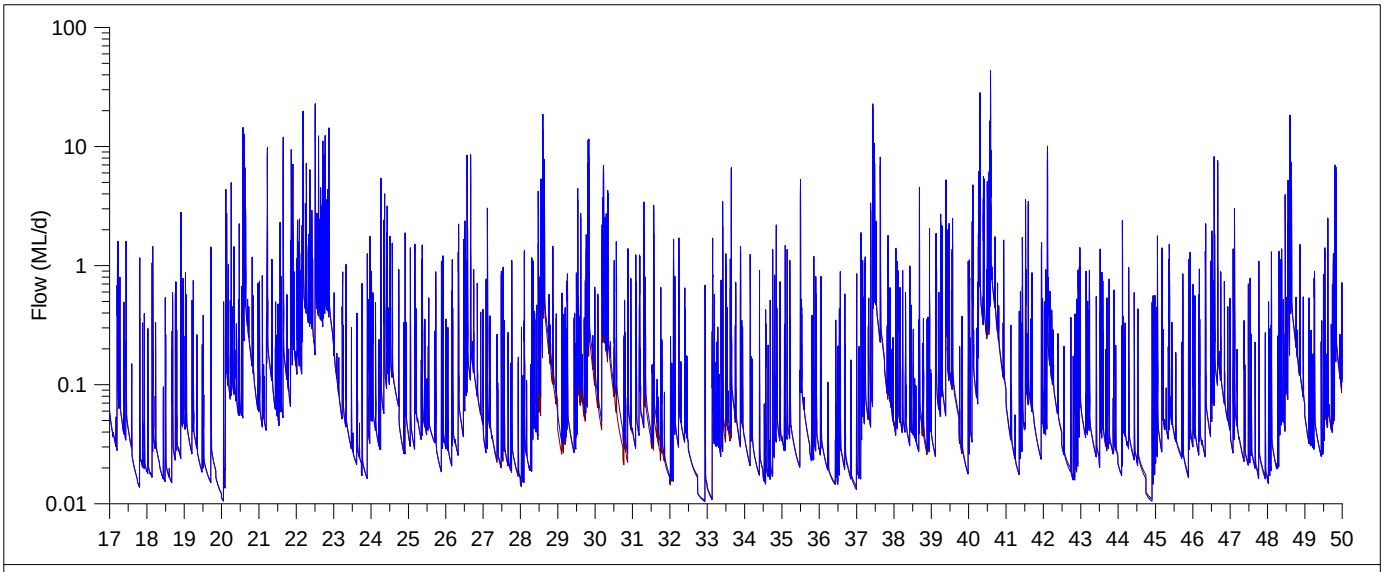
0 0.5 1
km

Coor. Sys. GDA 1994 MGA Zone 56

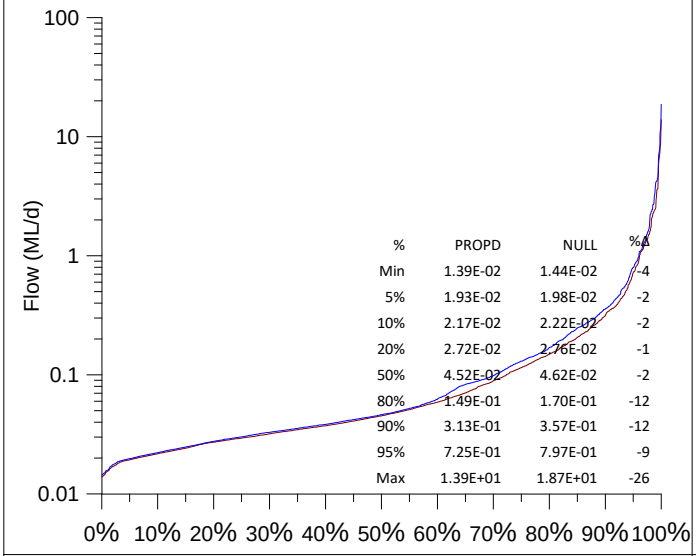
Surface Catchments
- Paddys Creek Upper (Node 751)

FIGURE: 4.19

File Name: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\GIS\Maps\68229_R01RevA_D052d_Catchments_Node751.mxd

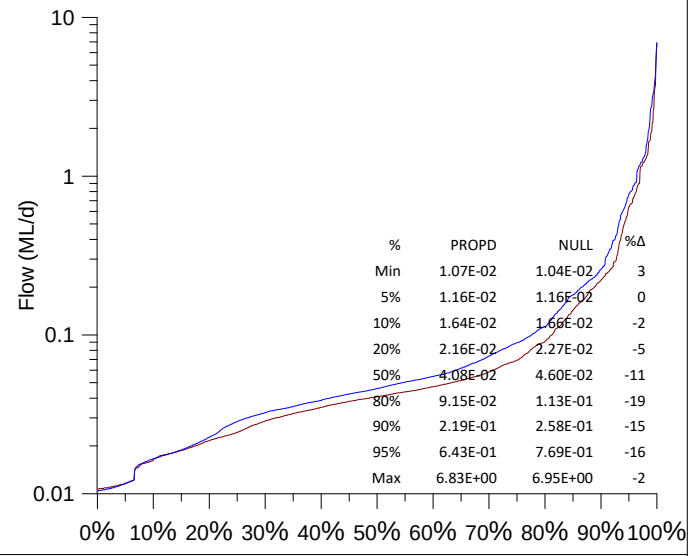


Time Series Model Output:



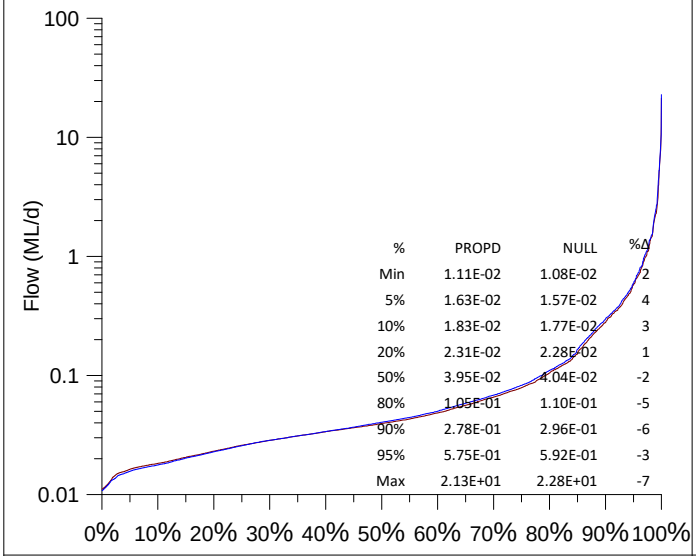
%	PROPD	NULL	%Δ
Min	1.39E-02	1.44E-02	-4
5%	1.93E-02	1.98E-02	-2
10%	2.17E-02	2.22E-02	-2
20%	2.72E-02	2.76E-02	-1
50%	4.52E-02	4.62E-02	-2
80%	1.49E-01	1.70E-01	-12
90%	3.13E-01	3.57E-01	-12
95%	7.25E-01	7.97E-01	-9
Max	1.39E+01	1.87E+01	-26

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



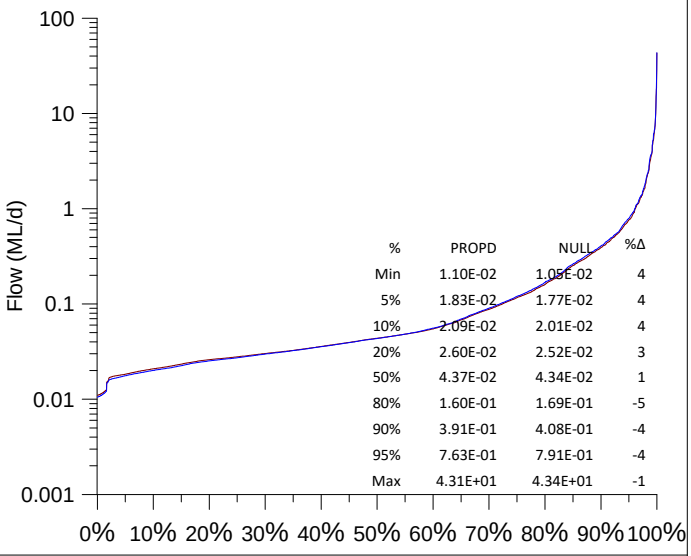
%	PROPD	NULL	%Δ
Min	1.07E-02	1.04E-02	3
5%	1.16E-02	1.16E-02	0
10%	1.64E-02	1.66E-02	-2
20%	2.16E-02	2.27E-02	-5
50%	4.08E-02	4.60E-02	-11
80%	9.15E-02	1.13E-01	-19
90%	2.19E-01	2.58E-01	-15
95%	6.43E-01	7.69E-01	-16
Max	6.83E+00	6.95E+00	-2

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



%	PROPD	NULL	%Δ
Min	1.11E-02	1.08E-02	2
5%	1.63E-02	1.57E-02	4
10%	1.83E-02	1.77E-02	3
20%	2.31E-02	2.28E-02	1
50%	3.95E-02	4.04E-02	-2
80%	1.05E-01	1.10E-01	-5
90%	2.78E-01	2.96E-01	-6
95%	5.75E-01	5.92E-01	-3
Max	2.13E+01	2.28E+01	-7

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
Min	1.10E-02	1.05E-02	4
5%	1.83E-02	1.77E-02	4
10%	2.09E-02	2.01E-02	4
20%	2.60E-02	2.52E-02	3
50%	4.37E-02	4.34E-02	1
80%	1.60E-01	1.69E-01	-5
90%	3.91E-01	4.08E-01	-4
95%	7.63E-01	7.91E-01	-4
Max	4.31E+01	4.34E+01	-1

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

Proposed Case (PRO) Simulation

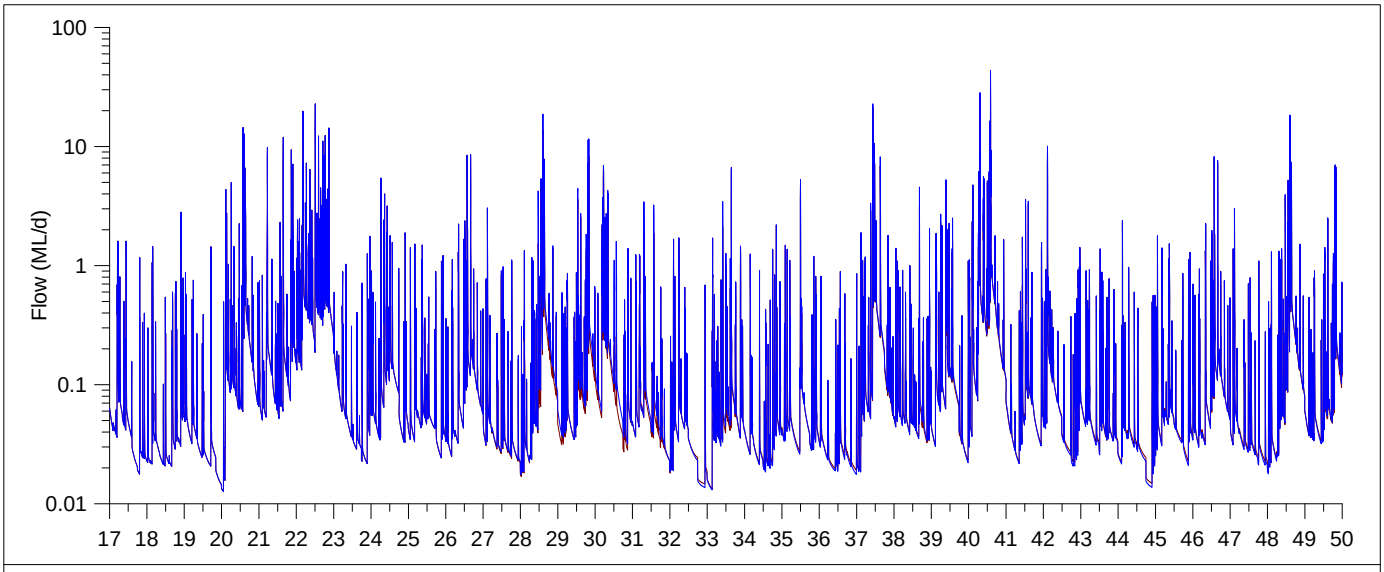
Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

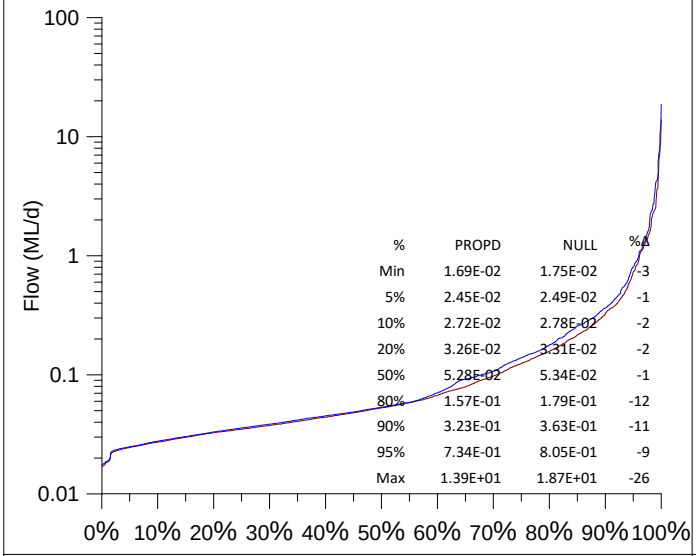
Job No.: 68229		**GoldSIM Model Output - Flow (R10)**
Client: Clarence Colliery Pty Ltd		**Paddys Creek Upper:** - Paddys Creek Tributary (Node 751)
Version: R02RevA	Date: 27/11/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.20a**

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D007_Predn_Node751\68229_R02RevA_D007a_PRO_02a_GoldSIMOutput_Flow_R10.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp

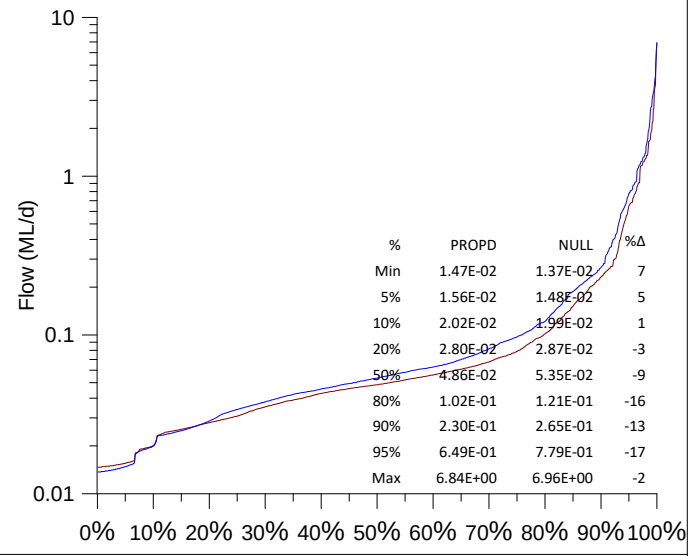


Time Series Model Output:



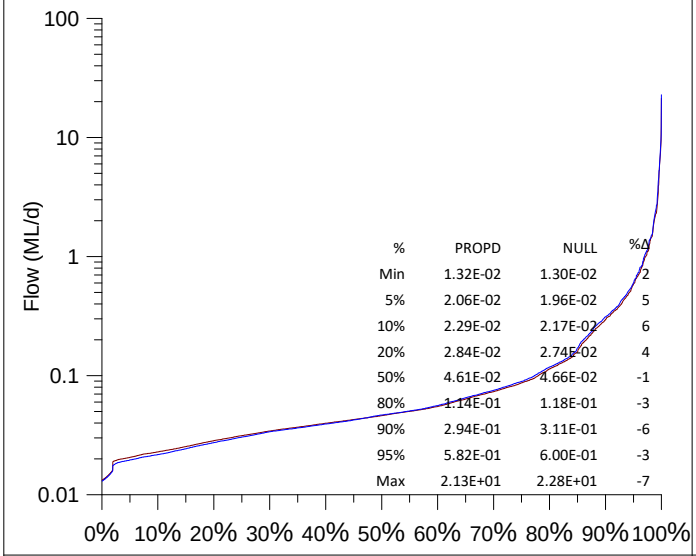
%	PROPD	NULL	%Δ
Min	1.69E-02	1.75E-02	-3
5%	2.45E-02	2.49E-02	-1
10%	2.72E-02	2.78E-02	-2
20%	3.26E-02	3.31E-02	-2
50%	5.28E-02	5.34E-02	-1
80%	1.57E-01	1.79E-01	-12
90%	3.23E-01	3.63E-01	-11
95%	7.34E-01	8.05E-01	-9
Max	1.39E+01	1.87E+01	-26

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



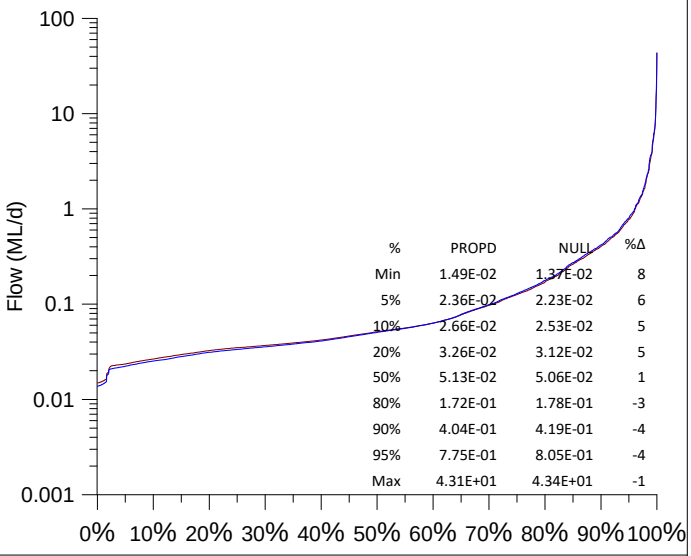
%	PROPD	NULL	%Δ
Min	1.47E-02	1.37E-02	7
5%	1.56E-02	1.48E-02	5
10%	2.02E-02	1.99E-02	1
20%	2.80E-02	2.87E-02	-3
50%	4.86E-02	5.35E-02	-9
80%	1.02E-01	1.21E-01	-16
90%	2.30E-01	2.65E-01	-13
95%	6.49E-01	7.79E-01	-17
Max	6.84E+00	6.96E+00	-2

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



%	PROPD	NULL	%Δ
Min	1.32E-02	1.30E-02	2
5%	2.06E-02	1.96E-02	5
10%	2.29E-02	2.17E-02	6
20%	2.84E-02	2.74E-02	4
50%	4.61E-02	4.66E-02	-1
80%	1.14E-01	1.18E-01	-3
90%	2.94E-01	3.11E-01	-6
95%	5.82E-01	6.00E-01	-3
Max	2.13E+01	2.28E+01	-7

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
Min	1.49E-02	1.37E-02	8
5%	2.36E-02	2.23E-02	6
10%	2.66E-02	2.53E-02	5
20%	3.26E-02	3.12E-02	5
50%	5.13E-02	5.06E-02	1
80%	1.72E-01	1.78E-01	-3
90%	4.04E-01	4.19E-01	-4
95%	7.75E-01	8.05E-01	-4
Max	4.31E+01	4.34E+01	-1

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

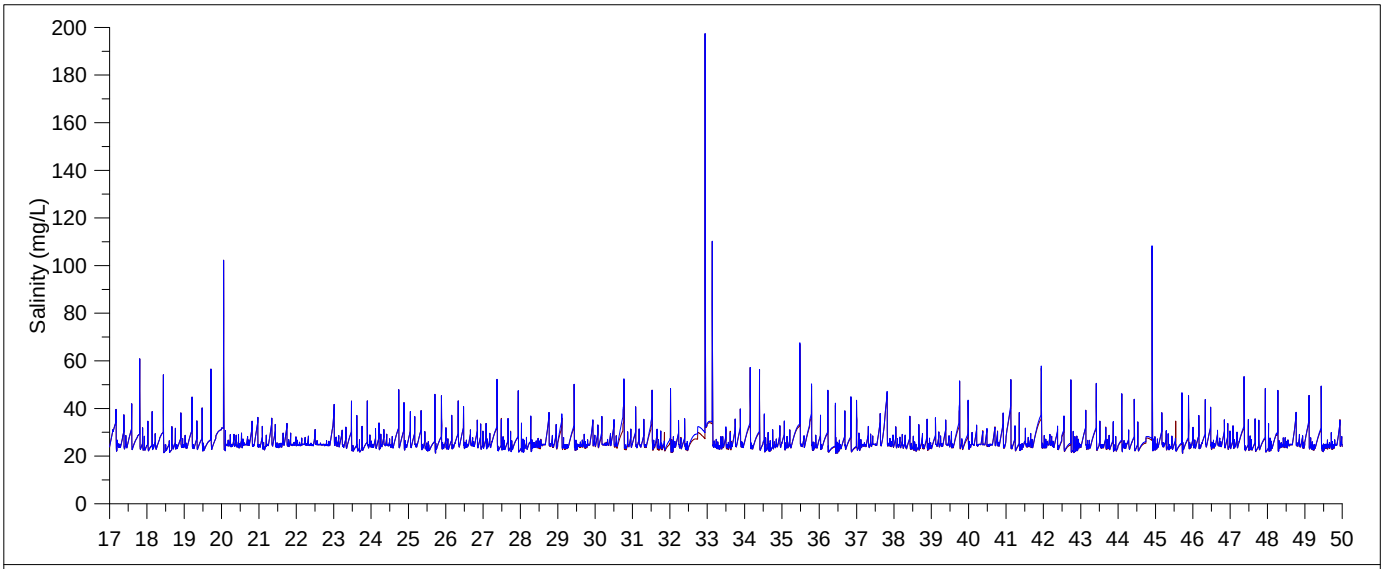
- Proposed Case (PRO) Simulation
- Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

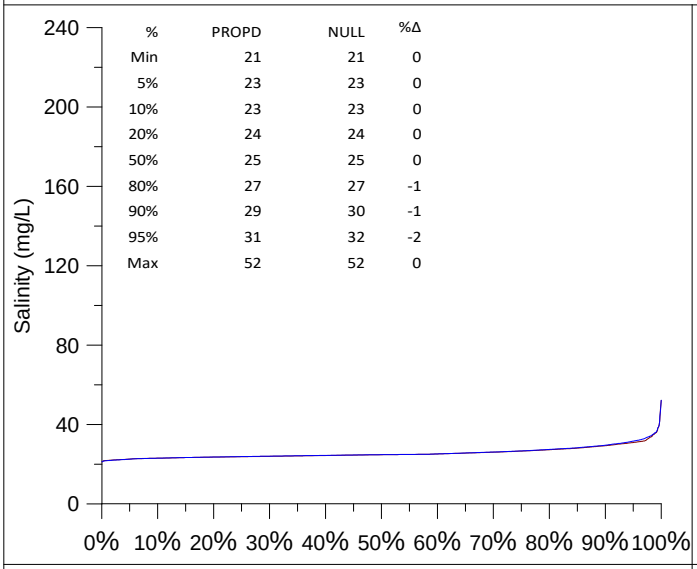
Job No.: 68229		**GoldSIM Model Output - Flow (R90)**
Client: Clarence Colliery Pty Ltd		**Paddys Creek Upper:** - Paddys Creek Tributary (Node 751)
Version: R02RevA	Date: 27/11/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.20b**

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EPI\Figures\Grapher\68229_R02RevA_D007_Predn_Node751\68229_R02RevA_D007b_PRO_02a_GoldSIMOutput_Flow_R90.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp

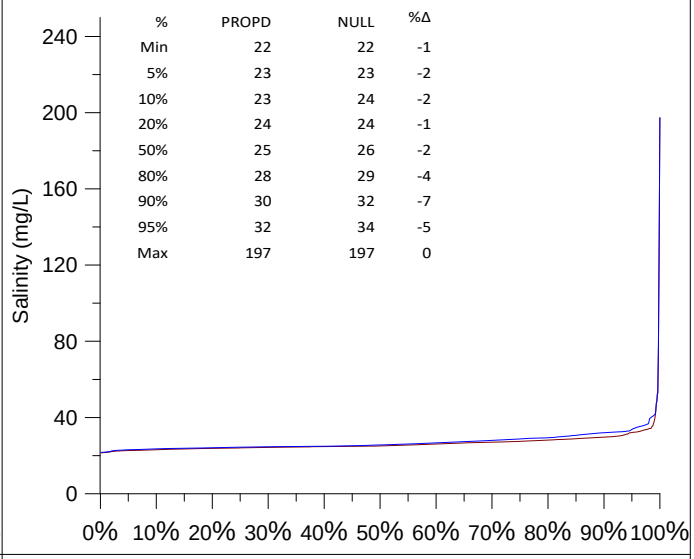


Time Series Model Output:



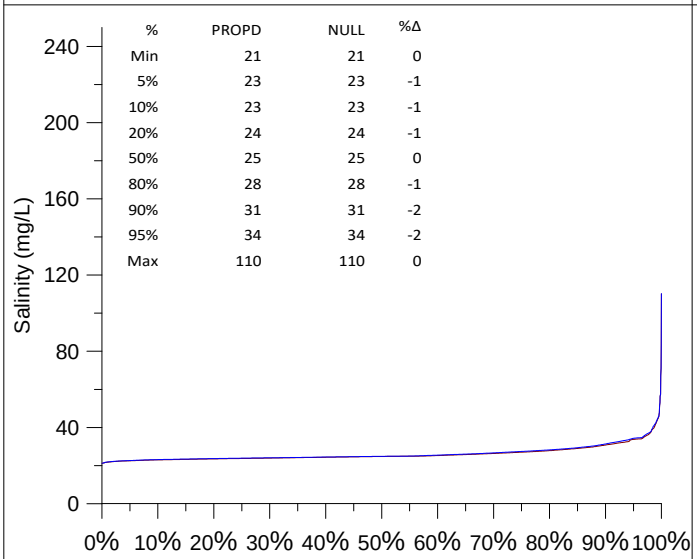
%	PROPD	NULL	%Δ
Min	21	21	0
5%	23	23	0
10%	23	23	0
20%	24	24	0
50%	25	25	0
80%	27	27	-1
90%	29	30	-1
95%	31	32	-2
Max	52	52	0

Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



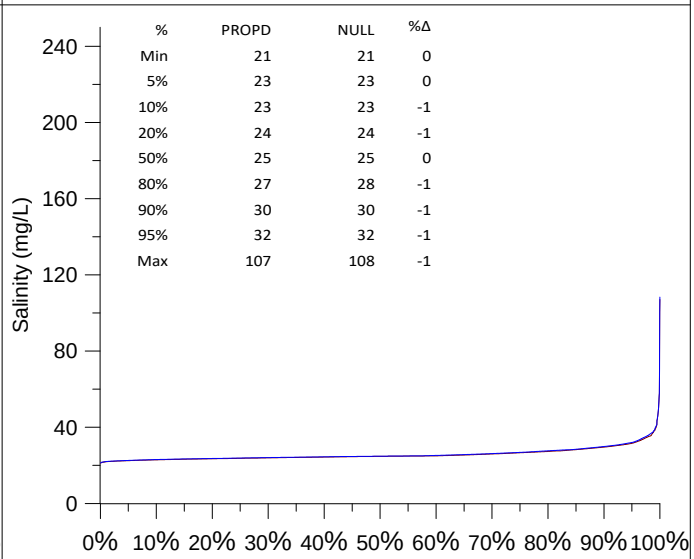
%	PROPD	NULL	%Δ
Min	22	22	-1
5%	23	23	-2
10%	23	24	-2
20%	24	24	-1
50%	25	26	-2
80%	28	29	-4
90%	30	32	-7
95%	32	34	-5
Max	197	197	0

Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



%	PROPD	NULL	%Δ
Min	21	21	0
5%	23	23	-1
10%	23	23	-1
20%	24	24	-1
50%	25	25	0
80%	28	28	-1
90%	31	31	-2
95%	34	34	-2
Max	110	110	0

Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



%	PROPD	NULL	%Δ
Min	21	21	0
5%	23	23	0
10%	23	23	-1
20%	24	24	-1
50%	25	25	0
80%	27	28	-1
90%	30	30	-1
95%	32	32	-1
Max	107	108	-1

Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

- Proposed Case (PRO) Simulation
- Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

Job No.: 68229

Client: Clarence Colliery Pty Ltd

Version: R02RevA | Date: 27/11/2025

Drawn By: DAW | Checked By: JRWB

GoldSIM Model Output - Salinity (R10)

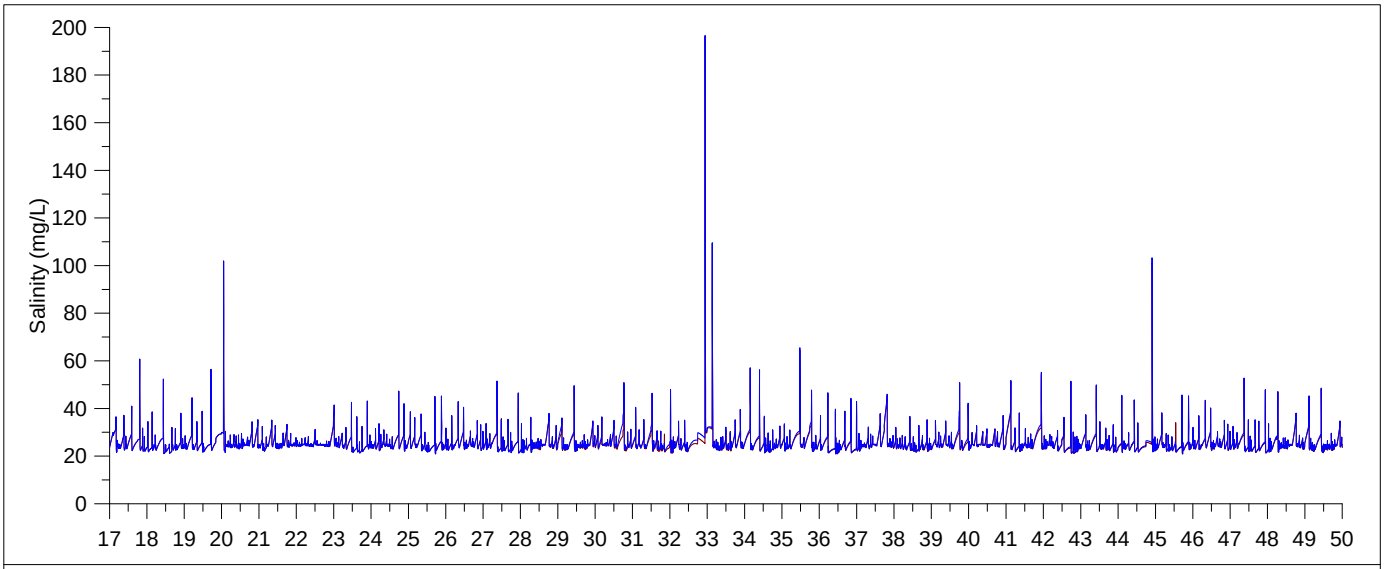
Paddys Creek Upper:
- Paddys Creek Tributary
(Node 751)

Figure 4.20c

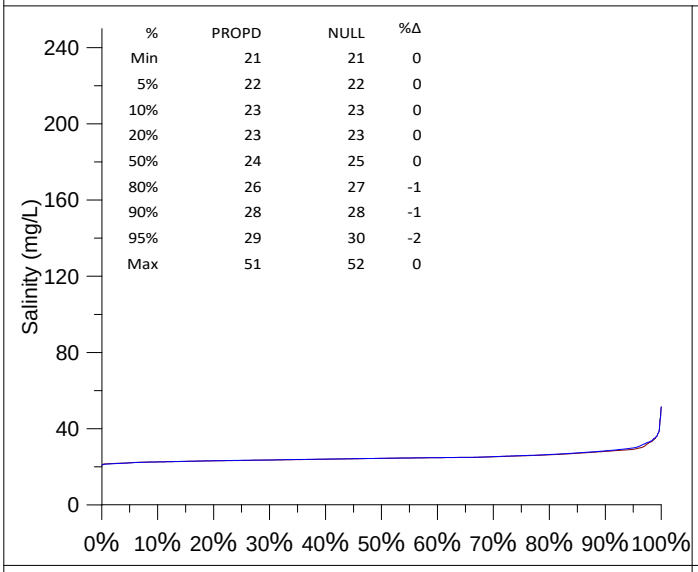
JBS&G

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D007_Predn_Node751\68229_R02RevA_D007c_PRO_02a_GoldSIMOutput_Salinity_R10.grf

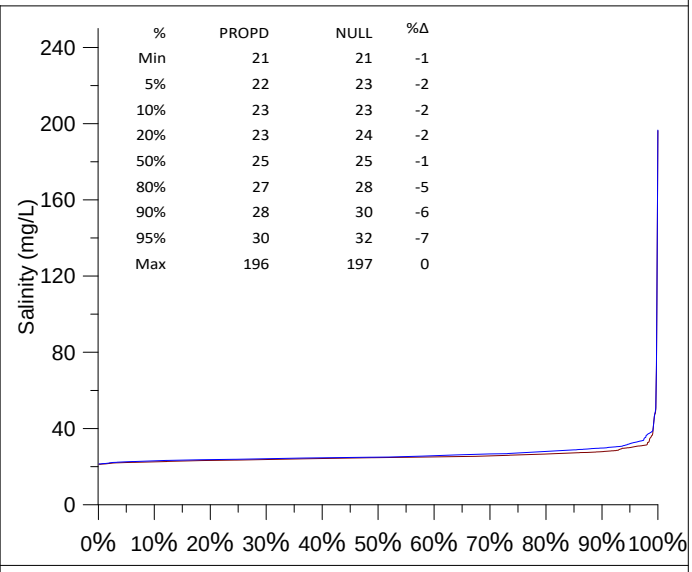
Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp



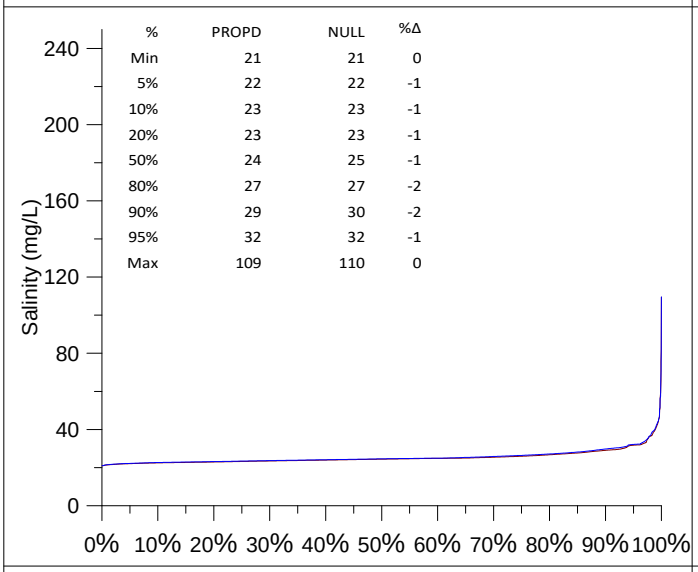
Time Series Model Output:



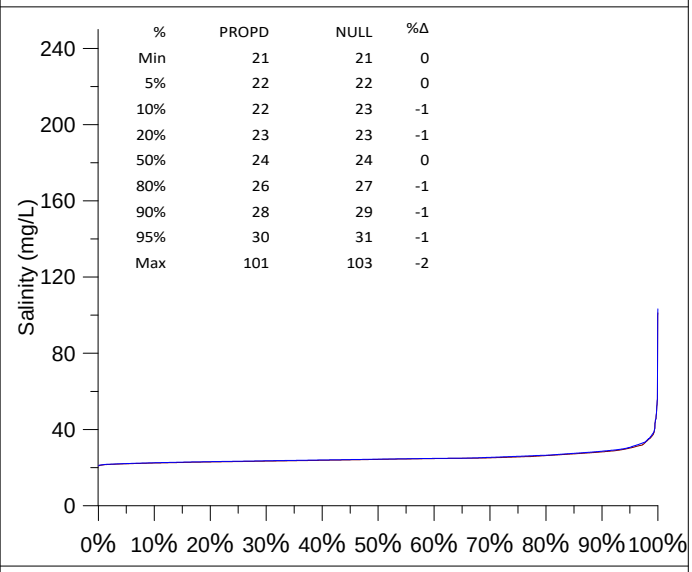
Statistical Distribution of Selected Model Output: 01/01/2025 to 31/12/2029



Statistical Distribution of Selected Model Output: 01/01/2030 to 31/12/2032



Statistical Distribution of Selected Model Output: 01/01/2033 to 31/12/2039



Statistical Distribution of Selected Model Output: 01/01/2040 to 31/12/2049

Legend

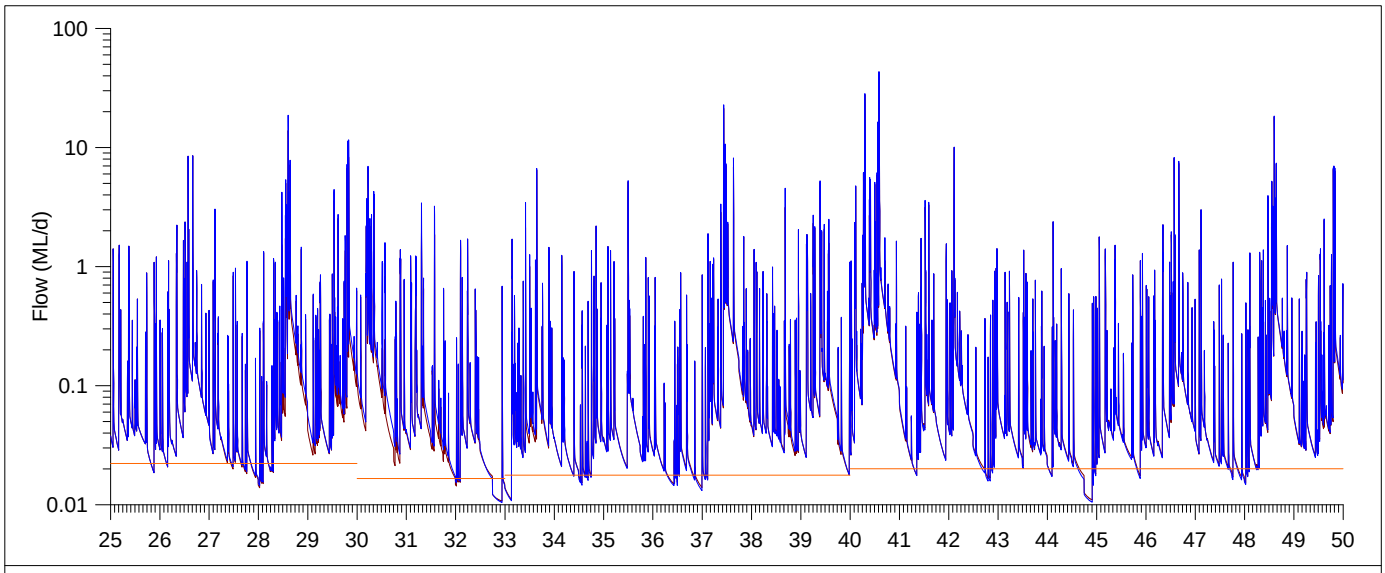
- Proposed Case (PRO) Simulation
- Approved Case (APR) Simulation

Notes: 1) %Δ is percent change between PRO and APR, calculated before rounding.

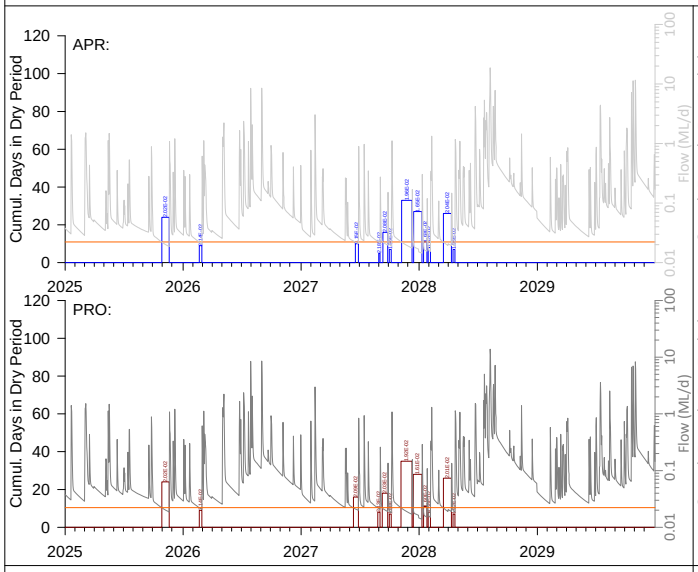
Job No.: 68229		**GoldSIM Model Output - Salinity (R90)**
Client: Clarence Colliery Pty Ltd		**Paddys Creek Upper:** - Paddys Creek Tributary (Node 751)
Version: R02RevA	Date: 27/11/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.20d** JBS&G

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D007_Predn_Node751\68229_R02RevA_D007d_PRO_02a_GoldSIMOutput_Salinity_R90.grf

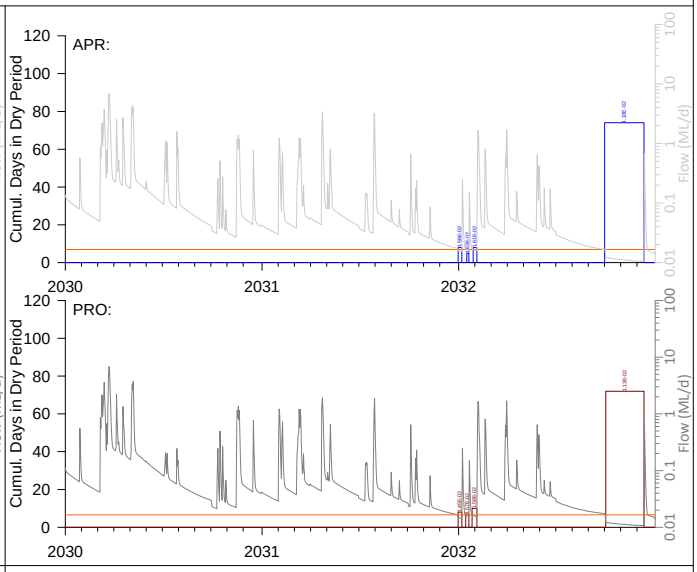
Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp



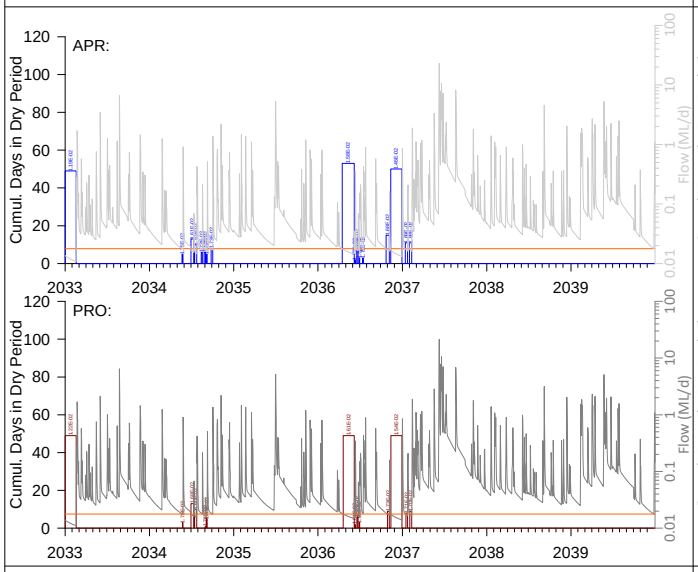
Time Series Model Output:



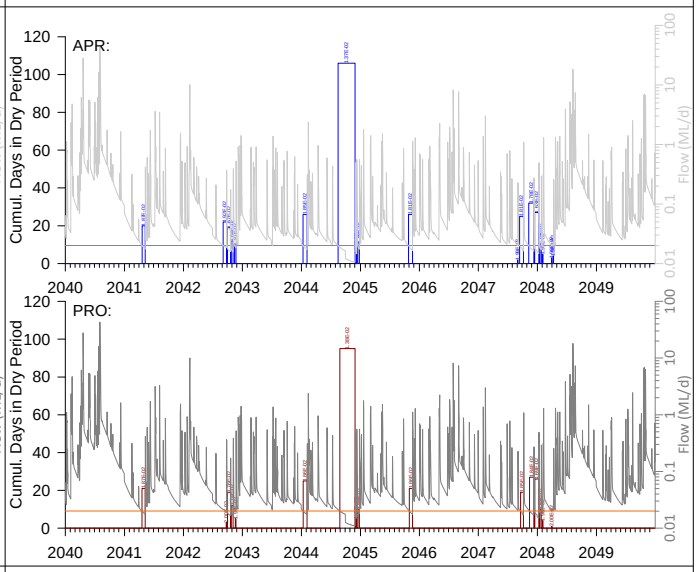
Cumul. Days in Dry Period: Flow at or below 2.22E-02ML/d (10%): 01/01/2025 to 31/12/2029



Cumul. Days in Dry Period: Flow at or below 1.66E-02ML/d (10%): 01/01/2030 to 31/12/2032



Cumul. Days in Dry Period: Flow at or below 1.77E-02ML/d (10%): 01/01/2033 to 31/12/2039



Cumul. Days in Dry Period: Flow at or below 2.01E-02ML/d (10%): 01/01/2040 to 31/12/2049

Legend

Upper Chart:
- Approved Flow (ML/d)
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)

Lower Charts:
- Approved Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Approved
- Cumulative Days in Dry Period - Approved
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Proposed
- Cumulative Days in Dry Period - Proposed

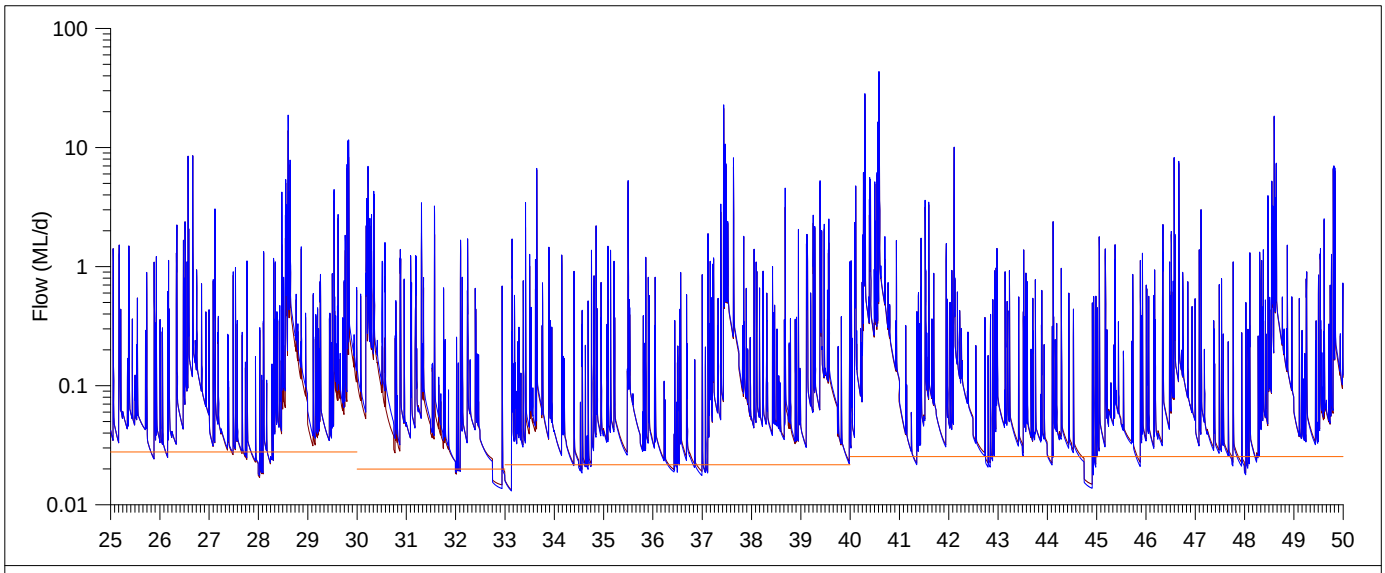
Notes:

Job No.: 68229		**GoldSIM Model Output - Cumulative Days in Dry Period (R10)**
Client: Clarence Colliery Pty Ltd		**Paddys Creek Upper:** - Paddys Creek Tributary (Node 751)
Version: R02RevA	Date: 04/12/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.21a**

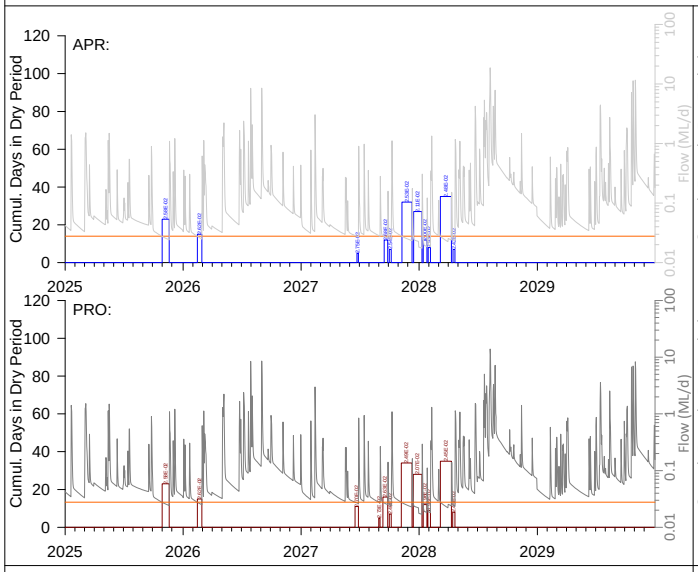
JBS&G

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D015_DryDays_Node751\68229_R02RevA_D015a\68229_R02RevA_D015a_PRO_02a_GoldSIMOutput_Node751_DryDays_R10.grf

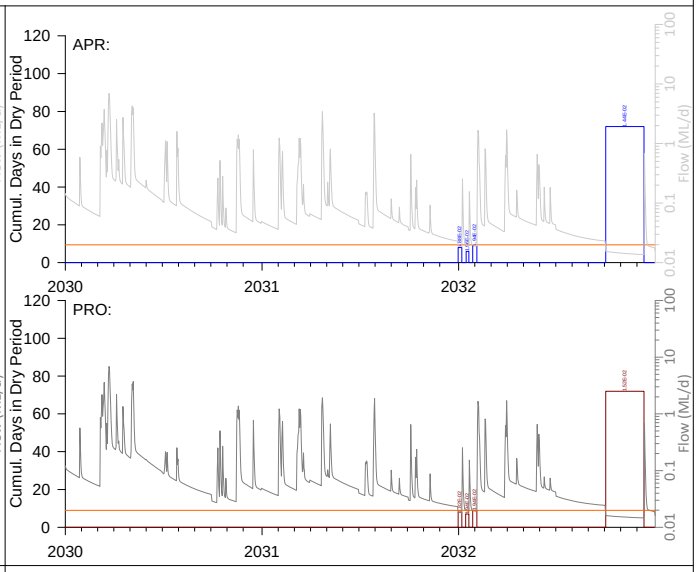
Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp



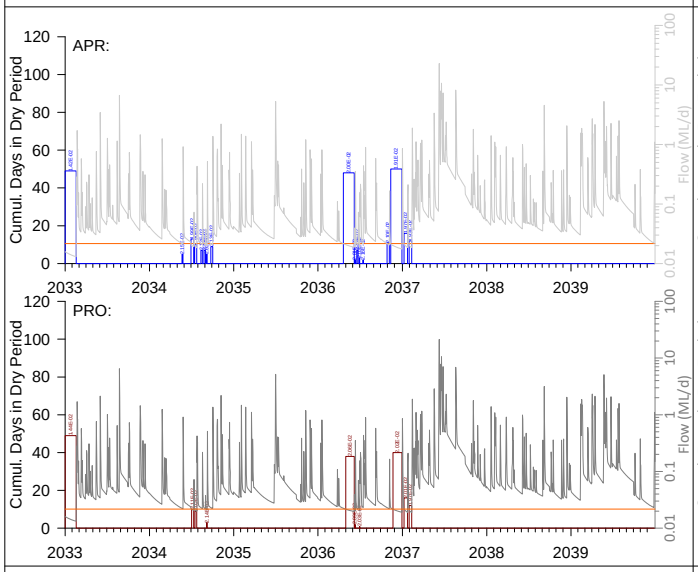
Time Series Model Output:



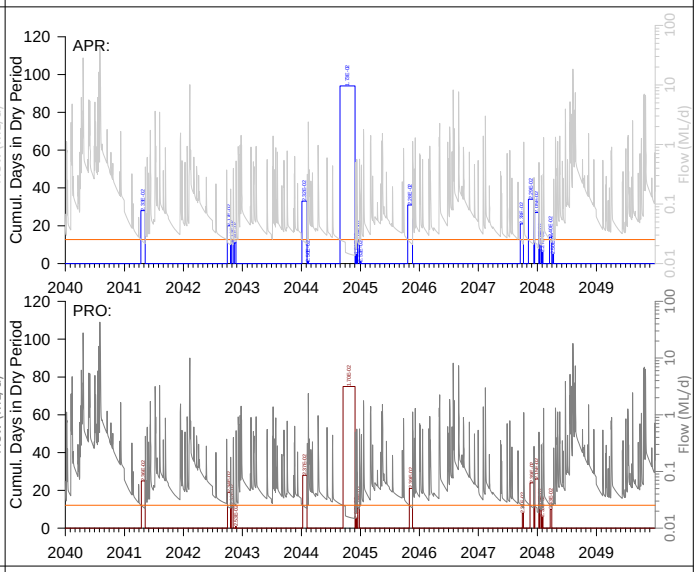
Cumul. Days in Dry Period: Flow at or below 2.78E-02ML/d (10%): 01/01/2025 to 31/12/2029



Cumul. Days in Dry Period: Flow at or below 1.99E-02ML/d (10%): 01/01/2030 to 31/12/2032



Cumul. Days in Dry Period: Flow at or below 2.17E-02ML/d (10%): 01/01/2033 to 31/12/2039



Cumul. Days in Dry Period: Flow at or below 2.53E-02ML/d (10%): 01/01/2040 to 31/12/2049

Legend

Upper Chart:
- Approved Flow (ML/d)
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)

Lower Charts:
- Approved Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Approved
- Cumulative Days in Dry Period - Approved
- Proposed Flow (ML/d)
- Flow Threshold (ML/d) (defined by Approved)
- Geomean Flow (ML/d) in Dry Period - Proposed
- Cumulative Days in Dry Period - Proposed

Notes:

Job No.: 68229		**GoldSIM Model Output - Cumulative Days in Dry Period (R90)**
Client: Clarence Colliery Pty Ltd		**Paddys Creek Upper:** - Paddys Creek Tributary (Node 751)
Version: R02RevA	Date: 04/12/2025	
Drawn By: DAW	Checked By: JRWB	**Figure 4.21b**

File Path: N:\Projects\CentennialCoal\ClarenceColliery\68229_UpdateTo918EP\Figures\Grapher\68229_R02RevA_D015_DryDays_Node751\68229_R02RevA_D015b\68229_R02RevA_D015b_PRO_02a_GoldSIMOutput_Node751_DryDays_R90.grf

Reference: 68229_R02RevA_SE-PRO_02a.gsp and 68229_R02RevA_SE-APR_03c.gsp

4.3.6 Summary of Model Findings

The Swamp Water Balance Model has been updated with revised groundwater contribution to surface water obtained from the Groundwater Model prepared for the Extraction Plan for 918 Panel (JBS&G, 2026). Some other changes were also implemented, to improve the representation of the change to 'catchment surfaces' (**Section 4.3.3.1**), which were first introduced in JBS&G (2021).

Analysis of modelling results indicated there are negligible (change is less than 2%) changes to streamflow and water quality (salinity) in Pine Swamp, Paddys Creek Swamp and Bungleboori Creek.

Analysis of modelling results in the short-term period indicated that the Paddys Creek Tributary will have a small (change is 2 to 5%) increase in daily surface water flows for low-flows, and a medium (change is 5 to 15%) decrease in daily surface water flows for median flows. Modelling indicates that, in a short time, the changes will ameliorate to be negligible (change is less than 2%) change in daily surface water flows for low-flow, and a negligible increase in daily surface water flows for median flows.

Analysis of modelling results in the short-term period indicated that the Paddys Creek Tributary will have a medium (change is 5 to 15%) decrease to predicted salinity during high salinity events, and a negligible (change is less than 2%) change to predicted salinity for median salinity events. Modelling indicates that, in a short time, the changes will ameliorate to be negligible change in predicted salinity for high salinity events, and a negligible change to predicted salinity for median salinity events. Overall, the predicted change to salinity is insignificant with respect to impact.

Analysis of modelling results indicated that there is a negligible change with respect to cumulative days and average (geomean) flow for dry periods for Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and Paddys Creek Tributary.

Accordingly, the impact of changes to modelled streamflow and water quality (salinity) in each of the catchments presented, due to implementation of the Extraction Plan for 918 Panel, is considered to be insignificant.

4.4 Geomorphology

4.4.1 Proposed Change

The Extraction Plan for 918 Panel will comprise a negligible (change is less than 5%) decrease in groundwater contribution to surface water for Pine Swamp and Paddys Creek Swamp, and a negligible increase in groundwater contribution to surface water for Bungleboori Creek and Paddys Creek Tributary (JBS&G, 2026).

Additionally, the Extraction Plan for 918 Panel is a 100mm extraction plan that does not directly undermine Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and Paddys Creek Tributary.

4.4.2 Analysis and Results

Scour will occur as a response to increased velocity along a watercourse. Given the negligible decreases and increases to groundwater to surface water contribution to the catchments in the vicinity, there will be a negligible predicted geomorphological response due to the Extraction Plan for 918 Panel.

At Paddys Creek Tributary, where there does exist a medium (change is 5 to 15%) decrease for median flows during the short term period (January 2030 to December 2032), these changes are arithmetically medium, but with respect to the corresponding values, the decreased daily surface flow is considered insignificant. For example, in the R10 scenario, a -11% decrease corresponds to a daily surface flow of 0.0460ML/d (0.53L/s) in the Approved Case to a 0.0408ML/d (0.47L/s) in the Proposed Case.

Additionally, there will be no adverse change through the thalweg (line of lowest elevation along a watercourse), due to development beneath watercourses. An assessment of subsidence for 918 Panel is presented in MSEC (2026) and GHD (2026) presents an additional geomorphological assessment.

Given the above, implementation of the Extraction Plan for 918 Panel is considered to have insignificant impact on geomorphology in Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and Paddys Creek Tributary.

4.5 Flooding and Drainage Assessment

4.5.1 Proposed Change

The Extraction Plan for 918 Panel will comprise a negligible (change is less than 5%) decrease in groundwater contribution to surface water for Pine Swamp and Paddys Creek Swamp, and a negligible increase in groundwater contribution to surface water for Bungleboori Creek and Paddys Creek Tributary (JBS&G, 2026).

There will be no adverse change through the thalweg (line of lowest elevation along a watercourse), due to development beneath watercourses, which could lead to water logging and drainage issues. Geotechnical, subsidence and caving assessment for 918 Panel was undertaken by SCT (2026).

The assessment also considered whether the implementation of the Extraction Plan for 918 Panel could flood flows during high rainfall events.

4.5.2 Analysis and Results

As presented in **Section 4.3.5**, the negligible change in groundwater contribution to surface water does not lead to a significant change in daily surface water flows.

As there is no expected change to bedslope along the thalweg of watercourses, there will be no change to drainage issues.

The Extraction Plan for 918 Panel does not consist of any change to existing infrastructure and site water management, hence there is no change to flooding characteristics due to the Extraction Plan.

4.6 Availability of Water

4.6.1 Proposed Change

The Extraction Plan for 918 Panel will comprise a negligible (change is less than 5%) decrease in groundwater contribution to surface water for Pine Swamp and Paddys Creek Swamp, and a negligible increase in groundwater contribution to surface water for Bungleboori Creek and Paddys Creek Tributary (JBS&G, 2026).

The availability of water assessment considered whether the Extraction Plan for 918 Panel could lead to hydrological changes that alter the volume or reliability of surface water in nearby catchments.

4.6.2 Analysis and Results

As presented in **Section 4.3.5**, the negligible change in groundwater contribution to surface water does not lead to a significant change in daily surface water flows. Modelling indicates that the water quality (salinity) will have an insignificant decrease providing an insignificant improvement to surface water quality.

The Extraction Plan for 918 Panel will result in a negligible change to availability and quality of water along Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and Paddys Creek Tributary.

4.7 Aquatic Ecological Environment

4.7.1 Proposed Change

The Extraction Plan for 918 Panel will comprise a negligible (change is less than 5%) decrease in groundwater contribution to surface water for Pine Swamp and Paddys Creek Swamp, and a negligible increase in groundwater contribution to surface water for Bungleboori Creek and Paddys Creek Tributary (JBS&G, 2026).

Additionally, the Extraction Plan for 918 Panel is a 100mm extraction plan that does not directly undermine Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and Paddys Creek Tributary.

4.7.2 Analysis and Results

THPSS located in the vicinity of 918 Panel include Paddys Creek Swamp and Lower Nine Mile Swamp along Bungleboori Creek. Analysis of daily surface flows, water quality (salinity) and duration and average flows of cumulative days in a dry period, are provided in **Section 4.3.5**, and analysis of geomorphology is provided in **Section 4.4**.

Analysis indicates an insignificant change in daily surface flow, water quality (salinity) and duration and average flows of cumulative days in dry periods, with respect to the aquatic ecological environment due to the Extraction Plan for 918 Panel.

5. Impact Assessment

This chapter presents an impact assessment of modelled changes to surface water due to implementation of the Extraction Plan for 918 Panel.

5.1 Approach to Cumulative Impact Assessment

Changes to the surface water system due to all existing and historical mining operations in the Western Coalfields have been incorporated into the hydrological analysis presented in this report.

5.2 Impact Assessment

5.2.1 Site Water Management

Site Water and Salt Balance

Additional mine dewatering associated with the implementation of the Extraction Plan for 918 Panel will be managed within existing mine water management infrastructure.

Accordingly, implementation of Extraction Plan for 918 Panel is considered to have an insignificant effect on site water management.

Further detail on this aspect is presented in the WMP (Clarence, 2026).

Erosion and Sediment Control

There is no proposed change to erosion and sediment control infrastructure at Clarence Pit Top due to implementation of the Extraction Plan for 918 Panel.

Accordingly, there will be no impact from the Extraction Plan on erosion and sediment control.

Further detail on erosion and sediment control at Clarence Colliery is presented in the WMP (Clarence, 2026).

5.2.2 Surface Water Environment

5.2.2.1 Regional Surface Water Flow and Quality

Table 5-1 presents a summary of the expected impact due to the Extraction Plan for 918 Panel at each output location of the Swamp Water Balance Model (used as the Regional Surface Water Flow and Quality model).

Table 5-1: Impact of Change to Flow, Level and Quality on Surface Water Environment

Node #	Impact to Change to Flow/Volume	Impact of Change to Quality (Salinity)
Node #716, Pine Swamp	1 January 2030 to 31 December 2032: Negligible change (median and 10th%) 1 January 2040 to 31 December 2049: Negligible change (median and 10th%)	1 January 2030 to 31 December 2032: Negligible change (median and 90th%) 1 January 2040 to 31 December 2049: Negligible change (median and 90th%)
Node #712, Paddys Creek Swamp	1 January 2030 to 31 December 2032: Negligible change (median and 10th%) 1 January 2040 to 31 December 2049: Negligible change (median and 10th%)	1 January 2030 to 31 December 2032: Negligible change (median and 90th%) 1 January 2040 to 31 December 2049: Negligible change (median and 90th%)

Node #	Impact to Change to Flow/Volume	Impact of Change to Quality (Salinity)
Node #746, Bungleboori Creek, below junction of Swamps	1 January 2030 to 31 December 2032: Negligible change (median and 10th%) 1 January 2040 to 31 December 2049: Negligible change (median and 10th%)	1 January 2030 to 31 December 2032: Negligible change (median and 90th%) 1 January 2040 to 31 December 2049: Negligible change (median and 90th%)
Node #751, Paddys Creek Tributary	1 January 2030 to 31 December 2032: Medium decrease (median) to negligible change (10th%) 1 January 2040 to 31 December 2049: Negligible increase (median) to small increase (10th%)	1 January 2030 to 31 December 2032: Negligible change (median) to medium decrease (90th%) 1 January 2040 to 31 December 2049: Negligible change (median) to negligible decrease (90th%)

From **Table 5-1**, there are negligible changes to daily streamflow and water quality (salinity) during low-flow periods (generally corresponding to high salinity events) and median flow periods for Pine Swamp, Paddys Creek Swamp and Bungleboori Creek.

From **Table 5-1**, there are negligible changes to daily streamflow during low-flow periods for Paddys Creek Tributary. From **Table 5-1**, at Paddys Creek Tributary, there is a medium decrease in daily streamflow for median flows in the short-term that ameliorates over time to become a small increase. This change is caused by time-series change to catchment surface in the model (refer **Section 4.3.3.1**), and is not due to a change in groundwater contribution to surface water. The change is not considered to be significant.

From **Table 5-1**, there are negligible to medium decreases to predicted salinity in Paddys Creek Tributary. That modelled change is not considered to be significant.

5.2.2.2 Geomorphology, Flooding and Drainage

Geomorphology

Analysis indicates that there is an insignificant change to daily surface water flows in the nearby surface water catchments and therefore, the average channel velocity will be insignificant.

The Extraction Plan for 918 Panel will also not lead to a change in the River Styles condition.

An additional assessment of geomorphology is presented in GHD (2026).

Given the above, the impact of the Extraction Plan for 918 Panel on geomorphology will be insignificant.

Flooding

The Extraction Plan for 918 Panel does not consist of any change to existing infrastructure and site water management, in terms of location of treated mine water discharge. As such the only changes to surface water are indirect (groundwater contribution to surface water and Time Series Changes to the AWBM) due to extraction. These changes are insignificant with respect to flooding.

Accordingly, the impact of the Extraction Plan for 918 Panel on flooding characteristics is insignificant.

Drainage

The Extraction Plan for 918 Panel does not consist of any change to existing infrastructure and site water management. As such the only changes to surface water are indirect (groundwater contribution to surface water and Time Series Changes to the AWBM) due to extraction, and as JBS&G understands it, there are no

adverse change along the thalweg (MSEC (2026) and GHD (2026)), it is considered that implementation of the Extraction Plan for 918 Panel will have an insignificant impact with respect to drainage/water logging.

5.2.3 Ecological Receptors

5.2.3.1 General

There is no clearing of vegetation that will occur as part of the Extraction Plan for 918 Panel. Impacts to groundwater dependent ecosystems are addressed in **Section 5.2.3.2**.

5.2.3.2 Groundwater Dependent Ecosystems

As identified in **Section 3.3.2**, Paddys Creek Swamp and Lower Nine Mile Swamp include Newnes Plateau Shrub Swamps and Newnes Plateau Hanging Swamps, and are located in the vicinity of 918 Panel.

Modelling indicates there will be insignificant change to surface water flow in the catchments containing the Paddys Creek Swamp and Lower Nine Mile Swamp due to implementation of Extraction Plan for 918 Panel. Modelling indicates there will be an insignificant change to water quality (salinity) in the catchments containing the Paddys Creek Swamp and Lower Nine Mile Swamp due to implementation of Extraction Plan for 918 Panel.

Accordingly, the impact of implementation of Extraction Plan for 918 Panel is considered to be insignificant.

5.2.4 Surface Water Users

There are no surface water users located in the vicinity of 918 Panel.

Modelling indicates that the Bungleboori Creek catchment, below the junction of swamps in the vicinity of 918 Panel, will have an insignificant change with respect to daily streamflow and water quality (salinity). Therefore, further downstream locations, including within the Greater Blue Mountains World Heritage Area, will have an insignificant change with respect to daily streamflow and water quality (salinity).

Accordingly, the Extraction Plan for 918 Panel will have an insignificant impact with respect to other licensed surface water users.

5.2.5 Surrounding Land-Uses

As outlined in **Section 3.4**, surrounding land-use includes the Greater Blue Mountains World Heritage Area.

Modelling indicates that the insignificant impacts due to the Extraction Plan for 918 Panel are limited to surface water flows to nearby water catchments, and will have insignificant impact with respect to surrounding land-uses including the Greater Blue Mountains World Heritage Area and the Garden of Stone Reserves. Changes to surface water flows or water quality in these catchments will not lead to impact of any infrastructure or inundation patterns.

5.3 Compliance Assessment

5.3.1 Commonwealth Legislation

5.3.1.1 Environment Protection and Biodiversity Conservation Act 1999

The following matters were listed as EECs under the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth) and are understood to be present and/or in the vicinity of the Site:

- Temperate Highland Peat Swamps on Sandstone (may occur)
- Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (may occur)
- Natural Temperate Grassland of the South Eastern Highlands (may occur)
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (may occur).

It is noted in **Section 2.1.1** that none of the EECs are listed as being 'likely to occur' and the only EEC that is a high priority GDE is the Temperate Highland Peat Swamps on Sandstone (THPSS). For the purpose of this assessment, it is assumed that these other EECs are not present in the vicinity of 918 Panel. Those other EECs, being the Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion, Natural Temperate Grassland of the South Eastern Highlands or White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.

In the vicinity of 918 Panel, Newnes Plateau Shrub Swamps and Newnes Plateau Hanging Swamps, will receive an insignificant impact with respect to groundwater (JBS&G, 2026). Modelling indicates that there will be insignificant change to surface water flow in the Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and Paddys Creek Tributary catchments, due to the implementation of the Extraction Plan for 918 Panel. Modelling indicates there will be insignificant change to water quality (salinity) in the Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and Paddys Creek Tributary catchments, due to implementation of Extraction Plan for 918 Panel. Other hydrological aspects that could affect THPSS include changes to site water management, erosion and sediment control, flooding and drainage and geomorphology. As presented in Section 4, these changes are not applicable or negligible.

Accordingly, the impact of implementation of Extraction Plan for 918 Panel is considered to be insignificant.

5.3.2 Commonwealth Guidelines and Policy

5.3.2.1 Significant Impact Guidelines

Water Quantity

Table 5-2 presents an assessment of the implementation of the Extraction Plan for 918 Panel against the CTH DCCEEW (2022) with respect to water quantity.

Table 5-2: Impact Assessment against Significant Impact Guidelines 2022 – Water Quantity

Requirement	Compliant	Response
A significant impact on the hydrological characteristics of a water resource may occur where there are, as a result of the action: • changes in the water quantity, including the timing of variations in water quantity	Yes (**Section 4.3.5**)	Modelling indicates that implementation of the Extraction Plan for 918 Panel will have an insignificant impact on streamflow and duration of dry periods.
• changes in the integrity of hydrological or hydrogeological connections, including structural damage (for example, large scale subsidence)	Yes (**Section 4.3.3** and **Section 4.3.5**)	Subsidence predictions along the thalweg of watercourses containing THPSS are presented in MSEC (2026) and are supplemented by a geomorphological assessment presented in GHD (2026). Those studies indicate that there is an insignificant impact to bedslope and erosivity respectively. Change to the connection between surface water and groundwater, due to subsidence, is presented in detail in the Groundwater Assessment (JBS&G, 2026). The Groundwater Assessment also includes consideration of geological lineaments, where most watercourses are in an orientation that is consistent with mapped geological lineaments. The approach to the Swamp Water Balance Model includes change to catchment surface as well as groundwater contribution to surface water (stochastic) obtained from the numerical groundwater model.

Requirement	Compliant	Response
• changes in the area or extent of a water resource. where these changes are of sufficient scale or intensity as to significantly reduce the current or future utility of the water resource for third party users, including environmental and other public benefit outcomes.	Yes (**Section 4.3.5**)	THPSS (shrub) are not static water bodies, rather are low topographic gradient (bedslope), locally wide ecosystems along watercourses. Modelling does not indicate an increase or decrease in the extent of these swamps due to implementation of the Extraction Plan for 918 Panel (implied by the insignificant change in streamflow); as well as the subsidence predictions of bedslope (MSEC, 2026) along the thalweg of watercourses containing THPSS.
The following aspects may need to be considered when assessing changes in hydrological characteristics: • flow regimes (volume, timing, duration and frequency of surface water flows)	Yes (**Section 4.3.5**)	Detailed output from the Swamp Water Balance Model is presented in **Section 4.3.5**. That output is presented as both time-series change and using flow duration curves. Furthermore, an assessment of the change in duration of dry periods is also presented in **Section 4.3.5**. From **Section 4.3.5**, the impact of the Extraction Plan is considered insignificant to flow regimes.
• recharge rates to groundwater	Yes (**Section 4.3.3**)	The Swamp Water Balance Model receives input (stochastic) from the numerical groundwater model (JBS&G, 2026), with groundwater/surface water interaction being an objective in the development and implementation of the groundwater model.
• aquifer pressure or pressure relationships between aquifers	Yes (**Section 4.3.3**)	The conceptual and numerical groundwater model presented in JBS&G (2026) incorporate three groundwater systems, being the perched (Burralow Formation), shallow (Banks Wall Sandstone above the Mount York Claystone) and deep (Illawarra Coal Measures). Variably saturated flow conditions were also applied to selected layers in the numerical groundwater model, so as to be consistent with the conceptual model. Further detail is presented in the Groundwater Assessment (JBS&G, 2026), however, the relationships between aquifers and aquitards informed the calculated groundwater contribution to surface water that was incorporated into the Swamp Water Balance (refer **Section 4.3.3**).
• groundwater table and potentiometric surface levels	Yes (**Section 4.3.3**)	Modelled groundwater contribution to surface water (obtained from the Groundwater Assessment (JBS&G, 2026), incorporates reflects the influence of depressurisation of the deep groundwater system.
• groundwater-surface water interactions	Yes (**Section 4.3.2** and **Section 4.3.5**)	The numerical groundwater model presented in JBS&G (2026) incorporates seepage faces, ephemeral watercourses, perennial watercourses and surface overland flow. As per the objectives of the Swamp Water Balance Model (refer **Section 4.3.2**), groundwater/surface water interaction was an objective of the modelling approach. As stated in the Groundwater Assessment (JBS&G, 2026), the change to groundwater contribution to surface water is considered to be insignificant. In the Surface Water Assessment (this report), an evaluation

Requirement	Compliant	Response
		of context of that change is presented, including with respect to the potential change to the duration of dry periods due to the implementation of the Extraction Plan. As presented in **Section 4.3.5**, the change to the duration of dry days is negligible and is considered insignificant.
• river-floodplain connectivity	Yes (**Section 4.3.3**)	The Western Coalfields does not include floodplains, however, does include THPSS along most watercourses on the Newnes Plateau and along the Upper Coxs River. The numerical groundwater model and the Swamp Water Balance Model encompass all watercourses of interest to the Extraction Plan for 918 Panel. Those watercourses contain groundwater dependent ecosystems, hence are gaining watercourses by definition and remain gaining.
• inter-aquifer connectivity	Yes (**Section 4.3.3**)	The numerical groundwater model presented in JBS&G (2026) was used to generate groundwater contribution to surface water (stochastic), which was then assessed in the Swamp Water Balance Model. Accordingly, this Surface Water Assessment takes into account inter-aquifer connectivity, including subsidence-related change (both within the groundwater model) as well as with respect to change to catchment surface in the Swamp Water Balance Model.
• coastal processes including changes to sediment movement or accretion, water circulation patterns, permanent alterations in tidal patterns, or substantial changes to water flows or water quality in estuaries.	N/A	Not applicable.
Unless the proponent can establish otherwise, the department will assume that there is a connection between surface water and groundwater. The proponent should also consider the potential impact of drilling, excavating or hydraulic stimulation on connectivity between surface water and groundwater, and whether this is likely to impact on the hydrology of the system beyond the life of the proposed action.	Yes (**Section 4.3.3**)	The potential impact on groundwater/surface water interaction from development and extraction of 918 Panel is accommodated in the approach to the numerical groundwater model and the Swamp Water Balance Model.

Section 4.3.1 of CTH DCCEEW (2022) notes that *"…proponent can demonstrate that all of the water used by a proposed action is authorised through such entitlements, the action is less likely to require a referral due to significant impacts on the hydrological characteristics of a water resource."*.

Groundwater extraction for the purpose of depressurisation during development and ahead of extraction will be undertaken within currently held WALs in the *Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources* 2023 (NSW). This includes the approach to licensing of any reduction in groundwater contribution to surface water in a gaining watercourse (which occurs at Clarence Colliery, in THPSS shrub swamps, as are groundwater dependent ecosystems), in accordance with Figure 7 of NSW DCCEEW (2022).

Water Quality

Table 5-3 presents an assessment of the implementation of the Extraction Plan for 918 Panel against CTH DCCEEW (2022) with respect to water quality.

Table 5-3: Impact Assessment against Significant Impact Guidelines 2022 – Water Quality

Requirement	Compliant	Response
A significant impact on a water resource may occur where, as a result of the action: • there is a risk that the ability to achieve relevant local or regional water quality objectives would be materially compromised, and as a result the action:		
○ creates risks to human or animal health or to the condition of the natural environment as a result of the change in water quality	Yes (**Section 4.3.5**)	• There is negligible change to groundwater and surface water quality due to implementation of the Extraction Plan for 918 Panel, since minor disruption of ground surface and change in groundwater flow path will not lead to a change to beneficial use class of groundwater or surface water. As noted in **Section 4.3.3**, the approach to surface water quality modelling was with respect to salinity. The determination of change to surface water quality (general) is considered reasonable, since water quality of swamp piezometers is of very high quality, and additional water/rock interaction, due to subsidence-related change, has not and will not lead to change in surface water quality.
○ substantially reduces the amount of water available for human consumptive uses or for other uses, including environmental uses, which are dependent on water of the appropriate quality	Yes (**Section 4.3.5**)	• Modelling indicates there will be a negligible change to groundwater contribution to surface water due to implementation of the Extraction Plan for 918 Panel.
○ causes persistent organic chemicals, heavy metals, salt or other potentially harmful substances to accumulate in the environment	Yes (**Section 3.6.1.1**)	• There are no significant quantities of potential contaminants of concern, including salts, associated with mining at Clarence Colliery.
○ seriously affects the habitat or lifecycle of a native species dependent on a water resource, or	Yes (**Section 4.3.5**)	• The change in groundwater contribution to surface water does not result in a change in the duration of dry periods. The geomorphological (**Section 4.4**) and flooding and drainage assessment (**Section 4.5**) is negligible. The impact of the implementation of

Requirement	Compliant	Response
		the Extraction Plan for 918 Panel is therefore considered to be insignificant.
○ causes the establishment of an invasive species (or the spread of an existing invasive species) that is harmful to the ecosystem function of the water resource, or	Yes (**Section 4.1** and **Section 4.2**)	• There are no changes to site water management infrastructure or erosion and sediment control infrastructure with implementation of the Extraction Plan for 918 Panel. There is also no clearing of vegetation or other surface activities along watercourses due to the Extraction Plan. The potential for impact of invasive species is considered to be insignificant. The potential for juvenile eucalypts to encroach on THPSS, due to a change in groundwater level in the THPSS is also considered to be insignificant.
• there is a significant worsening of local water quality (where current local water quality is superior to local or regional water quality objectives), or	Yes (**Section 4.3.5**)	Implementation of the Extraction Plan for 918 Panel will not lead to a change in the beneficial use class of groundwater or surface water.
• high quality water is released into an ecosystem which is adapted to a lower quality of water.	Yes (**Section 4.1**)	Mine water discharge occurs to the Wollangambee River from Clarence Colliery via its EPL LD002. There will be no change in water quality of discharge due to implementation of the Extraction Plan for 918 Panel as it is a continuation of existing activities.
For water-dependent ecosystems, a significant impact is likely if the predicted change in water quality is greater than that required for 'moderately to slightly disturbed' systems as described in the relevant local or regional water quality objectives (typically the 80% to 95% ecosystem protection guideline values listed in the Australian Water Quality Guidelines). Note that other thresholds may apply where changes in water quality may impact on other matters of national environmental significance, such as threatened species or ecological communities.	Yes (**Section 5.2.3**)	Implementation of the Extraction Plan for 918 Panel will not lead to a change in the beneficial use class of groundwater or surface water.

5.3.2.2 Information Guideline Explanatory Notes

Assessing groundwater-dependent ecosystems 2019

This Explanatory Note outlines scientific methodological framework, informed based on risk, to identify groundwater dependent ecosystems that may be impacted by an activity.

For the Extraction Plan for 918 Panel, all THPSS have been confirmed by field studies (refer **Section 3.3.2**), including on-going updates to mapped extents. That work is consistent with the designation of THPSS in both the *Biodiversity Conservation Act* 2016 (NSW), *Water Management Act* 2000 (NSW) (via the Water Sharing Plan (Groundwater), as listed high priority groundwater dependent ecosystems) and *Environment Protection and Biodiversity Conservation Act* 1999 (Cth).

The Surface Water Assessment is consistent with this Explanatory Note, and helped inform the focus of monitoring, conceptual hydrological model (specifically groundwater/surface water interaction), ecohydrological impact pathway diagram and design of the numerical groundwater model (presented in JBS&G (2026).

Deriving site-specific guideline values for physico-chemical parameters and toxicants 2019

Trigger levels for groundwater or surface water quality at Clarence Colliery are specified in Clarence (2026).

As JBS&G understands it, these trigger values were developed in accordance with CTH WQA (2025), insofar comparison to a reference to a control site. Further detail on the development of site-specific trigger values and an evaluation of consistency with CTH IESC (2019b) is presented in Clarence (2026).

There will be no change to groundwater and surface water quality due to implementation of the Extraction Plan for 918 Panel.

Mine water discharge to the Wollangambee River, after treatment, via EPL LDP002 is governed under the *Protection of the Environment Operations Act* 1997 (NSW).

Characterisation and modelling of geological fault zones 2021

Addressed in the Groundwater Assessment of the Extraction Plan for 918 Panel (JBS&G, 2026).

Uncertainty analysis for groundwater modelling 2023

Addressed in the Groundwater Assessment of the Extraction Plan for 918 Panel (JBS&G, 2026).

Subsidence associated with underground coal mining 2023

The subsidence assessment (MSEC, 2026) does not identify adverse change to the bed slope along the thalweg of relevant watercourses due to the implementation of the Extraction Plan for 918 Panel.

Review of the impact to geomorphology of predicted subsidence with implementation of the Extraction Plan for 918 Panel is presented GHD (2026). GHD (2026) concludes that the impact of the Extraction Plan is insignificant.

Another aspect of subsidence-related change pertains to change to catchment surface in the Swamp Water Balance Model. As presented in **Section 4.3.3.1**, this pertains to time-series change to losses in the AWBM.

Given the above, the Surface Water Assessment is considered compliant with the intent of the Explanatory Note.

Using impact pathway diagrams based on ecohydrological conceptualisation in environmental impact assessment 2024

Section 3.11 presents application of impact pathway diagram methodology outlined in CTH IESC (2024) to the Extraction Plan for 918 Panel.

For Clarence Colliery, the impact pathway to THPSS (groundwater dependent ecosystems) pertains to:

- changes to swamp water level
- changes to groundwater contribution to surface water.

The approach to the Groundwater Assessment and the numerical groundwater model (JBS&G, 2026) and the Surface Water Assessment and Swamp Water Balance Model (this report) were tailored to calculate the expected change with respect to these aspects.

5.3.2.3 Australian Drinking Water Guidelines 6 – 2011

Assessment of the impact of the Extraction Plan for 918 Panel against NHMRC (2022) is presented in **Section 5.3.4.1** in the context of NSW Water Quality and River Flow Objectives (NSW DCCEEW, 2006) and **Section 5.3.3.1** with respect to *State Environmental Planning Policy (Biodiversity and Conservation)* 2021 (NSW).

5.3.3 NSW Legislation

5.3.3.1 Environmental Planning and Assessment Act 1979

Table 5-4 presents an assessment of the Extraction Plan for 918 Panel against the Water Resources Impact Assessment Criteria of DA 504-00-Mod-10 (NSW DPH&I, 2024).

Table 5-4: Impact Assessment against Environmental Planning and Assessment Act 1979

Performance Measure	Compliant	Response
significant inflows to mine workings	Yes (Addressed in JBS&G (2026))	JBS&G (2026) states that the modelled increase in mine dewatering rate is 0.9ML/d and decreases to 0.2ML/d over the longer term. This is an insignificant change.
reduction in pumping yield in privately-owned groundwater bores	Yes (Addressed in JBS&G (2026))	JBS&G (2026) states that there are no groundwater users within 2km of 918 Panel, and therefore there will no significant change in yield in those water supply works.
reduction in surface flows and groundwater baseflow to upland swamps (Newnes Plateau Shrub Swamps) and wetlands	Yes (**Section 5.2.2.1**)	Modelling indicates there is a negligible change to groundwater contribution to surface flows and groundwater baseflow to upland swamps and wetlands (not relevant, but confirmed). Modelling also indicates there is negligible change to the duration of dry periods due to implementation of the Extraction Plan.
reduction in surface flows and groundwater baseflow to waterbodies including Marrangaroo Creek, Farmers Creek, Dargans Creek, Wolgan River, Dumbano Creek, Bungleboori Creek, and Wollangambee River (excluding reduction in flows associated with the proposed water transfer scheme)	Yes (**Section 5.2.2.1**)	Modelling indicates there is a negligible change to surface flows and groundwater baseflow in all watercourses in the vicinity of 918 Panel. Modelling also indicates there is negligible change to the duration of dry periods due to implementation of the Extraction Plan.

State Environmental Planning Policy (Biodiversity and Conservation) 2021

918 Panel is not within the Sydney Drinking Water Catchment and LDP002 at Clarence Colliery is also not within the Sydney Drinking Water Catchment.

Accordingly, *State Environmental Planning Policy (Biodiversity and Conservation)* 2021 (NSW) does not apply to the implementation of the Extraction Plan for 918 Panel.

5.3.3.2 Protection of the Environment Operations Act 1997

The Extraction Plan for 918 Panel will continue to operate under EPL 726, with a volumetric limit of 25000 kL/day for LDP002 to discharge to upstream of Main Dam.

From Section 4.15.5.3 of the Groundwater Assessment (JBS&G, 2026), the modelled change to mine dewatering rate is negligible and therefore the impact to discharge rate through LDP002 at Clarence will be insignificant.

Furthermore, implementation of the Extraction Plan for 918 Panel will not lead to a change in groundwater quality, hence will also not lead to change to the quality of discharge through LDP002.

5.3.3.3 Water Management Act 2000

Water Sharing Plans

Rules for granting access licences, managing access licences, water supply works approvals and access licence dealings are provided in the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources* 2023 (NSW).

There is no direct surface water extraction from the *Water Sharing Plan for the Greater Metropolitan Region Unregulated River Water Sources* 2023 (NSW).

Indirect take from surface water can occur due to operation of the Site and the Extraction Plan for 918 Panel and is associated with a change to groundwater contribution to surface water.

A discussion of licensable take is presented in **Section 6.1**.

Controlled Activity Approvals

There is no change to water management infrastructure associated with implementation of the Extraction Plan for 918 Panel, therefore an controlled activity approval for implementation of the Extraction Plan for 918 Panel is not required.

Harvestable Rights

There are no harvestable rights dams at Clarence Colliery and this state will not change with implementation of the Extraction Plan for 918 Panel.

Existing dams at Clarence Colliery pertain to erosion and sediment control and are exempt from limitations associated with harvestable rights.

5.3.3.4 Biodiversity Conservation Act 2016

EECs listed in the *Biodiversity Conservation Act* 2016 (NSW) are the same as those listed in the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth). Impact assessment of the Extraction Plan for 918 Panel with respect to these EECs is presented in **Section 5.3.1.1** and **Section 5.3.2.1**, with an insignificant impact expected on EECs.

5.3.4 NSW Guidelines and Policy

5.3.4.1 NSW Water Quality and River Flow Objectives 2006

Table 5-5 presents an assessment of the Extraction Plan for 918 Panel against NSW Water Quality Objectives. It is noted that only applicable objectives are discussed in **Table 5-5**.

Table 5-5: Impact Assessment against NSW Water Quality Objectives 2006

Water Quality Objective	Compliant	Response
Aquatic Ecosystems "Maintaining or improving the ecological condition of water bodies and their riparian zones over the long term."	Yes	Implementation of the Extraction Plan for 918 Panel will not lead to a change in water quality being discharged through LDP002 (upstream of Main Dam). The modelled change to water quality (salinity) is negligible and insignificant.
Visual Aesthetics "Aesthetic qualities of water"	Yes	Implementation of the Extraction Plan for 918 Panel will continue to comply with turbidity requirements of discharge through LDP002 (upstream of Main Dam).

		With respect to other watercourses in the vicinity of 918 Panel, subsidence predictions (MSEC, 2026), the geomorphological assessment (GHD, 2026) and outcomes of the Swamp Water Balance Model (this report) do not indicate a change in erosivity. Accordingly, the impact of implementation of the Extraction Plan for 918 Panel is considered insignificant.
Drinking Water "Refers to quality of drinking water drawn from the raw surface or groundwater sources before any treatment."	Yes	The catchment containing Bungleboori Creek lies outside of the Sydney Drinking Water Catchment and the contributing catchment to Farmers Creek Dam, which is operated by Lithgow City Council as a Local Water Utility. Accordingly, water quality aspects pertaining to Neutral or Beneficial Effect on Water Quality do not apply. Notwithstanding, implementation of the Extraction Plan for 918 Panel will not lead to a change in surface water quality. The Extraction Plan will not lead to a change in water quality being discharged through LDP002 (upstream of Main Dam). Outcomes of the Swamp Water Balance Model (this report) indicate that the negligible potential change in surface water quality will be insignificant.
Industrial Water Supplies "The high economic value of water taken from river and lakes for use by industry needs recognition in water quality planning and management. It has been identified as an important environmental value through community consultation."	Yes	Groundwater is treated at the Water Treatment Plan and then discharged to Main Dam via LDP002. There is no direct discharge of groundwater to surface water associated with the Extraction Plan for 918 Panel.

Table 5-6 presents an assessment of the Extraction Plan for 918 Panel against NSW River Flow Objectives. It is noted that only applicable objectives are discussed in **Table 5-6**.

Table 5-6: Impact Assessment against NSW River Flow Objectives 2006

Water Flow Objective	Compliant	Response
Protect natural pools in dry times "Protect natural water levels in pools of creeks and rivers and wetlands during period of no flow"	Yes	There is no direct extraction from surface watercourses at Clarence Colliery. Modelling indicates that implementation of the Extraction Plan for 918 Panel will not lead to a significant change in duration, frequency and magnitude of flows during dry periods.
Protect natural low flows	Yes	As above, there is not direct extraction from surface watercourse at Clarence Colliery. Modelling indicates that the Extraction Plan will not lead to a change in the duration of dry periods, nor the magnitude of surface water flows during those periods (or the frequency of when those periods will occur). The impact of the Extraction Plan with respect to this objective is considered to be insignificant.

Water Flow Objective	Compliant	Response
Maintain wetland and floodplain inundation "Maintain or restore natural inundation patterns and distribution or floodwaters supporting natural wetland and floodplain ecosystems"	Yes	The implementation of the Extraction Plan for 918 Panel will not lead to a change in pattern, distribution or distribution of inundation. The change to daily surface water flows in Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and Paddys Creek Tributary are considered insignificant.
Maintain natural flow variability "Maintain or mimic natural flow variability in all streams"	Yes	As above.
Minimise effects of weirs and other structures	Yes	Not applicable. There are no hydraulic structures in the vicinity of 918 Panel. Existing site water management infrastructure (erosion and sediment control and LDP002) will continue to be used and there are no changes proposed as part of the Extraction Plan.
Maintain groundwater for ecosystems "Maintain groundwater within natural levels and variability, critical to surface flows and ecosystems"	Yes	Groundwater dependent ecosystems, including Lower Nine Mile Hanging and Shrub Swamps and Paddys Creek Hanging and Shrub Swamps, will be maintained. Interpretation of modelling results indicates that the change to the elevation of the highest active node at Lower Nine Mile Hanging and Shrub Swamps and Paddys Creek Hanging and Shrub Swamps, presented in the Groundwater Assessment (JBS&G, 2026), will have an insignificant impact with respect to daily surface flows. Outcomes from the Swamp Water Balance Model (this report) indicates that the change to duration of dry periods is negligible. Given the above, the impact to THPSS due to implementation of the Extraction Plan for 918 Panel is considered to be insignificant.

5.3.4.2 Managing Urban Stormwater 2004 & 2008

The Extraction Plan for 918 Panel will utilise existing erosion and sediment control infrastructure, which is administered under EPL 726. There is no proposed change to existing infrastructure with implementation of the Extraction Plan for 918 Panel.

Accordingly, the Extraction Plan is considered to compliant with Landcom (2004) and NSW DPH&I (2008).

6. Licensing, Management, Mitigation and Monitoring

This chapter presents the response to licensing, management, monitoring and mitigation aspects associated with implementation of the Extraction Plan for 918 Panel at Clarence Colliery.

6.1 Licencing

6.1.1 Water Management Act 2000 (NSW)

The NSW Aquifer Interference Policy (NSW DCCEEW, 2012) requires that the estimated take from surface water and groundwater sources is based on a complex modelling platform, due to Clarence Colliery being a mine (as well as surface works, hence is a colliery).

In accordance with Figure 7 of NSW DCCEEW (2022), a reduction in groundwater contribution to surface water should be assigned to groundwater licensable take and not surface water licensable take, where those watercourses are gaining. Watercourses relevant to the Extraction Plan for 918 Panel are groundwater dependent ecosystems and are gaining watercourses.

The current WAL's at Clarence Colliery in the Sydney Basin West Groundwater Source are presented in the Groundwater Assessment (JBS&G, 2026) and are considered sufficient to accommodate the modelled change to groundwater contribution to surface water presented in the Groundwater Assessment (JBS&G, 2026).

6.1.2 Protection of the Environment Operations Act 1997

There are no changes proposed to the discharge limits in the current EPL 726 or the Licences Discharge Point Conditions (presented **Table 2-1**) associated with implementation of the Extraction Plan for 918 Panel.

6.2 Management

Water management at Clarence Colliery is detailed in the WMP (Clarence, 2026). Discharge of groundwater inflow to underground workings will continue to be treated via the Water Treatment Plant and discharged at LDP002, in accordance with the conditions specified in EPL 726.

There is no intended change to water management infrastructure at Clarence Colliery Pit Top due to implementation of the Extraction Plan for 918 Panel.

6.2.1 Adaptive Management

Experience in impacts to perched, shallow and deep groundwater system due to depressurisation of target coal seams and subsidence-induced change to hydraulic properties to strata overlying the target coal seam has evolved over the last decade, leading to amendment to mining methods. In the case of the Extraction Plan for 918 Panel, this comprises a low-subsidence method via the PPPE method.

For the Extraction Plan for 918 Panel, this represents a revision to that presented in an earlier version of the Extraction Plan (being 918-920 Panel Area). In the current Extraction Plan, extraction in the 918 Panel does not occur beneath THPSS shrub and hanging swamps (with the exception of Paddy's Creek Hanging Swamp which is located partly above the proposed 918B2 sub-panel).

6.3 Mitigation

Given the limited scale of the proposed mining activities associated with the implementation of the Extraction Plan for 918 Panel, the potential for significant impacts to surface water is considered low.

Future use of the PPPE method (outside of 918 Panel) depends on confirmation of the subsidence assessment (SCT, 2026), namely that "*Numerical modelling estimates a maximum surface subsidence of 76mm +/- 20mm tolerance due to natural variability and survey tolerance. The number model used for this assessment of two shortwall panels has been validated with Clarence 910-906 Panels. Numerical modelling has been successful*

in understanding the subsidence mechanisms and informing mine design at Airly Mine.". Subsidence contours and output from valley closure assessment are presented in MSEC (2026) and will also need to confirmed.

If it is not confirmed that PPPE is a low-subsidence method, as per its design, then alternative, lower potential subsidence mining methods will have to be considered and, potentially, adopted.

6.4 Monitoring

6.4.1 Surface Water Monitoring

A comprehensive surface water monitoring network exists at Clarence Colliery in accordance with Table 4.1 of the WMP (Clarence, 2026) (discussed in **Section 3.6.1**). Surface water monitoring comprises of flow and quality monitoring.

Given the requirements of NSW DDCEEW (2022) for groundwater quality sampling for SSD projects, it is suggested that consideration be given to extending the surface water quality parameters for monitoring site Bungleboori Creek US, Bungleboori Creek DS and Paddys Creek to include:

- Physiochemical: DO (mg/L), EC (µS/cm), pH, Temp (°C), TDS (mg/L), TSS (mg/L), turbidity
- Major Ions (Dissolved): alkalinity (bicarbonate, carbonate, hydroxide, total), calcium, chloride, magnesium, potassium, sodium, sulfate, total hardness
- Metals (Dissolved): aluminium, barium, cadmium, copper, chromium, cobalt, iron, manganese, nickel, zinc.

It is noted that the suggested analytical suite is based on the analytical suite for Farmers Creek US and Farmers Creek DS, as specified in Table 4.1 of Clarence (2026)), but with Nutrients, Total Metals and Other excluded.

The objective of the expanded analytical suite is to allow comparison between the quality of groundwater and surface water, as per the intent of NSW DCCEEW (2022).

It is suggested that the frequency of the expanded analytical suite, given the change to surface water quality at Bungleboori Creek US, Bungleboori Creek DS and Paddys Creek is expected to be negligible, is quarterly, with physio-chemical parameters (and flow via pygmy flow meter) continuing to be collected on a monthly basis, as per the WMP (Clarence, 2026).

6.4.2 Subsidence Monitoring

Continuous monitoring of subsidence performance is part of current Annual Environmental Management Review and will be required to be continued, to confirm the outcome of the Subsidence Assessment (SCT, 2026) for 918 Panel, namely 76mm +/- 20mm, as well as subsidence predictions in the wider area around 918 Panel, including valley closure, as presented in MSEC (2026). This is because the magnitude of subsidence-induced change to hydraulic properties adopted in the numerical groundwater model (and conceptual model) depends on minimal disruption to the regionally significant Mount York Claystone aquitard.

7. Conclusions

The objectives of this report was to assess the change to surface water flow and water quality (salinity), including with respect to site water management infrastructure (including erosion and sediment control), flooding and drainage, geomorphology and the aquatic ecological environment. The assessment was support by the numerical Swamp Water Balance Model.

The objectives of the numerical Swamp Water Balance Model were to assess the change to surface water flow and water quality (salinity).

The objectives of the report and the numerical Swamp Water Balance Model were met.

Analysis indicates:

Site Water and Salt Balance

The modelled change to mine dewatering rate presented in the Groundwater Assessment (JBS&G, 2026) is negligible and implementation of the Extraction Plan for 918 Panel will not lead to a change to site water management infrastructure at Clarence.

The Extraction Plan for 918 Panel will have an insignificant impact on the Site Water and Salt Balance.

Further detail on the Site Water and Salt Balance is presented in the WMP (Clarence, 2026).

Erosion and Sediment Control

There is no proposed change to erosion and sediment control infrastructure at Clarence due to implementation of the Extraction Plan for 918 Panel. The Extraction Plan is a continuation of existing operations at Clarence.

The Extraction Plan for 918 Panel will have an insignificant impact on Erosion and Sediment Control.

Further detail on the erosion and sediment control infrastructure at Clarence is presented in the WMP (Clarence, 2026).

Regional Surface Water Flow and Quality

Output from the Swamp Water Balance Model indicates:

- Insignificant change to surface water flow in Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and the unnamed tributary that leads into Paddys Creek, referred to as Paddys Creek Tributary, due to the Proposed Case compared to the Approved Case
- Insignificant change to water quality (salinity) in Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and Paddys Creek Tributary due to the Proposed Case compared to the Approved Case
- Insignificant change to duration, frequency and average flow of dry periods in Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and Paddys Creek Tributary due to the Proposed Case compared to the Approved Case.

Geomorphology

Subsidence prediction profiles along the thalweg of watercourses in the vicinity of 918 Panel are presented in MSEC (2026). These indicate no adverse change in bedslope due to implementation of the Extraction Plan for 918 Panel. A standalone assessment of geomorphology is presented in GHD (2026).

Analysis presented in this report indicates that there is no increase to streamflow (median) and therefore increase in potential erosivity due to the Extraction Plan. Due to the negligible increase in mine dewatering rate due to implementation of the Extraction Plan, there will be an insignificant change to mine water discharge (after treatment) to the Wollangambee River via EPL LDP002.

Given the above, the impact of the Extraction Plan for 918 Panel in geomorphological is considered insignificant.

Flooding and Drainage

There will be a negligible change to surface water flow due to implementation of the Extraction Plan for 918 Panel. Accordingly, the impact of the Extraction Plan on flooding will be insignificant.

Subsidence prediction profiles along the thalweg of watercourses in the vicinity of 918 Panel presented in MSEC (2026) do not indicate adverse changes to bedslope due to implementation of the Extraction Plan. There will be an insignificant change to mine water discharge (following treatment) due to the Extraction Plan in EPL LDP002. There is a negligible change in groundwater contribution to surface water due to the Extraction Plan. Accordingly, the Extraction Plan will have an insignificant impact on drainage.

Water Availability

As noted in **Section 3.5**, there are no surface water users within 5km of the 918 Panel. Notwithstanding, analysis indicates there will be a negligible change to groundwater contribution to surface water due to implementation of the Extraction Plan for 918 Panel.

Implementation of the Extraction Plan for 918 Panel will have an insignificant impact on water availability.

Aquatic Ecological Environment

As presented above, output from the Swamp Water Balance Model indicates that there will be an insignificant change to surface water flow due to implementation of the Extraction Plan for 918 Panel. Furthermore, there is an insignificant change to geomorphology.

Accordingly, the change to the aquatic ecological environment due to implementation of the Extraction Plan for 918 Panel is also insignificant.

8. Model Limitations

All models, whether they use an analytical or a numerical solution methodology, suffer constraints in their representation of environmental processes.

The following is a list of limitations of the Swamp Water Balance Model.

It is emphasised that these limitations do not invalidate the use of the Swamp Water Balance Model to assess the change to surface flow and quality to the due to implementation of the Extraction Plan for 918 Panel. This is because the limitations are applied to both the Proposed Case and Approved Case, and the impact assessment is based on the difference between the Proposed Case and the Approved Case.

Where there is a limitation that is relevant to an Area of Interest, namely, a water user or environmental receptor, a conservative approach was adopted in the Swamp Water Balance Model. In application this meant making choices during model development that will overestimate the potential change to that Area of Interest.

Limitations of the current version of the model are as follows:

- The water quality (salinity) model module in the Swamp Water Balance Model is relatively simple and considers increasing and decreasing water quality (salinity) based on a sequential multiplier
    - By demonstration of calibration, the current representation of water quality (salinity) model module is reasonable and, potentially, sufficient
    - In separate work undertaken by JBS&G, for non-Centennial clients, an alternative methodology has been developed. That methodology provides an improved mechanism for representing the 'first flush' mechanism, albeit is of reduced significance in the Western Coalfields.
- The calibration of the Swamp Water Balance Model was undertaken manually. Whilst satisfactory, during completion of this study, the Swamp Water Balance Model was previously upgraded (JBS&G, 2025) to provide the means to undertake automated calibration via tools such as PEST (Watermark, 2023ab), should it be required in the future
- A limitation of the Groundwater Model was the inclusion of RIV boundary conditions in the Quasi-Steady State, for Lake Lyell, Lake Wallace and Sawyer's Ash Dam. These RIV boundary conditions should be made transient to better represent these locations during historical time periods
- The modelled change to groundwater contribution to surface water determined from results of the Groundwater Model contains inflows and outflows from RIV boundary conditions. The inflows, which are considered to be surface water contribution to groundwater, are not considered in the Swamp Water Balance Model Report. The implication of this limitation is insignificant
- The observation dataset (manual measure of surface water flow via pygmy flow meters; plus surface water quality (salinity)) was updated during this assessment for Clarence Colliery. The observation dataset should be updated for Angus Place
- Whilst far from the area of interest for the Extraction Plan for 918 Panel, in the groundwater model, steady-state river (RIV) cells are used to present Lake Lyell, Lake Wallace and Sawyer's Ash Dam. Consideration should be given to switching these to transient in a future version of the groundwater model. This is limited relevance to the surface water model, since its simulation commences well after this initial steady-state period.

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