Springvale Coal Pty Limited

Western Coal Services Water Management Plan

July 2024

DOCUMENT CONTROL

DOCUMENT DETAILS	Name	Western Coal Services Water Management Plan
	Author	Bill Foster (GHD Pty Ltd)
	Revision	6
	Document status	Final

DETAILS OF CHANGE	**Revision**	**Trigger**	**Date**	**Brief details of change**
	0	SSD-5589	4/8/2014	Initial water management plan
	1	SSD-5579 MOD1	18/10/2017	Reflect site operations
	2	SSD-5579 MOD2 2018 IEA	22/02/2019	Move Kerosene Vale to Angus Place WMP Inclusion of brine and residual plan for SWTP Progress of clean water diversion
	3	EPL 21229 SSD-5579 MOD3	19/06/2020	Include EPL 21229 Update of progress of clean water diversion
	4		9/9/2020	Update conceptual groundwater model Minor changes
	5	2021 IEA	29/06/2022	Updated BH11 Minor changes Address actions from the 2021 IEA
	6	SSD-5579 MOD4	25/07/2024	Modifications to water transfer and management system

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Glossary

Alkalinity	A measure of the ability of an aqueous solution to neutralise acids. Alkalinity of natural waters is due primarily to the presence of hydroxides, bicarbonates and carbonates. It is expressed in units of calcium carbonate ($CaCO_3$).
Alluvial	Deposition from running waters.
Ambient	Pertaining to the surrounding environment or prevailing conditions.
Aquifer	An underground layer of permeable material from which groundwater can be usefully extracted.
Australian Height Datum	A common national surface level datum approximately corresponding to mean sea level.
Average recurrence interval	A statistical estimate of the average period in years between the occurrence of a flood of a given size or larger, e.g. floods with a discharge equivalent to the 100 year average recurrence interval flood event will occur on average once every 100 years.
Baseflow	The component of flow in a watercourse that is driven from the discharge of underground water.
Baseline monitoring	Monitoring conducted over time to collect a body of information to define specific characteristics of an area (e.g. species occurrence or water quality) prior to the commencement of a specific activity.
Bore	Constructed connection between the surface and a groundwater source that enables groundwater to be transferred to the surface either naturally or through artificial means.
Catchment	The land area draining through the main stream, as well as tributary streams, to a particular location.
Dewatering	The removal or pumping of water from an above or below ground storage, including the mine water within the water collection system of mine workings. Water removed from mine workings is regarded as dewatering unless the workings are flooded and at equilibrium with the surrounding strata (in which case the removal is considered groundwater extraction).
Discharge	The quantity of water per unit of time flowing in a stream, for example cubic metres per second or megalitres per day.
Electrical conductivity	A measure of the concentration of dissolved salts in water.
Endorheic void	Closed drainage basin that normally retains water and allows no surface flow to other external bodies.
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or overland runoff before entering a watercourse and/or coastal inundation resulting from super elevated sea levels and/or waves overtopping coastline defences.

Floodplain	Area of land that is periodically inundated by floods up to the probable maximum flood event.
Flood prone land	Areas potential to subject to flooding up to and including the 100 year Average Recurrence Interval
Geomorphology	Scientific study of landforms, their evolution and the processes that shape them. In this report relates to the form and structure of waterways.
Goaf	The part of a mine from which the mineral has been partially or wholly removed, including the waste left in workings.
Groundwater	Water occurring naturally below ground level.
Groundwater extraction	For the purposes of this assessment, groundwater extraction has been defined as the removal of groundwater from a groundwater source or aquifer, either via direct removal for use via a production bore or via incidental flow of groundwater from the aquifer into the mine workings during and after mining. Groundwater extraction includes the pumping of underground water from flooded mine workings in equilibrium with the surrounding strata as well as the removal of water from perched aquifers recharged directly from rainfall infiltration.
Guideline	A numerical concentration or narrative statement that provides appropriate guidance for a designated water use or impact.
Hardness	The concentration of multivalent cations present in water. Generally, hardness is a measure of the concentration of calcium and magnesium ions in water and is expressed in units of calcium carbonate ($CaCO_3$) equivalent. Hardness may influence the toxicity and bioavailability of substances in water.
Ion	Electrically charged atom.
Licensed discharge point	A location where the premises discharge water in accordance with conditions stipulated within the site Environmental Protection License.
Median	The middle value, such that there is an equal number of higher and lower values. Also referred to as the 50th percentile.
Percentile	The value of a variable below which a certain percent of observations fall. For example, the 80th percentile is the value below which 80 percent of values are found.
pH	The value taken to represent the acidity or alkalinity of an aqueous solution. It is defined as the negative logarithm of the hydrogen ion concentration of the solution.
Potable water	Water of a quality suitable for drinking.
Riparian	Pertaining to, or situated on, the bank of a river or other water body.
Runoff	The amount of rainfall which actually ends up as streamflow, also known as rainfall excess.
Run of mine	Raw coal production (unprocessed).

Sediment	Soil or other particles that settle to the bottom of lakes, rivers, oceans and other waters.
Stream order	Stream classification system, where order 1 is for headwater (new) streams at the top of a catchment. Order number increases downstream using a defined methodology related to the branching of streams.
Surface water	Water that is derived from precipitation or pumped from underground and may be stored in dams, rivers, creeks and drainage lines.
Topography	Representation of the features and configuration of land surfaces.
Toxicity	The inherent potential or capacity of a substance to cause adverse effects in a living organism.
Tributary	A stream or river that flows into a main river or lake.
Trigger value	The concentration or load of physicochemical characteristics of an aquatic ecosystem, below which there exists a low risk that adverse ecological effects will occur. They indicate a risk of impact if exceeded and should 'trigger' action to conduct further investigations or to implement management or remedial processes.
Turbidity	A measure of clarity (turbidity) of water. Turbidity in excess of 5 NTU is just noticeable to the average person.

Abbreviations

AHD	Australian height datum
ANOSIM	Analysis of similarity
ANZECC	Australian and New Zealand Environment and Conservation Council
ARI	Annual recurrence interval
AUSRIVAS	Australian Rivers Assessment System
AWTS	Aerated wastewater treatment system
bgl	Below ground level
BOM	Bureau of Meteorology
Centennial	Centennial Coal Pty Limited
CHPP	Coal handling and processing plant
CL&W	Crown Lands and Water Division of the Department of Industry
CRD	Cumulative rainfall departure
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CWD	Clean water diversion
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DGV	Default guideline value
DO	Dissolved oxygen
DPE	Department of Planning and Environment
DPHI	Department of Climate Change, Energy, the Environment and Water
DPI Water	Department of Primary Industries – Water
DPE Water	Department of Planning and Environment– Water
EC	Electrical conductivity
EPA	Environment Protection Authority
EPL	Environment Protection Licence
EPT richness	Ephemeroptera, Plecoptera and Tricoptera
FTE	Full time equivalent
GDE	Groundwater dependent ecosystem
ha	Hectare
kL/day	Kilolitre per day
km	Kilometre

km^2	Square kilometre
KVSA	Kerosene Vale Stockpile Area
L/s	Litre per second
LCC	Lithgow City Council
LDP	Licensed discharge point
LOR	Limit of reporting
m	Metre
mg/L	Milligram per litre
ML	Megalitre
ML/day	Megalitre per day
ML/year	Megalitre per year
mm	Millimetre
Mm^3	Million cubic metres
MPPS	Mount Piper Power Station
Mtpa	Million tonnes per annum
NRAR	Natural Resource Access Regulator
NTU	Nephelometric turbidity units
OEH	Office of Environment and Heritage
PIRMP	Pollution Incident Response Management Plan
POEO Act	Protection of the Environment Operations Act
RARC	Rapid Appraisal of Riparian Condition
REA	Reject emplacement area
RHCIP	Riparian Habitat and Catchment Improvement Plan
ROM	Run of mine
SCSS	Springvale Coal Services site
Secretary	Secretary of the Department of Planning and Infrastructure
SILO	Scientific Information for Land Owners
SIMPER	Similarity percentage
Springvale Coal	Springvale Coal Pty Limited
SSGV	Site-specific guideline value
SWTP	Springvale Water Treatment Project
TARP	Trigger Action Response Plan
TDS	Total dissolved solids
TSS	Total suspended solids

UCRAMP	Upper Coxs River Action and Monitoring Plan
WC	Water closet
WCS	Western Coal Services
WMP	Water Management Plan
WPS	Wallerawang Power Station
μS/cm	Microsiemens per centimetre

1. Introduction

Western Coal Services (WCS) is a coal handling and processing operation that is operated by Springvale Coal Pty Ltd (Springvale Coal), a wholly owned subsidiary of Centennial Coal Company Limited (Centennial). Centennial is a wholly owned subsidiary of Banpu Public Company Limited. WCS is located approximately 15 km north of Lithgow in the Western Coalfield, as shown in Figure 1-1.

This site-specific Water Management Plan (WMP) has been prepared for WCS and applies to all operations at WCS and includes the existing and approved operations and associated infrastructure within the site boundary.

In accordance with development consent SSD-5579 MOD4 for WCS and SSD_7592 for the Springvale Water Treatment Project (SWTP), this WMP has been prepared by GHD Pty Ltd in consultation with Springvale Coal.

The WMP was provided to NSW Environment Protection Authority (EPA), WaterNSW, NSW Department of Primary Industries – Water (DPI Water) (now Department of Planning and Environment – Water; DPE - Water), Lithgow City Council (LCC), Forestry Corporation of NSW and Energy Australia for consultation. All correspondence with government regulators with regard to the WMP is provided in Appendix A. Consultation comments are provided in Appendix B along with how these comments have been addressed in the WMP.

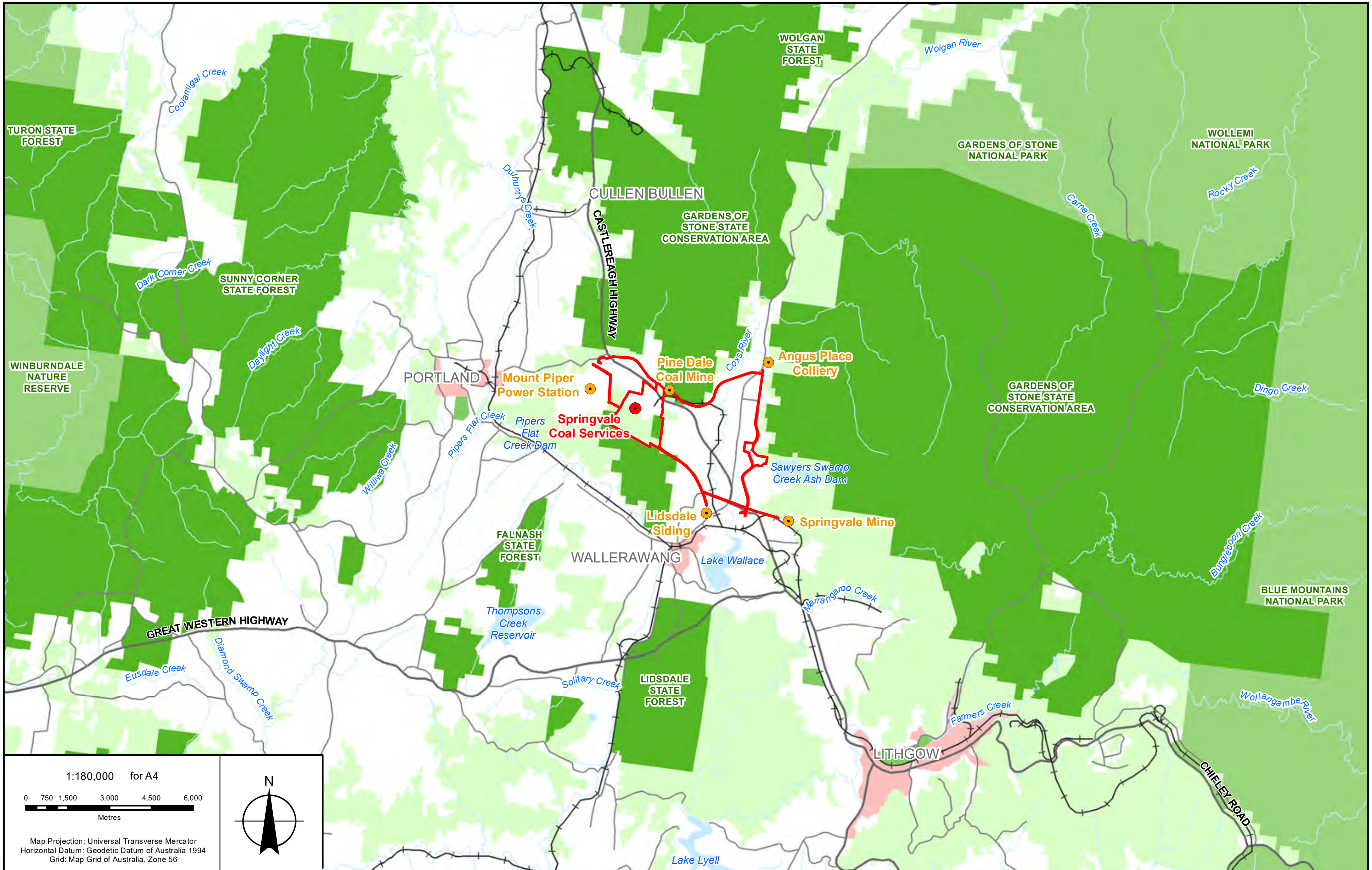
1.1 Overview of site operations

1.1.1 Site features

WCS consists of the following elements:

- Springvale Coal Services site (SCSS), which is a coal processing and storage facility that is used for run of mine (ROM) coal handling and stockpiling, ROM coal beneficiation (washing) and emplacement of coal reject material and residual material from the SWTP.
- Overland conveyor system, which extends from the Springvale Mine pit top to Mount Piper Power Station (MPPS) via SCSS and from SCSS to Lidsdale Siding rail loading facility.
- Mount Piper Haul Road, which extends from the Angus Place Colliery pit top to MPPS.
- Link Haul Road, which is a private road that has been approved to extend between the Mount Piper Haul Road and SCSS however is not yet constructed.
- Residuals stream pipeline, which transfers residual material from the SWTP to the reject emplacement area (REA) at SCSS.
- Bi-directional pipeline between SCSS and MPPS. The pipeline will facilitate the approved transfer of water to MPPS.
- Kerosene Vale Stockpile Area (KVSA) which is currently approved to stockpile excess coal under SSD-5579 for the Western Coal Services Project. KVSA is managed by Centennial Angus Place Pty Ltd, which also operates the nearby Angus Place Colliery. For consistency with the Environment Protection Licences (EPLs), Rehabilitation Management Plan and the consolidated leases, the water management of KVSA is described in the Angus Place Colliery Water Management Plan.
- Wallerawang Haul Road, which extends from the Angus Place Colliery pit top to Wallerawang Power Station (WPS). WPS is currently being decommissioned. Like KVSA, the Wallerawang Haul Road is managed by Centennial Angus Place.

Figure 1-2 provides an overview of WCS, including licensed discharge points introduced in Section 1.2.3. Neighbouring MPPS and the closed Pine Dale Coal Mine are owned by Energy Australia.



LEGEND

- Site location
- Project approval area
- Existing Rail
- Principal Road
- Secondary Road
- Minor Road
- Waterbody
- Waterway
- Built up area
- Recreation area
- Nature Conservation
- State Forest
- Forest or shrub

LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	Refer to scalebar

Western Coal Services
Water Management Plan

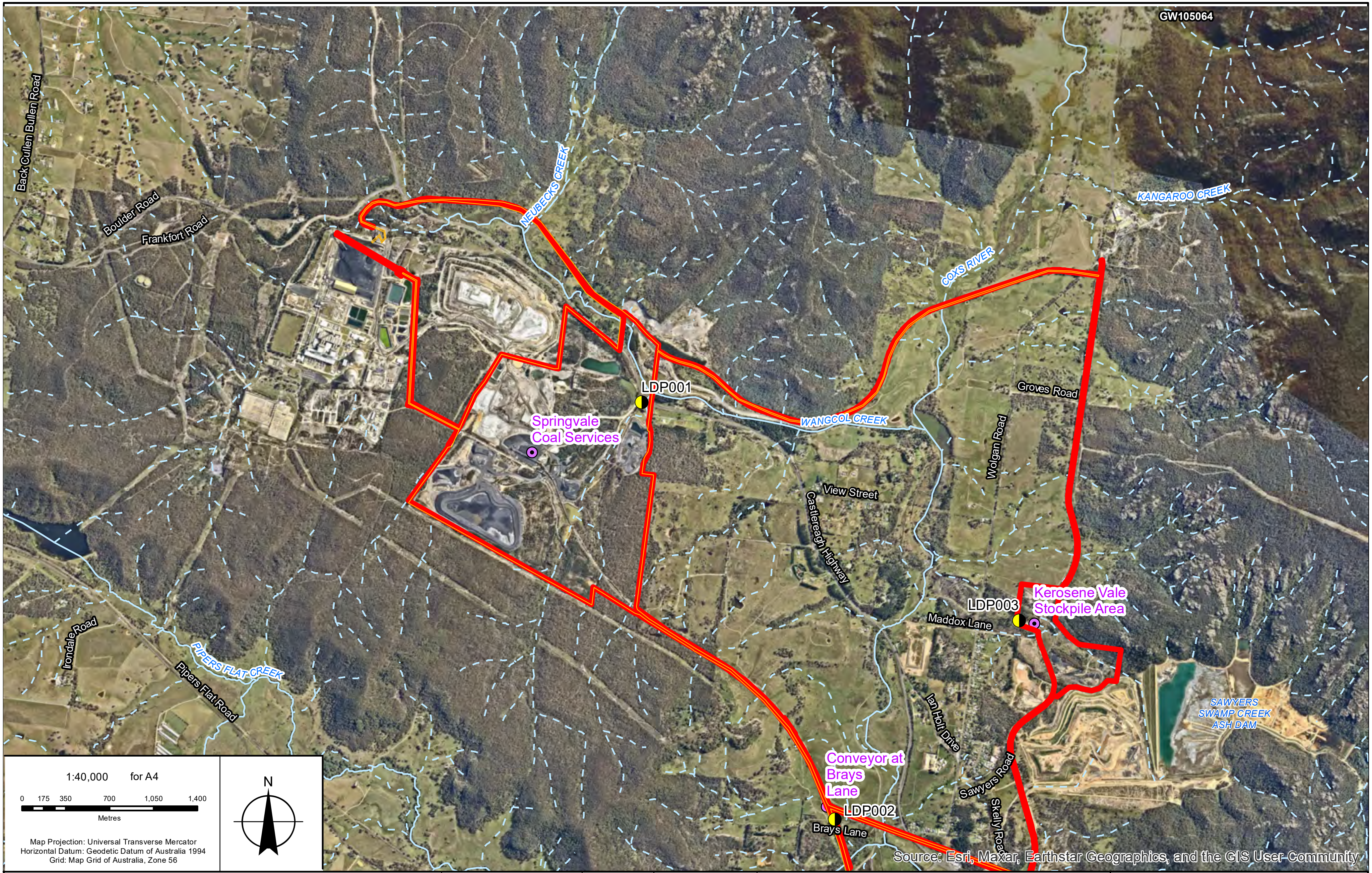
Locality plan

CENTENNIAL
Springvale Coal Services Operation

DATE 23/07/2024

Figure 1-1

GIS Filename: \\ghdnet\ghd\AU\Newcastle\Projects\22\0105001\GIS\Maps\Deliverables\Western\WesternCoal\12579944\WMP\12579944_WMP001_Locality_Plan_6.mxd



LEGEND

- Project approval area
- Managed by Springvale Coal
- Watercourse - Non Perennial
- Watercourse - Perennial
- Facility Locations
- Licensed discharge point

LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	Refer to scalebar

Western Coal Services
Water Management Plan

Overview of Western
Coal Services

CENTENNIAL
Springvale Coal Services Operation

DATE 23/07/2024

Figure 1-2

GIS Filename: \\ghdnet\ghd\AU\Newcastle\Projects\22\0105001\GIS\Maps\Deliverables\Western\WesternCoal\12579944\WMP\12579944_WMP004_OverviewWCS_6.mxd

The site features of SCSS are shown in Figure 1-3. The site consists of:

- A coal handling and processing plant (washery), and associated control room, workshop, offices, oil shed, washery makeup tank and magnetite bin.
- ROM and product stockpile areas.
- Reject emplacement areas (REAs) for coarse and fine coal reject material and residual material from the SWTP.
- A coal distribution network of conveyors from Springvale Mine to both MPPS (via SCSS) and WPS and from SCSS to Lidsdale Siding.
- The SCSS Water Transfer System, including a connection to the SCSS/Regis Transfer System and to Mount Piper Power Station via the bi-directional pipeline.
- A raw water offtake and tank for connection to the Angus Place Water Transfer System.
- Water management features, of which a number are managed by EnergyAustralia.

WCS is approved to:

- Receive up to 0.35 ML/day (annual average) or 0.43 ML/day (daily maximum) of residual waste from the SWTP. This residual waste is emplaced in the existing REA at SCSS.
- Transfer up to 790 ML/year (annual average) or 15.6 ML/day (daily maximum) of water via the SCSS Water Transfer System to the SCSS/Regis Transfer System.
- Transfer up to 2.6 ML/day of water via the SCSS Water System to Mount Piper Power Station.
- Receive up to 2.6 ML/day of raw water from the Angus Place Water Transfer System.

1.1.2 Coal handling and processing

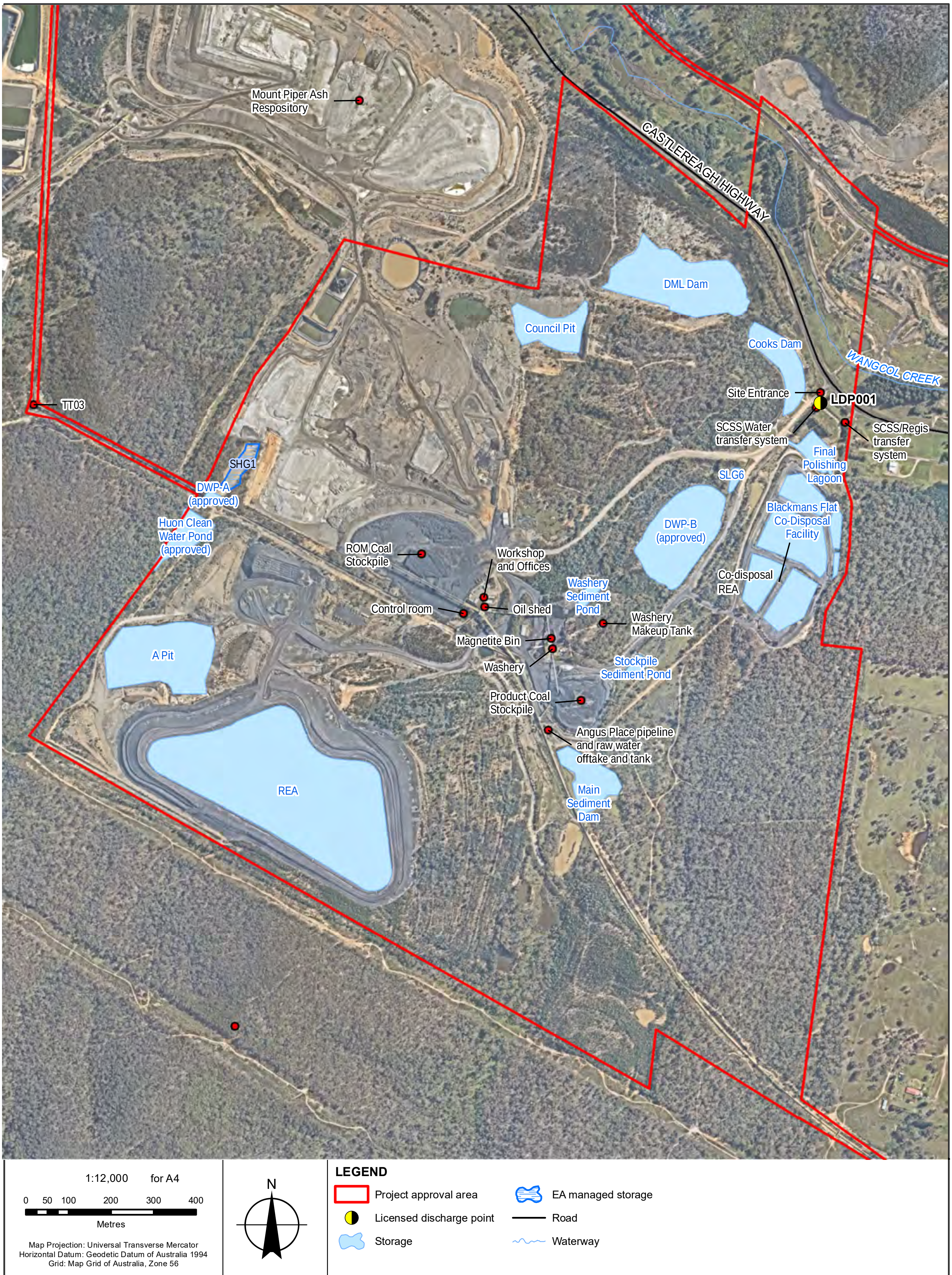
WCS is approved for:

- Receival of up to 9.5 million tonnes per annum (Mtpa) of ROM coal from:
  - Springvale Mine (up to 5.5 Mtpa).
  - Angus Place Colliery (up to 4 Mtpa).
  - Other sources (up to 1.5 Mtpa).
- Total coal processing (beneficiation) capacity of up to 7 Mtpa.
- Transfer of up to 6.3 Mtpa of product coal between Lidsdale Siding.

ROM coal is transported from the Springvale Mine pit top, or Lidsdale Siding via the overland conveyor system to MPPS directly or to SCSS for stockpiling and further processing (beneficiation). Product coal is transferred to Lidsdale Siding via the overland conveyor system for export.

ROM coal is approved to be transported from Angus Place Colliery to MPPS via the Mount Piper Haul Road and to WPS via the Wallerawang Haul Road. The private Link Haul Road between the Mount Piper Haul Road and SCSS is approved but not yet constructed. The Link Haul Road is approved to allow the transport of:

- ROM coal from the Angus Place Colliery pit top to SCSS.
- Coal between the KVSA and SCSS.
- Course reject material from SCSS to the proposed Neubeck Coal Project (once the development consent for this project is granted).
- ROM coal from other Centennial operations, including the proposed Neubeck Coal Project (once the development consent for this project is granted).



LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	refer to scalebar

Western Coal Services
Water Management Plan

Site features at
Springvale Coal Services

CENTENNIAL
Springvale Coal Services Operation

DATE 23 July 2024

Figure 1-3

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© LPI: DTDB, 2012. LIDAR: Imagery, 2015; Centennial: Boundary, site features

1.1.3 History of operations

A summary of historical operations at WCS is presented in Table 1-1.

Table 1-1 History of Western Coal Services

Date	Change
1940	Open cut operations at Lamberts Gully (located at the existing SCSS) commenced, extracting coal from the Lidsdale and Lithgow seams.
1942 to 1990s	Underground operations commenced in 1942, with the Western Main entries located opposite the existing CHPP and the Eastern Main entries located near the main entrance to SCSS.
1980 to 1994	Three separate open cuts mines were developed which extracted the remaining coal south of the Castlereagh Highway between MPPS and the main entrance to SCSS.
October 1994	Springvale Coal purchased SCSS and, under a 1992 planning consent relating to Springvale Mine, constructed the overland conveyor system, coal stockpile system and reject disposal facilities.
1994 to 2010	Lamberts Gully Open Cut Mine was operational and extracted coal from both north and south of the section of the overland conveyor system traversing through SCSS.
2013	Surface WMP for SCSS prepared by GHD.
2014	Development consent SSD-5579 was granted for the WCS Project.
2014	WMP for WCS prepared by RPS.
June 2017	Modification 1 to development consent SSD-5579 was granted to allow for the receipt of residual material from the SWTP.
October 2017	WMP revised for consistency with Western Regional Water Management Plan.
December 2017	Modification 2 to development consent SSD-5579 was granted to allow for: • Increased amounts of coal received from Springvale Mine with no increase to the approved total of 9.5 Mtpa from multiple sources. • The implementation of a noise reduction study for the overland coal conveyor and SCSS. • Revised operating hours relating to processing and transport activities at SCSS.
17 May 2019	EPL 21229 issued for Western Coal Services.
23 August 2019	Modification 3 to SSD-5579 was granted to allow for coal to be imported to Western Coal Services via the overland conveyor following the commission of the Lidsdale Siding Coal Unloader.
21 October 2022	Modification 4 to SSD-5579 was granted to allow for modifications to the water management system.

1.2 Approvals and licensing requirements

1.2.1 Development consent

The WMP addresses specific water components of the conditions of development consent SSD-5579 MOD4, which was granted by the Director Resource Assessments of NSW on 21 October 2022 for modification 4 to the WCS Project. This WMP also addresses the relevant parts of the conditions of development consent SSD_7592 MOD8, which was granted by the Minister for Planning on 19 June 2017. The relevant requirements of the WMP consent are outlined in Table 1-2 and Table 1-3 for SSD-5579 MOD4 and SSD_7592 MOD8 respectively, along with the sections of the plan where these have been addressed.

Table 1-2 Development consent SSD-5579 MOD4 conditions

Condition		Where addressed
Residual Waste		
Schedule 2 8A.	The Applicant must not receive or emplace more than 0.35 megalitres per day (annual average) or 0.43 megalitres per day (daily maximum) of residual waste from the Springvale Water Treatment Project.	Section 3.6 Section 4.5.1 Section 6.1.4
Schedule 2 8B.	The Applicant must not: (a) transfer more than 15.6 megalitres per day up to a maximum of 790 megalitres per year of water via the SCSS Water Transfer System to the SCSS/Regis Transfer System; (b) transfer more than 2.6 megalitres per day via the SCSS Water Transfer System to Mount Piper Power Station; and (c) receive more than 2.6 megalitres per day of raw water from the Angus Place Water Transfer System.	Section 3.2.2
Water Supply		
Schedule 3 19.	The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of operations on site to match its available water supply. *Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain the necessary water licences for the development.*	Section 3.7.1
Water Pollution		
Schedule 3 20.	Unless an EPL authorises otherwise, the Applicant must comply with Section 120 of the POEO Act.	Section 1.2.3

<table>
<tr><th colspan="2">Condition</th><th>Where addressed</th></tr>
<tr><td colspan="3">Remediation of Soil Contamination</td></tr>
<tr><td>Schedule 3 23.</td><td>The Applicant must comply with the performance measures in Table 10 to the satisfaction of the Secretary.

<table>
<tr><th>Feature</th><th>Performance Measure</th></tr>
<tr><td>Potable Water</td><td>• Minimise the use of potable water for purposes where non-potable water is acceptable</td></tr>
<tr><td>Construction and operation</td><td>• Design, install and maintain erosion and sediment controls generally in accordance with the series Managing Urban Stormwater: Soils and Construction including Volume 1, Volume 2A – Installation of Services and Volume 2C – Unsealed Roads, or its latest version
• Design, install and maintain all works within 40 m of watercourses generally in accordance with the Guidelines for Controlled Activities on Waterfront Land (DPI 2012), or its latest version
• Design, installation and maintenance of creek crossings generally in accordance with the Policy and Guidelines for Fish Friendly Waterway Crossings (NSW Fisheries, 2003) and Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings (NSW Fisheries 2003), or their latest versions</td></tr>
<tr><td>Sediment Dams</td><td>• Design, install and maintain dams generally in accordance with Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries, or its latest version</td></tr>
</table>
</td><td>Potable Water:
• Section 3.5
• Section 3.7.1

Construction and operation:
• Section 4.1
• Section 6.1.6

Sediment Dams:
• Section 3.3
• Appendix E</td></tr>
</table>

<table>
<tr><th colspan="2">Condition</th><th>Where addressed</th></tr>
<tr><td></td><td>
<table>
<tr><td>Clean water diversions & storage infrastructure</td><td>• Design, install and maintain the clean water system to capture and convey the 100 year ARI flood, as far as is reasonable and feasible
• Maximise diversion of clean water around disturbed areas, as far as is reasonable and feasible</td></tr>
<tr><td>Mine-water storages</td><td>• Design, install and maintain the mine-water storage infrastructure to store all runoff from a 95th percentile 5 day rain event
• Prevent seepage from the DML and Cooks Dams to the surface, as far as is reasonable and feasible</td></tr>
<tr><td>Chemical and hydrocarbon storage</td><td>• Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards</td></tr>
<tr><td>Aquatic and riparian ecosystems, including affected sections of Wangcol and Lamberts Gully Creeks</td><td>• Maintain or improve baseline channel stability
• Develop site-specific in-stream water quality objectives in accordance with ANZECC 2000 and Using the ANZECC Guidelines and Water Quality Objectives in NSW procedures (DECC 2006), or its latest version</td></tr>
</table>
</td><td>Clean water diversions & storage infrastructure:
• Section 3.2.1
• Section 3.2.2

Mine-water storages:
• Section 3.2.2

Chemical and hydrocarbon storage:
• Table 6-7

Aquatic and riparian ecosystems:
• Section 6.2.6
• Appendix H, Section H.4.3</td></tr>
<tr><td colspan="3">Water Management Plan</td></tr>
<tr><td>Schedule 3 24.</td><td>The Applicant must prepare and implement a Water Management Plan for the development to the satisfaction of the Secretary. This plan must:</td><td>This WMP</td></tr>
<tr><td>Schedule 3 24. (a)</td><td>Be prepared in consultation with the EPA, WaterNSW, DPE Water, LCC, Forestry Corporation of NSW and Energy Australia by suitably qualified and experienced person/s whose appointment has been approved by the Secretary.</td><td>Section 1
Appendix A
Appendix B</td></tr>
</table>

Condition		Where addressed
Schedule 3 24. (b)	Be submitted to the Secretary for approval within 4 months of the date of this consent, unless otherwise agreed by the Secretary.	Appendix A
Schedule 3 24. (c)	Include a: Site Water Balance, that:	
	Details of sources and security of water supply, including contingency supply for future reporting periods.	Section 3.7 Section 7.3
	Details of water use and management on site.	
	Details of any off-site water discharges.	
	Details of reporting procedures, including the preparation of a site water balance for each calendar year.	
	Investigates and implements all reasonable and feasible measures to minimise potable water use and to re-use and recycle water.	
Schedule 3 24. (c) (ii)	Surface Water Management Plan, that includes:	
	Detailed baseline data on water flows and quality in the watercourses that could potentially be affected by the development.	Section 5.1
	A detailed description of the SCSS water management system, including the: • Clean water diversion systems. • Erosion and sediment controls. • Mine-water management systems.	Section 3
	Detailed plans, including design objectives and performance criteria for: • Design and management for the emplacement of coal reject materials and potential acid-forming or sulphate-generating materials. • Management of sodic and dispersible soils. • Reinstatement of appropriate drainage lines on the rehabilitated areas of the site. • Control of any potential water pollution from the rehabilitated areas of the site.	Section 3
	Performance criteria for the following, including trigger levels for investigating any associated potentially adverse impacts: • SCSS water management system. • Downstream surface water quality. • Stream and riparian vegetation health for the Wangcol and Lamberts Gully Creeks.	Section 6.1 Section 6.2

Condition		Where addressed
	A program to monitor and report on: • Effectiveness of the SCSS water management system. • Surface water flows and quality in the watercourses potentially affected by the development.	Section 4
	Reporting procedures for the results of the monitoring program.	Section 7
	A plan to respond to any exceedances of the performance criteria and mitigate and/or offset and adverse surface water impacts of the development.	Appendix J
Schedule 3 24. (c) (iii)	Groundwater Management Plan, that includes:	
	Detailed baseline data of groundwater levels, yield and quality on the SCSS and surrounds that could be affected by the development, including any licensed privately-owned groundwater bores.	Section 5.3
	Groundwater impact assessment criteria including trigger levels for investigating any potential adverse groundwater impacts.	Section 6.1.3
	A program to monitor and report on: • Groundwater inflows to former open cut pits. • The seepage/leachate from water storages, emplacements of power station ash and/or coal rejects, and former open cut voids. • Background changes in groundwater yield/quality against changes induced by the development. • Impacts of the development on: – Regional and local (including alluvial) aquifers. – Groundwater supply of any potential affected private landowners. – Any potentially affected groundwater dependent ecosystems and riparian vegetation.	Section 4.4
	A program to validate the groundwater model for the development, including an independent review of the model every 3 years, and comparison of monitoring results with modelled predictions.	Section 7
	A plan to respond to any exceedances of the performance criteria.	Appendix J
Schedule 3 24. (c) (iv)	Protocol that has been prepared in consultation with the owners of nearby power generation or mining developments to: • Minimise cumulative water quality impacts. • Review opportunities for water sharing/water transfers between these developments.	Section 3.8 Appendix F

Condition		Where addressed
	• Co-ordinate water quality monitoring programs as far as practicable. • Undertake joint investigations/studies in relation to complaints/exceedances of trigger levels where cumulative impacts are considered likely. • Co-ordinate modelling programs for validation, re-calibration and re-running of groundwater and surface water models. *Note: The protocol can be developed in stages and will need to be subject to ongoing review, dependent upon the determination of, and commencement of, other mining and/or power generation developments in the area.*	
Riparian Habitat and Catchment Improvement Plan		
Schedule 3 27.	The Applicant must prepare and implement a Riparian Habitat and Catchment Improvement Plan for the development to the satisfaction of the Secretary. This plan must:	Riparian Habitat and Catchment Improvement Plan (GHD 2017b) Section 1.4.2
Schedule 3 27. (a)	Be prepared in consultation with Local Land Services, OEH [now BCD], EPA and WaterNSW, and be submitted to the Secretary for approval by the end of October 2017.	
Schedule 3 27. (b)	Describe the measures that would be implemented to improve and maintain the riparian habitat of Wangcol Creek for at least 100 metres downstream of the proposed Link Haul Road bridge crossing of the creek.	
Schedule 3 27. (c)	Detail additional compensatory water quality and catchment improvement measures to the value of at least $250,000 which must be undertaken prior to the commissioning of the Springvale Water Treatment Project.	
Schedule 3 27. (d)	Make arrangements to manage, protect and provide for the long-term security for the measures proposed to respond to (b) and (c) above.	
Pollution Reduction Works		
Schedule 3 46.	Prior to receiving any residual waste from the operation of the Springvale Water Treatment Project, the Applicant must complete the following pollution reduction works to the satisfaction of the EPA:	Section 3.2 Section 3.7 Section 4.4
Schedule 3 46. (a)	Establish a groundwater monitoring network across the Springvale Coal Services site that comprises an adequate number of bores that are located, established and operated in such a manner that will provide an understanding of surface water and groundwater interactions across the site.	
Schedule 3 46. (b)	Design and install run-off diversion works to divert all clean water run-off generated from catchment areas up-gradient of the Springvale Coal Services site.	

Condition		Where addressed
Schedule 3 46. (c)	Investigate options for long term management and discharge and/or beneficial reuse, of groundwater presently discharging from the site through LDP006 [now LDP001].	

Table 1-3 Development consent SSD_7592 conditions

Condition		Where addressed
Brine and Residual Waste Disposal Plan		
Schedule 3 5.	Prior to the commissioning of the Water Treatment Plant, the Applicant must prepare a Brine and Residuals Waste Disposal Plan, in consultation with WaterNSW and the EPA, and to the satisfaction of the Secretary. This Plan must:	GHD (2019b)
Schedule 3 5 (a)	Be prepared by suitably qualified and experienced person/s whose appointment has been approved by the Secretary;	GHD (2019b)
Schedule 3 5 (b)	Include a detailed investigation into the potential impacts of the disposal of residual waste and brine from the development, including: • An analysis of the presence and extent of any soil contamination impacts under the existing disposal arrangements, including the potential leachability of the residual waste and brine;	GHD (2019b)
	• Further options to decrease the quantity of residual waste and brine over time; and	GHD (2019b)
	• Additional management and mitigation measures to reduce the impacts of brine and residual waste.	GHD (2019b)
Schedule 3 5 (c)	Propose a program to implement measures to reduce the impacts of brine and residual waste.	GHD (2019b)

This WMP includes information extracted from GHD (2019b) in Section 3.6 and Appendix D for context of residual management at WCS.

1.2.2 Western Coal Services Project Statement of Commitments

In addition to the conditions of the development consent SSD-5579 MOD4 indicated in Table 1-2, Springvale Coal also committed to the management strategies and monitoring activities outlined in Table 1-4 as part of the WCS Project (SSD-5579) and modification 1 to the WCS Project (SSD-5579 MOD1).

Table 1-4 Statement of commitments

Commitment	Status	Where addressed
Western Coal Services Project (SSD-5579)		
Appropriate erosion and sediment control measures will be implemented for construction of the upgrading of the Washery and associated infrastructure (additional conveyors and transfer points on the SCSS), extension and enlargement of the existing reject emplacement area (REA), and construction of the Link Haul Road and overpass of the Castlereagh Highway and will be installed prior to commencement of disturbance activities, generally in accordance with the guidelines *Managing Urban Stormwater – Soils and Construction, Volume 2E: Mines and Quarries* (DECC 2008).	Ongoing	Section 3.3 Appendix E
Within six months of project approval, a single WMP will be prepared for the entire project application area and will include operation of the new infrastructure, water recycling system, surface and groundwater monitoring including Wangcol Creek mixing zone and a staged implementation of the separation of the Lamberts Gully drainage line as it passes through the SCSS as well as the localised changes associated with approved MPPS Ash Emplacement Project.	Completed	This WMP
Within six months of the date of the project approval, apply for any necessary water licences covering the SCSS.	Ongoing	Section 1.2.4
Within five years of the date of the project approval, complete the separation of clean and dirty water at the SCSS. The design will include the diversion of upstream catchments of Huon Gully around the new REA. The sub-catchment containing the existing A-Pit REA (previously the Lambert Gully upstream of the SCSS Open Cut) as well as the new REA will be diverted into the new sediment dam. This sub-catchment currently discharges to Huon Gully without treatment and the staged bypass and therefore the proposed change will lead to improved water quality in Huon Gully. Following remediation of the new REA, this sub-catchment of Huon Gully will be restored.	Ongoing	Section 3.2.1
Construct a staged bypass of the Conveyor Dam and Retention Dam on the SCSS within three years of the date of the consent.	Ongoing	Section 3.2.1
Construct a pollution control pond control to runoff from the new REA. This structure will have a capacity of approximately 15 ML and will be located on the north-eastern corner of the REA. The dam will have a pipe connection to the existing Washery Dam, which is connected to Cooks Dam via a pipeline. This will enable treated stormwater from the new REA to be recycled back to the Washery via Cooks Dam. This dam is to be constructed once the current A-Pit REA is completed but prior to the base of the new REA being completed.	Modified	Section 3.2.3

Commitment	Status	Where addressed
Provision of a belt press filter system (or equivalent) to recover water from the tailings produced from the new Washery. This water recovery system will cover tailings produced from the existing Washery but will be installed as part of the construction of the new Washery.	Not triggered	The new washery has not yet been constructed and hence the belt filter system has also not been constructed
Apply for a separate environment protection licence (EPL) covering the entire project application area that includes LDP003 (KVSA), LDP006 [now LDP001] (SCSS) and LDP007 [now LDP001] (conveyor at Duncan Street, Lidsdale).	Modified. Kerosene Vale managed as part of Angus Place Colliery	Section 1.2.3
Within three months of completion of the clean and dirty water separation system, apply to relocate the current LDP006 [now LDP001] to the spillway of Cooks Dam and replace the existing LDP006 [now LDP001] with a licensed monitoring point.	Modified	Section 3.2.1
Within six months of completion of the Link Haul Road, complete the additional riparian planting for a 100 m section of Wangcol Creek downstream of the Link Haul Road crossing. The species selection and density is to be determined in consultation with the Sydney Catchment Authority (now WaterNSW) and NSW Office of Water (now DPIE Water).	Not triggered	To be included within the Riparian Habitat and Catchment Improvement Plan (GHD 2017b) Section 1.4.2
Within 12 months of project approval, site-specific trigger values based on ANZECC (2000) guidelines will be developed for Wangcol Creek.	Completed and to be revised	Appendix H
To better understand the groundwater linkages, within 12 months of project approval, a baseline groundwater monitoring program will be established for the SCSS. The baseline groundwater monitoring program will include: • Quarterly monitoring of water levels from a network of monitoring bores following the completion of construction. • Six monthly sampling of monitoring bores for field analysis of pH, electrical conductivity (EC) and temperature and laboratory analysis on major ions, pH, EC, total dissolved solids (TDS), dissolved arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel and zinc. • An annual review so that its capacity as an accurate predictive tool can be assessed and maintained.	Modified	Section 4.4
Modification 1 to Western Coal Services Project (SSD-5579 MOD1)		
The surface and groundwater management and monitoring will be managed in accordance with the site's WMP.	Ongoing	This WMP

Commitment	Status	Where addressed
The WMP will be updated to include the following monitoring: • Water quality and flow monitoring will be implemented on the proposed clean water diversions works. • A select number of existing groundwater bores will be retrofitted with monitoring equipment that will continuously gauge both level and EC at a time step of less than one day.	Completed	Section 4
Springvale Coal will continue to implement measures to optimise the clean and surface water separation at SCSS and reduce flows and improve water quality through LDP006 [now LDP001] as much as practicable.	Ongoing	Section 3.2.1
The establishment of all proposed clean water diversions within the Lamberts Gully catchment within the SCSS will be completed in 2019 prior to the commencement of the Springvale Water Treatment Project (SSD 16_7592).	Completed	Section 3.2.1

1.2.3 Environment protection licence

WCS operates under EPL 21229 which licenses water to be discharged from WCS through the following licensed discharge points (LDPs):

- LDP001 – Located at weir at site boundary in the drain from the overflow point of Cooks Dam to Wangcol Creek.
- LDP002 – Duncan Street coal conveyor transfer drain from final filter lagoon (sediment basin) Located on a drainage channel adjacent to Overland Conveyors 1 and 2 Transfer Tower on Brays Lane. The point currently receives runoff from the pad area surrounding the conveyor and transfer system.

Centennial Angus Place Pty Ltd currently holds EPL 467 with water currently licensed to be discharged from WCS through the following LDP:

- LDP003 – Located on the outlet of a sediment dam, downstream of the KVSA. The point receives runoff from the pad area that is captured within the dirty water system. KVSA and EPL 467 are managed by Centennial Angus Place and are described in the Angus Place Colliery Water Management Plan (GHD 2019a).

No volumetric discharge limits apply to LDP001. The volume of water discharged through LDP001 is required to be monitored daily during any discharge.

Water quality concentration limits specified by EPL 21229 for LDP001 and LDP002 are summarised in Section 6.1. Water quality monitoring for selected parameters is also required during discharge, discussed further in Section 4.3.

Key conditions relevant to water management are as follows:

- L2.5: The concentration limits at LDPs do not apply when discharge occurs solely as a result of a rainfall event measured at the site which exceeds 56 mm over any consecutive five day period.
- L2.6: Turbidity can be used as a measure of TSS provided that if turbidity limit is exceeded during discharge, Centennial must analyse the TSS and provide the results within three working days to the EPA.
- L4.1: Receival and disposal of residuals from the SWTP is permitted under EPL 21229.

- O5.1: Requires that Cooks Dam and the sump at the Conveyor at Duncan Street are dewatered to maintain their design capacity within 5 days following rainfall. Currently, there is no feasible means for complete dewatering of Cooks Dam, as it is influenced by groundwater.
- O5.3: All sediment basins must be desilted as needed to retain their design storage capacities.
- U1.1: Centennial submitted the preferred project report for LDP001 pollution reduction program for managing water currently discharged through LDP001.

Centennial will comply with Section 120 of the POEO Act for any pollution of water not regulated by EPL21229.

1.2.4 Water licences

For groundwater, no entitlements are currently held specifically for WCS. However Centennial, within the Western Coalfield, holds licences to cover groundwater extraction by Centennial operations from the Sydney Basin West Groundwater Sources. These volumes are reviewed annually and as part of Project conditions. There are no water supply works or use approvals currently held by WCS, however a modification to receive water from Angus Place is currently pending approval.

For surface water, Centennial hold WAL 25659 and WAL 25774, which are currently associated with Pipers Flat Creek Dam managed by a subsidiary of Centennial. Centennial has confirmed that there is no forecast use of entitlements from these WALs, and Centennial intends to transfer the share components to be used for the approved Huon Clean Water Pond. In consultation with DPE Water, additional share components would be required to be purchased for DWP-A sump.

1.3 Water Management Plan objectives

The WMP has been developed to address the approvals and licensing requirements presented in Section 1.2 through:

- Review of existing information and studies relating to the operation of the water management system at WCS.
- Further establish an understanding of the water management system at the site.
- Categorise the existing conditions that are specific to water management requirements.
- Further develop catchment plans for the site.
- Identify and maximise the separation of the clean and dirty water management systems.
- Undertake a review of the capacity of dirty surface water storages in accordance with *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom 2004) and *Volume 2* (DECC 2008).
- Determine flood management requirements and waterway conditions.
- Undertake a water quality assessment and review of existing water quality assessment criteria.
- Minimise water discharges from the premises by maximising, where practicable, opportunities for the reuse and recycling of water on site.
- Manage discharge to natural waterways in accordance with the relevant EPL conditions or as agreed with the EPA.
- Determine the future water management requirements.
- Review and develop water monitoring requirements.

1.4 Relationship to other plans

1.4.1 Upper Coxs River Action and Monitoring Plan

Water management performance measures are specified by Springvale Mine's development consent, including the requirement to eliminate toxicity and reduce the EC of mine water discharges via LDPs.

The Upper Coxs River Action and Monitoring Plan (UCRAMP) identifies actions and monitoring requirements undertaken by Centennial to meet long term mine water discharges criteria for the upper Coxs River catchment, which includes WCS.

The UCRAMP includes actions specific to the operation of WCS, which are detailed in Appendix C. The UCRAMP was approved by DPE in May 2020.

1.4.2 Riparian Habitat and Catchment Improvement Plan

MOD1 of SSD-5579 required the preparation of a Riparian Habitat and Catchment Improvement Plan (RHCIP) to describe measures to improve and maintain the riparian habitat of Wangcol Creek for at least 100 metres downstream of the proposed Link Haul Road bridge crossing of the creek and additional compensatory water quality and catchment improvement measures.

The RHCIP identifies actions to improve and maintain the riparian habitat within Wangcol Creek and Lamberts Gully. The works in Wangcol Creek are proposed to be implemented within 12 months of the construction of the proposed Link Haul Road bridge crossing of the creek. The works in Lamberts Gully were completed in 2019.

The plan was submitted to the Secretary for approval in October 2017, but no approval was provided by DPE. The plan was resubmitted in July 2022 with DPE requesting to undertake a review of the plan to ensure its currency, which is in progress.

1.4.3 Angus Place Colliery Water Management Plan

KVSA is currently approved to stockpile excess coal under development consent SSD-5579 for the Western Coal Services Project. KVSA is managed by Centennial Angus Place Pty Ltd, which also operates the nearby Angus Place Colliery. For consistency with the Mine Operations Plan and the consolidated leases, the water management of KVSA is described in the Angus Place Colliery Water Management Plan.

1.4.4 Springvale Water Treatment Project Brine and Residual Waste Disposal Plan

This WMP includes relevant detail from the Brine and Residual Waste Disposal Plan to satisfy relevant conditions of SSD_7592 MOD2 for the SWTP. Residuals are a liquid waste with a solids contents of about 1.5% from the removal of solids from the raw mine water as part of the pre-treatment process at the water treatment plant. Residuals are transferred to SCSS for disposal with coal rejects from the coal washery in the REA.

2. Environment

2.1 Climate

2.1.1 Rainfall

SCSS has had a site meteorological station operating since February 2012. For the WMP, a longer term rainfall record was obtained from SILO[1] for the Lidsdale (Maddox Lane) Station (station number 63132), located approximately 3 km south-east of SCSS. Figure 2-1 presents the historical SILO patched point daily rainfall data from the Lidsdale (Maddox Lane) Station between 1889 and 2023 and site-based rainfall recorded between 2012 and 2023.

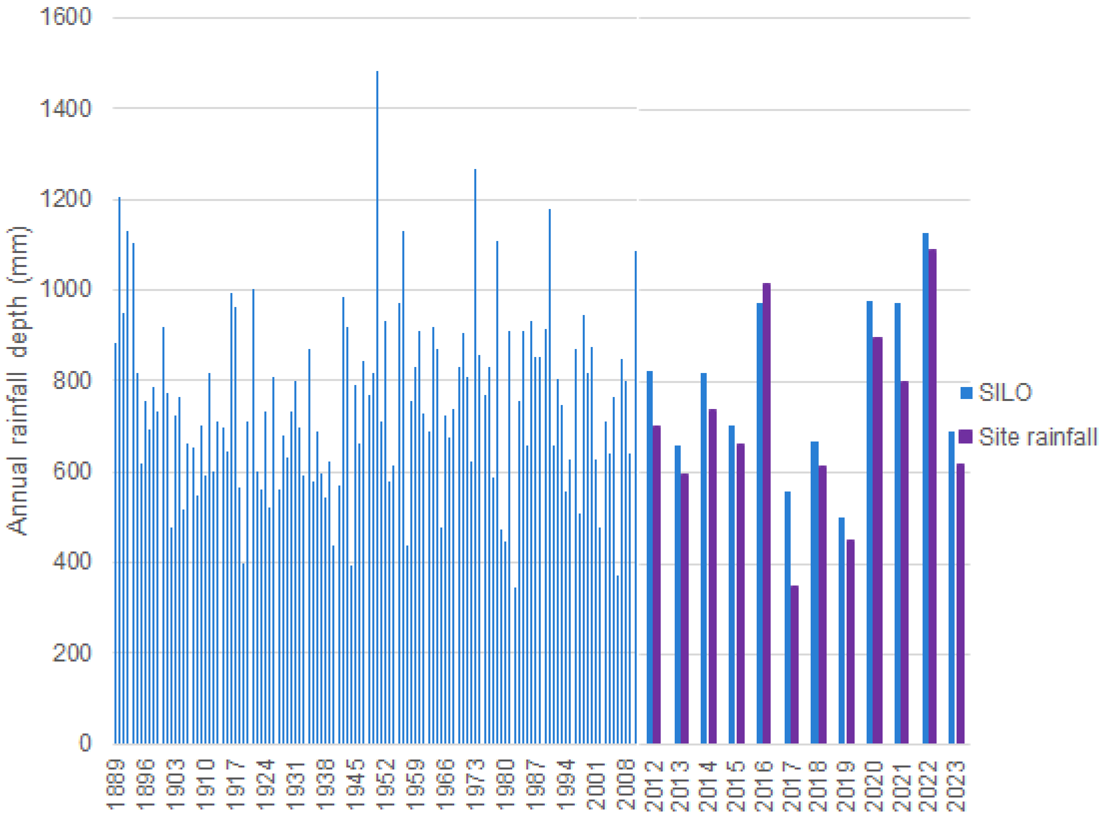


Figure 2-1 Historical daily rainfall at Lidsdale (Maddox Lane) Station and Springvale Coal Services site

The annual statistics associated with the SILO patched point daily rainfall data from the Lidsdale (Maddox Lane) Station presented in Figure 2-1 are:

- Minimum annual rainfall – 330 mm in 2006.
- Average annual rainfall – 753 mm.
- Median annual rainfall – 734 mm.
- Maximum annual rainfall –1,611 mm in 1950.

[1] Scientific Information for Land Owners (SILO) is a database operated by the Queensland Department of Science, Information Technology and Innovation. SILO patched point data is based on historical data from a particular Bureau of Meteorology (BOM) station with missing data 'patched in' with interpolations from nearby stations.

2.1.2 Evaporation

Evaporation estimates are not collected by the meteorological station at SCSS. Information provided at the closest BOM station which records evaporation, Bathurst Agricultural Station (station number 63005), was reviewed and average monthly evaporation rates were determined.

The average daily evaporation rates are presented in Figure 2-2 and is based on 58 years of data from 1966 to 2023. This station is approximately 60 km west of SCSS.

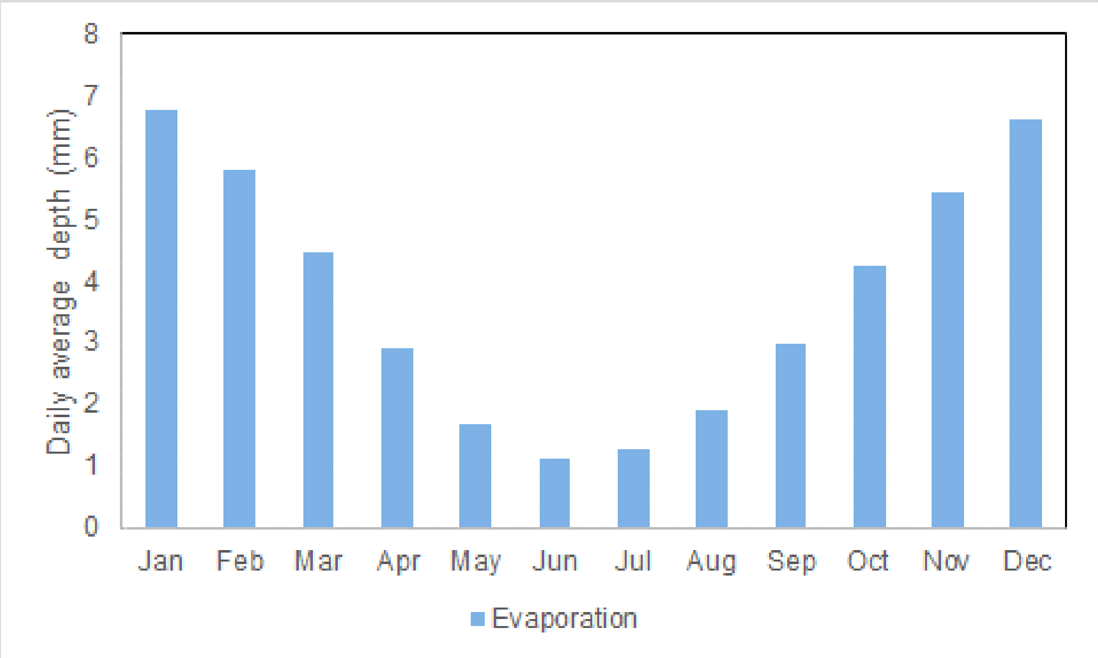


Figure 2-2 Average daily evaporation at Bathurst Agricultural Station

Total average annual evaporation is approximately 1,372 mm, compared to the annual average rainfall total of approximately 753 mm. This gives an annual deficit (difference between annual rainfall and annual evaporation) of approximately 619 mm.

2.1.3 Cumulative rainfall departure

A cumulative rainfall departure (CRD) curve presents the cumulative difference between the observed monthly rainfall and long-term average monthly rainfall. The CRD curve only deviates from zero due to atypical (above and below average) rainfall. Increase in the CRD reflects above average rainfall while a decrease reflects below average rainfall. The site rainfall dataset has been used in this assessment.

Figure 2-3 Site Cumulative Rainfall Departure curve

Figure 2-3 shows that below average rainfall (decreasing CRD trend) was generally observed from 2012 to 2019, with brief periods of above average rainfall in 2016 and late 2018. From December 2019 to February 2023, observed rainfall has been above average, followed by a return to below average rainfall.

2.2 Hydrology

WCS is located in the Coxs River valley, part of the Sydney Metropolitan Drinking water catchment, with SCSS in the catchment of Wangcol Creek. SCSS is on a northerly slope that is relatively steep, at about 950 m AHD elevation. SCSS is drained by Lamberts Gully in the east and Huon Gully in west.

The conveyor at Brays Lane is in the floodplain of the Coxs River. The Mount Piper Haul Road and overland conveyors cross multiple waterways including the Coxs River, Wangcol Creek and their tributaries at various locations. Watercourses near WCS are presented in Figure 2-4.

Wangcol Creek has been subject to diversions and instream impacts (such as mining) with its condition varying from partly vegetated to cleared and degraded lands. Huon Gully is now blocked due to the ash emplacement for MPPS. Flow within this waterway terminates at the SCSS storage of SHG1. Lamberts Gully is intercepted by sediment control dams located within the SCSS, which discharge water following treatment by settling.

2.2.1 Downstream water users

Licensed surface water users downstream of WCS identified by searching the *NSW Water Register* (WaterNSW 2024) within the Wangcol Creek and Coxs River catchments are summarised in Table 2-1. The search was limited to a downstream extent of the Coxs River confluence with Lake Burragorang. WCS does not extract surface water, so potential impacts are only associated with potential changes to water quality.

Table 2-1 Licensed surface water users downstream of Western Coal Services

WAL	Location	Category	Use	Allocation (ML)	Distance downstream of LDP001 (km)
25774	Lot 8, DP 252472	Unregulated river	Irrigation	1	3.6
35759	Lot 75, DP 1010834	Unregulated river	Irrigation	4	23.3
25579	Lot 2, DP 731149	Domestic and stock (Stock)	Irrigation	1	32.9
25534	Lot 31, DP 1009967	Unregulated river	Irrigation	40	22.8
27428	Lot 1, DP 1183453	Major utility (Power generation)	Power Generation	25,000	8.9
25672	Lot 52, DP 1210333	Unregulated river	Irrigation	19	22.6
25607	Lot 1, DP 1278212	Unregulated river	Irrigation	10	2.7
25598	Lot 32, DP 757063	Unregulated river	Irrigation	30	27
25578	Lot 25, DP 757063	Unregulated river	Irrigation	140	21.7
25654	Lot 330, DP 1108595	Unregulated river	Irrigation	10	28.6
25540	Lot 103, DP 871907	Unregulated river	Irrigation	100	39.7
25604	Lot 1, DP 251246	Domestic and stock (domestic)		1	30.2
25480	Lot 217, DP 1290505	Unregulated river	Irrigation	9	27.9
25504	Lot 48, DP 751657	Unregulated river	Irrigation	20	42.2

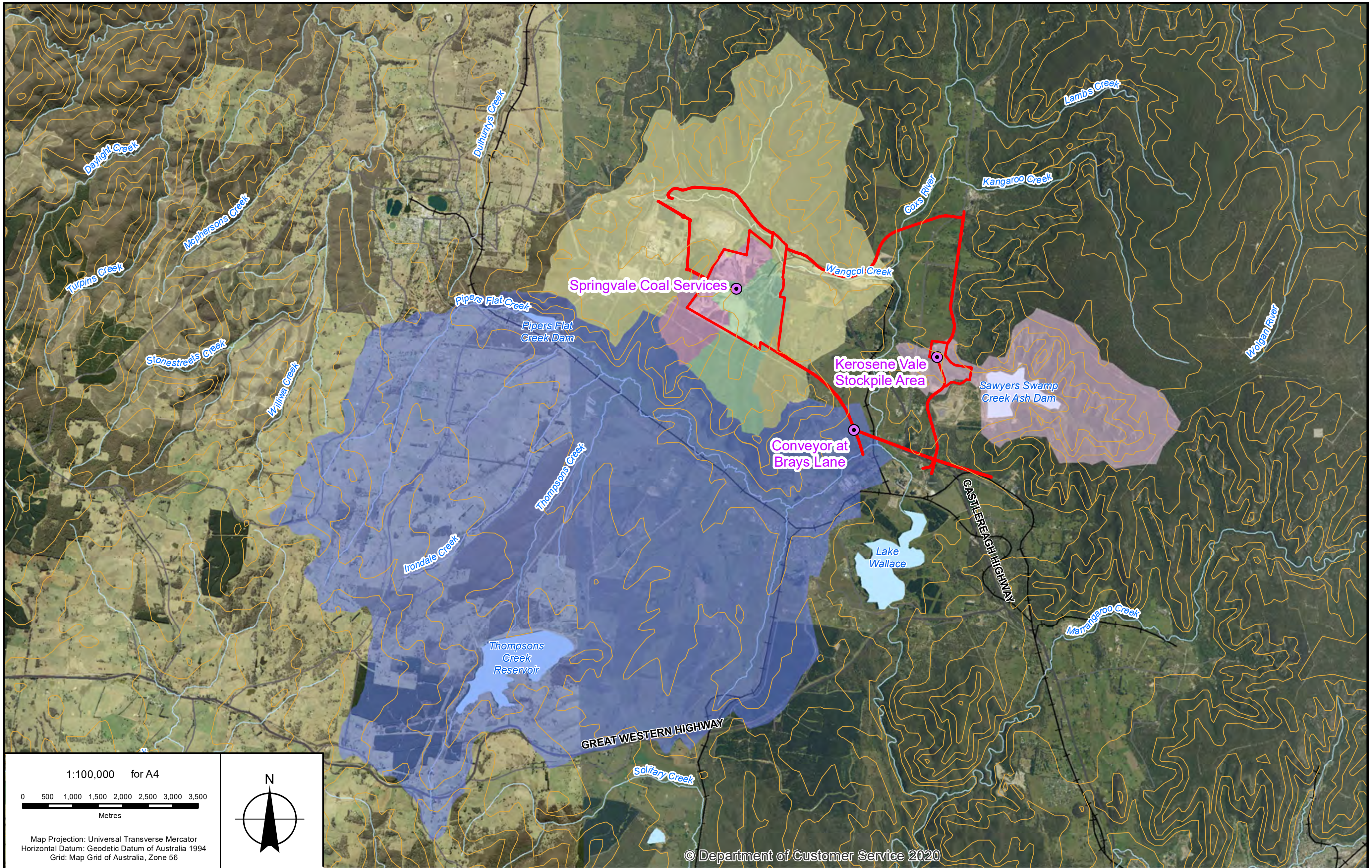
2.3 Hydrogeology

The local hydrogeology at SCSS is highly modified due to historical mining. The local geology creates a range of aquifer systems associated with higher permeability sandstones and coal seams. These are likely separated by lower permeability aquitards associated with mudstones, claystones and shale layers. Regional groundwater flows are generally to the northeast, with connectivity to Wangcol Creek is the shallow sandstone aquifer.

Local groundwater flow is influenced by the collection and channelling of infiltrated water into the mine voids and backfilled areas. Historical mine workings include the Western Main workings under the SCSS, the Eastern Main workings to the east of SCSS, and Wallerawang workings to the north of SCSS. Open cut workings were undertaken as part of the Western Main and Lamberts Gully mining operations within and surrounding the SCSS. Open cut mining involved extraction down to the floor of the Lithgow Seam, including extraction of remaining pillars from the Western Main underground workings. Following open cut extraction, the voids were generally backfilled. Historical mining within the vicinity of SCSS is provided in Figure 2-5.

The local groundwater sources near SCSS are 'less productive' in accordance with the criteria specified in the NSW Aquifer Interference Policy (i.e. the yield is typically less than 5 L/s and/or the TDS concentration is typically greater than 1,500 mg/L). The local groundwater sources are managed under the water sharing plan for the Greater Metropolitan Region Groundwater Sources and specifically are part of the Sydney Basin Coxs River groundwater source.

A search of the Australian Groundwater Explorer (BOM 2024) and WaterNSW (2024) was undertaken to identify registered bores within a 5 km radius of SCSS. The majority are registered as monitoring bores (107 bores) and water supply bores (38 bores). The remaining bores were registered for stock and/or domestics, dewatering, irrigation, and commercial and industrial use. There were three bores with an unknown use. Details of the registered bores are provided in Appendix G. No groundwater dependent ecosystems (GDEs) have been identified within the immediate vicinity of the SCSS.



LEGEND

- Project approval area
- Existing Rail
- Principal Road
- Minor Road
- Waterbody
- Waterway
- Contours (50m)

Catchment

- Huon Gully
- Lamberts Gully
- Pipers Flat Creek
- Sawyers Swamp Creek
- Wangcol Creek

LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	Refer to scalebar

Western Coal Services
Water Management Plan

Watercourses

CENTENNIAL
Springvale Coal Services Operation

DATE 23/07/2024

Figure 2-4

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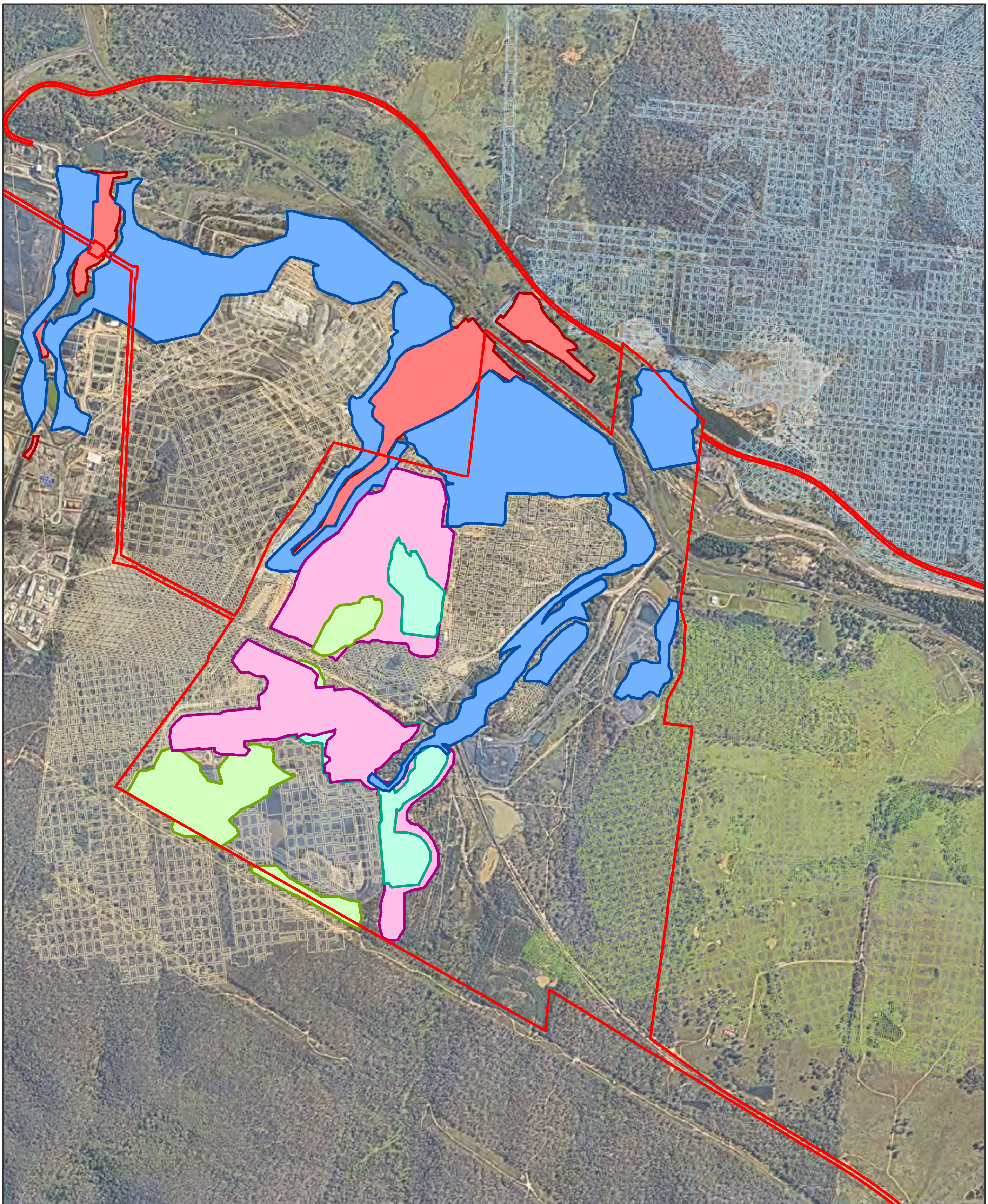

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0 75 150 300 450 600
Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

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LEGEND
- Project approval area
- Wallerawang Underground Workings
- Eastern Main Underground Workings
- Western Main Underground Workings
- Western Main Open Cut - Lithgow Seam
- Western Main Open Cut - Lidsdale Seam
- Lamberts Gully Open Cut - Lithgow Seam
- Lamberts Gully Open Cut - Lidsdale Seam
- Lamberts Gully Open Cut - Irondale Seam

LOCATION	WCS
SEAM	Lithgow
DRAWN	TM
CHECKED	TT
APPROVED	SG
SCALE	refer to scalebar

Western Coal Services
Water Management Plan
Historical mining near
Springvale Coal Services Site

CENTENNIAL
Springvale Coal Services Operation

DATE 23 July 2024 | Figure 2-5

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3. Water management

3.1 Water management overview

The water management systems at WCS are comprised of clean and dirty water. Sources of water include minimal potable water supply, rainfall, runoff and groundwater inflow to the open cut areas and Cooks Dam. WCS is also approved to receive residual waste from the SWTP, transfer water from Angus Place Colliery, transfer water to the proposed McPhillamys Gold Project, and to and from Mount Piper Power Station. The primary water demands are for surface dust suppression, coal washing activities and staff amenities.

Clean water is surface water runoff from areas where there is no coal storage, transportation, handling or processing. Clean water is unlikely to be contaminated with coal fines or sediment. Runoff is diverted around dirty water and coal-contact catchments to avoid mixing with clean water runoff. Clean water runoff is typically from areas of remnant vegetation or current rehabilitation catchments.

Dirty water is runoff from disturbed areas and areas with the potential to contain suspended sediment, oils, grease and hydrocarbons. This typically includes workshop and fuel storage areas. Dirty water including coal-contact water is runoff from catchments where coal storage, transportation, handling or processing occurs and is managed within the dirty water management systems.

A schematic of the overall approved water management system at WCS is presented in Figure 3-1 noting that MOD4 storages will be included once constructed.

3.2 Surface water management

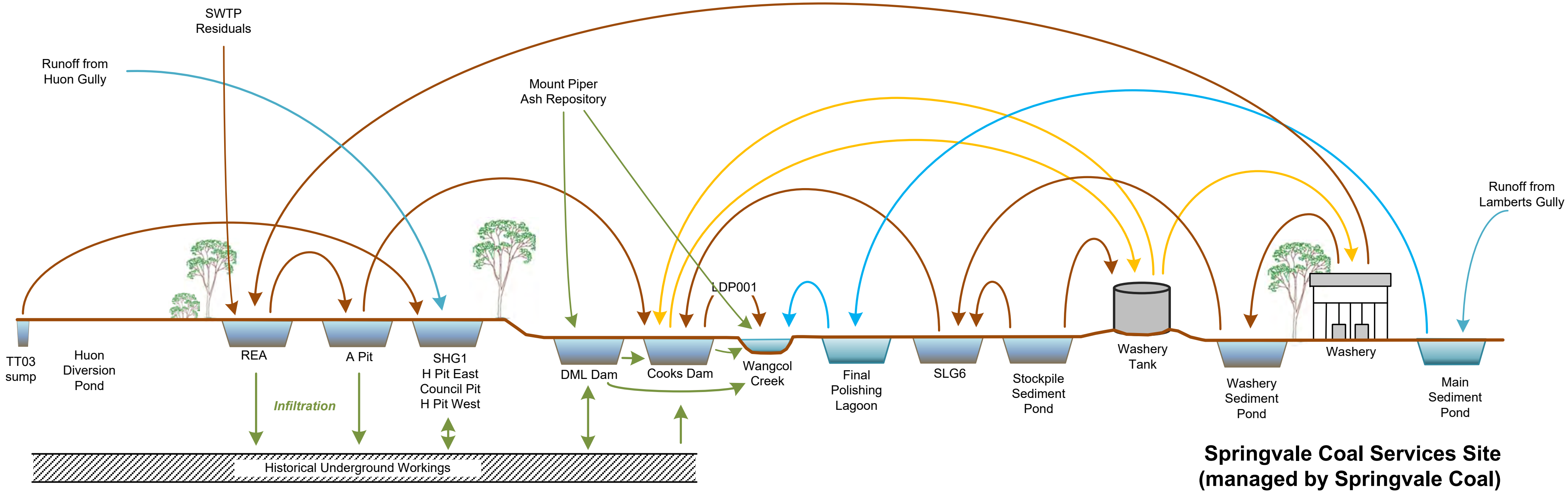
3.2.1 Clean water management – Springvale Coal Services site

Clean water diversions have been progressively implemented at the SCSS to divert clean catchment runoff from disturbed areas. This is continuing with further separation of coal processing catchments and disturbed catchments that are gradually undergoing rehabilitation. Figure 3-2 presents the clean water management components at SCSS. The clean water channels around the site have been designed to cater for a minimum of a 20 year ARI event (dependent upon the water levels in upstream storages at start of event). Table 3-1 outlines the details of the clean water diversions at the SCSS.

Table 3-1 Clean water diversions – Springvale Coal Services site

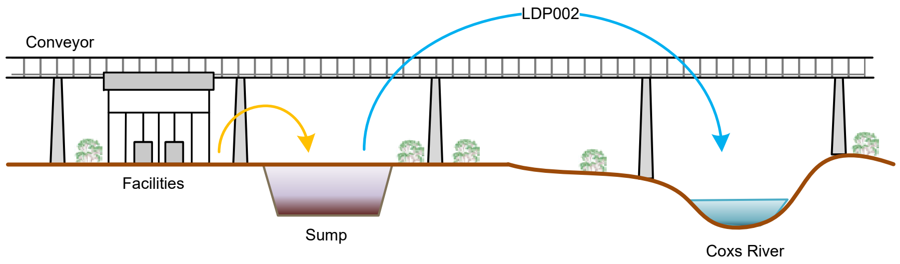
Location	Type	Catchment diverted	Top width	Depth	Discharge to	Design compliance
CW1	Open channel	106 ha	4 m	0.5 m	Existing: SHG1 Future: Huon Diversion Pond	100 year ARI
CW2	Open channel	17 ha	4 m	0.5 m	Main Sediment Dam	100 year ARI
PCW1	Open channel	269 ha	4 m	0.5 m	Final Polishing Lagoon	20 year ARI
PCW2	Open channel	270 ha	2 m	1.3 m	Wangcol Creek	20 year ARI

Construction works on clean water diversions commenced in 2017. Ongoing rehabilitation of the works from 2018 to mid-2019 were covered in part by the Riparian Habitat and Catchment Improvement Plan (RHCIP) (GHD 2017b).



Springvale Coal Services Site
(managed by Springvale Coal)

Note: SHG1, H Pit East, and H Pit West are EA managed storages and are displayed for influence to groundwater in underground workings.



Conveyor system at Brays Lane
(managed by Springvale Coal)

GHD

Clean water
Underground water
Dirty water (sediment)
Dirty water

LOCATION	WCS
SEAM	Lithgow seam
DRAWN	MR
CHECKED	BF
APPROVED	SG
SCALE	NTS

Western Coal Services
Water Management Plan

Water management schematic

CENTENNIAL

DATE	Jul 2024	Figure 3-1

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LEGEND

- Project approval area
- Pipeline
- Proposed surface water flowpath (clean)
- Clean water storage
- Pump
- Watercourse - Non Perennial
- Watercourse - Perennial

LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	Refer to scalebar

Western Coal Services
Water Management Plan

Clean water management - Springvale Coal Services site

CENTENNIAL
Springvale Coal Services Operation

DATE 23/07/2024

Figure 3-2

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The clean water storages at SCSS are summarised in Table 3-2.

Table 3-2 Clean water storages – Springvale Coal Services site

Storage	Maximum capacity	Function	Outflow type	Discharge to
Final Polishing Lagoon	4 ML	Water quality improvement/polishing and water source (up to harvestable rights)	Spillway	Wangcol Creek
Huon Clean Water Pond	3.4 ML	Intercept the clean catchment of Huon Gully and transfer it to the clean water diversion draining to the Main Sediment Pond via a pipe and pump system	Spillway	SHG1

Final Polishing Lagoon

Final Polishing Lagoon (formerly Retention Pond) currently collects catchment runoff from a large proportion of the SCS site and forms part of the ongoing rehabilitation program of Lamberts Gully. The waterway of Lamberts Gully, as part of the clean water diversion works has been diverted through the Final Polishing Lagoon. The overflow of the Final Polishing Lagoon was modified to connect to Wangcol Creek downstream of LDP001, removing non-coal contact catchment runoff from reporting to LDP001.

Huon Clean Water Pond (approved, not constructed)

The Huon Clean Water Pond is approved to be constructed on Huon Gully upstream of SHG1 (refer to Section 3.2.2), to the south of the coal conveyor to direct runoff from Huon Gully to Wangcol Creek via the Lamberts Gully clean water diversion and to minimise the opportunity for localised groundwater recharge following rainfall. The pond will intercept the clean catchment of Huon Gully and transfer it to the clean water diversion draining to the Main Sediment Pond via a pipe and pump system. The pipeline will be within the conveyor corridor. A diversion bund will be constructed directly north of the conveyor to minimise clean catchment runoff flowing onto EnergyAustralia’s property. This bund will be maintained by EnergyAustralia. The design storage volume of 3.4 ML and a maximum pumping rate of 320 L/s adopted for the Huon Clean Water Pond have been optimised to suit the site constraints in order to divert part of the runoff for design rainfall events to the 2% AEP, 72 hour design storm event (GHD 2018a). Any overflows from the Huon Clean Water Pond will flow into SHG1, or into DWP-A once it is constructed.

3.2.2 Dirty water management – Springvale Coal Services site

The dirty water management structures at the SCSS form the basis of permanent sediment control at the site. Dirty water runoff (coal-contact and sediment-laden water) is managed by dirty water storages which enable suspended solids to settle out of the water column and also allow for dirty water to be reused in site processes, thereby minimising the potential for dirty water discharges into the surrounding environment. The dirty water management structures are regularly de-silted to maximise water storage capacity.

Figure 3-3 presents the dirty water management systems at SCSS. Table 3-3 provides a summary of the dirty surface water storages at SCSS.

Cooks Dam

Cooks Dam is located within a backfilled void created from historical open cut mining operations by Western Main Colliery. Cooks Dam forms the key collection and management point for dirty water on site. Water is received from a pipeline from a low flow outlet from the Washery Sediment Pond and Washery Makeup Tank. Decant water from A Pit also reports to Cooks Dam. From Cooks Dam, water can be pumped to the washery or discharged to Wangcol Creek via LDP001.

Inflows to Cooks Dam occur from various locations along the western edge of the dam, originating from the underground workings. This has been supported by observed piping in this area (typical of an increased hydraulic conductivity) (RPS, 2013).

There was previously a pumped transfer from Cooks Dam to DML Dam in order to reduce overflows from the dam through LDP001. This was ceased in early 2016, as it was determined that there was no benefit achieved by this process and the action resulted in an elevated groundwater table surrounding Cooks Dam and DML Dam. Elevated groundwater tables were potentially contributing to an increase in water management transfers around the site.

DML Dam

The DML Dam has historically provided additional volumetric capacity to the dirty water management system. However, due to its location within a backfilled void along with Cooks Dam, it was determined that use of the dam resulted in an elevated groundwater table locally, contributing to seepage to the Castlereagh Highway and increased seepage to Cooks Dam.

The DML Dam is no longer actively managed with any pumping into or from the dam. The dam maintains its own water level, which is generally representative of the groundwater table and is typically slightly higher than Cooks Dam.

Council Pit

Like DML Dam, Council Pit is a historical open cut void with no surface outflows (endorheic), it is not actively managed and is generally in equilibrium with the surrounding shallow groundwater system.

Main Sediment Dam

Main Sediment Dam (also known as Conveyor Dam) is located south of the main coal stockpile area. The retention time within the dam allows for sediment settlement before the water is discharged to Lamberts Gully. Controlled discharges occur via a pipe with a valve on the downstream outlet that is operated as required by site operations. Dependent upon the water levels within the pond prior to rainfall, the storage will typically overflow via a nearby concrete spillway to Lamberts Gully.

Main Sediment Dam receives overflow from upstream ‘fill and spill’ sediment ponds in the Lamberts Gully rehabilitation area, originally associated with previous rehabilitation works. Since the Main Sediment Dam provides sufficient storage capacity to retain the 95th percentile 5 day rainfall event, active management of these structures is not required.

Main Sediment Dam is approved to receive clean water diverted from the Huon Clean Water Pond but is yet to be implemented.

Stockpile Sediment Pond

Stockpile Sediment Pond receives surface water runoff from the coal stockpile area, the embankment of REA and surrounding contributing catchments. Water levels within the pond are controlled by a manually operated diesel pump, which reports to the Washery Makeup Tank for re-use in the washery.

During high rainfall events, water may overflow from Stockpile Sediment Pond into SLG6 via a combination of open channels and pipe networks, ultimately contributing to Cooks Dam.

Washery Sediment Pond

Washery Sediment Pond receives runoff water from the washery and surface water runoff from the haul roads, administration building areas and surrounding catchments. During high rainfall events, depending on the water levels in the pond, water will overflow from Washery Sediment Pond into SLG6 via overland flow across rehabilitated land.

A low flow gravity pipeline connection between Washery Sediment Pond and Cooks Dam was installed in 2012 to minimise and reduce overflow events from the Washery Sediment Pond in high rainfall events.

The capacity of the Washery Sediment Dam is approved to be increased from 3.8 ML to 6.1 ML through desilting and maintenance activities. The material excavated from the dam will be utilised in on-site rehabilitation works.

Washery and Washery Makeup Tank

The Washery Makeup Tank is located on the top of the ridge north east of the washery. Water is pumped to this location from Cooks Dam (preferred) and Stockpile Sediment Pond to meet the demands of the washery. The tanks overflow into a pipe that joins the low flow outlet of the Washery Sediment Pond and returns to Cooks Dam.

The washery process separates ROM coal into product coal and coarse and fine rejects. Fine rejects are pumped away as a slurry to the REA.

DWP-A (approved, not constructed)

DWP-A is approved to be constructed to the north of the Huon Clean Water Pond to capture dirty water from the coal conveyor corridor and prevent runoff flowing north onto EnergyAustralia's land. It has been designed as a concrete sump with a volume of 0.85 ML to provide sufficient storage for a 10% AEP design storm event. The dam would capture dirty water from the coal conveyor corridor and prevent runoff flowing north onto EnergyAustralia's property. DWP-A will also receive pumped flows from the TT03 sump. Water from DWP-A would be transferred via a pipe and pump system to the Washery Dam for reuse within the washery. Any overflows from DWP-A will flow to SHG1, which will be managed by EnergyAustralia. Should DWP-A not be constructed, dirty water runoff will flow onto EnergyAustralia's property and will be managed by EnergyAustralia's dirty water management system. The decision to construct DWP-A is subject to commercial agreements between Centennial and EnergyAustralia and availability of the required surface water entitlements (refer to Section 1.2.4).

DWP-B (approved, not constructed)

DWP-B is approved be constructed upstream of Cooks Dam and will provide additional dirty water storage capacity at SCSS. The dam would be suitably lined with a permeability of less than $1x10^{-9}$ m/s (or equivalent performance) in order to minimise any interaction with the groundwater environment. DWP-B has a conceptual size of 50 ML to manage the 1% AEP, 72-hour design storm event. The use of DWP-B as an additional dirty water storage for SCSS will allow Cooks Dam to be maintained at a lower level and have sufficient capacity to manage inflow surges from rainfall events and will lead to reduced discharges to LDP001. The ROM coal stockpile pad, that currently drains to H Pit West, will be regraded to direct runoff to DWP-B via the Washery Dam. Water stored within DWP-B would be reused within the washery, taking priority over water supply from Cooks Dam. Overflows from DWP-B will be directed to Wangcol Creek via LDP001. Following the completion of the detailed design for DWP-B, if required, the dam will be referred to Dam Safety NSW and a consequence assessment will be undertaken prior to construction.

SCSS Water Transfer System (approved, not constructed)

The SCSS Water Transfer System will be constructed on disturbed land adjacent to the proposed SCSS/Regis Transfer System (as part of the McPhillamys Gold Project). It will include a new transfer pit, pumps, valves, transformer and motor control centre upstream of LDP001. Once operational, the SCSS Water Transfer System will be used to transfer water from Cooks Dam to McPhillamys Gold Project and MPPS:

- The SCSS Water Transfer System will be used to transfer up to 15.6 ML/day of water from SCSS to the proposed SCSS/Regis Transfer System.
- The SCSS Water Transfer System will be used to transfer up to 2.6 ML/day of water from SCSS to MPPS for treatment and reuse. This is subject to the successful conclusion of ongoing commercial discussions between Springvale Coal and EnergyAustralia.

A bi-directional pipeline will be installed between SCSS and MPPS, which will include an offtake from Cooks Dam and an offtake and discharge point at Pond D as well as a connection to the Springvale Coal Services/Regis transfer system. The pipeline will be sized up to a capacity of 15.6 ML/day, which is the maximum supply capacity to McPhillamys Gold Project. The pipeline will allow excess water stored at SCSS to be transferred from Cooks Dam to Pond D or alternatively from Pond D or Cooks Dam to McPhillamys Gold Project. The proposed transfer of water off-site seeks to reduce the volume and frequency of LDP001 discharges to Wangcol Creek. When water is being transferred to McPhillamys Gold Project from both SCSS and MPPS, flow rates will be controlled through pumping and real-time telemetry systems. In the event that either SCSS or MPPS are transferring the full demand of McPhillamys Gold Project, then either source will be isolated to facilitate the use of the pipeline. Prior to and following McPhillamys Gold Project, or during periods of no demand, water from SCSS may be pumped in a reverse flow arrangement to Pond D at MPPS at a maximum rate of 2.6 ML/day. In this way, water will only be transferred from Cooks Dam to Pond D during periods of no demand at McPhillamys Gold Project. The proposed transfer pipeline arrangements (including the pipeline and valve configurations) will be confirmed in the detailed engineering design phase; however, all infrastructure will be located within the proposed easement.

If this project proceeds, then similar controls to those currently in place for Residuals transfer will be adopted (See Section 4.5).

Angus Place Pipeline Raw Water Tank Offtake and Tank

An offtake from the Angus Place Raw Water Pipeline that traverses SCSS will be constructed to allow up to 2 ML/day of water from Angus Place Colliery to be transferred to the Washery Makeup Tank for use in the washery. The Angus Place to MPPS pipeline inherent hydraulic limitations of 2 ML/day prevents significant exceedance of the consent limit (2.6 ML/day).

The raw mine water from Angus Place Colliery is used to supplement washery supply.

Daily Angus Place to MPPS transfer totals are monitored by the Angus Place Control System on a continuous basis. Automated alarms and flow limiting are in place to stop the Angus Place to MPPS transfer system if these limits are reached. Weekly Centennial water management meetings are held, which track volumes transferred from Angus Place to MPPS and provide a forum to manage and flag any non-compliances.

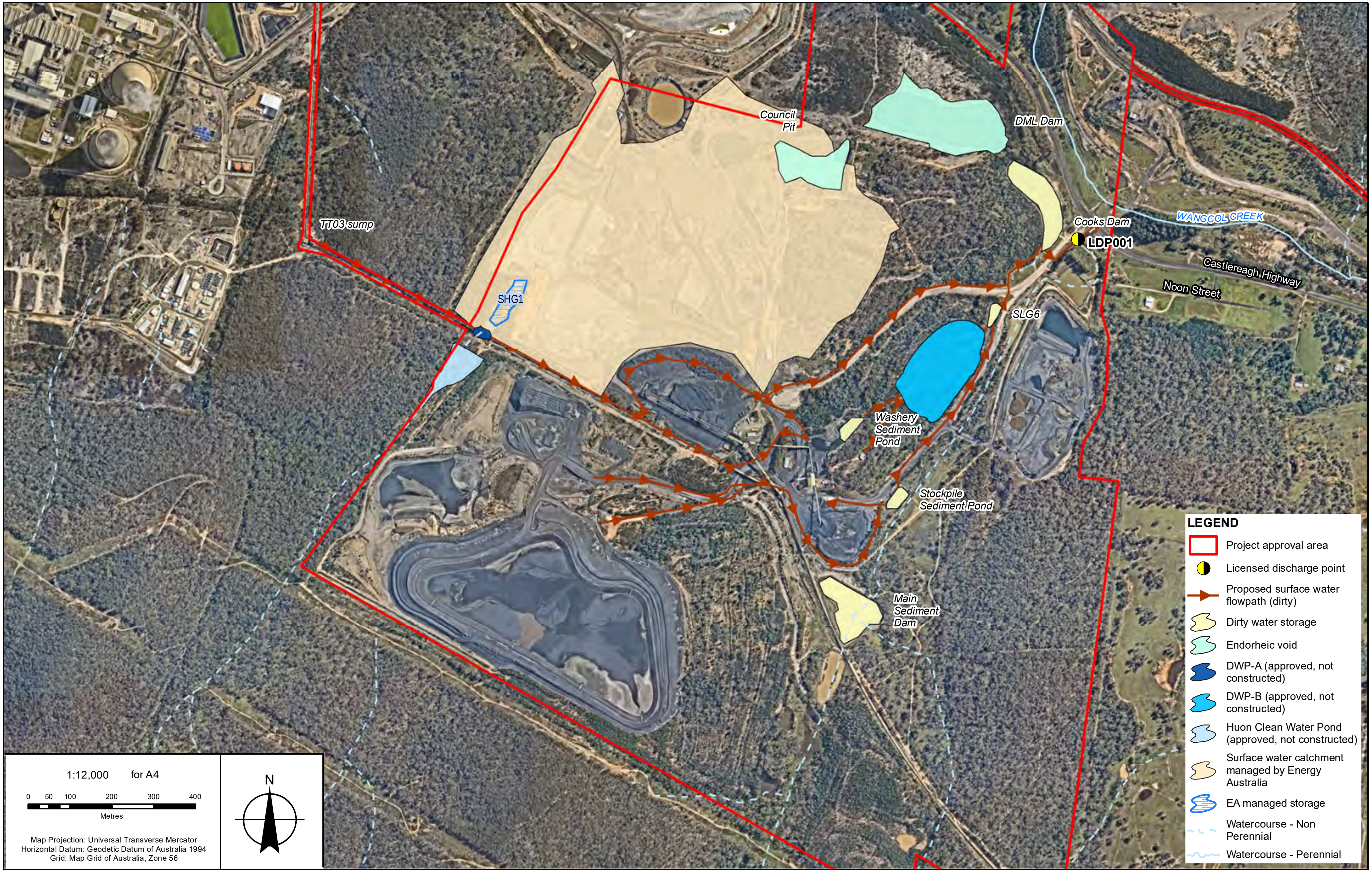
TT03 sump

The TT03 sump collects runoff from the overland conveyor near TT03, with stored water transferred via pipe and pump to Huon Gully immediately upstream of SHG1. As part of the modification to the SCSS water management system, the pipeline would be extended to DWP-A, once DWP-A is constructed.

EnergyAustralia managed features - Historical open cut voids

There are a number of historical open cut voids (extraction down to the Lithgow Seam) in the western part of the site that typically store water. The water in these voids is connected to the historical mine workings and then down gradient to Cooks Dam. These voids do not have surface outflows (endorheic), are not actively managed and are generally in equilibrium with the surrounding shallow groundwater system. The voids include H Pit West (backfilled), H Pit East (backfilled), and SHG1.

Transfer of approximately 50.6 ha of the existing surface water catchment at SCSS to EnergyAustralia occurred as part of the transfer of land from Springvale Coal back to EnergyAustralia. As a result, management of SHG1, H Pit East, H Pit West was transferred to EnergyAustralia.



LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	Refer to scalebar

Western Coal Services
Water Management Plan

Dirty water management - Springvale Coal Services site

CENTENNIAL
Springvale Coal Services Operation

DATE 24/07/2024

Figure 3-3

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Table 3-3 Dirty water storages – Springvale Coal Services site

Storage	Maximum capacity	Function	Treatment	Design criteria	Outflow type	Discharge to
Dirty water storages						
Cooks Dam	45 ML	Dirty water management	Settlement	95th percentile, 5 day rainfall depth	Spillway	LDP001
Main Sediment Dam	30 ML	Sediment control	Settlement	95th percentile, 5 day rainfall depth	Low flow pipe Spillway	Final Polishing Lagoon
Stockpile Sediment Pond	3.8 ML	Capture of coal-contact water	Settlement	95th percentile, 5 day rainfall depth	Low flow pipe Spillway	Cooks Dam via SLG6
Washery Sediment Pond	3.7 ML (desilting to increase to 6.1 ML approved)	Capture of coal-contact water	Settlement	95th percentile, 5 day rainfall depth	Low flow pipe Spillway	Cooks Dam via SLG6
DWP-A	0.85 ML (design)	Capture of coal-contact water	Settlement	95th percentile, 5 day rainfall depth	Pump Spillway	Washery SHG1

Storage	Maximum capacity	Function	Treatment	Design criteria	Outflow type	Discharge to
DWP-B	50 ML (concept design)	Capture of coal-contact water	Settlement	95th percentile, 5 day rainfall depth	Pump Spillway	Washery Cooks Dam via SLG6
TT03 sump	0.06 ML	Capture of coal-contact water	Settlement	95th percentile, 5 day rainfall depth	Pump Spillway	DWP-A H Pit West
Historical open cut voids						
DML Dam	193 ML	Open void	N/A	N/A	Seepage	Historical mine workings, ultimately reporting to Cooks Dam via seepage
Council Pit	20 ML	Open void	N/A	N/A	Seepage	
SHG1[A]	10 ML	Endorheic void	N/A	N/A	Seepage	

[A] Managed by Energy Australia

3.2.3 Reject emplacement management - Springvale Coal Services site

There are historical and operational REAs at SCSS. Figure 3-4 presents the location of the REAs. Table 3-4 provides a summary of the REAs at SCSS, including their status.

Table 3-4 Reject emplacement areas – Springvale Coal Services site

Storage	Maximum capacity	Function	Design compliance	Outflow type	Discharge to
A Pit	50 ML	Dewatering location for REA	100 year, 72 hr event	Pump Spillway	Cooks Dam (via underground workings)
Co-disposal storage facility	122 ML	Complete	100 year, 72 hr event	Spillway	Lamberts Gully - rare events only
REA	1,449 ML	Management of coarse and fine reject material	100 year, 72 hr event	Spillway	A Pit

A Pit

A Pit is a historical open cut used for fine rejects emplacement until late 2015. The design of the REA included modifications to A Pit to allow it to serve as the sediment pond for the REA by receiving tailings return water, which would then be pumped to Cooks Dam. Since the commissioning of the REA, the A Pit decant pumps have not been required to be operated, as surface water has been infiltrating into the historical underground workings.

Blackmans Flat co-disposal storage facility

The Blackmans Flat co-disposal storage facility is separated into six distinct cells, with four utilised for tailings and coarse reject co-disposal and the remaining two (located along the eastern side) used to hold decant water. Historically the cells were used to temporarily hold tailings and coarse rejects for a drying period, before they were mined out using a long-arm excavator and blended with coal product.

REA

The REA is a fine and coarse coal reject storage facility that extends to the south and east of the A Pit in order to store up to 1.4 Mm^3 of sub-aerially deposited fine coal reject material. The fine coal reject material is pumped from the washery and deposited. The REA at the SCSS was approved as part of the Western Coal Services Project (SSD-5579) to be constructed up to approximately 1000 m long and 700 m wide surrounded by a purpose built dirty water management system. The REA is a progressive structure that incorporates the former A Pit REA, which is located in the final void of the Lamberts Gully Open Cut Mine. Coarse reject material is used to construct the walls of the REA. Fine reject material is pumped from the washery as a slurry (tailings) into the REA.

The REA is planned in three stages:

- Stage 1 with crest level at 960 m AHD.
- Stage 2A facility extension westwards with crest level at 965 m AHD.
- Stage 2B with the final crest level at 970 m AHD.
- Stage 3 with the final crest level at 970 m AHD.

REA construction commenced in 2015 and Stage 3 commenced in May 2019.

Water management of the REA allows for any water captured within the area to be dewatered to the A Pit which reports to Cooks Dam and LDP001. Since the construction of the REA, dewatering of A Pit has not been required, as the decant water has infiltrated into historical underground workings and reports to Cooks Dam.

Dirty water runoff from embankments of the REA is captured in a series of drains that report to SHG1 and Stockpile Sediment Dam.

3.2.4 Conveyor at Brays Lane

The conveyor at Brays Lane is defined as a spill point for coal from the conveyor system. To manage coal spillage, a collection pit and sump capture coal material and dirty water. The water management system is maintained using mobile plant where captured material is cleaned out regularly. The capacity and description of the water management infrastructure is summarised in Table 3-5 and presented in Figure 3-5.

Table 3-5 Dirty water storages – Conveyor at Brays Lane

Storage	Maximum capacity	Function	Treatment	Design compliance	Outflow type	Discharge to
Sump	0.027 ML	Sediment control	Settlement	95th percentile, 5 day rainfall depth	Overflow	Collection pit

3.2.5 Haul roads

The haul roads are located within the Wangcol Creek and Coxs River catchments crossing small tributaries and trunk waterways via culverts. The road surface is sealed with runoff directed to table drains when the road is in cut and when in fill, runoff is allowed to sheet to the receiving environment. There are no dedicated water storages to manage runoff from the road nor is there any clean water diversions associated with large cuttings.

LEGEND

- Project approval area
- REA
- Licensed discharge point
- Watercourse - Non Perennial
- Watercourse - Perennial

LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	Refer to scalebar

Western Coal Services
Water Management Plan

Reject emplacement areas - Springvale Coal Services site

CENTENNIAL
Springvale Coal Services Operation

DATE 23/07/2024

Figure 3-4

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LEGEND

- Project approval area
- Licensed discharge point
- Existing clean water flow path
- Existing dirty water flow path
- Waterbody
- Watercourse - Non Perennial
- Watercourse - Perennial

LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	Refer to scalebar

Western Coal Services
Water Management Plan

Water management system - Conveyor at Brays Lane

CENTENNIAL
Springvale Coal Services Operation

DATE 25/07/2024

Figure 3-5

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3.3 Erosion and sediment control

As part of surface water management, erosion and sediment control is critical to minimise excessive soil loss as a result of activities that require disturbance of existing groundcover. Erosion and sediment controls are implemented for all phases of operation including construction/maintenance activities, operational activities and during rehabilitation to mitigate the impacts of the operations on watercourses and the surrounding environment.

Erosion and sediment control measures are focused on prevention of erosion through development of erosion and sediment control plans (ESCPs) that:

- Identify activities with the potential to cause erosion and generate sediment.
- Plan activities to minimise the area of disturbance.
- Install erosion and sediment controls prior to commencement of disturbance activities.
- Maintain erosion and sediment control structures.
- Design erosion and sediment control structures with the capacity to handle the critical 20 year ARI rainfall event.

The design parameters and typical details for ESCPs at WCS are included in Appendix E.

3.4 Groundwater management

Groundwater management at SCSS is limited to monitoring of any groundwater abstraction, levels and quality. Therefore operations at the SCSS pose a low risk to surrounding groundwater users. Potential spills and contamination will be dealt with according to the Pollution Incident Response Management Plan (PIRMP).

No groundwater interaction occurs at the conveyor at Brays Lane.

3.5 Potable and wastewater systems

Potable and ablutions water at SCSS is supplied by a LCC water main. Drinking water is provided to site by contractor in the form of bottled water. Potable water, of up to approximately 11 ML/year, is used predominately for site ablutions. Potable water is minimised through implementation of the clean and dirty water management systems (see Section 3.2), whereby water from these systems is reused on-site in preference to potable water use.

Wastewater is aerobically treated by two biocycle Aerated Wastewater Treatment Systems (AWTSs), one adjacent to the control room and one adjacent to the main office. The control room has a single water closet (WC) and hand basin. The main unit is attached to the bathhouse and change rooms and consists of two WC, one trough, eight showers and three hand basins, and clean and dirty sided change rooms. This unit was designed to cater for the Lamberts Gully Open Cut mining as well as the Coal Services personnel of 40 full time equivalent (FTE), with current load consists of approximately 15 personnel. Treated effluent is irrigated on adjacent landscaped areas.

Any water required at the conveyor system at Brays Lane will be provided from the Lidsdale Siding transfer tank via a pipeline along the conveyor.

3.6 Residuals management

Residuals from the SWTP are approved to be emplaced in the REA. This WMP forms part of the Brine and Residuals Waste Disposal Plan. This section satisfies the requirements of this plan while further detail on potential impacts and alterative options previously considered is included in Appendix D.

Two sources that contribute to the residuals stream to be transferred to the REA at the SCSS are:

- Residuals generated from the removal of solids from the raw mine water feed during the pre-treatment (clarification) processes in the water treatment plant.
  - The residuals stream has a dry solids content of up to 2% solids and is classified as liquid waste in accordance with the *Waste Classification Guidelines* (EPA 2014). The pre-treatment process removes suspended solids in the raw mine water feed, thickening the solids via a thickener process to allow transfer of the residuals material stream to the transfer pipeline.
- Clean-in-place waste from the reverse osmosis membrane cleaning.
  - Minor quantities of backflush material from the water treatment plant generated during quarterly maintenance activities is also transferred to the REA at the SCSS. The cleaning uses approximately 10 kL of treated water from the reverse osmosis process with the addition of acids and bases to backflush the membranes. The water is then neutralised and gradually blended with the residuals stream for disposal in the REA.

The pipeline is capable of transferring residuals at a flow rate of 30 L/s in batch flow periods. The maximum daily transfer rate to the REA from the water treatment plant is 0.43 ML/day. The residuals transfer pipeline leading into the REA and the header at the end of the pipe are installed above the ground surface to allow for the transfer of the residual material into the REA sub-aerially, similar to the practice of transferring fine coal reject material into the REA.

The header at the end of the residuals transfer pipeline is designed as a distribution header to allow the water to discharge at multiple points with low velocity and low volumetric flow to avoid localised erosion within the REA.

3.6.1 Potential impacts

The potential impacts of the disposal of residuals material within the REA at the SCSS has been assessed by the *Western Coal Services Project Modification 1: Water Resources Impact Assessment* (GHD 2016c). A detailed investigation of the potential impacts is presented in Appendix D, and summarised in Table 3-6.

Table 3-6 Potential impact of residuals

Aspect	Potential impact
Residuals quality	The residuals are expected to have a similar parameters to the raw mine water stream, with potentially higher TSS and proportionally higher total metals.
Discharge volume	On average, the discharge volume from LDP001 is expected to increase by, at most, the volume of residuals emplacement in the REA.
Discharge quality	The EC and pH are expected to increase. Concentrations of major ions and metals are generally expected to remain the same or decrease due to co-precipitation.
Groundwater levels	Increase seepage into the historical underground works from the REA is not predicted to have a measurable impact on groundwater levels outside of the SCSS.

Aspect	Potential impact
Groundwater quality	Increased transport of metals due to seepage from the REA to the groundwater environment because of residuals disposal is considered unlikely. Although concentrations of aluminium may increase, the metals concentrations from the REA source are expected to be less than those historically observed based on data from a majority of the groundwater bores at the site.

3.6.2 Management and mitigation measures

Reject emplacement area seepage

The REA is an unlined storage and likely has some connectivity to the shallow groundwater environment at the SCSS. To mitigate connectivity between the REA and the shallow groundwater environment, the use of coarse coal reject material around the REA perimeter and the deposition of fine coal reject material in the centre has been undertaken historically. This emplacement methodology continues to be utilised in the new REA. Adopting this approach seeks to form a reduced hydraulic conductivity of the REA with the shallow groundwater environment, as over time the coarse coal reject material voids are filled with fine coal slurry and material consolidation occurs.

Groundwater quality

The risk of increased transport of metals from the REA to the groundwater environment is unlikely due to co-precipitation with ferric chloride dosing. To mitigate the potential for the remobilisation of metals within residuals disposed of within the REA, the management of pH will be undertaken to ensure that water stored is between 6.5 to 8.5 pH units.

Erosion and sediment control

The residuals transfer pipeline from the water treatment plant at MPPS to the REA at the SCSS will be terminated as an open end pipe arranged as a distribution header. This will allow the residuals to discharge at multiple points with low velocity and low volumetric flow to avoid localised erosions within the REA.

3.6.3 Implementation program

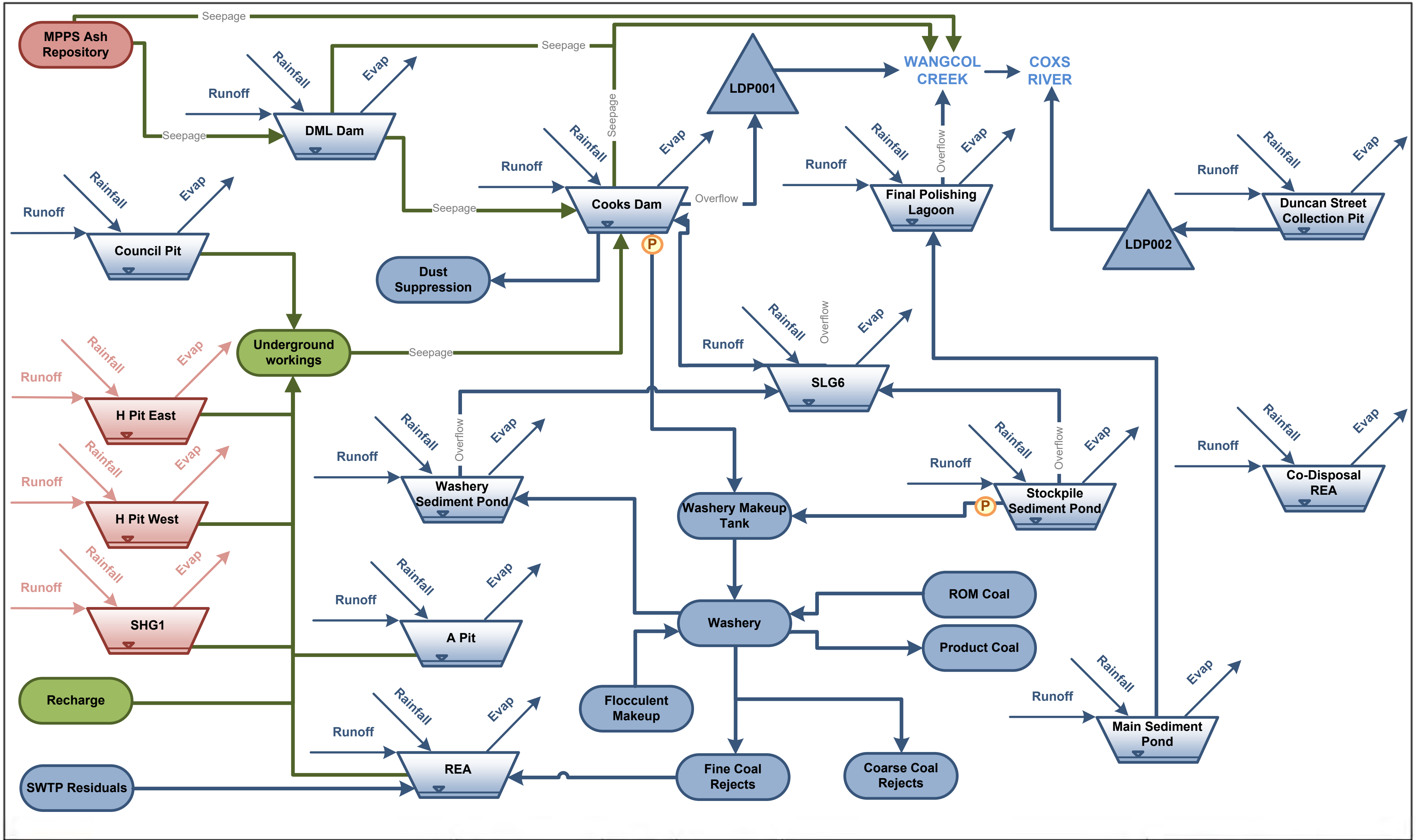
The commissioning phase of the SWTP included specific monitoring of the water treatment plant's performance, including the volume and quality of residuals that will be compared to the predictions of the *Western Coal Services Project Modification 1: Water Resources Impact Assessment* (GHD 2016c), as summarised in this WMP. The residuals monitoring program is provided in Section 4.5.

Weekly meetings are held between the SWTP operations team and the Centennial/Energy Australia teams to monitor and manage key performance metrics such as residuals transfer volumes or related exceedances. Monthly reports on all key performance metrics of the SWTP operations team are provided to Centennial/Energy Australia.

Surface water and groundwater monitoring is undertaken on a regular basis at the SCSS. Further detail is provided in Section 4.

3.7 Site water balance

An operational site water balance model was developed for WCS to quantify water transfers within the site under various rainfall patterns (GHD 2022a). The most recent version of water balance was prepared as part of the Modification 4 Report (EMM 2022). The results of EMM (2022) have been used as representative of future conditions pending confirmation of the staging of construction and commissioning of the approved changes to the water management system. There are slight differences between the results of GHD (2022a) and EMM (2022) due to differences in modelling inputs and assumptions. The actual water balance is reviewed regularly as per Section 7.3. A schematic of the overall existing water management system is provided in Figure 3-6. A summary of the predicted average annual inputs and outputs is provided in Table 3-7.



GHD

- Underground storage
- Underground process
- Surface storage
- Surface process
- Licensed discharge point
- EA managed surface process
- EA managed surface storage
- Surface water flow
- Groundwater flow

LOCATION	WCS
SEAM	Lithgow seam
DRAWN	MR
CHECKED	BF
APPROVED	SG
SCALE	NTS

Western Coal Services
Water Management Plan

Water management features schematic

CENTENNIAL

DATE Jul 2024 Figure 3-6

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Table 3-7 Summary of site water balance results

	Existing conditions	Future conditions (EMM 2022)
Catchment Runoff into storages	652	556
Groundwater recharge	299	159
SWTP residuals	128	128
Flocculant makeup	0	11
ROM coal moisture	20	22
Seepage from Mount Piper Ash Repository	454	354
Transfer from Angus Place Colliery	-	99
TOTAL INPUTS	**1,644**	**1,329**
Evaporation	145	97
Dust suppression	55	55
Coarse coal reject moisture	5	2
Product coal moisture	13	20
Discharge via LDP001 to Wangcol Creek (SCSS)	1053	4
Overflow from Final Polishing Lagoon to Wangcol Creek	302	291
Seepage from DML Dam and Cooks Dam to Wangcol Creek	204	49
Transfer to Pond D at MPPS	-	810
Discharge via LDP002 to Coxs River (conveyor at Brays Lane)	0	0
TOTAL OUTPUTS	**1,779**	**1,328**
Surface water storages	-113	0
Underground storage	-22	0
TOTAL CHANGE IN STORAGE	**-135**	**0**
Inputs – outputs – change in storage	**0**	**1**

As shown in Table 3-7, the major inputs to the water cycle were identified as rainfall runoff and groundwater recharge. The largest outputs from the water cycle under existing conditions were identified as discharges via LDP001 and evaporation. Following the commissioning of the approved MOD4 changes to the water management system, the discharge via LDP001 is expected to be minimised and replaced by transfers to MPPS as the main output from the water cycle.

Water balance modelling indicates that the underground storage volume will remain essentially unchanged on average, having reached a new equilibrium following changes to site operations in 2016. As rainfall leading up to present conditions have been below the historical average, the groundwater recharge and total water storage is more likely than not to increase slightly in the short term future.

Water balance modelling indicates that discharge from LDP002 is relatively minor, compared to LDP001. The discharges are proportional to the small catchment areas contributing to the LDP002.

3.7.1 Water supply security and reuse strategies

Water supply security

With the ongoing groundwater contribution to Cooks Dam, water supply security is high. The risk of water shortage for the operation is low. Any minor volumes of water required at the conveyor system at Brays Lane will be provided from the Lidsdale Siding transfer tank via a pipeline. Water supply security at KVSA is described in the Angus Place Colliery Water Management Plan.

Reuse strategies

Cooks Dam is utilised as the primary source of water for washery activities. Nearly all water demands at SCSS are supplied through reuse activities. Reuse on site is a key mechanism in reducing LDP001 discharges to Wangcol Creek, however most of the water reused through washery activities and disposed as part of fine reject slurry within the REA reports back to Cooks Dam via groundwater infiltration.

Reuse strategies are not practical for captured water at the conveyor system at Brays Lane, due to the small volumes and minimal operational water requirements.

Reuse strategies at KVSA are described in the Angus Place Colliery Water Management Plan.

3.7.2 Discharge frequency

Discharge frequency has been assessed using cumulative frequency distributions of the predicted daily average discharge.

LDP001 discharge

Under existing conditions discharges were modelled to occur every day, between a minimum rate of 0.5 ML/day, average rate of 2.9 ML/day and a maximum rate of 65 ML/day. Commissioning of the approved changes to the water management system are predicted to decrease in LDP001 discharges to Wangcol Creek (EMM 2022).

LDP002 discharges

Discharges from LDP002 occur because of management requirements at the conveyor system located at Brays Lane. A cumulative frequency distribution[2] of LDP002 discharges are shown in Figure 3-7.

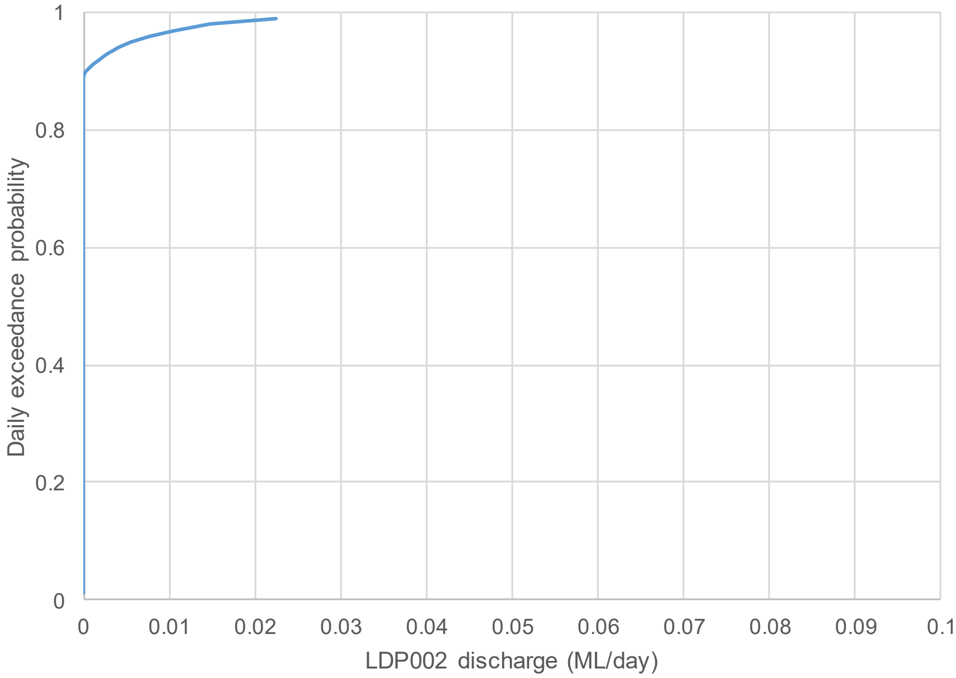

Figure 3-7 Predicted daily discharges from LDP002

Figure 3-7 indicates that discharges exceeding 10 kL/day from LDP002 are predicted to occur on approximately 15% of days and unlikely to exceed 0.1 ML/day.

3.8 Communication protocol

A communication protocol has been prepared to guide the coordination and planning of water management at SCSS and nearby power generation and mining operations, with the aim to minimise the cumulative impacts on downstream receiving environment. The communication protocol is provided in Appendix F and was developed in consultation with relevant stakeholders.

[2] Cumulative frequency distribution show the probability (based on water balance modelling results) that discharge will exceed a particular value on any particular day.

4. Monitoring requirements

4.1 Inspections

Site inspections are completed by the Environment and Community team and occur:

- Weekly for SCSS and the conveyor system at Brays Lane.
- As soon as practicable following rainfall events that exceed 20 mm in 24 hours.
- Following any non-compliance or reported internal incident.

An example of an inspection is undertaking the following activities:

- Walking around the site systematically.
- Inspecting water management and sediment control structures for capacity, structural integrity and effectiveness in accordance with maintenance considerations in DPI (2012) and NSW Fisheries (2003) guidelines for instream structures. This includes the volume of water and volume of sediment, relative to the design capacity of water storages. Typical inspection and management of dirty water storages is summarised in Figure 4-1.

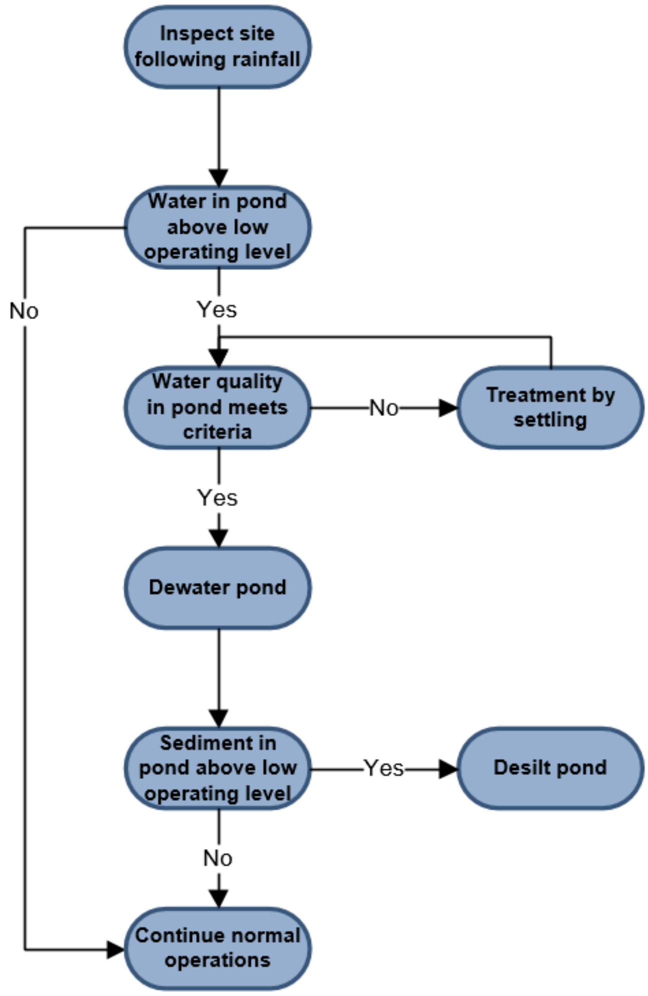

Figure 4-1 Typical inspection and management of dirty water storages

The procedures for dewatering of water storages are specified in the SCSO Surface Water Management Improvement Letter (GHD 2022b) which includes routine and response actions to manage water within these structures.

4.2 Surface water monitoring

4.2.1 Surface water flow

No monitoring of surface water flow in Wangcol Creek is undertaken by WCS. Water flow monitoring in downstream watercourses is undertaken by WaterNSW, including gauge 212055 on Wangcol Creek downstream of the SCSS. Discharge flow monitoring is described in Section 4.3.

4.2.2 Surface water quality

Figure 4-2 provides the location of the surface water quality monitoring points for WCS. Surface water quality is currently monitored at the following locations:

- Cooks Dam.
- Collection Pond.
- Final Polishing Lagoon.
- Main Sediment Dam.
- Stockpile Sediment Pond.
- Washery Sediment Pond.
- Collection Pond (small weir pool immediately upstream of LDP001).
- Wangcol Creek Gauge – located on Wangcol Creek approximately 600 m upstream of LDP001 discharge from the SCSS.
- Wangcol Creek US – located on Wangcol Creek immediately upstream of LDP001 discharge from the SCSS.
- Wangcol Creek DS – located on Wangcol Creek immediately downstream of LDP001 discharge from the SCSS.
- Wangcol Creek Far DS – located on Wangcol Creek approximately 1 km upstream of the confluence with the Coxs River.
- Lamberts Gully Clean Water Diversion (CWD) – located on Lamberts Gully, downstream of the Final Polishing Lagoon.

Additional monitoring of approved water management features would commence following construction and commissioning at the following locations:

- DWP-A.
- DWP-B.
- Huon Clean Water Pond.

Table 4-1 summarises the location, frequency and parameters of surface water quality monitoring for WCS.

LEGEND

- Project approval area
- Storage
- Watercourse - Non Perennial
- Watercourse - Perennial

Monitoring locations

- Residuals
- Surface water storage
- Surface water

LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	Refer to scalebar

Western Coal Services
Water Management Plan

Surface water monitoring locations - Springvale Coal Services site

CENTENNIAL
Springvale Coal Services Operation

DATE 25/07/2024

Figure 4-2

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Table 4-1 Surface water quality monitoring program

Location	Frequency	Parameters
Cooks Dam	Fortnightly	**Physicochemical:** EC, pH, TSS, turbidity. **Dissolved metals:** iron, manganese. **Other:** oil and grease.
	Quarterly	**Major ions:** alkalinity (bicarbonate, carbonate, hydroxide, total), calcium, chloride, magnesium, potassium, sodium, sulfate, total hardness. **Nutrients:** nitrate, nitrite, nitrate + nitrite. **Dissolved metals:** aluminium, boron, cadmium, nickel, selenium, zinc. **Total metals:** nickel, zinc.
Final Polishing Lagoon	Monthly	**Physicochemical:** EC, pH, TSS. **Other:** oil and grease.
Main Sediment Dam Stockpile Sediment Pond Washery Sediment Pond	Quarterly	**Physicochemical:** EC, pH, TSS. **Other:** oil and grease.
Collection Pond	Monthly	**Physicochemical:** EC, pH, TSS, turbidity. **Dissolved metals:** iron, manganese. **Other:** oil and grease.
Wangcol Creek Gauge Wangcol Creek US Wangcol Creek DS Wangcol Creek Far DS Lamberts Gully CWD Following commissioning: DWP-A DWP-B Huon Clean Water Pond	Monthly	**Physicochemical:** EC, pH, 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 Kjeldahl nitrogen, total nitrogen, total phosphorus. **Dissolved metals:** aluminium, boron, cadmium, iron, manganese, nickel, selenium, zinc. **Total metals:** nickel, zinc. **Other:** oil and grease.

Conveyor at Brays Lane

There are no surface water quality monitoring locations at the conveyor system at Brays Lane.

4.3 Discharge water monitoring

Continuous flow monitoring is undertaken for the discharge at LDP001 in accordance with EPL 21229. The location of LDP001 and LDP002 are shown in Figure 1-3 and Figure 3-5 respectively.

Table 4-2 outlines the discharge water quality monitoring required by EPL 21229.

Table 4-2 Discharge water quality monitoring program

Location	Frequency	Parameters
LDP001	Monthly during discharge	**Physicochemical:** EC*, pH*, TSS, turbidity*. **Dissolved metals:** iron, manganese, nickel, zinc. **Other:** oil and grease.
LDP002		**Physicochemical:** EC*, pH*, TSS, turbidity*. **Other:** oil and grease.

*Sampling method - Representative sample. All others are grab samples.

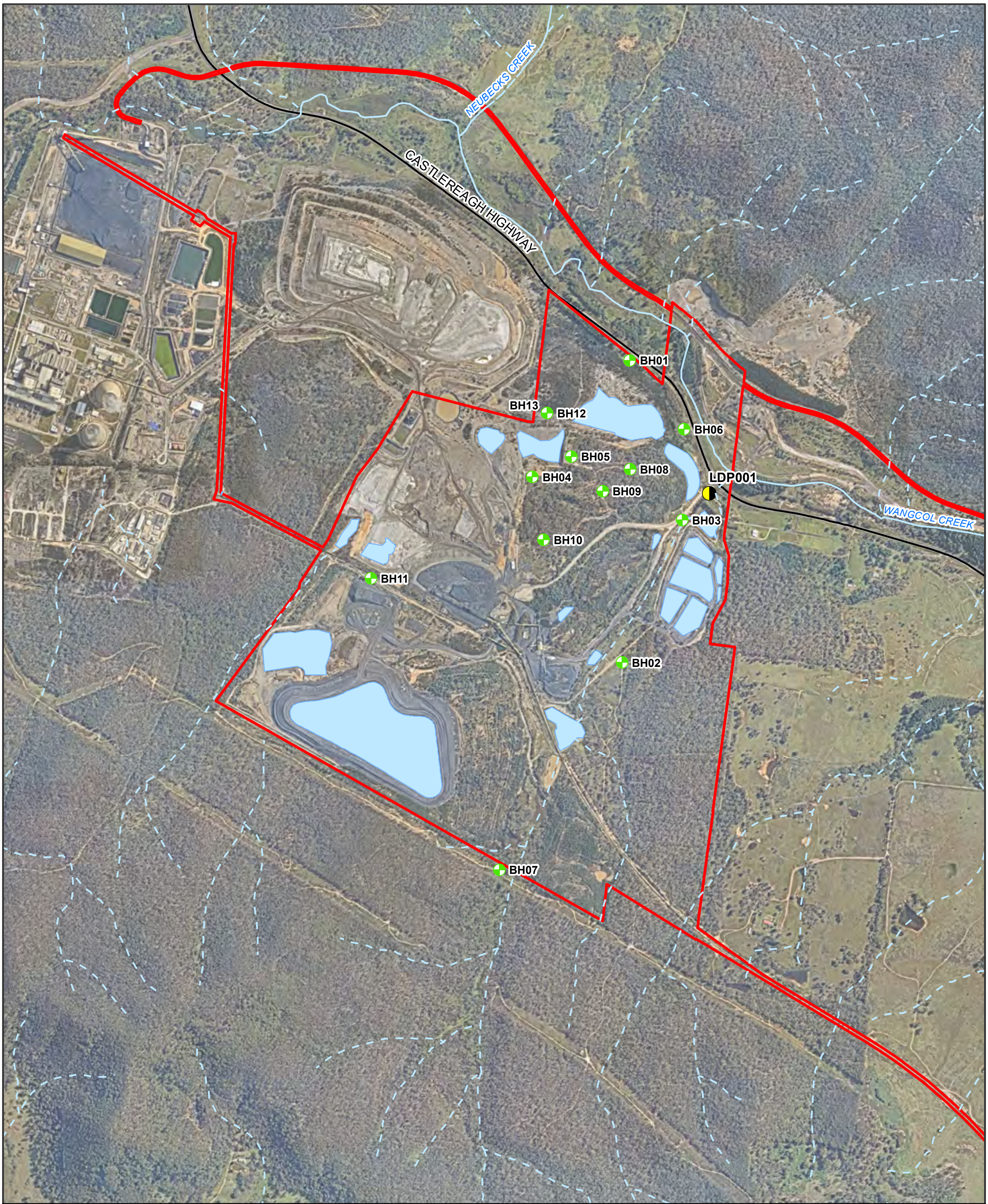
4.4 Groundwater monitoring

4.4.1 Springvale Coal Services site

The groundwater monitoring program at SCSS includes manual sampling of groundwater bores for water level and water quality. Monitoring location details are provided in Table 4-3, with locations shown in Figure 4-3. Table 4-4 summarises the location, frequency, parameters of groundwater monitoring, and monitoring category.

Loggers were installed in select monitoring bores in 2017 to inform groundwater level response to climatic and operational changes. Groundwater levels and EC are collected automatically at these bores and recorded every one to two hours. Monitoring results are presented in Appendix G.

BH11 was decommissioned as part of rehabilitation works being undertaken in the area as part of handback activities to EnergyAustralia. On completion of the rehabilitation works a new bore was installed to allow safe access and appropriate monitoring in proximity to the decommissioned BH11.



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Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

LEGEND

- Project approval area
- Licensed discharge point
- Road
- Storage
- Watercourse - Non Perennial
- Watercourse - Perennial
- Centennial Coal borehole

LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	refer to scalebar

Western Coal Services
Water Management Plan

Groundwater monitoring -
Springvale Coal Services site

CENTENNIAL
Springvale Coal Services Operation

DATE 23 July 2024

Figure 4-3

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Table 4-3 Groundwater monitoring details – Springvale Coal Services site

Location	Easting, Northing (MGA94 Zone 56)	Top of casing elevation (m AHD)[3]	Lithology	Monitoring category
BH01	225978, 6305018	912.96	Lithgow Seam (18.3 m bgl)	Site boundary water quality
BH02	225944, 6303877	916.87	Marrangaroo Formation/Berry Siltstone (30 m bgl)	Clean water quality
BH03	226205, 6304410	906.02	Saturated overburden (18.57 m bgl)	Lamberts Gully water quality
BH04	225611, 6304579	930.68	Lithgow Seam (void) (27.51 m bgl)	Historical underground mine groundwater
BH05	225757, 6304656	929.56	Lithgow Seam (unmined pillar) (30.19 m bgl)	Historical underground mine groundwater
BH06	226234, 6304651	906.30	Lithgow Seam (9.3 m bgl)	Site boundary water quality
BH07	225486, 6303099	925.09	Up-gradient saturated overburden (33 m bgl)	Site boundary water quality
BH08	225979, 6304608	928.23	Lithgow Seam (void) (24.4 m bgl)	Historical underground mine groundwater
BH09	225876, 6304526	930.68	Lithgow Seam (void) (25.5 m bgl)	Historical underground mine groundwater
BH10	225653, 6304342	937.27	Lithgow Seam (void) (25.2 m bgl)	Lamberts Gully Open Cut
BH11	225002, 6304196	TBC[4]	TBC[4]	TBC[4]
BH12	225669, 6304820	917.57	Marangaroo Formation (18.68 m bgl)	Western Main Open Cut
BH13	225666, 6304820	917.60	Backfill (12.37 m bgl)	Western Main Open Cut

[3] CEH survey 28 May 2021
[4] The relocated BH11 drill logs are yet to be reviewed and is yet to be surveyed.

Table 4-4 Groundwater monitoring program

Location	Frequency	Parameters
BH01 **BH02** **BH03** **BH04** **BH05** **BH06** **BH07** **BH08** **BH09** **BH10** **BH11** **BH12** **BH13**	Monthly	Standing water level **Physicochemical:** EC, pH, temperature, TDS, TSS. **Major ions:** alkalinity (bicarbonate, carbonate, hydroxide, total), calcium, chloride, magnesium, potassium, sodium, sulfate, total hardness. **Nutrients:** nitrate, nitrite, nitrate + nitrite, total phosphorus. **Dissolved metals:** iron, manganese, nickel, zinc. **Total metals:** aluminium, boron, cadmium, iron, manganese, selenium, zinc.

4.5 Residuals monitoring

4.5.1 Volume

The volume (or 'flow') of residual stream transferred to the REA is managed by Springvale Coal under SSD-7592, specifically through implementation of the SWTP Brine and Residual Waste Disposal Plan (GHD 2019b). GHD (2019b) states that *"…continuous flow monitoring of the residuals stream pipeline occurs with an inline electronic metering device recording the total volume discharged*.". Flow monitoring results are recorded daily by Springvale Coal and are reported annually in SSD-7592 Annual Review documents, annually in SSD-5579 Annual Review documents, and monthly in accordance with EPL21229 condition L3 which reproduces the SSD-5579 residuals transfer volumetric limits of:

- Daily maximum flow: 0.43 ML/day
- Annual average flow: 0.35 ML/day

Daily maximum flow volumes are monitored via the SWTP supervisory control and data acquisition (SCADA) system and provide notification/alarm when the limit is being approached.

4.5.2 Quality

Monitoring of water quality associated with the residuals stream transferred to the REA from the SWTP and water decanted from the REA is undertaken.

Table 4-5 summarises the location, frequency and parameters of monitoring related to residuals emplacement at the SCSS. The REA cannot be accessed for direct sampling due to safety risks. Water samples are to be collected from the associated infrastructure where a grab sample can be safely collected. The residual monitoring locations are shown in Figure 4-2.

Table 4-5 Residuals monitoring program

Location	Frequency	Parameters
REA Decant	Monthly	**Physicochemical:** EC, pH, TSS, turbidity. **Major ions:** alkalinity (bicarbonate, carbonate, hydroxide, total), calcium, chloride, magnesium, potassium, sodium, sulfate, total hardness. **Nutrients:** nitrate, nitrite, nitrate + nitrite.

Location	Frequency	Parameters
		Dissolved metals: aluminium, boron, cadmium, iron, manganese, nickel, selenium, zinc. **Total metals:** nickel, zinc. **Other:** oil and grease.
SWTP Residuals	Monthly	**Physicochemical:** EC, pH, TSS, turbidity. **Major ions:** alkalinity (bicarbonate, carbonate, hydroxide, total), calcium, chloride, magnesium, potassium, sodium, sulfate, total hardness. **Dissolved and total metals:** aluminium, boron, cadmium, iron, lead, manganese, nickel, selenium, zinc. **Other:** oil and grease.

4.6 Stream health monitoring

4.6.1 Watercourse stability and stream health

Watercourse stability and stream health monitoring is undertaken on an annual basis for Lamberts Gully and Wangcol Creek to provide a baseline assessment of the riparian condition through rating monitoring points using:

- The Rapid Appraisal of Riparian Condition (RARC) protocol developed by Land & Water Australia (Jansen et al., 2005). This assesses the ecological condition of riparian habitats using indicators that reflect functional aspects of the physical, community and landscape features of the riparian zone (a measure of stream health).
- The Ephemeral Stream Assessment protocol developed by the CSIRO to assess the erosional state of the creek at the monitoring location (a measure of channel stability) (CSIRO, 2011).

Each assessment type considers a number of indicators to evaluate (provide a rating for) the condition of watercourse stability and stream health, which are combined into a scoring system to produce a classification.

The monitoring locations presented in Table 4-6 undergo watercourse stability and stream health monitoring.

Table 4-6 Stream health monitoring locations

Location	Purpose	Description	Coordinates UTM Zone: 56H
Lamberts Gully			
LG01	Upstream reference site	Upstream from the REA embankment. The channel at this location consists of a broad floodplain with water ponding in areas.	225599 E 6303251 N
LG02	Impact site	Downstream of the Main Sediment Dam, upstream of the Stockpile Sediment Pond within the CWD.	225833 E 6303818 N
LG03		Downstream of the Stockpile Sediment Pond within the CWD.	225957 E 6304027 N

LG04		Within a constructed trapezoidal channel adjacent to the CWD and the Co-disposal REA.	226136 E 6304346 N
LG05		Downstream of LDP001 at the Castlereagh Highway culvert.	226315 E 6304533 N
Wangcol Creek			
WC01	Impact site	Downstream of LDP001 discharge (Lamberts Gully) confluence with Wangcol Creek.	226426 E 6304596 N
WC02	Upstream reference site	Approximately 200 m upstream of LDP001 discharge confluence with Wangcol Creek.	226269 E 6304787 N
WC03		Approximately 600 m upstream of LDP001 discharge confluence with Wangcol Creek.	226222 E 6305082 N

The program monitors the effects of the WCS water management system on the receiving waterways including impacts and/or risks pertaining to vegetation cover, erosion, and creek stability.

4.6.2 Aquatic ecology

Centennial has a comprehensive aquatic ecology monitoring program within the upper Coxs River catchment. Aquatic ecology monitoring occurs biannually in spring and autumn seasons as per the NSW AUSRIVAS protocols (Turak *et al*. 2004).

The following monitoring locations, as shown in Figure 4-4, are relevant to operations at WCS:

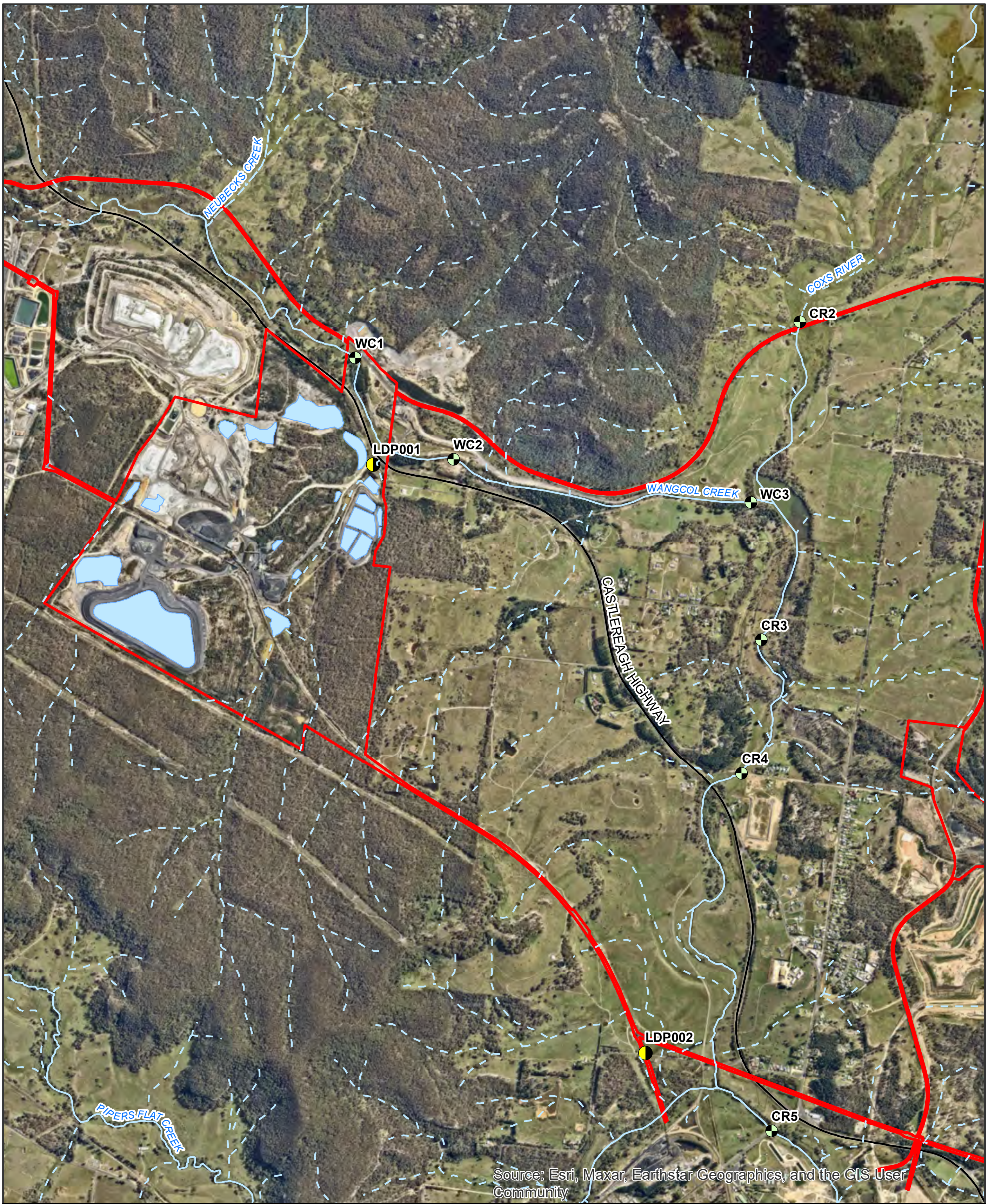
- Reference site:
  - WC1 – located on Wangcol Creek approximately 700 m upstream of LDP001 discharge from the SCSS.
- Impact sites:
  - WC2 – located approximately 400 m downstream from LDP001 on Wangcol Creek.
  - WC3 – located on Wangcol Creek, nearby its confluence with the Coxs River, approximately 2 km downstream of LDP001.
  - CR2 – located on Coxs River at the Mount Piper Haul Road crossing, approximately 1 km downstream of LDP001 discharge from Angus Place Colliery.
  - CR3 – located on Coxs River downstream of Wangcol Creek and upstream of Sawyers Swamp Creek confluences.
  - CR4 – located on Coxs River at the Maddox Lane Road crossing downstream of discharges from Angus Place Colliery, Springvale Mine and WCS.
  - CR5 – located on Coxs River at the Main Street Road crossing downstream of discharges from Angus Place Colliery, Springvale Mine and WCS.

The aquatic ecology monitoring methodology includes:

- Sampling, sorting and identification of macroinvertebrates, associated with pool edge habitat in accordance with the Australian Rivers Assessment System (AUSRIVAS) protocols (Turak *et al*. 2004).
- Assessment of the condition of the aquatic habitat using modified NSW AUSRIVAS field sheets.
- Measurement of DO, EC, pH, temperature and turbidity just below the surface of the water column and at depth where sufficient water is available.
- Collection of surface water and sediment grab samples for water and sediment quality analysis.

Aquatic ecology monitoring is undertaken in autumn and spring seasons as defined by the AUSRIVAS manual (Turak *et al.* 2004). There is some inherent variability in weather conditions, however samples are avoided shortly after substantial rain (greater than 20 mm in 24 hours), which can both flush macroinvertebrates from sites and also fill previously dry pools, which would contain limited taxa if sampled only shortly after rain.

The program monitors the effects of licensed discharges to the Coxs River catchment including the impacts on water quality, sediment quality and the impacts of these on river health (based on macroinvertebrate community condition).



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Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

LEGEND

- Project approval area
- Aquatic ecology monitoring site
- Licensed discharge point
- Storage
- Watercourse - Non Perennial
- Watercourse - Perennial
- Road

LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	refer to scalebar

Western Coal Services
Water Management Plan

Aquatic ecology monitoring

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Springvale Coal Services Operation

DATE 23 July 2024

Figure 4-4

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© LPI: DTDB, 2012. LIDAR: Imagery, 2015; Centennial: Boundary, site features

5. Baseline data

5.1 Surface water monitoring

5.1.1 Surface water quality

Appendix H presents the baseline surface water quality data for selected parameters monitored at surface water storages on site and Wangcol Creek. Table 5-1 presents the extent of baseline data considered.

Where the analytical result was below the limit of reporting (LOR) for a particular parameter, then the detection limit was included in the calculation.

Table 5-1 Details of baseline surface water quality data

Location	Period from	Period to	Number of points
Cooks Dam	26/07/2010	21/03/2024	137-377
Final Polishing Lagoon (formerly Retention Pond)	29/10/2010	21/03/2024	232-306
Main Sediment Dam	29/10/2010	21/03/2024	227-311
Stockpile Sediment Pond	24/05/2011	21/03/2024	221-304
Washery Sediment Pond	22/09/2011	21/03/2024	218-297
Collection Pond	12/01/2012	21/03/2024	161-198
Lamberts Gully CWD	01/05/2020	07/03/2024	20-21
Wangcol Creek Gauge	22/09/2011	07/03/2024	104-240
Wangcol Creek US	05/01/2000	07/03/2024	105-840
Wangcol Creek DS	05/01/2000	07/03/2024	105-840
Wangcol Creek Far DS	22/09/2011	07/03/2024	109-240

5.1.2 Surface water flow

No monitoring of surface water flow is required to be undertaken by WCS.

5.2 Discharge water monitoring

5.2.1 Volume

LDP001

LDP001 discharge volume at the SCSS is measured continuously. Historical discharges are presented in Figure 5-1, along with rainfall recorded on site.

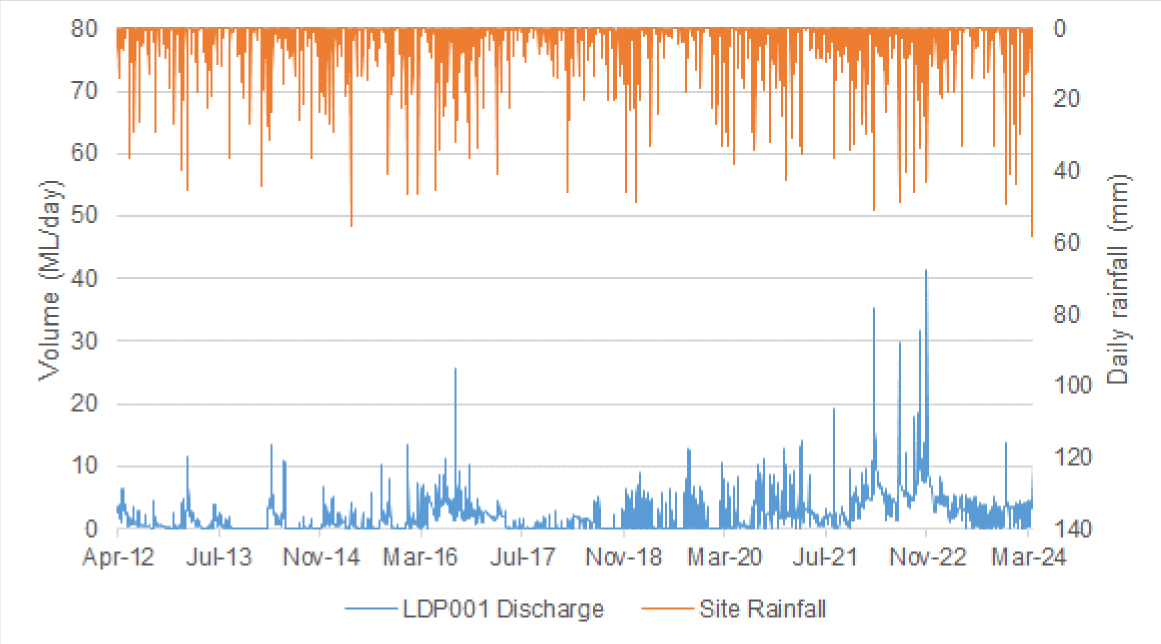

Figure 5-1 Recorded LDP001 discharge volume

5.2.2 Water quality

Appendix I presents the baseline discharge water quality data. Table 5-2 presents the extent of baseline data considered.

Table 5-2 Details of baseline discharge water quality data

Location	Period from	Period to	Number of points
LDP001	05/01/2000	07/03/2024	127–543

LDP001 discharge EC, pH and turbidity is monitored continuously. Historical results are presented in Figure 5-2, Figure 5-3, Figure 5-4 for EC, pH and turbidity respectively, along with rainfall recorded on site.

No baseline data are available for LDP002 as it has only discharged on four occasions.

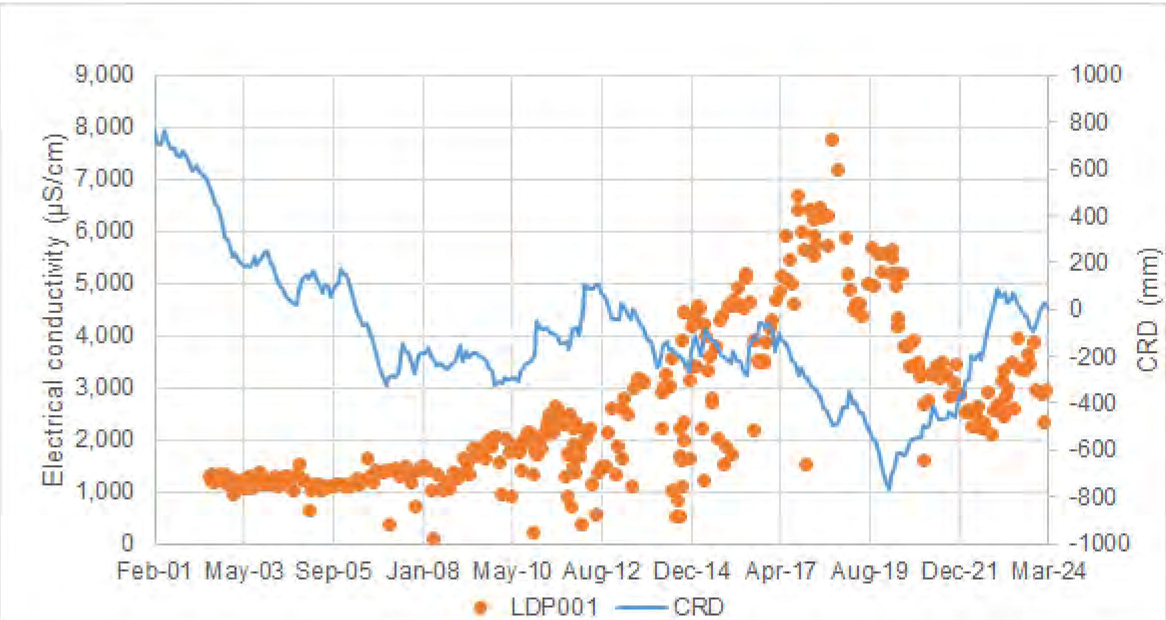

Figure 5-2 Recorded LDP001 discharge electrical conductivity

EC trended upwards from the beginning of monitoring until August 2018. Over the last five years, EC has generally trended downward, which is likely attributable to the above average rainfall received throughout this period.

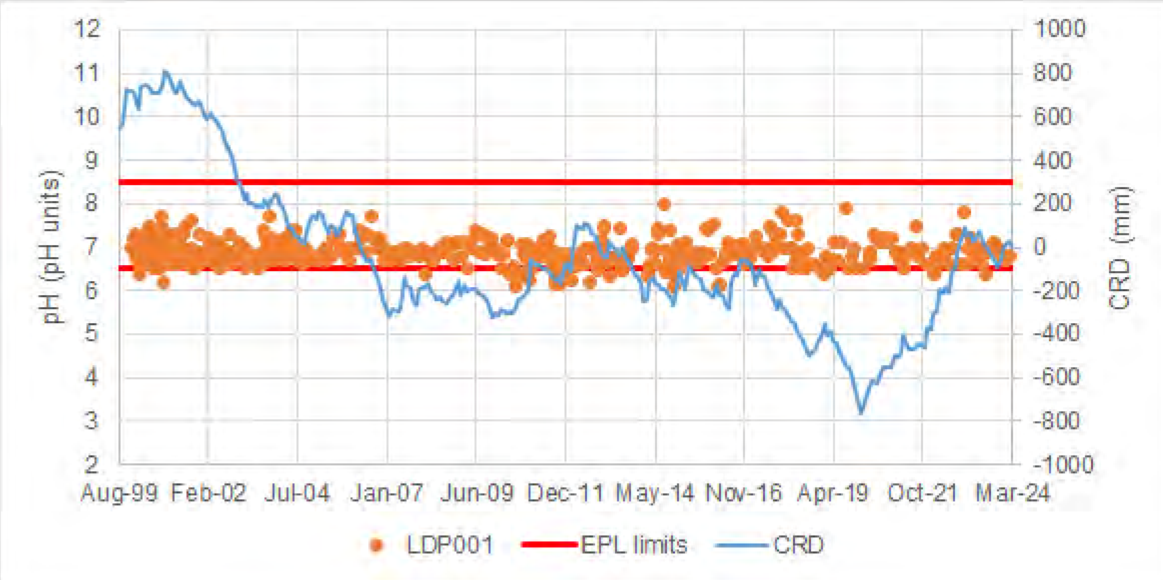

Figure 5-3 Recorded LDP001 discharge pH

pH levels have remained relatively constant throughout the reporting period. The trend indicates neutral pH conditions for the discharge, which are generally within the EPL limits.

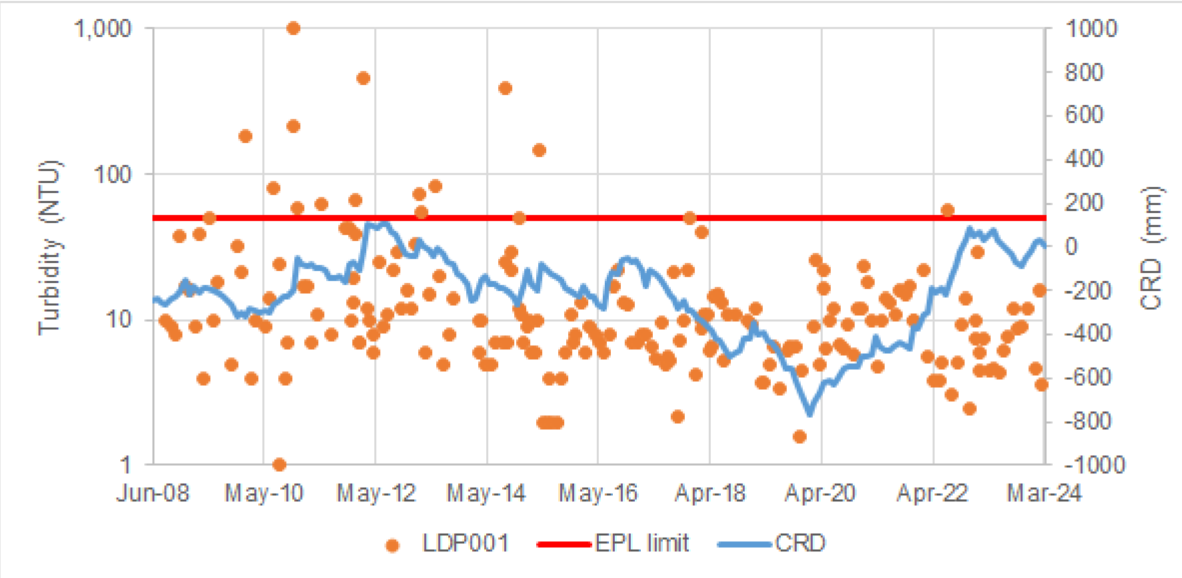

Figure 5-4 Recorded LDP001 discharge turbidity

Turbidity has remained below the EPL limit for the past five reporting years, except for one event due to above average rainfall. Periods of higher turbidity strongly correlate with rainfall events.

5.3 Groundwater monitoring

Appendix G presents the baseline groundwater level and quality data for SCSS. Table 5-3 presents the extent of baseline data considered. BH10 and BH12 have been consistently dry over the monitoring period and therefore no baseline groundwater data are presented for these bores.

Table 5-3 Details of baseline groundwater data

Location	Period from	Period to	Number of points
BH01	22/05/2015	27/03/2024	96-191
BH02	22/05/2015	09/02/2023	59-128
BH03	22/05/2015	27/03/2024	98-196
BH04	11/06/2015	27/03/2024	100-189
BH05	22/05/2015	27/03/2024	100-189
BH06	22/05/2015	27/03/2024	102-195
BH07	22/05/2015	27/03/2024	106-196
BH08	22/05/2015	27/03/2024	103-197
BH09	22/05/2015	27/03/2024	76-143
BH11	11/06/2015	23/06/2021	68-123
BH13	22/05/2015	27/03/2024	94-180

5.4 Residuals monitoring

Monitoring of decant water and residuals stream commenced in 2019 following the commissioning of the residuals pipeline. Residuals flow, and residuals and decant water quality results are displayed and discussed annually in the Western Coal Services Annual Review.

5.5 Stream health monitoring

5.5.1 Geomorphic condition

Springvale Coal Services site

A baseline assessment of geomorphology for Wangcol Creek downstream of LDP001 discharges from SCSS was undertaken for the SWTP (GHD 2016b). The reach of Wangcol Creek downstream of LDP001 is considered to be in poor to moderate geomorphic condition.

Based on the River Styles and geomorphic condition, the assessed extent of Wangcol Creek downstream of LDP001 has been subdivided into six reaches as mapped in Figure 5-5 and summarised in Table 5-6. Downstream of LDP001, Wangcol Creek exhibits four different watercourse types (as per the River Styles framework, Brierley and Fryirs, 2005). The River Styles identified were:

- Valley fill system – These are relatively flat, featureless valley floor surfaces highly susceptible to heavy rainfall events.
- Low sinuosity, gravel bed system – Low-sinuosity channel surrounded by continuous floodplains.
- Partly confined, gravel bed system – Low-sinuosity channel set within a partly confined valley.
- Gorge system – Exhibits a single, low-sinuosity channel confined within bedrock considered very stable.

Further inspections of the condition of Wangcol Creek were undertaken in July 2017, with no change in geomorphic condition observed since 2016.

Kerosene Vale Stockpile Area and conveyor at Brays Lane

No geomorphic assessment has been undertaken within the Coxs River catchment to cover the conveyor at Brays Lane, due to the low risk from the minor catchment. Baseline geomorphic conditions and watercourse stability at KVSA, if any, is described in the Angus Place Colliery Water Management Plan (GHD 2019a).

5.5.2 Watercourse stability and stream health condition

Annual baseline data for watercourse stability and stream health are available from 2022 (SLR 2023) and are produced in Table 5-4 and Table 5-5 respectively.

Table 5-4 Watercourse stability baseline data

Location	2022 Classification	2023 Classification	Trend
WC01	Very Poor	Very Poor	Static
WC02	Very Poor	Very Poor	Static
WC03	Very Poor	Very Poor	Static
LG01	Excellent	Excellent	Static
LG02	Average	Average	Static
LG03	Average	Average	Static
LG04	Very Poor	Very Poor	Static
LG05	Very Poor	Very Poor	Static

There is no description for each designated 'Classification'; the information collected is useful to compare this total score over time to see how the biodiversity and functionality of the riparian zone is progressing at each of the locations.

Table 5-5 Stream health baseline data

Location	2022 Classification	2023 Classification	Trend
WC01	Potentially stabilising	Potentially stabilising	Static
WC02	Stable	Stable	Static
WC03	Potentially stabilising	Potentially stabilising	Static
LG01	Very stable	Very stable	Static
LG02	Potentially stabilising	Potentially stabilising	Static
LG03	Stable	Stable	Static
LG04	Potentially stabilising	Potentially stabilising	Static
LG05	Potentially stabilising	Potentially stabilising	Static

Key for Table 5-5 'Classifications':

Very stable	Drainage line is very stable and likely to be in original form. It is able to withstand all flow velocities that have previously occurred in this area and only minimal monitoring is required, predominantly after high flow events, to ensure condition does not deteriorate.
Stable	Drainage line is stable. It is important to assess this zone in relation to the other classifications and define whether this zone is moving from potentially stabilizing to a more stable form, or if it is deteriorating from a very stable form. The nature of this relationship will identify the type of monitoring required.
Potentially stabilising	Drainage line is potentially stabilising. Ongoing monitoring is required while rehabilitation works are not needed in the immediate future.

5.5.3 Aquatic ecology

Routine aquatic ecology monitoring of the upper Coxs River and its major tributaries is undertaken as part of a regional monitoring program by Angus Place Colliery, Lidsdale Siding, Springvale Mine and WCS. Generally, the monitoring program has shown that Wangcol Creek has minimal instream aquatic habitat, due to historical mining within the catchment, a diversion of the watercourse, and the preponderance of exotic trees including pines and willows in the riparian zone. There is evidence of ongoing erosion of the creek banks, and in some areas the substrate of the creek is bedrock.

LEGEND

Springvale Coal Services Development Consent

Historical mining area

Reach

- WC1
- WC2
- WC3
- WC4
- WC5
- WC6

Waterbody

Watercourse - Non Perennial

Watercourse - Perennial

LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	Refer to scalebar

Western Coal Services
Water Management Plan

Distribution of reaches along Wangcol Creek downstream of LDP001

CENTENNIAL
Springvale Coal Services Operation

DATE 23/07/2024

Figure 5-5

\\ghdnet\ghd\AU\Newcastle\Projects\22\0105001\GIS\Maps\Deliverables\Western\WesternCoal\12579944\WMP\12579944_WMP022_WCReaches_6.mxd

Data source: LPI: DTDB/Imagery, 2012, 2015. Centennial Coal: Imagery, 2016. Created by: tmorton

Table 5-6 Wangcol Creek geomorphology summary

Reach	Length	Type	Condition	Comments	Photographs	
WC1	N/A, extends upstream from LDP001 discharge entry point	Valley fill	Moderate	Swampy area with no defined channel. Active headcut zone at downstream extent. LDP001 discharges enter Wangcol Creek uncontrolled on the right bank upstream of culvert crossing causing bank erosion.	 Upstream view towards headcut zone	 Discharges are eroding the right bank upstream of the culvert Pine Dale Access Road crossing (Structure 2, Table 5-9)
WC2	440 m	Low-sinuosity, gravel bed	Poor	Low-sinuosity channel with limited in-channel diversity. Channel is considered to have been largely excavated into the surrounding in situ material including clay and bedrock.	 Clay and conglomerate exposed in right bank	 . Uniform excavated channel

Reach	Length	Type	Condition	Comments	Photographs	
WC3	845 m	Low-sinuosity, gravel bed	Poor to moderate	In the upstream section, the channel is inset within natural materials and banks are prone to localised erosion. In the downstream section, the channel is deeper and bounded by overburden and coal reject material.	 Upstream section displays localised erosion of banks composed of in situ alluvial silt	 View of right bank composed of coal reject materials
WC4	740 m	Partly confined, gravel bed	Moderate	Typically, stable channel with well vegetated banks composed of overburden materials. Valley is confined by Pine Dale haul road to the north and a flood and/or visual bund to the south of the channel.	 Upstream view with southern bank adjacent to Pine Dale haul road	 Downstream view displaying right bank composed of overburden

Reach	Length	Type	Condition	Comments	Photographs	
WC5	130 m	Partly confined, gravel bed	Poor	Section impacted by disused railway bridge crossing. Shotcrete channel to protect crossing which discharges via an approximate 1 m drop into a large scour pool with eroding banks.	 Upstream view of rail crossing and shotcrete channel (Structure 6 Table 5-9)	 Large scour pool downstream of rail crossing with eroding banks
WC6	85 m	Gorge	Poor	Excavated channel in bedrock before discharging into flooded open pit void of the Commonwealth Mine.	 Downstream view of gorge section	 Wangcol Creek discharges to flooded void of Commonwealth Mine

6. Response plans

6.1 Triggers

6.1.1 Surface water quality triggers

Water quality monitored at the Lamberts Gully CWD and Wangcol Creek Far DS monitoring site is assessed against surface water quality triggers derived for the catchment, as shown in Table 6-1. Previously, trigger values were based on site-specific guideline values (see Appendix H.3.8) derived from up-catchment reference site SW1 and were deemed unsuitable for water quality performance due to downstream influence of surrounding mining and power generation activities. Surface water quality trigger values have been revised and are based on Wangcol Creek Gauge as a reference site (see Appendix H.3.9) to better assess influence from WCS LDP001 discharges.

Downstream water quality impacts due to LDP001 are subject to a pollution reduction program under EPL 21229 (refer to Section 1.2.3). Until the implementation of the MOD4 approved water management system, downstream surface water quality is assessed against these management triggers. Management triggers have been derived based on the 95th percentile of water quality within the upstream Wangcol Creek Gauge using 38 data points between June 2019 and April 2022, shown in Table 6-1. Where 95th percentile values were below the DGVs outlined in ANZG (2018), the DGV was applied, excepting the lower pH value, of which the 5th percentile value was chosen.

Wangcol Creek Gauge was selected as the monitoring location farthest upstream on Wangcol Creek but within the Project Approval Area. The 95th percentile has been adopted to reflect the observed historical range but exclude outliers due to potential sampling inconsistencies.

Table 6-1 Surface water quality triggers

Parameter	Units	Trigger value
Physicochemical		
pH	pH units	5.9–9.0
EC	µS/cm	4,063
TDS	mg/L	3,173
TSS	mg/L	25
Turbidity	NTU	35
Nutrients		
Ammonia	mg/L	0.04
Total nitrogen	mg/L	0.8
Total phosphorus	mg/L	0.08
Dissolved metals		
Aluminium	mg/L	0.11
Boron	mg/L	1.15
Cadmium	mg/L	0.0026

Parameter	Units	Trigger value
Iron	mg/L	0.80
Manganese	mg/L	3.81
Nickel	mg/L	0.207
Selenium	mg/L	0.011
Zinc	mg/L	0.11

6.1.2 Discharge water triggers

Discharge water limits for the LDPs are detailed in Table 6-2.

Table 6-2 Licensed discharge point water quality concentration limits

Parameter	Units	LDP001 and LDP002
Oil and grease	mg/L	10
pH	pH units	6.5–8.5
Total suspended solids (TSS)	mg/L	30
Turbidity	NTU	50

In accordance with EPL 21229 Conditions:

- L2.5 The concentration limits stipulated by condition L2.4 (Table 6-2) for EPA identification point 1 and 2 are deemed not to apply when the discharge from the stormwater control structures (sediment dams) occurs solely as a result of rainfall measured at the premises which exceeds: a) a total of 56 millimetres of rainfall over any consecutive 5 day period.
- Note: A 56mm rainfall event is defined by the EPA endorsed publication "Managing urban stormwater: soils and construction" (Landcom 2004; 6-24) as the rainfall depth in millimetres for a 95th percentile 5 day rainfall event for "Lithgow" which is also consistent with the storage capacity (recommended minimum design criteria) for Type D sediment basins for mines and quarries (see "Managing urban stormwater: soils and construction, Volume 2E, mines and quarries" (DECC, 2008).
- L2.6 The concentration limit for total suspended solids stipulated by condition L2.4 (Table 6-2) for EPA identification point 1 and 2 is deemed not to have been breached where:

  a) the water discharged is covered by condition L2.5; or
  b) the water discharged complies with the turbidity limit at the time of the discharge; and
  c) the EPA is advised within 3 working days of the completion of the sample testing and analysis as required by condition M2.3 of any results above the licence limit.

  Note: The purpose of condition L2.6 is to expedite the assessment and subsequent discharge of the clarified water from the stormwater control structures (sediment basins).

6.1.3 Groundwater triggers

Groundwater level

Groundwater level trigger values are based on an exceedance of historical 95th percentile of the observed groundwater level, as shown in Table 6-3. With no active mining at the site, depressurisation leading to potential impacts is highly unlikely. Changes in water management or emplacement of material have the potential to elevate groundwater levels leading to new or changes to existing surface groundwater interactions.

As discussed in Section 5.3, bores BH10 and BH12 have been consistently dry over the monitoring period. Therefore, trigger values have not been applied at these monitoring locations. BH11 has been decommissioned and a new trigger will be developed when it is replaced.

Table 6-3 Groundwater level trigger values

Location	Lithology	Trigger value (m AHD)
BH01	Lithgow Seam	909.0
BH02	Marrangaroo Formation/Berry Siltstone	900.0
BH03	Saturated overburden	904.0
BH04	Lithgow Seam (void)	910.0
BH05	Lithgow Seam (unmined pillar)	909.0
BH06	Lithgow Seam	901.0
BH07	Up-gradient saturated overburden	910.0
BH08	Lithgow Seam (void)	909.0
BH09	Lithgow Seam (void)	910.0
BH13	Backfill	910.0

Groundwater quality

The commonwealth *National Environment Protection Council Act 1994* was consulted for the method to develop Groundwater Investigation Levels (GILs) (Schedule B1 of the National Environment Protection (Assessment of site contamination) measure (NEPM 2011)). Groundwater quality trigger values have been developed by the same GIL method for selected parameters which is in accordance with ANZG (2018) methodology for deriving site specific guideline values. Trigger values are based on a comparison of 80th percentile historical concentrations (20th percentile for lower pH), and DGVs for physicochemical stressors (ANZECC 2000) and toxicants (ANZG 2018). The highest of the DGV or 80th percentile was chosen to represent the natural fluctuations in the groundwater source (the lower of the 20th percentile value or the DGV was used for the lower pH trigger value). Groundwater trigger values are presented in Table 6-4. Historical baseline 80th percentile, 20th percentile, median and count data is given in Appendix G. 3.1.

Table 6-4 Groundwater quality trigger values

Parameter	Units	Trigger values										
		BH01	BH02	BH03	BH04	BH05	BH06	BH07	BH08	BH09	BH11	BH13
Physicochemical												
EC	µS/cm	4,440	1,468	1,377	505	640	2,660	3,500	5,478	5,742	1,828	4,228
pH	pH Units	5.5-8.0	6.4-8.0	3.6-8.0	6.3-8.0	6.4-8.0	6.1-8.0	5.5-8.0	5.9-8.0	6.0-8.0	6.5-8.0	6.2-8.0
Major ions												
Sulfate	mg/L	2,244	444	634	36	38	1,042	1,986	2,760	2,860	749	1,930
Nutrients												
Nitrite	mg/L	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.01
Nitrate	mg/L	0.16	0.45	0.39	0.69	0.54	0.12	0.49	0.28	0.32	0.40	0.20
NOx	mg/L	0.16	0.06	0.39	0.70	0.54	0.15	0.49	0.28	0.32	0.40	0.20
TP	mg/L	0.09	0.49	0.04	0.06	0.07	0.06	0.12	0.04	0.04	0.04	0.16
Dissolved metals												
Iron	mg/L	4.5	0.7	77.1	2.3	0.6	10.0	126.4	3.4	13.9	1.3	10.5
Manganese	mg/L	9.90	1.90	7.61	1.90	1.90	1.90	4.92	8.76	7.87	1.90	8.76
Nickel	mg/L	1.01	0.100	0.316	0.012	0.029	0.148	0.693	0.791	0.716	0.028	0.406
Zinc	mg/L	0.949	0.100	1.02	0.071	0.074	0.079	2.71	0.409	0.496	0.101	0.193

Parameter	Units	Trigger values										
		BH01	BH02	BH03	BH04	BH05	BH06	BH07	BH08	BH09	BH11	BH13
Total metals												
Aluminium	mg/L	2.26	44.8	12.4	0.78	0.79	0.31	2.09	0.44	0.90	0.53	1.81
Boron	mg/L	0.94	0.94	0.94	0.94	0.94	0.94	0.94	2.04	2.13	0.94	1.48
Cadmium	mg/L	0.0005	0.0020	0.0005	0.0002	0.0002	0.0002	0.0007	0.0004	0.0004	0.0002	0.0003
Selenium	mg/L	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

6.1.4 Water from Springvale Water Treatment Project

EPL 21229 stipulates limits that the site can accept filtration residuals from the SWTP. These are details in Table 6-5 below.

Table 6-5 Waste from Springvale Water Treatment Project limits

Waste	Description	Activity	Other Limits
Filtration residuals	Residuals from primary treatment of mine water from the Springvale Water Treatment Project	Waste disposal (application to land)	Volume accepted must not exceed 0.35 ML/day (annual average) or 0.43 ML/day (daily maximum)

6.1.5 Residuals triggers

Monitored water quality of the decant water from the REA is assessed against triggers with reference to monitoring data from REA Decant. Trigger values are based on an exceedance of the 80th percentile historical concentrations (based on over four years of data from June 2019 to March 2024) as shown in Table 6-6. For lower pH, the 20th percentile historical values are used.

Table 6-6 Decant water quality trigger values

Parameter	Units	Trigger value
Physicochemical parameters		
EC	µS/cm	3,252
pH	pH units	7.5-8.5
TSS	mg/L	13,020
Turbidity	NTU	4,000
Dissolved metals		
Aluminium	mg/L	0.06
Boron	mg/L	0.20
Cadmium	mg/L	0.0003
Iron	mg/L	0.13
Manganese	mg/L	0.234
Nickel	mg/L	0.080
Selenium	mg/L	0.01
Zinc	mg/L	0.189
Other		
Oil and grease	mg/L	5

6.1.6 Stream health triggers

Watercourse stability and stream health triggers have been derived from baseline data for the monitoring points presented in Section 5.5.2. Triggers are based on the condition classifications whereby a declining trend in watercourse stability and/or stream health would trigger a response action.

6.2 Performance criteria

Performance criteria have been developed from baseline information. These criteria form the basis of the trigger action response plans (TARPs) provided in Appendix J.

6.2.1 Surface site operations

The performance criteria for surface water management are outlined in Table 6-7.

Table 6-7 Surface water management criteria

Aspect	Criteria
Surface water storages	Storages sized in accordance with Landcom (2004) and DECC (2008) and maintained within the capacity of each storage to maximise containment capacity and minimise seepage to surface.
Water quality management	Clean and dirty water separation.
Erosion and sediment control	Minimising disturbance area. Surface disturbance and other construction activities is to be managed in accordance with the approach and guidelines outlined in Appendix E. Where construction works are significant, an erosion and sediment control plan and construction environmental management plan will be prepared.
Hydrocarbon management	Chemical and hydrocarbon storage to be undertaken in accordance with Australian Standard AS1940:2004.

6.2.2 Watercourses

Table 6-8 presents the watercourse management criteria for WCS.

Table 6-8 Watercourse criteria

Aspect	Criteria
Water quality	Within or below triggers provided in Appendix H, Table H-5. Until the implementation of the MOD 4 water management system (refer to Section 3), within or below interim surface water quality triggers provided in Table 6-1.

6.2.3 Discharge management

The performance criteria developed for discharge management is provided in Table 6-9.

Table 6-9 Discharge management criteria

Aspect	Criteria
Discharge volume	Consistent with site water balance predictions and historical baseline data.
Discharge quality	Within or below water quality limits for LDP001 and LDP002 provided in EPL 21229.

6.2.4 Groundwater environment

Table 6-10 presents the groundwater environment management criteria.

Table 6-10 Groundwater environment criteria

Aspect	Criteria
Groundwater level	Groundwater level below trigger values provided in Table 6-3.
Groundwater quality	Within or below trigger values provided in Table 6-4.
Surface to groundwater connectivity	Divert all feasible surface water volumes that are likely to form recharge of the groundwater environment.

6.2.5 Residuals

The performance criteria for management of the rejects (at the REA) are outlined in Table 6-11.

Table 6-11 Springvale Coal Services site – Residuals management criteria

Aspect	Criteria
Erosion or scour	Occurrence of erosional or scour processes do not occur as a result of residual disposal.
Water volume	Divert all feasible surface water volumes that are likely to form recharge of the groundwater environment.
Water quality	Within or below trigger values provided in Table 6-6.

6.2.6 Stream health

The performance criteria developed for stream health are provided in Table 6-12.

Table 6-12 Stream health criteria

Aspect	Criteria
Watercourse stability and stream health	
Incisional processes and instabilities	Occurrence of erosional processes does not occur as a result of discharges.
Instream/riparian vegetation	No change in vegetation type and density from previous monitoring rounds.
Aquatic ecology	
Macroinvertebrate community condition	Assessment of macroinvertebrate metrics (taxa richness, EPT richness and SIGNAL-2) and multivariate analyses of macroinvertebrate data (including MDS, Cluster analysis, ANOSIM and SIMPER) indicates no impairment attributable to licensed discharges from the site.

6.3 Trigger action response plans

TARPs are provided in Appendix J for:

- Surface site operations.
- Watercourses.
- Discharge management.
- Groundwater environment.
- Stream health.
- Residuals management.

7. Site-specific reviews and reports

7.1 Reporting requirements

The reporting requirements for Western Coal Services are as per the requirements provided within EPL 21229 and SSD-5579.

7.2 Groundwater model

A groundwater flow model was developed in 2016 (GHD 2016a) for the Western Coal Services site which estimated groundwater flow conditions and connectivity to surface water storages. The groundwater model was then extended to include groundwater information from MPPS, and updated to include additional data inputs, and modifications to the water management system. The updated groundwater model (Golder 2023) was commissioned in 2019, with a final draft report completed in 2023 in two stages:

- Stage 1 – Conceptual groundwater model.
- Stage 2 – Numerical groundwater model.

The groundwater model is required to be validated every three years in consultation with an independent reviewer. Where the validation process identifies significant variances between monitored and predicted groundwater levels, then a recalibration process may be required to be undertaken.

The model is currently undergoing independent peer review in 2024.

7.3 Site water balance

The site water balance will be reviewed and revised every three years as a minimum or as necessary when there are changes to operations. For each calendar year, the site water balance will be reported as part of the annual review.

The site water balance review was completed in 2022 (GHD 2022a).

8. References

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APPENDIX A – Correspondence with regulators

SUBMISSION FOR APPROVAL DETAILS	Revision	Circulation date	Feedback date	Approval date
	0	04/08/2014	Nil	Nil
	1	18/10/2017	12/11/2017	Nil
	2	15/03/2019	Nil	Nil
	6	16/02/2023	23/11/2023	TBC

CONSULTATION DETAILS	Circulation date	Department	Feedback date
	28/07/2014	DPI Division of Resources and Energy	04/08/2014
		EnergyAustralia	Nil
		NSW EPA	Nil
		Forestry Corporation	Nil
		Lithgow City Council	Nil
		Sydney Catchment Authority	Nil
	27/09/2017	WaterNSW	18/10/2017
		Forestry Corporation	Nil
		EnergyAustraila	26/10/2017
		Lithgow City Council	06/10/2017
		Crown Lands and Water Division of Industry NSW	12/11/2017
		Office of Environment and Heritage	13/10/2017
		NSW EPA	Nil
	28/02/2019	NSW EPA	14/03/2019
	22/12/2016	DPI Water	10/02/2017
	22/12/2016	EPA	03/02/2017
	16/02/2023	NSW DPE	23/11/2023

Centennial Coal

29 July 2014

Mr Greg Kininmonth
Manager & Principal Inspector Environment
NSW Trade & Investment
PO Box 674
WOLLONGONG NSW 2500

Dear Greg,

Western Coal Services Water Management Plan (Western Coal Services DA SSD-5579)

Schedule 3, Condition 24 of the Western Coal Services Project's Development Consent SSD-5579 sets out the requirement for the preparation and implementation of a Water Management Plan within 4 months of the Consent.

The Water Management Plan has been prepared in consultation with the Environment Protection Authority, NSW Office of Water, Sydney Catchment Authority, Forestry Corporation of NSW, Energy Australia and Lithgow City Council.

Western Coal Services is submitting the Water Management Plan electronically. Please see attached a copy of the final draft of the 2014 Water Management Plan for your information and comment.

If you have further questions regarding the Western Coal Services Water Management Plan, please contact our Environmental Officer, Martin Howe on martin.howe@centennialcoal.com.au.

Yours faithfully,

Graeme Glazebrook

Graeme Glazebrook

Coal Distribution Manager - West
Centennial Coal

Centennial Coal

Centennial Coal
Environment Matters

29 July 2014

Mr Nino Di Falco
Energy Australia
Environment Manager - Western
350 Boulder Road
PORTLAND NSW 2847

Dear Nino,

Western Coal Services Water Management Plan (Western Coal Services DA SSD-5579)

Schedule 3, Condition 24 of the Western Coal Services Project's Development Consent SSD-5579 sets out the requirement for the preparation and implementation of a Water Management Plan in consultation with the Environment Protection Authority, NSW Office of Water, Sydney Catchment Authority, Forestry Corporation of NSW, Energy Australia and Lithgow City Council.

Please see attached a copy of the draft 2014 Water Management Plan for your information and comment.

If you have further questions regarding the Western Coal Services Water Management Plan, please contact our Environmental Officer, Martin Howe on martin.howe@centennialcoal.com.au.

Yours faithfully,

Graeme Glazebrook

Graeme Glazebrook

Coal Distribution Manager - West
Centennial Coal

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Centennial Coal

Centennial Coal Environment Matters

29 July 2014

Mr Andrew Helms
Environment Protection Authority
Regional Operations Bathurst
PO Box 1388
BATHURST NSW 2795

Dear Andrew,

Western Coal Services Water Management Plan (Western Coal Services DA SSD-5579)

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If you have further questions regarding the Western Coal Services Water Management Plan, please contact our Environmental Officer, Martin Howe on martin.howe@centennialcoal.com.au.

Yours faithfully,

Graeme Glazebrook

Graeme Glazebrook

Coal Distribution Manager - West
Centennial Coal

Centennial Coal

29 July 2014

Mr Jack Cotterill
Regional Manager
Forests NSW
PO Box 143
BATHURST NSW 2795

Dear Jack,

Western Coal Services Water Management Plan (Western Coal Services DA SSD-5579)

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If you have further questions regarding the Western Coal Services Water Management Plan, please contact our Environmental Officer, Martin Howe on martin.howe@centennialcoal.com.au.

Yours faithfully,

Graeme Glazebrook

Graeme Glazebrook

Coal Distribution Manager - West
Centennial Coal

Centennial Coal

29 July 2014

Ms Jessica Heath
Environment and Development Department
Lithgow City Council
PO Box 19
LITHGOW NSW 2790

Dear Jessica,

Western Coal Services Water Management Plan (Western Coal Services DA SSD-5579)

Schedule 3, Condition 24 of the Western Coal Services Project's Development Consent SSD-5579 sets out the requirement for the preparation and implementation of a Water Management Plan in consultation with the Environment Protection Authority, NSW Office of Water, Sydney Catchment Authority, Forestry Corporation of NSW, Energy Australia and Lithgow City Council.

Please see attached a copy of the draft 2014 Water Management Plan for your information and comment.

If you have further questions regarding the Western Coal Services Water Management Plan, please contact our Environmental Officer, Martin Howe on martin.howe@centennialcoal.com.au.

Yours faithfully,

Graeme Glazebrook

Graeme Glazebrook

Coal Distribution Manager - West
Centennial Coal

Centennial Coal

Centennial Coal
Environment Matters

29 July 2014

Dr Girja Sharma
Senior Assessment Officer
Sydney Catchment Authority
PO Box 323
PENRITH NSW 2750

Dear Girja,

Western Coal Services Water Management Plan (Western Coal Services DA SSD-5579)

Schedule 3, Condition 24 of the Western Coal Services Project's Development Consent SSD-5579 sets out the requirement for the preparation and implementation of a Water Management Plan in consultation with the Environment Protection Authority, NSW Office of Water, Sydney Catchment Authority, Forestry Corporation of NSW, Energy Australia and Lithgow City Council.

Please see attached a copy of the draft 2014 Water Management Plan for your information and comment.

If you have further questions regarding the Western Coal Services Water Management Plan, please contact our Environmental Officer, Martin Howe on martin.howe@centennialcoal.com.au.

Yours faithfully,

Graeme Glazebrook

Graeme Glazebrook

Coal Distribution Manager - West
Centennial Coal

RE: Western Coal Services Water Management Plan
Greg Kininmonth
to:
Martin Howe
04/08/2014 11:22 AM
Cc:
Bernie Kirsch
Hide Details
From: Greg Kininmonth <greg.kininmonth@trade.nsw.gov.au>
To: Martin Howe <martin.howe@centennialcoal.com.au>,
Cc: Bernie Kirsch <Bernie.Kirsch@centennialcoal.com.au>

Hi Martin

I have reviewed the 'Centennial Western Coal Services Project Water Management Plan", submitted with a covering letter from Graeme Glazebrook dated 29 July 2014.

It is noted that the Water Management Plan does not need to be prepared in consultation with DRE. However, the opportunity to provide comment is appreciated.

The content of the Plan is generally supported by DRE, with some significant improvements noted compared to a previously reviewed document "Surface Water Management Plan, Springvale Coal Services, January 2013". The majority of issues raised in my review of that document (letter dated 26 April 2013, sent to Graeme Glazebrook) are satisfactorily addressed in the new Plan.

Further Action

Is suggested that the following additional changes are made to the Water Management Plan:

1) It would be preferable if a surface map of the site included differentiation of clean and dirty water areas. At present, catchment boundaries are marked on Figures 7 and 15 but there is no clearly defined differentiation between clean and dirty water areas of the site.
2) It would be preferable if general flow paths/flow direction within sub-catchments were identified to more clearly show flow direction. At present, it is difficult to work out flow paths across the site on Figures 7 and 15 without referring back to the contour plan (Figure 5). An additional figure or figures may be worthwhile which included catchment boundaries, contours and arrows showing general water flow direction. Alternatively, contour lines could be added to Plans 7 and 15 or catchment boundaries could be added to Figure 5, provided this would not result in loss of clarity.

Once approved by the Dept of Planning and Environment, please submit a copy of the Water Management Plan to DRE as an attachment to the Mining Operations Plan. The Mining Operations Plan may also require modification to ensure consistency with the Water Management Plan.

If you require further information with regard to this issue please feel free to contact me.

Regards

Greg Kininmonth | Manager & Principal Inspector Environment (Wollongong)
NSW Trade & Investment | Division of Resources & Energy | Environmental Sustainability Unit
Level 1, Block H | 84 Crown Street | Wollongong NSW 2500
PO Box 674 | Wollongong NSW 2500
T: 02 4222 8304 | F: 02 4226 3851 | M: 0429 168 021 | E: greg.kininmonth@trade.nsw.gov.au
E: www.trade.nsw.gov.au

From: Martin Howe [mailto:martin.howe@centennialcoal.com.au]
Sent: Tuesday, 29 July 2014 8:04 AM
To: greg.kininmonth@industry.nsw.gov.au
Subject: Western Coal Services Water Management Plan

Greg,

Please find attached a copy of the Western Coal Services Water Management Plan for your review. Any feed back and comments would be greatly appreciated.

Thank you.

Regards

Martin Howe
Environment and Community Officer

p: +61 (0) 2 6355 9509 | m: +61 (0) 428 602 069

Centennial Coal

Centennial Coal Company Limited | Western Coal Services
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W: www.centennialcoal.com.au

27 September 2017

Mr Mitchell Isaacs
Director Planning, Policy, Assessment and AD
DPI-Water
Locked Bag 5123
PARRAMATTA NSW 2124

Dear Mr Isaacs

Centennial Coal - Western Coal Services Water Management Plan

Following approval of the Western Coal Services Project (SSD_5579) MOD 1, Springvale Coal has revised the Western Coal Services Water Management Plan.

A copy of the revised Western Coal Services Water Management Plan has been enclosed for your review and comment.

Can you please provide feedback in writing by 5pm on Friday 13 October 2017 to:

James Wearne
Group Approvals Manager
Centennial Coal
PO Box 1000
TORONTO NSW 2283
james.wearne@centennialcoal.com.au

Yours sincerely

James Wearne
Group Approvals Manager

Enclosed

- Western Coal Services Water Management Plan

Centennial Coal Company Limited ABN 30 003 714 538

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27 September 2017

Mr Darryl Clift
Head Central West Unit
Environment Protection Authority
PO Box 1388
BATHURST NSW 2795

Dear Mr Clift

Centennial Coal - Western Coal Services Water Management Plan

Following approval of the Western Coal Services Project (SSD_5579) MOD 1, Springvale Coal has revised the Western Coal Services Water Management Plan.

A copy of the revised Western Coal Services Water Management Plan has been enclosed for your review and comment.

Can you please provide feedback in writing by 5pm on Friday 13 October 2017 to:

James Wearne
Group Approvals Manager
Centennial Coal
PO Box 1000
TORONTO NSW 2283
james.wearne@centennialcoal.com.au

Yours sincerely

James Wearne
Group Approvals Manager

Enclosed
- Western Coal Services Water Management Plan

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27 September 2017

Mr Dan Kirby
Fire and Stewardship Manager
Forestry Corporation of NSW
PO Box 143
BATHURST NSW 2795

Dear Mr Kirby

Centennial Coal - Western Coal Services Water Management Plan

Following approval of the Western Coal Services Project (SSD_5579) MOD 1, Springvale Coal has revised the Western Coal Services Water Management Plan.

A copy of the revised Western Coal Services Water Management Plan has been enclosed for your review and comment.

Can you please provide feedback in writing by 5pm on Friday 13 October 2017 to:

James Wearne
Group Approvals Manager
Centennial Coal
PO Box 1000
TORONTO NSW 2283
james.wearne@centennialcoal.com.au

Yours sincerely

James Wearne
Group Approvals Manager

Enclosed
- Western Coal Services Water Management Plan

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27 September 2017

Mr Graeme Faulkner
General Manager
Lithgow City Council
PO Box 19
LITHGOW NSW 2790

Dear Mr Faulkner

Centennial Coal - Western Coal Services Water Management Plan

Following approval of the Western Coal Services Project (SSD_5579) MOD 1, Springvale Coal has revised the Western Coal Services Water Management Plan.

A copy of the revised Western Coal Services Water Management Plan has been enclosed for your review and comment.

Can you please provide feedback in writing by 5pm on Friday 13 October 2017 to:

James Wearne
Group Approvals Manager
Centennial Coal
PO Box 1000
TORONTO NSW 2283
james.wearne@centennialcoal.com.au

Yours sincerely

James Wearne
Group Approvals Manager

Enclosed
- Western Coal Services Water Management Plan

Centennial Coal Company Limited ABN 30 003 714 538

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W: www.centennialcoal.com.au

27 September 2017

Mr Peter Dupen
Manager Mining
WaterNSW
PO Box 323
PENRITH NSW 2751

Dear Mr Dupen

Centennial Coal - Western Coal Services Water Management Plan

Following approval of the Western Coal Services Project (SSD_5579) MOD 1, Springvale Coal has revised the Western Coal Services Water Management Plan.

A copy of the revised Western Coal Services Water Management Plan has been enclosed for your review and comment.

Can you please provide feedback in writing by 5pm on Friday 13 October 2017 to:

James Wearne
Group Approvals Manager
Centennial Coal
PO Box 1000
TORONTO NSW 2283
james.wearne@centennialcoal.com.au

Yours sincerely

James Wearne
Group Approvals Manager

Enclosed

- Western Coal Services Water Management Plan

DOC17/496331

Mr James Wearne
Group Approvals Manager
Centennial Coal
james.wearne@centennialcoal.com.au

Dear Mr Wearne

Western Coal Services Water Management Plan

Springvale Mine Catchment Improvement and Land Management Plan

I refer to the two draft documents emailed to the Office of Environment and Heritage (OEH) on the 27 and 28 September 2017 for comment.

OEH has no specific comment to make on the Western Coal Services Water Management Plan.

Springvale Mine Catchment Improvement and Land Management Plan (CILMP)

OEH considers that the CILMP meets the requirements for schedule 3 condition 18A of the development consent for SSD 5594.

We note that there is overlap between land parcels included in the CILMP and those included as land management and rehabilitation areas (not direct offsets) in the Western Region Biodiversity Offset Package (December 2016).

The CILMP states that the intended instrument for providing long-term security for the subject land is through a positive covenant on the land title under Section 88B of the *Conveyancing Act 1919*. As these are not biodiversity offsets, and condition 18A does not require the parcels to be secured in accordance with the *NSW Biodiversity Offset Policy for Major Projects* or its current version, OEH accepts that this security mechanism is appropriate for these parcels.

Threatened species and endangered ecological communities

The CILMP includes bush regeneration works to rehabilitate and restore two endangered ecological communities (EECs):

- Montane Peatlands and Swamps
- Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland

The CILMP lists three threatened species as being recorded within the project site; Gang-gang Cockatoo, Black Gum and Capertee Stringybark.

Please note that a number of additional species have been recorded in the *Atlas of NSW Wildlife* close to the CLIMP area. These include:

- Dusky Woodswallow

- Scarlet Robin
- Purple Copper Butterfly
- White-bellied Sea-eagle

The CLIMP is also located within areas of Saving Our Species (SOS) conservation projects for Purple Copper Butterfly, Capertee Stringybark and Black Gum.

OEH recommends that the CILMP project manager liaise with OEH threatened species experts and SOS species project co-ordinators regarding the rehabilitation and restoration of EECs and threatened species habitat.

If you have any queries, please contact Liz Mazzer, Conservation Planning Officer on 6883 5325 or email liz.mazzer@environment.nsw.gov.au.

Yours sincerely

PETER CHRISTIE
Director North West
<u>Regional Operations</u>

Date: 13 October 2017

Contact officer: LIZ MAZZER
6883 5325

cc: Paul Freeman, Department of Planning and Environment

1536559: LGS
Environment and Development

Lithgow CITY COUNCIL

Surrounded by Nature · Steeped in History

6 October 2017

James Wearne
James.Wearne@centennialcoal.com.au

Dear James

Centennial Coal - Western Coal Services Water Management Plan

I refer to your email received 27 September 2017 and your request for review of the revised Western Coal Services Water Management Plan for the Western Coal Services Project (SSD_5579) MOD 1.

Council considers that the revised Western Coal Services Water Management Plan, adequately highlights the relevant issues and therefore has no objection to the submission of the Plan in accordance with the requirements of the Western Coal Services Project (SSD_5579) MOD 1.

Please do not hesitate to contact Miss Lauren Stevens who is available between 8.15 am and 11.00 am on (02) 6354 9999, Monday to Friday; in Council's Economic Development and Environment Department should you require any additional information in relation to this matter.

Yours Sincerely

J. Nichols

J Nichols
DEVELOPMENT MANAGER

Centennial Coal
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27 September 2017

Mr Ben Eastwood
NSW Environmental Leader
Mount Piper Power Station
Energy Australia
Locked Bag 1000
PORTLAND NSW 2847

Dear Mr Eastwood

Centennial Coal - Western Coal Services Water Management Plan

Following approval of the Western Coal Services Project (SSD_5579) MOD 1, Springvale Coal has revised the Western Coal Services Water Management Plan.

A copy of the revised Western Coal Services Water Management Plan has been enclosed for your review and comment.

Can you please provide feedback in writing by 5pm on Friday 13 October 2017 to:

James Wearne
Group Approvals Manager
Centennial Coal
PO Box 1000
TORONTO NSW 2283
james.wearne@centennialcoal.com.au

Yours sincerely

James Wearne
Group Approvals Manager

Enclosed

- Western Coal Services Water Management Plan

Fw: Western Coal Services Water Management Plan

James Wearne to: 'Lachlan Hammersley', Neil Thompson, Iain Hornshaw 18/10/2017 12:30 PM

History: This message has been replied to.

Hi Lachlan,

We will discuss this email next week too. No need to action anything now. Management Plan was submitted to DPE today however we may need to make revisions at a later stage depending on this email (which I haven't read yet) and feedback from EA.

Iain, Can you please file email in Doc One and update the register for me please.

Regards

James Wearne
Group Manager Approvals

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Centennial Coal

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100 Miller Road, Fassifern NSW 2283 Australia
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----- Forwarded by James Wearne/CentennialCoal on 18/10/2017 12:29 PM -----

From: Ravi Sundaram <ravi.sundaram@waternsw.com.au>
To: "'james.wearne@centennialcoal.com.au'" <james.wearne@centennialcoal.com.au>
Cc: Peter Dupen <Peter.Dupen@waternsw.com.au>, Malcolm Hughes <Malcolm.Hughes@waternsw.com.au>
Date: 18/10/2017 12:18 PM
Subject: RE: Western Coal Services Water Management Plan

Hello James

Thank you for providing WaterNSW the opportunity to review the WCS Water Management Plan. WaterNSW considers the WMP to be adequate and broadly meets requirements specified in the development consent SSD-5579 MOD1. Some comments and suggestions regarding the WMP are provided below.

- The Upper Coxs River Action and Monitoring Plan (UCRAMP) apply to operations of the WCS site. The UCRAMP includes a number of actions specific to the operation of WCS which are listed in Appendix C of the WMP. WaterNSW supports the actions identified and notes that some of these actions have already been implemented while others have been commenced. One of the actions under the plan relevant to WCS site operations is Wangcol Creek catchment improvement works to maintain and enhance the biodiversity values in the catchment. WaterNSW requests these works be implemented as soon as possible.

- Clean water diversions (WMP Table 3-1) are being progressively implemented since 2017 to divert clean catchment runoff from disturbed areas. One such diversion is the clean water diversion of the surface water from the upper Huon Gully to Lamberts Gully. The diversion once in place will improve clean water management at the WCS site and reduce the amount of groundwater entering Cooks Dam.
WaterNSW notes that the Mt Piper Power Station (MPPS) Brine Conditioned Fly Ash Co-Placement Project Annual environmental Monitoring Report (AEMR) 2016-17 recommended consideration of increasing groundwater recharge in Huon Gully to dilute salts in groundwater and reduce concentration of analytes at groundwater bores downstream of Huon Gully (D8 and D9) and at Neubecks (Wangcol) Creek at surface water monitoring site WX22. The diversion of surface water from the upper Huon Gully will effectively remove a source of groundwater recharge from the Huon Gully and hence remove a possible control measure for the chloride plume entering Huon Gully groundwater from the Mt Piper brine conditioned fly ash placement area. This issue must be addressed in accordance with the communication protocol developed with Energy Australia (see below).
- Dirty water runoff (coal contact and sediment-laden water) is managed by a number of dirty water storages (Cooks Dam, Main Sediment Pond, SLG 1 to SLG6, Stockpile Sediment Pond and Washery Sediment Pond) which enable suspended solids to settle out and reuse of the water in site processes, thereby minimising the potential for dirty water discharges into the surrounding environment. WaterNSW notes that the sediment ponds SLG1 to SLG5 located upstream of the Main Sediment Pond in the Lamberts Gully Area discharge into the Main Sediment Pond. These are designed as ‘fill and spill’ sediment ponds and not as per the 95^{th} percentile 5 day design criteria specified in the Blue Book as listed in WMP Table 3-3. WaterNSW considers that more justification as to why the Blue Book criteria was not adopted in this instance must be provided.
- The Erosion and Sediment Control Plan provided in Appendix E is generic and needs to refer to actual plan(s) that can be implemented on-site by on-site personnel and that show where the erosion and sediment control features are to be located. This plan needs to be updated as site conditions change.
- There is significant interaction between the WCS site managed by Centennial Coal and the adjoining MPPS owned and operated by Energy Australia with regards to water management. A communication protocol has been established to guide the coordination and management of WCS site and mining operations, and MPPS site to minimise impacts on downstream receiving water environment (refer Appendix F). WaterNSW supports this communication protocol and recommends that discussion between Centennial Coal and Energy Australia is necessary to address the issue of reduced groundwater recharge from Huon Gully identified above.
- Section 5.2.2 and Appendix G presents the baseline surface water quality data for selected parameters monitored at WCS surface water storages on site, Wangcol Creek, and LDP discharges. However there is no discussion provided regarding these results. WaterNSW requests that an analysis and discussion of these results including any trends must be provided in the WMP.
- WaterNSW notes that the time series graphs of water quality results (G.1.2 – Site Sediment Ponds; G2.2.2 – Wangcol Creek sites; and Figure 5.3 – LDP006 discharge) during the baseline period include electrical conductivity and Total Dissolved Solids (TDS) as key water quality parameters. An increasing trend in EC and TDS values is seen from 2012 to 2017 at both the Wangcol Downstream and Far Downstream sites and at discharges from LDP006. The Response Plans and surface water quality triggers presented in Section 6.1, Table 6.1 and Appendix G however do not set any triggers for EC or TDS. Both EC and TDS are important water quality parameters in relation to salinity and considered important with regards to the requirements for salinity in the Upper Coxs River. Centennial Coal must clarify how EC and TDS measurements will be considered in assessing the impacts on surface water quality due to WCS site construction and operations.

Please call or email me if you wish to discuss any matter raised above.

Regards.

Ravi

Dr Ravi Sundaram
Mining Catchment Specialist
WaterNSW
Level 14 169 Macquarie Street
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Parramatta, NSW 2124
www.waternsw.com.au

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m.: +61 428 226 152
email: Ravi.Sundaram@waternsw.com.au

From: James Wearne [mailto:James.Wearne@centennialcoal.com.au]
Sent: Wednesday, 27 September 2017 1:47 PM
To: Peter Dupen
Subject: Western Coal Services Water Management Plan

Hi Peter,

Please find attached a copy of the revised Water Management Plan for our Western Coal Services operation for review and comment by WaterNSW

Regards

James Wearne
Group Manager Approvals

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Centennial Coal

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EnergyAustralia
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Wallerawang Power Station
1 Main Street
Wallerawang NSW 2845
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Facsimile (02) 6352 8

enq@energyaustralia.com.au
www.energyaustralia.com.au

26 October 2017

James Wearne
Group Approvals Manager
Centennial Coal
PO Box 1000
TORONTO NSW 2283

Reference: A976329

Dear Mr Wearne,

Western Coal Services Water Management Plan

I refer to your letter dated 27 September 2017 regarding the draft Western Coal Services Water Management Plan (WMP). Thank you for the opportunity for EnergyAustralia NSW to provide comment on the WMP. The WMP has been well considered and appears to be very thorough in the identification of environmental risks and trigger action response plans to manage potential environmental impacts. EnergyAustralia NSW requests that Centennial Coal consider the following observations in the draft WMP:

- The Project Boundary for the Western Coal Services Site on some plans (e.g. Figure 1-3) appears to cover land which is managed by EnergyAustralia NSW as part of the Lamberts North Ash repository Project. Please ensure figures accurately reflect the current land management arrangements at the sites.
- Bore Hole 11 is shown as part of the groundwater monitoring network in the WMP. It should be noted that this monitoring point was installed by EnergyAustralia NSW in 2012 as part of the Lamberts North and Lamberts South ash repository area project. This site is identified by EnergyAustralia NSW as groundwater bore MPGM4-D16 and is currently monitored on a monthly basis. It is understood that Centennial Coal access and monitor this groundwater bore on a monthly basis. There is potential for results from this site to be affected from oversampling. EnergyAustralia NSW would appreciate being notified if any other of its existing compliance monitoring groundwater bores are proposed to be accessed by Centennial Coal for monitoring purposes.

- The WMP includes a 'Communications Protocol' in Appendix F of the WMP. EnergyAustralia NSW acknowledges the value that this type of arrangement may have in managing potential cumulative environmental impacts. EnergyAustralia NSW has not had the opportunity to consider this type of arrangement prior to the receipt of the draft WMP. EnergyAustralia NSW would like to discuss these arrangements with Centennial Coal before they be considered finalised and incorporated in the approved WMP.

I would be interested in discussing these arrangements further with Centennial Coal. Please contact me at your earliest convenience to progress this matter.

Please do not hesitate to contact me if you have any questions relating to the above on (02) 63 548 362 or email ben.eastwood@energyaustraliansw.com.au.

Yours sincerely,

Ben Eastwood
NSW Environment Leader
EnergyAustralia NSW

	Energy Australia	Preliminary response	Change/discuss / leave as the same
1	The Project Boundary for the Western Coal Services Site on some plans (e.g. Figure 1-3) appears to cover land which is managed by EnergyAustralia NSW as part of the Lamberts North Ash repository Project. Please ensure figures accurately reflect the current land management arrangements at the sites.	Resolved. EA misunderstanding sorted ?	leave
2	Bore Hole 11 is shown as part of the groundwater monitoring network in the WMP. It should be noted that this monitoring point was installed by EnergyAustralia NSW in 2012 as part of the Lamberts North and Lamberts South ash repository area project. This site is identified by EnergyAustralia NSW as groundwater bore MPGM4-D16 and is currently monitored on a monthly basis. It is understood that Centennial Coal access and monitor this groundwater bore on a monthly basis. There is potential for results from this site to be affected from oversampling. EnergyAustralia NSW would appreciate being notified if any other of its existing compliance monitoring groundwater bores are proposed to be accessed by Centennial Coal for monitoring purposes.	notes to be added to the water management plan, either as words in plan or on the bottom of figures.	discuss
3	The WMP includes a 'Communications Protocol' in Appendix F of the WMP. EnergyAustralia NSW acknowledges the value that this type of arrangement may have in managing potential cumulative environmental impacts. EnergyAustralia NSW has not had the opportunity to consider this type of arrangement prior to the receipt of the draft WMP. EnergyAustralia NSW would like to discuss these arrangements with Centennial Coal before they be considered finalised and incorporated in the approved WMP.	→ Draft to EA to comments – W.I.P. already discussed. Has there been any progression on this ? Will there be anything to address on this yet ?	leave
	Water NSW		
4	The Upper Coxs River Action and Monitoring Plan (UCRAMP) apply to operations of the WCS site. The UCRAMP includes a number of actions specific to the operation of WCS which are listed in Appendix C of the WMP. WaterNSW supports the actions identified and notes that some of these actions have already been implemented while others have been commenced. One of the actions under the plan relevant to WCS site operations is Wangcol Creek catchment improvement works to maintain and enhance the biodiversity values in the catchment. WaterNSW requests these works be implemented as soon as possible.	→ The plan is yet to be approved – not binding agreement Noted	leave
5	Clean water diversions (WMP Table 3-1) are being progressively implemented since 2017 to divert clean catchment runoff from disturbed areas. One such diversion is the clean water diversion of the surface water from the upper Huon Gully to Lamberts Gully. The diversion once in place will improve clean water management at the WCS site and reduce the amount of groundwater entering Cooks Dam.	Noted	leave
6	WaterNSW notes that the Mt Piper Power Station (MPPS) Brine Conditioned Fly Ash Co-Placement Project Annual environmental Monitoring Report (AEMR) 2016-17 recommended consideration of increasing groundwater recharge in Huon Gully to dilute salts in groundwater and reduce concentration of analytes at groundwater bores downstream of Huon Gully (D8 and D9) and at Neubecks (Wangcol) Creek at surface water monitoring site WX22. The diversion of surface water from the upper Huon Gully will effectively remove a source of groundwater recharge from the Huon Gully and hence remove a possible control measure for the chloride plume entering Huon Gully groundwater from the Mt Piper brine conditioned fly ash placement area. This issue must be addressed in accordance with the communication protocol developed with Energy Australia (see below).	As per EIS Commitments The AEMR is not public? Centennial are in the process of implementing a diversion of Huon Gully	discuss
7	Dirty water runoff (coal contact and sediment-laden water) is managed by a number of dirty water storages (Cooks Dam, Main Sediment Pond, SLG 1 to SLG6, Stockpile Sediment Pond and Washery Sediment Pond) which enable suspended solids to settle out and reuse of the water in site processes, thereby minimising the potential for dirty water discharges into the surrounding environment. WaterNSW notes that the sediment ponds SLG1 to SLG5 located upstream of the Main Sediment Pond in the Lamberts Gully Area discharge into the Main Sediment Pond. These are designed as 'fill and spill' sediment ponds and not as per the 95th percentile 5 day design criteria specified in the Blue Book as listed in WMP Table 3-3. WaterNSW considers that more justification as to why the Blue Book criteria was not adopted in this instance must be provided.	– remove from plan as structures (formal) – depression device We were going to propose a self siphon system for these storages to be drawn down. We do believe that these storages have the potential to improve water quality BUT the catchment is stable within these areas.	discuss
8	The Erosion and Sediment Control Plan provided in Appendix E is generic and needs to refer to actual plan(s) that can be implemented on-site by on-site personnel and that show where the erosion and sediment control features are to be located. This plan needs to be updated as site conditions change.	Terminology? Tidy up w/ disclaimer ESCP are typically not undertaken for mine sites, its not practical. These typicals and details are for temporary construction features and or to address problem areas.	discuss
9	There is significant interaction between the WCS site managed by Centennial Coal and the adjoining MPPS owned and operated by Energy Australia with regards to water management. A communication protocol has been established to guide the coordination and management of WCS site and mining operations, and MPPS site to minimise impacts on downstream receiving water environment (refer Appendix F). WaterNSW supports this communication protocol and recommends that discussion between Centennial Coal and Energy Australia is necessary to address the issue of reduced groundwater recharge from Huon Gully identified above.	As above Noted	leave
10	Section 5.2.2 and Appendix G presents the baseline surface water quality data for selected parameters monitored at WCS surface water storages on site, Wangcol Creek, and LDP discharges. However there is no discussion provided regarding these results. WaterNSW requests that an analysis and discussion of these results including any trends must be provided in the WMP.	Discussion to be provided – High level explanation / summary – disclaim	change
11	WaterNSW notes that the time series graphs of water quality results (G.1.2 – Site Sediment Ponds; G2.2.2 – Wangcol Creek sites; and Figure 5.3 – LDP006 discharge) during the baseline period include electrical conductivity and Total Dissolved Solids (TDS) as key water quality parameters. An increasing trend in EC and TDS values is seen from 2012 to 2017 at both the Wangcol Downstream and Far Downstream sites and at discharges from LDP006. The Response Plans and surface water quality triggers presented in Section 6.1, Table 6.1 and Appendix G however do not set any triggers for EC or TDS. Both EC and TDS are important water quality parameters in relation to salinity and considered important with regards to the requirements for salinity in the Upper Coxs River. Centennial Coal must clarify how EC and TDS measurements will be considered in assessing the impacts on surface water quality due to WCS site construction and operations.	Further consultation / SWTP Study / Upstream value concluded The management of EC/TDS is a known issue for the area and not solely the responsibility of Centennial. Sampling of upstream of the sites LDP006 also shows similar trends between 2012 and 2017 as is observed at LDP006. Centennial to provide details on Regis ???	discuss
	DPI Water-Groundwater		
12	The water balance in regards to groundwater is found to be satisfactory. However the details of reporting procedures, including the preparation of a site water balance for each calendar year are not outlined in the WMP.	– no requirement The site is not likely to undergo change like an open cut mine and hence a calendar year approach is not undertaken. Only some components are to change in the life of the site and these were provided in the impact assessment. We have discussed this in the water balance	leave

13	There is no outline of monitoring of groundwater flow into open cut voids. Provision of information in regard to which bores monitor inflow into mining voids is to allow the water regulators to assess the fitness for purpose against the condition of approval (CoA) of the monitoring network;	Table – bores that monitor identified	discuss
14	The proponent has not satisfactorily documented in the WMP report information in regard to CoA 24. (c) (iii) third dot point to "a program to monitor and report on:". No outline or tabulation of the groundwater monitoring bores that monitor seepage leachate from water stores ash emplacements, coal rejects and former open voids is provided. Inclusion of this information along with a brief summary of the ability of the monitoring network to measure this would assist in assessing the adequacy of the Groundwater monitoring programme within the WMP;	Management of the ash emplacement is not part of the WCS Project and is part of MPPS operation and approval conditions	discuss
15	The proponent has not satisfactorily documented in the WMP report information in regard to changes to background groundwater yield/quality against changes induced by development / operations;	CoA 0 for 2014 onwards. Is this a request to retrospectively review predevelopment conditions ?? Pre Lamberts Gully Open cut ? Pre underground mining in the 70's/80s	→ discuss
16	The proponent has not qualified information in regard to monitoring for potential impacts upon regional or local aquifers in the WMP to the satisfaction of the Crown Lands and Water Division; and	– locally significant aquifer – disclaimer based on [illegible] quality	discuss
17	No monitoring of potential impacts upon groundwater supply of surrounding private landholder bores have been qualified or elucidated in the WMP.	the operations interface with a shallow groundwater source (primarily formed out of previous mining activities),	change
18	The WMP does not state when the next three-year review is due or when the last review was conducted. A revision was stated to have occurred during 2016 in Section 3.5.1. Crown Lands and Water Division assumes this is the year in which the last revision occurred. This should be clarified within the relevant modelling validation statement.	→ Statement This will be updated	change
19	The TARP does not provide timeframes for the actions and notifications to be conducted.	Update TARP. (Regional) As per the notification requirements, this will be added to the TARP	change – Consulted approach
	DPI Water-Surface water		
	Section 3.1 of the WMP notes that clean water runoff is typically from remnant vegetation or rehabilitated catchments (page 33). Figure 3.1 shows clean water runoff from Lamberts Gully is diverted into the main sediment pond at the Springvale Coal Services site. It is noted that the diversion of all clean water from upstream catchment areas is currently being implemented (see section 3.2.1, page 44). It is suggested the WMP explains why clean water is being diverted to the sediment pond and whether this will stop once the diversion of clean water at the site is implemented.	– Water Contingency Structure, The main sediment dam has been part of the landform for some time. To change this would require some significant disturbance works. Until the site operation is completed the use of the sediment basin as a feature of that catchment was a comprimise to allow for restoration works to commence.	discuss
	Section 3.2.1 notes the waterway of Lamberts Gully as part of the clean water diversion works has been diverted through the Retention Pond. It is also indicates that water from the Retention Pond supplements water supply to the washery when required (page 36). The proponent needs to clarify whether the Retention Pond will continue to collect clean water and use it as a water supply. If so, the volume of clean water being used will need to have a water access licence.	RCIP, Reference, EIS Commitment A section on harvestable rights and licensing conditions will be added. The water balance provided as part of the plan provides a transparent accounting of the water take of which requires licensing under industrial use.	discuss
	Section 3.2.1 of the WMP notes surface water management actions currently being implemented include improvement and maintenance of the riparian habitat of Lamberts Gully and Wangcol Creek within the Springvale Coal Services Site. Crown Lands and Water Division supports the improvement and maintenance of the riparian habitat and recommends the WMP includes a scaled plan which locates the areas along Lamberts Gully and Wangcol Creek where riparian habitat is being rehabilitated.	Reference. RHCIP prepared in 2017 for these works. Works were also outlined in modification assessment	discuss
	Section 4.1 notes site inspections are undertaken within 24 hours following rainfall events that exceed 20mm in 24 hours. It is recommended the sediment and erosion and control measures are inspected weekly and prior to heavy rainfall events	Talk to Geoff M. → Reconcile inspection list. Inspection requirements to be updated	change
	Table 1.2 in the WMP indicates that Condition 24 (c) (ii) of the Development Consent for SSD-5579 MOD 1 requires a program to monitor and report on surface water flow in the watercourses potentially affected by the development but Section 4.2.2 notes no monitoring of surface water flow is undertaken by Western Coal Services. It is recommended Section 4.2.2 explains why no surface water flow monitoring is undertaken when a condition of approval requires this monitoring to occur.	→ VCRAMP Commitment → Propose at end of diversion – LDP006 has historically monitored all catchment flow. New equipment to be installed ?	discuss

→ Done for LDP006

	Section 4.6.1 notes watercourse stability monitoring is undertaken where discharges from the Springvale Coal Services Site contribute to the downstream environment. It indicates visual monitoring is undertaken during routine inspections. Additional details are required on this including: - the frequency of proposed inspections - it is suggested visual inspections are undertaken after storm / rainfall events (once the water levels drop in the creek) and when discharges are made as the potential impacts on the stability of the watercourses are likely to be greatest following heavy rainfall/flow events and site discharge;	Inspection checklist update Justification. not feasable, we will suggest putting a risk perspective on it. Erosion downstream of the site is a low risk with flood modelling prepared by others. The works undertaken by others within the waterway are likely to present greater impact than anything proposed from WCS.	leave
	details on where the inspections are undertaken and the length along the watercourses that are inspected and whether areas both upstream and downstream of the discharge points are inspected. The areas inspected should be shown on a scaled map in the WMP;	As above not feasable, downstream of site	leave
	any specific site inspection locations should also be identified and details included in the WMP on their location;	NA	leave
	the inspection locations need to be identified on the ground to assist with ongoing inspections;	NA (GPS Point location)	~~leave~~ subsidence
	details on how the visual inspections will measure and record if any watercourse instability has occurred, for example a photographic record should be kept at the inspection sites to provide supporting evidence for the visual inspections - the WMP needs to include a comprehensive plan for visual and photographic surveys.	This is appropriate at Mandalong Mine not WCS. WCS is not an underground mine and the operations are not likely to create impact from discharges alone over and above that of exisitng catchement contribution has. If there was to be a dam failure or multiple this would be the only instance that a change of any magnitude would occur???	leave
	The WMP should explain why cross-sectional surveys along the watercourses are not proposed to show if the watercourses are stable or eroding. It is noted in Section 5.4.2 that there is evidence of ongoing erosion of Wangcol Creek. Cross sectional surveys would show the extent the creek is eroding over time.	noted but the risk is not there. Maybe every 3 years undertake this. Geomorph determined rates of change are unlikely to indicate changes in time less than that period. Exemplified by the head cut at the boundary.	leave
	Section 4.6.1 states no watercourse stability monitoring is undertaken at the Kerosene Vale Stockpile Area or the Conveyor at Brays Lane. The WMP should explain why monitoring is not undertaken or proposed at these locations.	risk assessment. As Monitoring per EPL Again risk assessment indicates that this is a low risk??? Maybe site inspection weekly can look at this	change
	The WMP indicates that two of the impact monitoring sites (WC2 and WC3) are to be replaced by WC4. It notes these points were determined to be inappropriate locations for monitoring (page 66). It is suggested the WMP includes an explanation as to why these sites are considered to be inappropriate and why WC4 is preferred.	commentary can be added	change
	identify if aquatic monitoring will be undertaken over a range of seasons and weather conditions; - identify if the monitoring program proposes to monitor discharge related impacts or watercourse stability, or both; - provide clarity around both the design and type of impact being monitored (macroinvertebrates may be affected differently depending on the type of impact); - include information about what will define/determine an impact including a statement about affect size (ie how large does the difference between reference and impact assemblages have to be before it is decided there is an impact).	yes all information is available	change
	Table 5.2 indicates baseline discharge water quality data at LDP006 has been monitored from 5/1/2000 but Figures 5.3, 5.4 and 5.5 for LDP006 only show historical results commencing from April 2012. It is suggested the figures are amended to include the full record of water quality monitoring from 2000.	2014 Onward. We typically present historical data sets at 2 year windows to provide clarity in the data.	change
	Section 5.4.1 notes downstream of LDP006 that Wangcol Creek exhibits four different watercourse types as per the River Styles Framework: Valley Fill system; Low Sinuosity Gravel bed system; Partly Confined Gravel Bed system and Gorge system. It is recommended: - a figure is included in the WMP which shows the location of these 4 different watercourse types; - details are provided on the sensitivity of these watercourse types, for example valley fill systems are fragile types of watercourses; and - the WMP includes details on current erosion along the watercourses and how this relates to the watercourse types.	→ Update as required. → Dismiss where possible yes more information can be provided, the reviewer needs to appreciate that the operational influence is limited by the cumulative environmental influence from other neighbouring operations. Not all surrounding environment features are the responsibilities for management by CEY.	change

Department of Primary Industries
Water

Contact: Janne Grose
Phone: 02 8838 7505
Email: janne.grose@dpi.nsw.gov.au

Our ref: V13/1132#35 & OUT17/45593
File No:
Your Ref:

12 November 2017

Mr James Wearne
Centennial Coal Company Limited
100 Miller Road
FASSIFERN NSW 2283
James.Wearne@centennialcoal.com.au

Dear Mr Wearne

Western Coal Services Project – SSD-5579 MOD 1 – Springvale Coal – Revised Western Coal Services Water Management Plan

Thank you for your email of 27 September 2017 to DPI requesting that Crown Lands and Water Division (formerly DPI Water) reviews the revised Water Management Plan (WMP).

Crown Lands and Water Division has reviewed the WMP and provides the following recommendations below, and further detail in Attachment A.

<u>Groundwater</u>

The WMP does not adequately meet all required in the Conditions of Approval (CoA) (Condition 24 (c) (iii)).

The WMP can be improved by clearly covering all the Conditions of Approval in a well-structured document that is set out to directly reflect the listed Conditions of Approval. The WMP should include the following recommendations.

Prior to approval

- Outline details of reporting procedures, including the preparation of a site water balance for each calendar year.
- Provide an outline of monitoring of groundwater flow into open cut voids, qualification of which bores monitor which historic disturbance (former open cut pits). Such information could be captured in one of the existing tables relating to the drill holes locations or drill hole target stratigraphy.
- Include:
    - an outline or tabulation of the groundwater monitoring bores which monitor seepage leachate from water stores ash emplacements, coal rejects and former open voids. Along with a brief summary of the ability of the monitoring network to measure the seepage to these features;
    - a brief summary of any changes to background groundwater yield/quality against changes induced by development / operations has been qualified or elucidated in the WMP;
    - a brief summary to qualify how the groundwater monitoring programme will monitor potential impacts upon regional or local aquifers in the WMP;

    - a brief discussion on how the groundwater monitoring program will enable monitoring of potential impacts upon groundwater supply of surrounding private landholder water users; and
    - timeframes within the TARP for which the actions and notifications are to be conducted within.
- Clarify within the relevant modelling validation statement, when the last model revision was done and when the next model revision is due.

A hydrogeologist from Crown Lands and Water Division can be made available to discuss the above groundwater issues and any outstanding matters.

Surface Water

- The proponent needs to clarify whether clean water will continue to be collected and used as a water supply at the Springvale Coal Services site. If so, the volume of clean water being used will need to have a Water Access Licence.
- The WMP includes a scaled plan which locates the areas along Lamberts Gully and Wangcol Creek where riparian habitat is being rehabilitated.
- Sediment and erosion and control measures are also inspected weekly and prior to heavy rainfall events.
- The WMP explains why no surface water flow monitoring is being undertaken when a condition of approval requires this monitoring to occur.
- The WMP includes additional details on the geomorphic condition and watercourse stability monitoring and the watercourse types as per the River Styles Framework and how this relates to erosion along the watercourses.
- The WMP includes additional details on the aquatic monitoring as outlined in Attachment A.

For further information please contact Janne Grose, Water Regulation Officer at Crown Land and Water Division (Parramatta Office) on **t:** (02) 8838 7505; **e:** janne.grose@dpi.nsw.gov.au.

Yours sincerely

Irene Zinger
Manager – Regulatory Operations
Metro
Water Regulation

Attachment A

Western Coal Services Project – SSD-5579 MOD 1 – Springvale Coal
Revised Western Coal Services Water Management Plan
Crown Lands and Water Division comments

Crown Lands and Water Division provides the following comments on the draft Water Management Plan (WMP).

Groundwater

The WMP is not clear on a number of categories, as listed in the Conditions of Approval.

The water balance in regards to groundwater is found to be satisfactory. However the details of reporting procedures, including the preparation of a site water balance for each calendar year are not outlined in the WMP.

The current groundwater monitoring network as outlined is also found to be satisfactory. However, several aspects of groundwater monitoring plan as required by development consent conditions of approval are not elucidated in the WMP:

- There is no outline of monitoring of groundwater flow into open cut voids. Provision of information in regard to which bores monitor inflow into mining voids is to allow the water regulators to assess the fitness for purpose against the condition of approval (CoA) of the monitoring network;
- The proponent has not satisfactorily documented in the WMP report information in regard to CoA 24. (c) (iii) third dot point to "*a program to monitor and report on:".* No outline or tabulation of the groundwater monitoring bores that monitor seepage leachate from water stores ash emplacements, coal rejects and former open voids is provided. Inclusion of this information along with a brief summary of the ability of the monitoring network to measure this would assist in assessing the adequacy of the Groundwater monitoring programme within the WMP;
- The proponent has not satisfactorily documented in the WMP report information in regard to changes to background groundwater yield/quality against changes induced by development / operations;
- The proponent has not qualified information in regard to monitoring for potential impacts upon regional or local aquifers in the WMP to the satisfaction of the Crown Lands and Water Division; and
- No monitoring of potential impacts upon groundwater supply of surrounding private landholder bores have been qualified or elucidated in the WMP.
- The WMP does not state when the next three-year review is due or when the last review was conducted. A revision was stated to have occurred during 2016 in Section 3.5.1. Crown Lands and Water Division assumes this is the year in which the last revision occurred. This should be clarified within the relevant modelling validation statement.
- The TARP does not provide timeframes for the actions and notifications to be conducted.

Surface water

<u>3.2.1 Springvale Coal Services Site – clean water management</u>
Section 3.1 of the WMP notes that clean water runoff is typically from remnant vegetation or rehabilitated catchments (page 33). Figure 3.1 shows clean water runoff from Lamberts Gully is diverted into the main sediment pond at the Springvale Coal Services site. It is noted that the diversion of all clean water from upstream catchment areas is currently being

implemented (see section 3.2.1, page 44). It is suggested the WMP explains why clean water is being diverted to the sediment pond and whether this will stop once the diversion of clean water at the site is implemented.

Section 3.2.1 notes the waterway of Lamberts Gully as part of the clean water diversion works has been diverted through the Retention Pond. It is also indicates that water from the Retention Pond supplements water supply to the washery when required (page 36). The proponent needs to clarify whether the Retention Pond will continue to collect clean water and use it as a water supply. If so, the volume of clean water being used will need to have a water access licence.

Riparian corridors along Lamberts Gully and Wangcol Creek

Section 3.2.1 of the WMP notes surface water management actions currently being implemented include improvement and maintenance of the riparian habitat of Lamberts Gully and Wangcol Creek within the Springvale Coal Services Site. Crown Lands and Water Division supports the improvement and maintenance of the riparian habitat and recommends the WMP includes a scaled plan which locates the areas along Lamberts Gully and Wangcol Creek where riparian habitat is being rehabilitated.

4.1 Inspections

Section 4.1 notes site inspections are undertaken within 24 hours following rainfall events that exceed 20mm in 24 hours. It is recommended the sediment and erosion and control measures are inspected weekly and prior to heavy rainfall events.

4.2.2 Surface Water Flow

Table 1.2 in the WMP indicates that Condition 24 (c) (ii) of the Development Consent for SSD-5579 MOD 1 requires a program to monitor and report on surface water flow in the watercourses potentially affected by the development but Section 4.2.2 notes no monitoring of surface water flow is undertaken by Western Coal Services. It is recommended Section 4.2.2 explains why no surface water flow monitoring is undertaken when a condition of approval requires this monitoring to occur.

4.6.1 Geomorphic Condition and watercourse stability

Section 4.6.1 notes watercourse stability monitoring is undertaken where discharges from the Springvale Coal Services Site contribute to the downstream environment. It indicates visual monitoring is undertaken during routine inspections. Additional details are required on this including:

- the frequency of proposed inspections - it is suggested visual inspections are undertaken after storm / rainfall events (once the water levels drop in the creek) and when discharges are made as the potential impacts on the stability of the watercourses are likely to be greatest following heavy rainfall/flow events and site discharge;
- details on where the inspections are undertaken and the length along the watercourses that are inspected and whether areas both upstream and downstream of the discharge points are inspected. The areas inspected should be shown on a scaled map in the WMP;
- any specific site inspection locations should also be identified and details included in the WMP on their location;
- the inspection locations need to be identified on the ground to assist with ongoing inspections;
- details on how the visual inspections will measure and record if any watercourse instability has occurred, for example a photographic record should be kept at the inspection sites to provide supporting evidence for the visual inspections - the WMP needs to include a comprehensive plan for visual and photographic surveys.

The WMP should explain why cross-sectional surveys along the watercourses are not proposed to show if the watercourses are stable or eroding. It is noted in Section 5.4.2 that there is evidence of ongoing erosion of Wangcol Creek. Cross sectional surveys would show the extent the creek is eroding over time.

Section 4.6.1 states no watercourse stability monitoring is undertaken at the Kerosene Vale Stockpile Area or the Conveyor at Brays Lane. The WMP should explain why monitoring is not undertaken or proposed at these locations.

<u>4.6.2 Aquatic Monitoring</u>
The WMP indicates that two of the impact monitoring sites (WC2 and WC3) are to be replaced by WC4. It notes these points were determined to be inappropriate locations for monitoring (page 66). It is suggested the WMP includes an explanation as to why these sites are considered to be inappropriate and why WC4 is preferred.

The WMP should:

- identify if aquatic monitoring will be undertaken over a range of seasons and weather conditions;
- identify if the monitoring program proposes to monitor discharge related impacts or watercourse stability, or both;
- provide clarity around both the design and type of impact being monitored (macroinvertebrates may be affected differently depending on the type of impact);
- include information about what will define/determine an impact including a statement about affect size (ie how large does the difference between reference and impact assemblages have to be before it is decided there is an impact).

<u>5.2,2 Water quality</u>
Table 5.2 indicates baseline discharge water quality data at LDP006 has been monitored from 5/1/2000 but Figures 5.3, 5.4 and 5.5 for LDP006 only show historical results commencing from April 2012. It is suggested the figures are amended to include the full record of water quality monitoring from 2000.

<u>5.4.1 Geomorphic Condition and watercourse stability</u>
Section 5.4.1 notes downstream of LDP006 that Wangcol Creek exhibits four different watercourse types as per the River Styles Framework: Valley Fill system; Low Sinuosity Gravel bed system; Partly Confined Gravel Bed system and Gorge system. It is recommended:

- a figure is included in the WMP which shows the location of these 4 different watercourse types;
- details are provided on the sensitivity of these watercourse types, for example valley fill systems are fragile types of watercourses; and
- the WMP includes details on current erosion along the watercourses and how this relates to the watercourse types.

End of Attachment A

NSW GOVERNMENT | Planning & Environment

Planning Services
Resource Assessments

Contact: Anthony Ko
Tel: (02) 8217 2022
Email anthony.ko@planning.nsw.gov.au

Mr James Wearne
Group Approvals Manager
Centennial Coal
PO Box 1000
TORONTO NSW 2283

Dear Mr Wearne

Springvale Coal Services (SSD 5579) & Lisdale Siding Upgrade (08_0223)
Water Management Plans

I refer to your letter dated 20 December 2016, seeking the Secretary's endorsement of experts to prepare the Water Management Plans for the Springvale Coal Services Project and Lisdale Siding Upgrade Project.

The Department has reviewed the information you provided on Mr Lachlan Hammersley and Dr Stuart Gray of GHD, and is satisfied that they are suitably experienced and qualified to prepare the Water Management Plans.

Accordingly, the Secretary has endorsed their appointment.

If you have any further enquiries about this matter, please contact Anthony Ko on (02) 8217 2022.

Yours sincerely

CPreshaw 23/12/16

Clay Preshaw
A/Director
Resource Assessments
as nominee of the Secretary

NSW EPA

Your reference	:
Our reference	: EF13/3625; DOC19/214626-1
Contact	: Mr Allan Adams; (02) 6333 3804

Mr Lachlan Hammersley
Manager Water Engineering
Centennial Coal
100 Miller Road
Fassifern NSW 2283

Dear Mr Hammersley

14 March 2019

RE: WESTERN COAL SERVICES WATER MANAGEMENT PLAN 2019

I refer to your email correspondence to the Environment Protection Authority (EPA) dated 28 February 2019 regarding the Water Management Plan (WMP) 2019 for Western Coal Services (WCS). The EPA acknowledges that the development of this plan in consultation with the EPA is a requirement of the development consent relating to the Springvale Water Treatment Project (SWTP); specifically, Schedule 3 of MOD 2 for SSD-5579.

The EPA does not review these plans or programs unless in circumstances deemed necessary, as the role of the EPA is to establish and regulate against environment protection and management criteria, not to become directly involved in the development of plans and strategies to comply with such criteria.

However, the EPA also has a role in pollution reduction and therefore has read the WMP with specific reference to the addressing the polluting discharge from Cooks Dam to Neubecks Creek via LDP006 (the options assessment); and other matters as stated below due to the EPA being in discussion with Centennial Coal (Centennial) regarding the discharge from LDP006. The requirement to undertake the options assessment along with the establishment of a groundwater monitoring network to provide an understanding of surface water and groundwater interactions across the site; along with the installation of a clean water diversion to divert clean water run-off generated up-gradient of WCS are also requirements of Schedule 3 of MOD 2 of SSD-5579, and of interest to the EPA. In reviewing the plan, the EPA is satisfied with the groundwater monitoring network as established with its capacity to log water level and Electrical Conductivity (EC) as described in Section 4.4.1 and with the progress on the clean water diversions which will be completed prior to the commencement of the SWTP.

As you are aware the EPA is currently preparing a separate environment protection licence 21229 for the WCS premises. EPL 21229 will include the options assessment and a timeframe for implementation of the preferred option for ceasing the polluting discharge from LDP6 as pollution reduction programs. As such, the EPA will continue to work with Centennial towards finalising a completion date for this pollution reduction program to address the discharge from Cooks Dam at LDP006.

Should you have any queries regarding this matter, please contact me at the Central West (Bathurst) Office of the EPA by telephoning (02) 6333 3802 or email central.west@epa.nsw.gov.au.

Yours sincerely

Darryl Clift
Head Regional Operations Unit Central West
Environment Protection Authority

PO Box 1388 Bathurst NSW 2795
Level 102, 346 Panorama Avenue Bathurst NSW 2795
Tel: (02) 63 333800
ABN 30 841 387 271
www.epa.nsw.gov.au

Department of Planning and Environment

Our ref: SSD-5579-PA-29

Veronica Howat
Assurance Specialist
Springvale Coal Pty Limited
PO Box 1000
Toronto, NSW, 2283
23/11/2023

Subject: **Western Coal Services (SSD-5579) - Water Management Plan**

Dear Ms. Howat,

I refer to the Water Management Plan submitted to the Department of Planning and Environment (the Department) as required under the conditions of consent for the Western Coal Services (SSD-5579). The Department has carefully reviewed the document and requests that you provide additional information.

Please submit a revised document that addresses the comments provided in the attached review table.

You are requested to provide the information, or notification that the information will not be provided, to the Department by Friday 22 December 2023. If you are unable to provide the requested information within this timeframe, you are required to provide, and commit to, a timeframe detailing the provision of this information.

If you have any questions, please contact Scotney Moore, on 02 9274 6342.

Yours sincerely

W Jones

Wayne Jones
Team Leader - Post Approval
Resource Assessments

As nominee of the Planning Secretary

Post Approval Review

Documents: Centennial's Western Services WMP
Revision: Rev 6 – 16/02/2023
Reviewed: 13/09/2023

Condition	**Sufficient (Yes/No/ Partial)**	**Document reference and comment**	**Action Required**	**Company Response**
Residual Waste **<u>Sch 2 Condition 8A</u>** The Applicant must not receive or emplace more than 0.35 megalitres per day (annual average) or 0.43 megalitres per day (daily maximum) of residual waste from the Springvale Water Treatment Project	Partial	Section 3.6 Not mentioned how will this be monitored/enforced	Clarify how the maximum daily transfer rate is monitored/enforced	
Residual waste **<u>Sch 2, Condition 8B</u>** **The Applicant must not:** (a) transfer more than 15.6 megalitres per day up to a maximum of 790 megalitres per year of water via the SCSS Water Transfer System to the SCSS/Regis Transfer System; (b) transfer more than 2.6 megalitres per day via the SCSS Water Transfer System to Mount Piper Power Station; and (c) receive more than 2.6 megalitres per day of raw water from the Angus Place Water Transfer System	Partial	Section 3.2.2 a & b: Not mentioned how will this be monitored/enforced c: Below the amount allowable under the COC. Wording suggest that flowrate will be constrained by pipeline construction. This is a good outcome.	Clarify how the maximum daily transfer rate is monitored/enforced	
Residual waste- Water Supply **<u>Sch 3, Condition 19</u>** The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of operations on site to match its available water supply.	No	Section 3.7.1 No acknowledgement/ commitment to adjusting operations on site to match available water supply.	Clearer description of what water is used for in all stages of the development, and how much. Elaborate on rate of GW contribution. Comment on adjusting operations on site to match available water supply Summary of water supply security at KVSA, to have all info in one document	

Documents: Centennial's Western Services WMP
Revision: Rev 6 – 16/02/2023
Reviewed: 13/09/2023

Condition	Sufficient (Yes/No/ Partial)	Document reference and comment	Action Required	Company Response
Residual waste- Water Pollution **Sch 3, Condition 20** Unless an EPL authorises otherwise, the Applicant must comply with Section 120 of the POEO Act.	Parital	Section 1.2.3 Section 120 of the POEO Act : "*person who pollutes any waters is guilty of an offence*" Not sure how to assess this, to be discussed	Add sentence into Section 1.2.3 that: Centennial will comply with Section 120 of the POEO Act.	
Remediation and Soil Contamination **Sch 3, Condition 23** The Applicant must comply with the performance measures in Table 10 to the satisfaction of the Secretary;				
Potable Water: Minimise the use of potable water for purposes where non-potable water is acceptable	Partial	Section 3.1 Section 3.5 Not mentioned in Section 6.2 as described in WMP	Update Table 1-2 to reflect where the relevant info is located Clarify how potable water use has been minimised	
Construction and operation: • Design, install and maintain erosion and sediment controls generally in accordance with the series Managing Urban Stormwater: Soils and Construction	Yes	Section 6.2.1 Appendix E		
• Design, install and maintain all works within 40 m of watercourses generally in accordance with the Guidelines for Controlled Activities on Waterfront Land (DPI 2012), or its latest version	No	Section 4.6.2 Appendix B Confirm whether response to to DPE Water is appropriate Performance criteria for watercourses concentrates on water quality – is there any other way to confirm that works are 'generally in accordance'? No triggers set for Electrical Conductivity or Total Dissolved Soilds	Set triggers for EC and TDS	

Post Approval Review

Documents: Centennial's Western Services WMP
Revision: Rev 6 – 16/02/2023
Reviewed: 13/09/2023

Condition	Sufficient (Yes/No/ Partial)	Document reference and comment	Action Required	Company Response
• Design, installation and maintenance of creek crossings generally in accordance with the Policy and Guidelines for Fish Friendly Waterway Crossings and Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings, or their latest versions	No	Section 6.2.6 Response lacks detail. Several references to stream crossings in the report with no design, installation or maintenance strategies mentioned. Note that a specific crossing (Link Haul Road bridge) is conditioned separately- response says “refer to Riparian Habitat and Catchment Improvement Plan (GHD 2017b)” – prepared for SSD-5579- Mod1	Clarify design, installation and maintenance of creek crossing details	
Sediment Dams: Design, install and maintain dams generally in accordance with Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries, or its latest version	Partial	Section 1.3 Section 3.2.2 Table 1.2 states this is address in Section 6.2	Update Table 1-2 to reflect where the relevant info is located	
Clean water diversions & Storage infrastructure: • Design, install and maintain the clean water system to capture and convey the 100 year ARI flood, as far as is reasonable and feasible • Maximise diversion of clean water around disturbed areas, as far as is reasonable and feasible	Yes	Section 3.2.1		
Mine-water Storages: • Design, install and maintain the mine-water storage infrastructure to store all runoff from a 95th percentile 5 day rain event • Prevent seepage from the DML and Cooks Dams to the surface, as far as is reasonable and feasible	Partial	Section 3.2.2 Note from WaterNSW: the sediment ponds SLG1 to SLG5 (upstream of main sediment pond) are ‘fill and spill’ sediment ponds, not 95th percentile 5 day designs.	Please address WaterNSW comment	
Chemical and hydrocarbon storage:	Yes	Table 6.7 Section 6.2.1		

Documents: Centennial's Western Services WMP
Revision: Rev 6 – 16/02/2023
Reviewed: 13/09/2023

Condition	Sufficient (Yes/No/ Partial)	Document reference and comment	Action Required	Company Response
Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards				
Aquatic and riparian ecosystems, Including affected sections of Wangcol and Lamberts Gully Creeks: • Maintain or improve baseline channel stability • Develop site-specific instream water quality objectives in accordance with ANZECC 2000 and Using the ANZECC Guidelines and Water Quality Objectives in NSW procedures (DECC 2006), or its latest version	No	Appendix B Appendix C Not mentioned in Section 6.2 as described in WMP No site-specific water quality objectives anywhere in the report In response to DPI-Water (letter dated 12 November 2017) advice: "*The works undertaken by others within the waterway are likely to present greater impact than any existing or proposed activity as part of WCS…Therefore* ***dedicated site inspection locations, photographic records and cross sectional surveys are not considered necessary, nor are requirements of this WMP***."	Update Table 1-2 to reflect where the relevant info is located Detail site-specific water quality objectives DPI-Water advice needs to be addressed appropriately.	
Water Management Plan **<u>Sch 3, Condition 24</u>** The Applicant must prepare and implement a Water Management Plan for the development to the satisfaction of the Secretary. This plan must:				
Be prepared in consultation with the EPA, WaterNSW, DPE Water, LCC, Forestry Corporation of NSW and Energy Australia by suitably qualified and experienced person/s whose appointment has been approved by the Secretary	No	Section 1 Appendix A Appendix B Not all advice actioned, particularly from DPE Water	Action outstanding advice	

Documents: Centennial's Western Services WMP
Revision: Rev 6 – 16/02/2023
Reviewed: 13/09/2023

Condition	Sufficient (Yes/No/ Partial)	Document reference and comment	Action Required	Company Response
Be submitted to the Secretary for approval within 4 months of the date of this consent, unless otherwise agreed by the Secretary.	Yes	Appendix A		
Include a: Site Water Balance, that: •Details of sources and security of water supply, including contingency supply for future reporting periods •Details of water use and management on site •Details of any off-site water discharges •Details of reporting procedures, including the preparation of a site water balance for each calendar year •Investigates and implements all reasonable and feasible measures to minimise potable water use and to re-use and recycle water	Partial	Section 3.7.1 Contingency supply for future reporting periods not discussed	Include contingency supply for future reporting periods	
Water Management Plan **<u>Sch 3, Condition 24(c) (ii)</u>** Surface Water Management Plan, that includes:				
Detailed baseline data on water flows and quality in the watercourses that could potentially be affected by the development.	Yes	Section 5.1.1		
A detailed description of the SCSS water management system, including the: Clean water diversion systems. Erosion and sediment controls. Mine-water management systems.	Yes	Section 3		
Detailed plans, including design objectives and performance criteria for: Design and management for the emplacement of coal reject materials and potential acid-forming or sulphate-generating materials. Management of sodic and dispersible soils.	Partial	Section 3.2.3 Soils, drainage lines on rehabilitated areas of the site and "Control of any potential water pollution from the rehabilitated areas of the site" not described.	Describe Soils, drainage lines on rehabilitated areas of the site and "Control of any potential water pollution from the rehabilitated areas of the site"	

Documents: Centennial's Western Services WMP
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Reviewed: 13/09/2023

Condition	Sufficient (Yes/No/ Partial)	Document reference and comment	Action Required	Company Response
Reinstatement of appropriate drainage lines on the rehabilitated areas of the site. Control of any potential water pollution from the rehabilitated areas of the site.				
Performance criteria for the following, including trigger levels for investigating any associated potentially adverse impacts: SCSS water management system. Downstream surface water quality. Stream and riparian vegetation health for the Wangcol and Lamberts Gully Creeks.	Partial	Section 6.1.1 Not mentioned in Section 6.1.4 as described in WMP No trigger level for riparian vegetation	Update Table 1-2 to reflect where the relevant info is located Update section 6.1.1 to include trigger levels	
A program to monitor and report on: Effectiveness of the SCSS water management system. Surface water flows and quality in the watercourses potentially affected by the development. Reporting procedures for the results of the monitoring program.	Yes			
A plan to respond to any exceedances of the performance criteria and mitigate and/or offset and adverse surface water impacts of the development	No	Appendix J No triggers defined in “Section 4” as per flowchart in Appendix J Surface water storage volume TARP: Stage 1 seems like more of a failure to follow procedure than a storage volume problem – not sure if this is appropriate but might be ok. Erosion and sediment Control TARP: Stage 2 does not seem to be a progression from Stage 1. Also, “Controls are not in place” is not something that can be ‘triggered”	Update Appendix J to reflect where the relevant info is located Update TARPs so that Stage 1 is below exceedance levels Update TARPs so that Stage 2 is a progression of stage 1	

Documents: Centennial's Western Services WMP
Revision: Rev 6 – 16/02/2023
Reviewed: 13/09/2023

Condition	Sufficient (Yes/No/ Partial)	Document reference and comment	Action Required	Company Response
		Water quality TARP: Stage 1 already requires an exceedance to be triggered, for two consecutive events – no room for preventative action, also unsure why two events are needed Stage 2 is just the response to Stage 1 – no new parameter has been 'triggered' except for "community complaint" LDP discharge Quality TARP: Stage 1 already requires an exceedance to be triggered– no room for preventative action LDP discharge Volume TARP: same as above **Unlicensed emergency Discharges TARP**: for stage 2, does 'continued discharge' need to be quantified? **Groundwater level TARP:** Stage 1 already requires an exceedance- no room for mitigation. Stage 2 is just the response to Stage 1 – no new parameter has been 'triggered' **Groundwater quality:** same as above **Instream vegetation**: do we need parameters to define 'minor' and 'major'? **Erosion or scour of material within REA**: same as above **Water volume within REA:** Stage 1 seems like more of a failure to follow procedure than		

Documents: Centennial's Western Services WMP
Revision: Rev 6 – 16/02/2023
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Condition	Sufficient (Yes/No/ Partial)	Document reference and comment	Action Required	Company Response
		a water volume problem – not sure if appropriate **Surface water quality of decant water from REA**: Stage 1 already requires an exceedance to be triggered, for two consecutive events – no room for preventative action, also unsure why two events are needed Stage 2 is just the response to Stage 1 – no new parameter has been 'triggered'		
Schedule 3, **<u>Condition 24 (c) (iii)</u>** Groundwater Management Plan, that includes:				
Detailed baseline data of groundwater levels, yield and quality on the SCSS and surrounds that could be affected by the development, including any licensed privately-owned groundwater bores.	No	Section 6.2.3 No trigger levels Contains info that is not in this WMP	Include summary in this WMP Update to include trigger levels	
A program to monitor and report on: Groundwater inflows to former open cut pits. The seepage/leachate from water storages, emplacements of power station ash and/or coal rejects, and former open cut voids. Background changes in groundwater yield/quality against changes induced by the development. Impacts of the development on: – Regional and local (including alluvial) aquifers. – Groundwater supply of any potential affected private landowners. – Any potentially affected groundwater dependent ecosystems and riparian vegetation.	Partial	Section 4.4 based on the 'monitoring category' assigned to each bore, it is not clear whether most items specified in the condition are being met. The exception is "Groundwater inflows to former open cut pits", which seems to be covered.	Update 'monitoring category' to clarify that condition criteria is being met	

Documents: Centennial's Western Services WMP
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Condition	Sufficient (Yes/No/ Partial)	Document reference and comment	Action Required	Company Response
A program to validate the groundwater model for the development, including an independent review of the model every 3 years, and comparison of monitoring results with modelled predictions.	No	Section 7.2 Says that last report was in 2016	Confirm whether a review has been conducted since 2016	
A plan to respond to any exceedances of the performance criteria	No	Appendix J See TARP comments above	See TARP comments above	
Schedule 3, **<u>Condition 24 (c) (iv)</u>** Protocol that has been prepared in consultation with the owners of nearby power generation or mining developments to: Minimise cumulative water quality impacts. Review opportunities for water sharing/water transfers between these developments. Co-ordinate water quality monitoring programs as far as practicable. Undertake joint investigations/studies in relation to complaints/ exceedances of trigger levels where cumulative impacts are considered likely. Co-ordinate modelling programs for validation, recalibration and re-running of groundwater and surface water models. Note: *The protocol can be developed in stages and will need to be subject to ongoing review, dependent upon the determination of, and commencement of, other mining and/or power generation developments in the area.*	Partial	Section 3.8 "Minimise cumulative water quality impacts" is named as a shared objective, but not how this might be achieved. Data-sharing for water monitoring data is mentioned, which is good. No mention of water sharing/transfers No mention of coordinating water quality monitoring programs Joint investigation in the event of a complaint or exceedance is mentioned- non-committal "endevour to…" "where practicable.." No mention of Co-ordinating modelling programs for validation, recalibration or re-running of groundwater and surface water models	Amend section to address the condition	
Describe the measures that would be implemented to improve and maintain the riparian habitat of Wangcol Creek for at least 100 metres downstream of the proposed Link Haul Road bridge crossing of the creek.		As above		
Detail additional compensatory water quality and catchment improvement measures to the value of at least $250,000 which must		As above		

Documents: Centennial's Western Services WMP
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Condition	Sufficient (Yes/No/ Partial)	Document reference and comment	Action Required	Company Response
be undertaken prior to the commissioning of the Springvale Water Treatment Project.				
Make arrangements to manage, protect and provide for the long-term security for the measures proposed to respond to (b) and (c) above		As above		
Pollution Reduction Works **Sch 3, Condition 46** Prior to receiving any residual waste from the operation of the Springvale Water Treatment Project, the Applicant must complete the following pollution reduction works to the satisfaction of the EPA:				
Establish a groundwater monitoring network across the Springvale Coal Services site that comprises an adequate number of bores that are located, established and operated in such a manner that will provide an understanding of surface water and groundwater interactions across the site.	Partial (administrative)	Section 4.4 Not mentioned in section 3.2 as per the WMP- This section concerns surface water management	Update Table 1-2 to reflect where the relevant info is located	
Design and install run-off diversion works to divert all clean water run-off generated from catchment areas upgradient of the Springvale Coal Services site.	Yes	Section 3.2.1		
Investigate options for long term management and discharge and/or beneficial reuse, of groundwater presently discharging from the site through LDP006 [now LDP001].	Partial (administrative)	Section 3.7.1 Section 3.7.2 Not mentioned in section 3.2 as per the WMP	Update Table 1-2 to reflect where the relevant info is located	
Brine and Residual Waste Disposal Plan **Sch 3, Condition 5** Prior to the commissioning of the Water Treatment Plant, the Applicant must prepare a Brine and Residuals Waste Disposal Plan, in consultation with WaterNSW and the EPA, and to the satisfaction of the Secretary. This Plan must:				

Documents: Centennial's Western Services WMP
Revision: Rev 6 – 16/02/2023
Reviewed: 13/09/2023

Condition	Sufficient (Yes/No/ Partial)	Document reference and comment	Action Required	Company Response
Be prepared by suitably qualified and experienced person/s whose appointment has been approved by the Secretary;	Yes	Section 1		
Include a detailed investigation into the potential impacts of the disposal of residual waste and brine from the development, including:				
an analysis of the presence and extent of any soil contamination impacts under the existing disposal arrangements, including the potential leachability of the residual waste and brine;	Yes	Section 3.6.1 Appendix D	Typo in table 3-6	
further options to decrease the quantity of residual waste and brine over time; and	No	Appendix D 'alternative disposal options' and why they were not chosen are discussed, but not committing to further options.	Commit to investigate and implement further options to decrease quantity of residual waste and brine.	
additional management and mitigation measures to reduce the impacts of brine and residual waste	Yes	Section 6.3.2		
Propose a program to implement measures to reduce the impacts of brine and residual waste	Yes	Section 3.6.3		

APPENDIX B – Consultation outcomes

Comment	Response
OEH (letter dated 13 October 2017)	
OEH has no specific comment to make on the Western Coal Services Water Management Plan.	No response required.
Lithgow City Council (letter dated 6 October 2017)	
Council considers that the revised Western Coal Services Water Management Plan, adequately highlights the relevant issues and therefore has no objection to the submission of the Plan in accordance with the requirements of the Western Coal Services Project (SSD-5579) MOD 1.	No response required.
EnergyAustralia (letter dated 26 October 2017)	
The Project Boundary for the Western Coal Services Site on some plans (e.g. Figure 1-3) appears to cover land which is managed by EnergyAustralia NSW as part of the Lamberts North Ash repository Project. Please ensure figures accurately reflect the current land management arrangements at the sites.	EnergyAustralia and Centennial Coal have reviewed and clarified boundaries, as per the communication protocol (refer to Appendix F).
Bore Hole 11 is shown as part of the groundwater monitoring network in the WMP. It should be noted that this monitoring point was installed by EnergyAustralia NSW in 2012 as part of the Lamberts North and Lamberts South ash repository area project. This site is identified by EnergyAustralia NSW as groundwater bore MPGM4-D16 and is currently monitored on a monthly basis. It is understood that Centennial Coal access and monitor this groundwater bore on a monthly basis. There is potential for results from this site to be affected from oversampling. EnergyAustralia NSW would appreciate being notified if any other of its existing compliance monitoring groundwater bores are proposed to be accessed by Centennial Coal for monitoring purposes.	An agreed monitoring arrangement has been developed between EnergyAustralia and Springvale Coal Services, as per the communication protocol (refer to Appendix F).

Comment	Response
The WMP includes a 'Communications Protocol' in Appendix F of the WMP. EnergyAustralia NSW acknowledges the value that this type of arrangement may have in managing potential cumulative environmental impacts. EnergyAustralia NSW has not had the opportunity to consider this type of arrangement prior to the receipt of the draft WMP. EnergyAustralia NSW would like to discuss these arrangements with Centennial Coal before they be considered finalised and incorporated in the approved WMP.	The communication protocol has been developed in consultation EnergyAustralia (refer to Appendix F). The communication protocol was reviewed by Centennial Coal and EnergyAustralia as part of the 2018 update to the WMP.
DPI-Water (letter dated 12 November 2017)	
The water balance in regard to groundwater is found to be satisfactory. However the details of reporting procedures, including the preparation of a site water balance for each calendar year are not outlined in the WMP.	For each calendar year, the site water balance will be reported as part of the annual review. Refer to Section 7.3.
There is no outline of monitoring of groundwater flow into open cut voids. Provision of information regarding which bores monitor inflow into mining voids is to allow the water regulators to assess the fitness for purpose against the condition of approval (CoA) of the monitoring network.	Figure 4-3 shows the location of groundwater monitoring bores that can be cross referenced with Figure 2-5 that shows the location of historical voids and against Table 4-3.
The proponent has not satisfactorily documented in the WMP report information in regard to CoA 24. (c) (iii) third dot point to "a program to monitor and report on:". No outline or tabulation of the groundwater monitoring bores that monitor seepage leachate from water stores ash emplacements, coal rejects and former open voids is provided. Inclusion of this information along with a brief summary of the ability of the monitoring network to measure this would assist in assessing the adequacy of the Groundwater monitoring programme within the WMP.	Monitoring categories have been added to Table 4-3 which describe the monitoring category of each bore, which include groundwater monitoring near coal rejects and open cut voids. Monitoring of groundwater near ash emplacement area is the responsibility of Mount Piper Power Station, is the not the subject of this WMP.
The proponent has not satisfactorily documented in the WMP report information in regard to changes to background groundwater yield/quality against changes induced by development / operations.	Baseline groundwater data and triggers are presented in Section 5.3 and 6.2.4 respectively. The site does not extract groundwater from bores and therefore yields are considered in the WMP.

Comment	Response
The proponent has not qualified information in regard to monitoring for potential impacts upon regional or local aquifers in the WMP to the satisfaction of the Crown Lands and Water Division.	Section 3.4 describes potential for impacts with respect to groundwater. The primary receptor of groundwater for the site is Wangcol Creek, as impacts are isolated to the local aquifer in the operations area formed by historical mining voids. This local aquifer is monitored as described in Section 2.3 with respect to the potential impacts. As impacts are isolated to the operations area, formed by historical mining activities, therefore the potential impacts upon regional or local aquifers are considered low.
No monitoring of potential impacts upon groundwater supply of surrounding private landholder bores have been qualified or elucidated in the WMP.	The locally significant aquifer is isolated to the operations area, formed by historical mining activities. Therefore the potential impact on surrounding private landholder bores is considered low. Nearby, registered groundwater bores are described in Appendix G.
The WMP does not state when the next three-year review is due or when the last review was conducted. A revision was stated to have occurred during 2016 in Section 3.5.1. Crown Lands and Water Division assumes this is the year in which the last revision occurred. This should be clarified within the relevant modelling validation statement.	The more recent review of the hydrogeological model was undertaken in November 2016. The next review is to be completed in 2019. Refer to Section 7.2.
The TARP does not provide timeframes for the actions and notifications to be conducted.	It is not a requirement to provide timeframes for actions and notifications within the TARP. Timeframes are listed in subsequent documents such as PIRMPs. Notifications, as specified in the PIRMP, are to be completed immediately or as soon as reasonably practicable.

Comment	Response
Section 3.1 of the WMP notes that clean water runoff is typically from remnant vegetation or rehabilitated catchments (page 33). Figure 3-1 shows clean water runoff from Lamberts Gully is diverted into the main sediment pond at the Springvale Coal Services site. It is noted that the diversion of all clean water from upstream catchment areas is currently being implemented (see Section 3.2.1, page 44). It is suggested the WMP explains why clean water is being diverted to the sediment pond and whether this will stop once the diversion of clean water at the site is implemented.	Clean water runoff on site contains sediment that requires settlement before leaving site. The main sediment dam is a key component for controlling sediment discharge off site from rehabilitated areas, therefore the diversion of clean water to the sediment pond will remain in place. Removal or diversion around the Main Sediment Dam would require some significant disturbance works. Until the site operation is completed, the use of the sediment basin as a feature of that catchment is considered a reasonable approach to allow for restoration works to proceed.
Section 3.2.1 notes the waterway of Lamberts Gully as part of the clean water diversion works has been diverted through the Retention Pond. It also indicates that water from the Retention Pond supplements water supply to the washery when required (page 36). The proponent needs to clarify whether the Retention Pond will continue to collect clean water and use it as a water supply. If so, the volume of clean water being used will need to have a water access licence.	At the completion of clean water diversion works to Lamberts Gully, no water will be extracted from the Retention Pond. Therefore, there is no need for assessment of harvestable rights or licencing of the Retention Pond [now referred to as Final Polishing Lagoon].
Section 3.2.1 of the WMP notes surface water management actions currently being implemented include improvement and maintenance of the riparian habitat of Lamberts Gully and Wangcol Creek within the Springvale Coal Services Site. Crown Lands and Water Division supports the improvement and maintenance of the riparian habitat and recommends the WMP includes a scaled plan which locates the areas along Lamberts Gully and Wangcol Creek where riparian habitat is being rehabilitated.	The RHCIP includes information on works to be completed in 2018 and 2019. Works completed in 2018 will be described in the 2018 Annual Review.

Comment	Response
Section 4.1 notes site inspections are undertaken within 24 hours following rainfall events that exceed 20 mm in 24 hours. It is recommended the sediment and erosion and control measures are inspected weekly and prior to heavy rainfall events.	This recommendation is noted. As described in Section 4.1, site inspections of permanent erosion and sediment controls are undertaken periodically and following rainfall events. This is considered appropriate for the permanent controls. Periodic inspections may occur prior to heavy rainfall, where the rainfall is reasonably foreseeable. Inspections of construction erosion and sediment controls are undertaken more frequently, as per the project or contract specific ESCP.
Table 1-2 in the WMP indicates that Condition 24 (c) (ii) of the Development Consent for SSD-5579 MOD 1 requires a program to monitor and report on surface water flow in the watercourses potentially affected by the development but Section 4.2.2 notes no monitoring of surface water flow is undertaken by Western Coal Services. It is recommended Section 4.2.2 explains why no surface water flow monitoring is undertaken when a condition of approval requires this monitoring to occur.	Section 4.2.1 has been updated. Monitoring location LDP001 in Table 4-2 and Section 4.2.1 monitors surface water for site discharges from site that may impact on downstream receivers.
Section 4.6.1 notes watercourse stability monitoring is undertaken where discharges from the Springvale Coal Services Site contribute to the downstream environment. It indicates visual monitoring is undertaken during routine inspections. Additional details are required on this including: • The frequency of proposed inspections. • It is suggested visual inspections are undertaken after storm / rainfall events (once the water levels drop in the creek) and when discharges are made as the potential impacts on the stability of the watercourses are likely to be greatest following heavy rainfall/flow events and site discharge. • Details on where the inspections are undertaken and the length along the watercourses that are inspected and whether areas both upstream and downstream of the discharge points are inspected. The areas inspected should be shown on a scaled map in the WMP.	Visual inspections of the confluence of Lamberts Gully and Wangcol Creek are undertaken routinely as part of general site inspections, which occur periodically and following rainfall events that exceed 20 mm in 24 hours (refer to Section 4.1). The habitat assessment undertaken as part of the aquatic ecology monitoring includes the assessment of stream bed and bank conditions in the vicinity of each aquatic ecology monitoring site (refer to Section 4.6.1). The works undertaken by others within the waterway are likely to present greater impact than any existing or proposed activity as part of WCS. All discharges from site are of low velocity and pose little risk to downstream stability. Therefore dedicated site inspection locations, photographic records and cross sectional surveys are not considered necessary, nor are requirements of this WMP.

Comment	Response
• Any specific site inspection locations should also be identified and details included in the WMP on their location. • The inspection locations need to be identified on the ground to assist with ongoing inspections. • Details on how the visual inspections will measure and record if any watercourse instability has occurred, for example a photographic record should be kept at the inspection sites to provide supporting evidence for the visual inspections - the WMP needs to include a comprehensive plan for visual and photographic surveys. • The WMP should explain why cross-sectional surveys along the watercourses are not proposed to show if the watercourses are stable or eroding. It is noted in Section 5.4.2 that there is evidence of ongoing erosion of Wangcol Creek. Cross sectional surveys would show the extent the creek is eroding over time.	The previous response has been reviewed for Revision 6 of the WMP. Stream health monitoring requirements are provided in section 4.6.1, with baseline data in section 5.5, a response plan in section 6.1.6, and performance criteria in section 6.2.6.
Section 4.6.1 states no watercourse stability monitoring is undertaken at the Kerosene Vale Stockpile Area or the Conveyor at Brays Lane. The WMP should explain why monitoring is not undertaken or proposed at these locations.	No watercourse stability monitoring is undertaken at the conveyor at Brays Lane. Given the relatively minor small disturbed and impervious catchment at this location, the risk to watercourse stability is considered low. Watercourse stability monitoring at KVSA, if any, is now described in the Angus Place Colliery Water Management Plan. Refer to Section 4.6.1.
The WMP indicates that two of the impact monitoring sites (WC2 and WC3) are to be replaced by WC4. It notes these points were determined to be inappropriate locations for monitoring (page 66). It is suggested the WMP includes an explanation as to why these sites are considered to be inappropriate and why WC4 is preferred.	In 2016, a review of the aquatic ecology monitoring program recommended that an additional location, WC4, be monitored and potentially replace WC2 and WC3. WC4 was selected as an improved monitoring location based on its macroinvertebrate habitat in terms of shading, the detritus present and the damming effect offered by large woody debris. During 2017 and 2018, WC2, WC3 and WC4 were all monitored to compare their effectiveness. A subsequent review recommended that all three locations be included in the aquatic ecology monitoring program. Refer to Section 4.6.2.

Comment	Response
The WMP should: • Identify if aquatic monitoring will be undertaken over a range of seasons and weather conditions. • Identify if the monitoring program proposes to monitor discharge related impacts or watercourse stability, or both. • Provide clarity around both the design and type of impact being monitored (macroinvertebrates may be affected differently depending on the type of impact). • Include information about what will define/determine an impact including a statement about affect size (i.e. how large does the difference between reference and impact assemblages have to be before it is decided there is an impact).	Aquatic ecology monitoring is undertaken in the autumn and spring seasons as prescribed by the AUSRIVAS sampling protocols (Turak et al. 2004), which run from 15 March to 15 June, and 15 September to 15 December respectively. Sampling within these seasons allows for the capture of various weather conditions, though it is noted that monitoring within two weeks following rainfall events exceeding 20 mm per day is generally avoided to prevent the possible sampling of macroinvertebrates translocated by increased stream flow. The monitoring program assesses the potential impacts of the LDP001 discharge. The habitat assessment undertaken as part of the aquatic ecology monitoring includes the assessment of stream bed and bank conditions in the vicinity of each site. The potential impacts of the licensed discharge on macroinvertebrate community composition and condition that are monitored are impacts to water quality, sediment quality, and habitat availability and condition. Any impacts to macroinvertebrate community condition and composition will be determined based on the assessment of macroinvertebrate metrics (taxa richness, EPT richness and SIGNAL-2) and multivariate analyses of macroinvertebrate data (including MDS, Cluster analysis, ANOSIM and SIMPER). These assessments also take into account climatic conditions, discharges and water and sediment quality.
Table 5.2 indicates baseline discharge water quality data at LDP006 [now LDP001] has been monitored from 5/1/2000 but Figures 5.3, 5.4 and 5.5 for LDP006 [now LDP001] only show historical results commencing from April 2012. It is suggested the figures are amended to include the full record of water quality monitoring from 2000.	The baseline data presented in the WMP has been updated to include historical data prior to 2012. Refer to Section 5.1.

Comment	Response
Section 5.4 notes downstream of LDP006 [now LDP001] that Wangcol Creek exhibits four different watercourse types as per the River Styles Framework: Valley Fill system; Low Sinuosity Gravel bed system; Partly Confined Gravel Bed system and Gorge system. It is recommended: • A figure is included in the WMP which shows the location of these four different watercourse types. • Details are provided on the sensitivity of these watercourse types, for example valley fill systems are fragile types of watercourses. • The WMP includes details on current erosion along the watercourses and how this relates to the watercourse types.	Section 5.5.1 has been updated to show a plan of the different watercourse types, discussion of sensitivity and photographic evidence of the condition of the watercourse.
EPA (letter dated 14 March 2019)	
EPA is satisfied with the groundwater monitoring network as established with its capacity to log water level and Electrical Conductivity (EC) as described in Section 4.4.1 and with the progress on the clean water diversion which will be completed prior to the commencement of the SWTP.	Noted. Centennial and EPA are undertaking active and ongoing consultation with respect to LDP001.
Forestry Corporation of NSW	
No consultation received.	

Comment	Response
WaterNSW (email dated 18 October 2017)	
The Upper Coxs River Action and Monitoring Plan (UCRAMP) apply to operations of the WCS site. The UCRAMP includes a number of actions specific to the operation of WCS which are listed in Appendix C of the WMP. WaterNSW supports the actions identified and notes that some of these actions have already been implemented while others have been commenced. One of the actions under the plan relevant to WCS site operations is Wangcol Creek catchment improvement works to maintain and enhance the biodiversity values in the catchment. WaterNSW requests these works be implemented as soon as possible.	The plans for the UCRAMP are yet to be finalised. This is considered a non-binding agreement until approved. The 2018 RHCIP works are to be completed prior to commissioning of the Springvale WTP which is expected in June 2019. Refer to condition 27 of the development consent.
Clean water diversions (WMP Table 3-1) are being progressively implemented since 2017 to divert clean catchment runoff from disturbed areas. One such diversion is the clean water diversion of the surface water from the upper Huon Gully to Lamberts Gully. The diversion once in place will improve clean water management at the WCS site and reduce the amount of groundwater entering Cooks Dam.	Noted in Section 3.2.1.
WaterNSW notes that the Mt Piper Power Station (MPPS) Brine Conditioned Fly Ash Co-Placement Project Annual environmental Monitoring Report (AEMR) 2016-17 recommended consideration of increasing groundwater recharge in Huon Gully to dilute salts in groundwater and reduce concentration of analytes at groundwater bores downstream of Huon Gully (D8 and D9) and at Neubecks (Wangcol) Creek at surface water monitoring site WX22. The diversion of surface water from the upper Huon Gully will effectively remove a source of groundwater recharge from the Huon Gully and hence remove a possible control measure for the chloride plume entering Huon Gully groundwater from the Mt Piper brine conditioned fly ash placement area. This issue must be	This issue is related to Mount Piper Power Station. Centennial will continue to liaise with EnergyAustralia as per the communication protocol (refer to Section 3.8).

Comment	Response
addressed in accordance with the communication protocol developed with Energy Australia (see below).	
Dirty water runoff (coal contact and sediment-laden water) is managed by a number of dirty water storages (Cooks Dam, Main Sediment Pond, SLG 1 to SLG6, Stockpile Sediment Pond and Washery Sediment Pond) which enable suspended solids to settle out and reuse of the water in site processes, thereby minimising the potential for dirty water discharges into the surrounding environment. WaterNSW notes that the sediment ponds SLG1 to SLG5 located upstream of the Main Sediment Pond in the Lamberts Gully Area discharge into the Main Sediment Pond. These are designed as 'fill and spill' sediment ponds and not as per the 95th percentile 5 day design criteria specified in the Blue Book as listed in WMP Table 3-3. WaterNSW considers that more justification as to why the Blue Book criteria was not adopted in this instance must be provided.	Main Sediment Dam receives overflow from five upstream 'fill and spill' sediment ponds in the Lamberts Gully area, SLG1, SLG2, SLG3, SLG4 and SLG5. These structures were originally associated with previous rehabilitation works. Once their original purpose was served, these structures were retained to attenuate high flows and to further reduce potential sediment loads. As Main Sediment Dam provided sufficient storage capacity to retain the 95th percentile 5 day rainfall event, active management of these structures is not required. Refer to Section 3.2.2.
The Erosion and Sediment Control Plan provided in Appendix E is generic and needs to refer to actual plan(s) that can be implemented on-site by on-site personnel and that show where the erosion and sediment control features are to be located. This plan needs to be updated as site conditions change.	The ESCP in Appendix E is intended to provide a standardised site wide approach for erosion and sediment control. The standard plan forms the basis for detailed ESCPs for temporary and construction work. These detailed plans are prepared as part of detailed designs of civil works on a project or contract basis. Permanent erosion and sediment controls on site are documented in Section 3.2.

Comment	Response
There is significant interaction between the WCS site managed by Centennial Coal and the adjoining MPPS owned and operated by Energy Australia with regards to water management. A communication protocol has been established to guide the coordination and management of WCS site and mining operations, and MPPS site to minimise impacts on downstream receiving water environment (refer Appendix F). WaterNSW supports this communication protocol and recommends that discussion between Centennial Coal and Energy Australia is necessary to address the issue of reduced groundwater recharge from Huon Gully identified above.	Noted in Appendix F.
Section 5.2.2 and Appendix H presents the baseline surface water quality data for selected parameters monitored at WCS surface water storages on site, Wangcol Creek, and LDP discharges. However there is no discussion provided regarding these results. WaterNSW requests that an analysis and discussion of these results including any trends must be provided in the WMP.	Discussion of trends has been included in Section 5.2.2 and Appendix H.

<table>
<tr><th>Comment</th><th>Response</th></tr>
<tr><td>WaterNSW notes that the time series graphs of water quality results (G.1.2 – Site Sediment Ponds; G2.2.2 – Wangcol Creek sites; and Figure 5-3– LDP006 [now LDP001] discharge) during the baseline period include electrical conductivity and Total Dissolved Solids (TDS) as key water quality parameters. An increasing trend in EC and TDS values is seen from 2012 to 2017 at both the Wangcol Downstream and Far Downstream sites and at discharges from LDP006 [now LDP001]. The Response Plans and surface water quality triggers presented in Section 6.1, 6.3 and Appendix G (now Appendix J) however do not set any triggers for EC or TDS. Both EC and TDS are important water quality parameters in relation to salinity and considered important with regards to the requirements for salinity in the Upper Coxs River. Centennial Coal must clarify how EC and TDS measurements will be considered in assessing the impacts on surface water quality due to WCS site construction and operations.</td><td>The observed trends in EC and TDS are noted.

The potential impacts on surface water quality due to WCS site construction and operations have been assessed as appropriate in the WCS Environmental Impact Statement and environmental assessments for subsequent modifications to the project.

EC (and TDS) is subject to continual monitoring and annual investigations as part the WMP update and the Annual Review. Where appropriate, monitoring and investigation is undertaken in coordination between Centennial Coal and EnergyAustralia in accordance with the communication protocol (refer Appendix F).

Since trends in EC (and TDS) have been identified and are subject to regular and ongoing investigation, triggers for EC and TDS are not considered to be required.

Centennial Coal has committed to overall reductions in salinity in the Upper Coxs River.</td></tr>
<tr><td colspan="2">NSW DPE (letter dated 23 November 2023)</td></tr>
<tr><td>SSD-5579 Sch 2 Condition 8A - Residual Waste

The Applicant must not receive or emplace more than 0.35 megalitres per day (annual average) or 0.43 megalitres per day (daily maximum) of residual waste from the Springvale Water Treatment Project.

<u>Comment:</u>

Clarify how the maximum daily transfer rate is monitored/enforced.</td><td>A new Section 4.5.1 has been added which details how transfers are monitored and reported. Additional information regarding implementation is provided in Section 3.6.3.</td></tr>
</table>

Comment	Response
SSD-5579 Sch 2 Condition 8B - Residual Waste The Applicant must not: (a) transfer more than 15.6 megalitres per day up to a maximum of 790 megalitres per year of water via the SCSS Water Transfer System to the SCSS/Regis Transfer System; (b) transfer more than 2.6 megalitres per day via the SCSS Water Transfer System to Mount Piper Power Station; and (c) receive more than 2.6 megalitres per day of raw water from the Angus Place Water Transfer System. <u>Comment:</u> a & b: Not mentioned how will this be monitored/enforced. c: Below the amount allowable under the COC. Wording suggest that flowrate will be constrained by pipeline construction. This is a good outcome. Clarify how the maximum daily transfer rate is monitored/enforced.	The SCSS/Regis Transfer System is not operational as of February 2024. SCSO will include further detail on this system once the SSD-9505 (McPhillamys Gold Project) post approval Water Management Plan has been approved. If this project proceeds, then similar controls to those currently in place for Residuals transfer will be adopted. Daily Angus Place to MPPS transfer totals are monitored by the Angus Place Control System on a continuous basis. Automated alarms and flow limiting are in place to stop the Angus Place to MPPS transfer system if these limits are reached. The Angus Place to MPPS pipeline has inherent hydraulic limitations that prevent significant exceedance of the consent limit. Weekly Centennial water management meetings are held, these track volumes transferred from Angus Place to MPPS and provide a forum to manage flag any non-compliances. Changes have been made to Section 3.2.2 accordingly.
SSD-5579 Sch 3 Condition 19 – Water Supply The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of operations on site to match its available water supply. <u>Comment:</u> Clearer description of what water is used for in all stages of the development, and how much. Elaborate on rate of GW contribution.	Site water balance reports are produced annually and are provided in the WCS Annual Review to assess water security at WCS. To duplicate all modelling inputs, methodology and outputs in the water management plan would be superfluous to the requirements of the WMP and would create information duplication. Section 3.7.1 summarises water supply for WCS under the existing water management system, and predicted future conditions (post MOD4 implementation) and demonstrates that the site has a net positive water balance with upwards of 1,000 ML excess annually, hence the proposed projects to transfer excess water to MPPS and Regis.

Comment	Response
Comment on adjusting operations on site to match available water supply. Summary of water supply security at KVSA, to have all info in one document.	Groundwater contribution rates are also provided in site water balance reports and were based on preliminary findings of the groundwater model (Golder 2023). KVSA is managed by Centennial Angus Place Colliery, so as not to duplicate information, water supply information would be reported under the Angus Place Water Management Plan.
SSD-5579 Sch 3 Condition 20 – Water Pollution Unless an EPL authorises otherwise, the Applicant must comply with Section 120 of the POEO Act. <u>Comment:</u> Add sentence into Section 1.2.3 that: Centennial will comply with Section 120 of the POEO Act.	Added in Section 1.2.3.
SSD-5579 Sch 3 Condition 23 – Potable Water Minimise the use of potable water for purposes where non-potable water is acceptable. <u>Comment:</u> Update Table 1-2 to reflect where the relevant info is located. Clarify how potable water use has been minimised.	Clarified in Section 3.5. Cross-reference added to Table 1-2.

Comment	Response
SSD-5579 Sch 3 Condition 23 – Construction and operation Design, install and maintain all works within 40 m of watercourses generally in accordance with the Guidelines for Controlled Activities on Waterfront Land (DPI 2012), or its latest version. <u>Comment:</u> Confirm whether response to DPE Water is appropriate. Performance criteria for watercourses concentrates on water quality – is there any other way to confirm that works are 'generally in accordance'? No triggers set for Electrical Conductivity or Total Dissolved Solids. Set triggers for EC and TDS.	It is not clear on what is being referred to with "*Confirm whether response to DPE Water is appropriate*". Responses were made to the then DPI Water in response to a letter dated 12 November 2017. Those DPI Water responses related to SSD-5579 Sch 3 Condition 23 point in question refer to either the RCHIP (not approved) which included design and installation of works in accordance with DPI (2012), or that such works would be undertaken in accordance with DPI (2012) under Construction Environmental Management Plan (CEMP). Operationally as implemented by this WMP, maintenance activities, for such instream works would be identified during routine inspections (refer Section 4.1) to identify any instabilities and via implementation of the RHCIP, once approved. Text has been added to this section. Stream health performance criteria are provided in Section 6.2.6, which would be used to confirm the works, from a maintenance perspective, are 'generally in accordance' with DPI (2012). It is assumed that "*Set triggers for EC and TDS"* refers to Table 6-1 Surface water quality triggers. Triggers have been added for EC and TDS.
SSD-5579 Sch 3 Condition 23 – Construction and operation Design, installation and maintenance of creek crossings generally in accordance with the Policy and Guidelines for Fish Friendly Waterway Crossings and Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings, or their latest versions. <u>Comment:</u> Clarify design, installation and maintenance of creek crossing details.	Design and installation of creek crossings in accordance with NSW Fisheries (2003) would be considered under design and post approval construction phases and not as part of the operational phase i.e., this WMP. Maintenance considerations as outlined in NSW Fisheries (2003) would be considered and implemented as identified during routine inspections (refer Section 4.1).

Comment	Response
SSD-5579 Sch 3 Condition 23 – Sediment Dams Design, install and maintain dams generally in accordance with Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries, or its latest version. <u>Comment:</u> Update Table 1-2 to reflect where the relevant info is located.	Table 1-2 cross-referencing has been updated.
SSD-5579 Sch 3 Condition 23 – Mine-water Storages • Design, install and maintain the mine-water storage infrastructure to store all runoff from a 95th percentile five day rain event. • Prevent seepage from the DML and Cooks Dams to the surface, as far as is reasonable and feasible. <u>Comment:</u> Please address WaterNSW comment: the sediment ponds SLG1 to SLG5 (upstream of main sediment pond) are 'fill and spill' sediment ponds, not 95th percentile five day designs.	No design criteria are provided for SLG1 to SLG5 as addressed in the WaterNSW comment.

Comment	Response
SSD-5579 Sch 3 Condition 23 – Aquatic and riparian ecosystems, including affected sections of Wangcol and Lamberts Gully Creeks: • Maintain or improve baseline channel stability. • Develop site-specific instream water quality objectives in accordance with ANZECC 2000 and Using the ANZECC Guidelines and Water Quality Objectives in NSW procedures (DECC 2006), or its latest version. <u>Comment:</u> Update Table 1-2 to reflect where the relevant info is located. Detail site-specific water quality objectives. DPI-Water advice needs to be addressed appropriately.	Table 1-2 cross-referencing has been updated. Site-specific water quality objectives have been developed in Appendix H, Section H.4.3 and are discussed from then onward in the appendix. A watercourse stability and stream health monitoring program has been included in the WMP, see Section 4.6. Baseline results for 2022-2023 are presented in Section 5.5.
SSD-5579 Sch 3 Condition 24 – Water Management Plan Be prepared in consultation with the EPA, WaterNSW, DPE Water, LCC, Forestry Corporation of NSW and Energy Australia by suitably qualified and experienced person/s whose appointment has been approved by the Secretary. <u>Comment:</u> Not all advice actioned, particularly from DPE Water. Action outstanding advice.	It is not clear what 'advice' is being referred to in this comment. Centennial seeks further specific direction on this comment. No correspondence from 'DPE Water' was received, again it is unclear what this is referring to.
Include a: Site Water Balance, that: • Details of sources and security of water supply, including contingency supply for future reporting periods. • Details of water use and management on site. • Details of any off-site water discharges.	See response above to NSW DPE comment on 'SSD-5579 Sch 3 Condition 19 – Water Supply'.

Comment	Response
• Details of reporting procedures, including the preparation of a site water balance for each calendar year. • Investigates and implements all reasonable and feasible measures to minimise potable water use and to re-use and recycle water. <u>Comment:</u> Contingency supply for future reporting periods not discussed. Include contingency supply for future reporting periods.	

Detailed plans, including design objectives and performance criteria for:
• Design and management for the emplacement of coal reject materials and potential acid-forming or sulphate-generating materials.
• Management of sodic and dispersible soils.
• Reinstatement of appropriate drainage lines on the rehabilitated areas of the site.
• Control of any potential water pollution from the rehabilitated areas of the site.
 	
<u>Comment:</u>
 	
Describe soils, drainage lines on rehabilitated areas of the site and “Control of any potential water pollution from the rehabilitated areas of the site”.
	There is no requirement under SSD-5579 to ‘describe’ rehabilitated area soils and drainage lines, though requires the provision of:
	• Detailed plans
	  ○ Water management of rehabilitated areas either managed by the clean or dirty water management systems as shown on Figure 3-2 and Figure 3-3 respectively. The “*Control of any potential water pollution from the rehabilitated areas of the site*” is managed by these systems with retention of potentially polluted water provided by site storages which are monitored at least monthly to detect such pollutants.
	• Design objectives
	  ○ Design objectives of water management drainage lines are provided in tables under Section 3.2.
	• Performance criteria
	  ○ Performance criteria for surface water management is displayed in Table 6-7.
	
	A description of soils in rehabilitated areas is provided in the SCS Rehabilitation Management Plan (Centennial 2022) main text and appendices along with management towards rehabilitation completion.

Comment	Response
Performance criteria for the following, including trigger levels for investigating any associated potentially adverse impacts: • SCSS water management system. • Downstream surface water quality. • Stream and riparian vegetation health for the Wangcol and Lamberts Gully Creeks. <u>Comment:</u> Not mentioned in Section 6.1.4 as described in WMP. No trigger level for riparian vegetation. Update Table 1-2 to reflect where the relevant info is located. Update section 6.1.1 to include trigger levels.	Triggers levels have been added for stream health in Section 6.1.6. EC and TDS surface water quality triggers have been added to Section 6.1.1. Table 1-2 cross-referencing has been updated.
A plan to respond to any exceedances of the performance criteria and mitigate and/or offset and adverse surface water impacts of the development. <u>Comment:</u> No triggers defined in "Section 4" as per flowchart in Appendix J **Surface water storage volume TARP**: Stage 1 seems like more of a failure to follow procedure than a storage volume problem – not sure if this is appropriate but might be ok. **Erosion and sediment Control TARP**: Stage 2 does not seem to be a progression from Stage 1. Also, "Controls are not in place" is not something that can be 'triggered"	The flowchart in Appendix J has been updated to refer to Section 6. **Surface water storage volume TARP:** Stage 1 has been updated. An additional reference to the letter is included in Section 4.1. **Erosion and sediment Control TARP:** Stage 1 has been clarified that this relate to 'onsite' erosion and sedimentation and Stage 2 relates to 'offsite'. TARP has been updated to remove "*Controls are not in place*" as a trigger. **Water quality TARP**: The trigger 'exceedance' is based on the 80th percentile of the water quality dataset which is the preventative measure in identifying potential water quality impact from WCS. Two events are specified as one event can be alarmist given laboratory results may be erroneous due to sample collection or laboratory errors. Stage 2 is a progression from Stage 1, in that, if the Stage 1 investigation identifies that WCS operations are responsible for the

Comment	Response
Water quality TARP: Stage 1 already requires an exceedance to be triggered, for two consecutive events – no room for preventative action, also unsure why two events are needed Stage 2 is just the response to Stage 1 – no new parameter has been 'triggered' except for "community complaint". **LDP discharge Quality TARP**: Stage 1 already requires an exceedance to be triggered– no room for preventative action. **LDP discharge Volume TARP**: same as above. **Unlicensed emergency Discharges TARP**: for stage 2, does 'continued discharge' need to be quantified? **Groundwater level TARP**: Stage 1 already requires an exceedance- no room for mitigation. Stage 2 is just the response to Stage 1 – no new parameter has been 'triggered' **Groundwater quality**: same as above. **Instream vegetation**: do we need parameters to define 'minor' and 'major'? **Erosion or scour of material within REA**: same as above. **Water volume within REA**: Stage 1 seems like more of a failure to follow procedure than a water volume problem – not sure if appropriate. **Surface water quality of decant water from REA**: Stage 1 already requires an exceedance to be triggered, for two consecutive events – no room for preventative action, also unsure why two events are needed. Stage 2 is just the response to Stage 1 – no new parameter has been 'triggered'. Update Appendix J to reflect where the relevant info is located.	water quality trigger event, then a far more rigorous corrective action is implemented. The source of water quality trigger events may be caused by factors external to WCS. **LDP discharge Quality TARP:** Stage 1 and 2 triggers have been updated in Appendix J to be more reflective of preventing EPL concentration limits. **LDP discharge Volume TARP**: Stage 1 and 2 triggers are based on modelled predictions therefore variance greater than these triggers may be expected. There is no EPL discharge volumetric limit in EPL21229 hence why more stringent triggers are not applied. **Unlicensed emergency Discharges TARP:** The Stage 2 trigger wording has been changed to reflect that Stage 2 would be a repeated Stage 1 trigger. **Groundwater level TARP:** Please see response to 'Water quality TARP'. **Groundwater quality**: As above **Instream vegetation**: Triggers have been adjusted for suitability with performance criteria and are now qualified. **Erosion or scour of material within REA**: Stage triggers have been updated to qualify 'minor' and 'major'. **Water volume within REA**: The Stage 1 trigger would be the result of a REA routine inspection and is not necessarily a failure, but an identified improvement action. The trigger has been updated the refer to the REA Operation and Maintenance Manual which is used to respond to the outcomes of REA inspections.

Comment	Response
Update TARPs so that Stage 1 is below exceedance levels. Update TARPs so that Stage 2 is a progression of stage 1.	**Surface water quality of decant water from REA**: Please see response to 'Water quality TARP'.
Detailed baseline data of groundwater levels, yield and quality on the SCSS and surrounds that could be affected by the development, including any licensed privately-owned groundwater bores. <u>Comment:</u> No trigger levels Contains info that is not in this WMP Include summary in this WMP Update to include trigger levels	Trigger levels are provided in Table 6-3. Appendix G provides: • Surrounding licensed privately-owned groundwater bores • Detailed baseline groundwater level and quality data. The groundwater model (Golder 2023) addresses details of groundwater yield for WCS via numerical modelling, and also provides cumulative impacts to water resources from WCS and MPPS managed areas.

Comment	Response

A program to monitor and report on:
• Groundwater inflows to former open cut pits.
• The seepage/leachate from water storages, emplacements of power station ash and/or coal rejects, and former open cut voids.
• Background changes in groundwater yield/quality against changes induced by the development.
• Impacts of the development on:
  ○ Regional and local (including alluvial) aquifers.
  ○ Groundwater supply of any potential affected private landowners.
  ○ Any potentially affected groundwater dependent ecosystems and riparian vegetation.
<u>Comment:</u>
Based on the ‘monitoring category’ assigned to each bore, it is not clear whether most items specified in the condition are being met.
The exception is “Groundwater inflows to former open cut pits”, which seems to be covered.
Update ‘monitoring category’ to clarify that condition criteria is being met.
	The monitoring category of a groundwater monitoring well is not directly related the consent condition. It requires a ‘program to monitor’ for which the groundwater monitoring program presented in this WMP is derived from assessment and design under groundwater impact assessments (GIAs) and approved for SSD-5579 and subsequent modifications. The GIAs contain details justifying the placement, target aquifer and monitoring purpose. It is not the purpose of a management plan to provide how obtained monitoring data from each monitoring well should be interpreted as some monitoring wells serve multiple purposes (or categories) dependent on the impact source-pathway-receptor linkages for operational (or other) influences on groundwater.

A program to validate the groundwater model for the development, including an independent review of the model every three years, and comparison of monitoring results with modelled predictions. <u>Comment:</u> Section 7.2 says that last report was in 2016. Confirm whether a review has been conducted since 2016.	Section 7.2 has been updated to reflect that the 2016 model underwent a significant update from 2019 onward and is currently under peer review as of 2024.

Comment	Response
A plan to respond to any exceedances of the performance criteria. <u>Comment:</u> See TARP comments above.	Addressed under the TARP response.
Protocol that has been prepared in consultation with the owners of nearby power generation or mining developments to: • Minimise cumulative water quality impacts. • Review opportunities for water sharing/water transfers between these developments. • Co-ordinate water quality monitoring programs as far as practicable. • Undertake joint investigations/studies in relation to complaints/ exceedances of trigger levels where cumulative impacts are considered likely. • Co-ordinate modelling programs for validation, recalibration and re-running of groundwater and surface water models. Note: The protocol can be developed in stages and will need to be subject to ongoing review, dependent upon the determination of, and commencement of, other mining and/or power generation developments in the area.	The water management objectives are achieved through implementation of the following subsections i.e., information sharing, joint investigations, meetings, and review. Water sharing and transfers and coordinating water quality monitoring programs would be a topic of the 'Water management meetings' as outlined in section F.4. Section F.3 has been updated to be more committal towards the implementation of joint investigations. The coordination of modelling programs would be discussed at 'Water management meetings' when model reviews lead to an update or calibration of a model involving shared components.

Comment	Response
Comment: “Minimise cumulative water quality impacts” is named as a shared objective, but not how this might be achieved. Data-sharing for water monitoring data is mentioned, which is good. No mention of water sharing/transfers. No mention of coordinating water quality monitoring programs. Joint investigation in the event of a complaint or exceedance is mentioned- non-committal “endeavour to…” “where practicable..”. No mention of Co-ordinating modelling programs for validation, recalibration or re-running of groundwater and surface water models. Amend section to address the condition.	
Describe the measures that would be implemented to improve and maintain the riparian habitat of Wangcol Creek for at least 100 metres downstream of the proposed Link Haul Road bridge crossing of the creek. Comment: As above.	It is not clear what ‘As above’ is referring to though it is assumed it is referring to the ‘SSD-5579 Sch 3 Condition 23 – Aquatic and riparian ecosystems’ comment. Please see the response to this condition above.
Detail additional compensatory water quality and catchment improvement measures to the value of at least $250,000 which must be undertaken prior to the commissioning of the Springvale Water Treatment Project. Comment: As above.	The condition relates to the provision and implementation of the Riparian Habitat Catchment Improvement Plan (RHCIP) as outlined in section 1.4.2. The RHCIP is yet to be endorsed (approved) by the (then) Department of Planning and Environment (DPE). Section 1.4.2 includes a progress update on the RHCIP.
Make arrangements to manage, protect and provide for the long-term security for the measures proposed to respond to (b) and (c) above Comment: As above.	As above for the RHCIP.

Comment	Response
SSD-5579 Sch 3 Condition 46 – Pollution Reduction Works Establish a groundwater monitoring network across the Springvale Coal Services site that comprises an adequate number of bores that are located, established and operated in such a manner that will provide an understanding of surface water and groundwater interactions across the site. Comment: Not mentioned in Section 3.2 as per the WMP- This section concerns surface water management. Update Table 1-2 to reflect where the relevant info is located.	Table 1-2 has been updated.
Investigate options for long term management and discharge and/or beneficial reuse, of groundwater presently discharging from the site through LDP006 [now LDP001]. Comment: Not mentioned in section 3.2 as per the WMP. Update Table 1-2 to reflect where the relevant info is located.	Table 1-2 has been updated.

Comment	Response
SSD-5579 Sch 3 Condition 46 – Pollution Reduction Works Include a detailed investigation into the potential impacts of the disposal of residual waste and brine from the development, including: further options to decrease the quantity of residual waste and brine over time. Comment: 'alternative disposal options' and why they were not chosen are discussed, but not committing to further options. Commit to investigate and implement further options to decrease quantity of residual waste and brine.	Section 3.9 of 'The Springvale Water Treatment Project – Brine and Residual Waste Disposal Plan' (GHD 2019b) includes detail on waste reduction strategies with a 'Forward program to implement measures to reduce impacts'.

APPENDIX C – Upper Coxs River Action and Monitoring Plan actions

Action	Status
Changes in pumping arrangements of Cooks Dam and the DML Dam, resulting in a reduction in the volume of water stored within the water management system.	Completed
Establish a pumping system for the transfer of tailings water from the A-Pit to Cooks Dam.	Completed
Installation of the head of catchment separation to divert upstream clean water from Lamberts Gully away from the Retention Pond [now referred to Final Polishing Lagoon].	Completed
Further modifications to water management infrastructure associated with the Lamberts Gully diversion.	Completed
Works to divert the upstream catchment of Huon Gully around the REA to enable clean water flows down Huon Gully.	Completed
Review of options for the interception and transfer of clean water runoff prior to entering surface voids at Huon Gully.	Completed
Long-term options study for the beneficial reuse of LDP001 discharge, including a risk assessment and cost benefit analysis for identified options.	Completed
Works to automate groundwater monitoring (levels and EC) at strategic locations around the SCSS.	Completed
Wangcol Creek catchment improvement works to maintain or enhance the biodiversity values in the catchment.	Completed
Stabilisation, rehabilitation and diversion of catchments at KVSA that contribute to LDP003 in an effort to reduce the volume and frequency of discharges.	To be completed. This action is detailed within the Angus Place Colliery Water Management Plan (GHD 2019a).

APPENDIX D – Potential impacts of residual management

D.1 Potential impacts

The potential impacts of the disposal of residuals material within the REA at the SCSS has been assessed by the *Western Coal Services Project Modification 1: Water Resources Impact Assessment* (GHD 2016c). A summary of the predicted impacts is provided below.

D.1.1 Residuals quality

Jar testing

The predicted water quality of the residuals stream was assessed by GHD (2016c) based on the results of jar testing performed by Hunter Water Australia. The required dosing rate of ferric chloride was assumed to be 90 mg/L (as $FeCl_3$) for an average flow of 30 ML/day and median TSS concentration of 46 mg/L and 180 mg/L (as $FeCl_3$) for maximum flow of 36 ML/day with TSS concentration of 721 mg/L. It is important to note that these dosing rates were based on jar tests undertaken on a sample of raw mine water taken from a single dewatering bore and therefore may not accurately represent the mine water to be supplied to the water treatment plant, which handles water from both Angus Place Colliery and Springvale Mine.

Table D-1 presents the water quality of the raw mine water used for the jar tests and the predicted residuals stream quality based on the dosing rates discussed above. These results are considered to be conservative as the assessment assumes that the pre-treatment process captures all of the constituents listed, whereas in practice some of these will pass through to the reverse osmosis process.

Table D-1 Predicted residuals stream quality based on jar testing

Parameter	Units	Raw mine water		Residuals stream	
		Median	Maximum	Median	Maximum
Physicochemical parameters					
EC	µS/cm	1167[1]	1310[1]	1170[2]	2500
pH	pH units	7.81–7.97[1]	8.28[1]	7.81–7.97	6.5–8.5[3]
TSS	mg/L	46	721	3224	60,363
Total solids	kg/day	–	–	2317	28,189
Total metals					
Aluminium	mg/L	0.4	1.57	27.9	131.4
Arsenic	mg/L	0.04	0.07	2.79	5.86
Boron	mg/L	0.08	0.12	5.6	10.0
Cadmium	mg/L	0.0002	0.0002	0.014	0.017
Chromium	mg/L	0.002	0.002	0.14	0.17
Cobalt	mg/L	0.002	0.002	0.14	0.17
Copper	mg/L	0.002	0.006	0.14	0.50
Iron	mg/L	1.26	2.22	2252	5379
Lead	mg/L	0.001	0.001	0.07	0.08

Parameter	Units	Raw mine water		Residuals stream	
		Median	Maximum	Median	Maximum
Manganese	mg/L	0.02	0.07	1.4	5.9
Mercury	mg/L	0.0001	0.0001	0.007	0.008
Nickel	mg/L	0.005	0.008	0.35	0.67
Selenium	mg/L	0.01	0.01	0.7	0.8
Zinc	mg/L	0.02	0.07	1.4	5.9

1 EC and pH data from Springvale Mine LDP009 discharges.

2 Based on the makeup of the water that would form the residuals stream, the EC is expected to be equal to or less than the median raw water EC. However, this outcome is to be confirmed during the commissioning phase of the water treatment plant.

3 Maximum pH required to be within the range provided.

Case study

GHD (2016c) also undertook water quality testing of mine water pre- and post-dosing with ferric chloride in order to provide a better indication of the likely mobility of metals in the residuals stream. These samples were collected from the Centennial's Newstan Colliery water treatment plant on 23 September 2016 and analysed by the NATA accredited Eurofins|MGT laboratory in Sydney.

Table D-2 presents the water quality results of the samples taken from the water treatment plant at Newstan Colliery. Comparison of the metal concentrations within the raw mine water and residuals stream indicates that ferric chloride dosing is effective in decreasing concentrations of arsenic, chromium, cobalt, copper, iron, lead and zinc, as the total concentrations of these metals all exceeded the dissolved concentrations, which were below the laboratory limit of reporting. A proportion of the total aluminium, barium, boron, manganese and nickel concentrations were shown to remain in solution following dosing, indicating the possibility of the residuals transfer to the REA impacting upon concentrations of these metals in the surface water and groundwater managed at the SCSS.

Table D-2 Raw mine water and residuals stream at Newstan Colliery water treatment plant

Parameter	Units	Raw mine water	Residuals stream
Physicochemical parameters			
EC	µS/cm	2400	2500
pH	pH units	8.4	8.2
Anions			
Chloride	mg/L	380	400
Sulfate	mg/L	100	99
Total alkalinity as $CaCO_3$	mg/L	740	780

Parameter	Units	Raw mine water	Residuals stream
Cations			
Calcium	mg/L	29	31
Magnesium	mg/L	11	11
Potassium	mg/L	5.5	5.1
Sodium	mg/L	450	470
Dissolved metals			
Aluminium	mg/L	<0.05	0.46
Arsenic	mg/L	<0.001	<0.001
Barium	mg/L	0.23	0.19
Boron	mg/L	0.16	0.17
Cadmium	mg/L	<0.0002	<0.0002
Chromium	mg/L	<0.001	<0.001
Cobalt	mg/L	<0.001	<0.001
Copper	mg/L	0.002	<0.001
Iron	mg/L	<0.05	<0.05
Lead	mg/L	0.001	<0.001
Manganese	mg/L	0.048	0.075
Nickel	mg/L	0.007	0.008
Selenium	mg/L	<0.001	<0.001
Zinc	mg/L	<0.005	<0.005
Total metals			
Aluminium	mg/L	0.12	0.75
Arsenic	mg/L	0.001	0.01
Barium	mg/L	0.24	0.74
Boron	mg/L	0.18	0.2
Cadmium	mg/L	<0.0002	<0.0002
Chromium	mg/L	<0.001	0.018
Cobalt	mg/L	<0.001	0.002
Copper	mg/L	0.003	0.008

Parameter	Units	Raw mine water	Residuals stream
Iron	mg/L	0.24	89
Lead	mg/L	0.003	0.016
Manganese	mg/L	0.078	0.34
Nickel	mg/L	0.007	0.012
Selenium	mg/L	<0.001	<0.001
Zinc	mg/L	0.006	0.037

From the review of the results obtained from the Newstan Colliery water treatment plant, it is clear that there is little variance observed between the raw mine water feed and residuals stream for EC and pH, which should be noted when comparing these results to the jar testing results presented in Table D-1. The Hunter Water Australia jar testing results predicted at least a two-fold increase in EC for the residuals (at 2500 µS/cm) compared to the raw mine water (at 1310 µS/cm). However, it is unlikely that the pre-clarification process in the water treatment plant will result in such a large increase in EC in the residuals.

D.1.2 Discharges

Discharge volume

A water balance model for the SCSS was used by GHD (2016c) to predict the changes to the volume of water managed at the site. The transfer of residuals to the REA was modelled to increase the load on the water management system and increase the discharges to Wangcol Creek via LDP001. A maximum annual input of 157 ML (0.43 ML/day) of residuals to the SCSS water management system was predicted to result in an increase in LDP001 discharges of 29% to 570 ML/year on average.

Discharge quality

PHREEQC modelling was undertaken by GHD (2016c) using median LDP001 discharge water quality data and Newstan Colliery residual stream data to predict the effect of seepage from the REA on discharges from the SCSS to Wangcol Creek. A qualitative summary of the predicted changes to the water quality of LDP001 discharge is presented in Table D-3.

Table D-3 Summary of predicted changes to LDP001 discharge water quality

Parameter	Predicted change	Reasoning
Physicochemical parameters		
EC	Increase	The EC of residuals is predicted to be lower than the groundwater at the SCSS, however increased flows reporting to Cooks Dam is likely to result in an increase in the EC of LDP001 discharges.
pH	Increase	Residuals material is predicted to have bicarbonate alkalinity concentrations an order of magnitude higher than historically observed LDP001 concentrations.
Ions		
Chloride, sodium	Cannot be confirmed	Differences in the raw mine water studied make prediction unreliable.
Calcium, magnesium, potassium, sulfate	Decreased concentration	Concentrations of the residuals is predicted to be significantly lower than historically observed at LDP001.
Total alkalinity	Increased concentration	As above for pH.
Dissolved metals		
Aluminium	Cannot be confirmed	Residuals quality from Newstan Colliery's water treatment plant indicates that a substantial portion of the total aluminium remains in the residuals stream.
Arsenic, copper, lead, zinc	Decreased concentration	These metals are shown to co-precipitate with ferric hydroxide and as such the residuals stream is predicted to dilute any concentrations in LDP001 discharge.
Boron, manganese, nickel	Decreased concentration	Residuals material is predicted to have low concentrations of these metals compared to the surface water at the SCSS.
Cadmium	No change predicted	LDP001 discharge generally has a cadmium concentration below the laboratory limit of reporting, which is also predicted for the residuals.
Iron	Decreased concentration	The majority of all iron in the residuals stream is predicted to precipitate as ferric hydroxide and the residuals reporting to LDP001 is predicted to dilute dissolved iron concentrations.

The PHREEQC modelling results are limited by the use of historical LDP001 data, which is not considered representative of conditions at the site following the construction of clean water diversions at the SCSS. Without the significant dilution provided by catchment runoff following construction of the diversions, dissolved metal concentrations in the dirty water management system are predicted to increase.

D.1.3 Groundwater

Groundwater level

Seepage of residuals into the historical mine workings from the REA was not predicted by GHD (2016c) to have a measurable impact on the groundwater table outside of the SCSS.

Groundwater quality

The results of the case study of residuals from Newstan Colliery water treatment plant undertaken by GHD (2016c) indicated that increased transport of metals due to seepage from the REA to the groundwater environment as a result of residuals disposal is unlikely. The case study showed that the majority of metals were co-precipitated with ferric hydroxide as a result of ferric chloride dosing. Aluminium may be concentrated in the residuals stream compared to the raw mine water, however the concentrations indicted by the Hunter Water Australia jar testing and the Newstan Colliery case study are less than those historically observed at the majority of the groundwater bores at the SCSS.

D-2 Alternative disposal options

GHD (2016c) considered a number of options for the management of residuals within the SCSS. The transfer of liquid residuals for disposal within the REA was chosen as the preferred option resulting in minimal environmental and operational constraints. A dedicated system of lined sludge lagoons and drying beds as well as a number of mechanical dewatering systems were also considered as alternative options for the management of residuals from the SWTP prior to emplacement in the REA at the SCSS. These options were found to significantly increase the cost and operational complexity of the residuals management system for minimal environmental benefit compared to the liquid transfer option.

D.2.1 Sludge lagoons and drying beds

A sludge lagoon and drying beds system would consist of two sludge lagoons (to allow one to be taken offline periodically for maintenance) for consolidation of the thickened sludge, followed by four drying beds, each sized for three months of consolidated sludge. The sludge lagoons and drying beds would be lined to minimise the risk of water migrating to the groundwater system. Given a favourable climate, the system would be able to produce dried sludge of up to 30% to 40% solids by weight. During prolonged unfavourable climate conditions, disposal of more liquid sludge (approximately 10% to 25% solids by weight) may be necessary.

Supernatant from the sludge lagoons would need to be returned to the new water treatment plant for treatment requiring additional pipeline infrastructure than already approved for the SWTP. This will also result in an increase in the brine production requiring management within the MPPS systems.

Removal of dewatered sludge from the drying beds is typically done manually with an excavator. The dewatered cake would be too thick to enable transfer to the REA within the residuals pipeline and would require an alternate transport system to be developed utilising either a vehicle haulage or conveyor system. Establishing a direct haulage route or conveyor route would require considerable ground disturbance and clearance of native vegetation between the water treatment plant and the REA. A new haulage or conveyor system would also introduce the potential for further noise and dust impacts requiring active mitigation and management measures. Alternatively, the dewatered cake would require haulage via the public road network involving an additional two to four heavy vehicle movements per day. Figure D-1 presents photographs of the sludge lagoon system from Clarence Colliery, which is also managed by Centennial.

Disadvantages of the sludge lagoons and drying beds system include:

- Considerable area is required for the additional sludge lagoons and drying beds. A preliminary estimate indicates approximately 2 ha of additional land would be required for two lagoons and four drying beds.
- Land available at the new water treatment plant site at MPPS is limited and is affected by historical underground mine workings in the area, resulting in the potential for subsidence impacting upon the suitability of the site for the establishment of new infrastructure.
- Removal of dewatered sludge and transport to the REA can be labour intensive compared to the liquid transfer option.
- High additional capital cost is involved (preliminary estimate of $8 to $12 million) based on the area and number of sludge lagoons and drying beds involved.

D.2.2 Mechanical dewatering

Different types of mechanical equipment can be used for dewatering residuals, including filter presses, belt presses and centrifuges. Any mechanical dewatering system would require additional infrastructure to be provided at the water treatment plant site. This includes a building to house the dewatering equipment, a crane for maintenance, a storage pond to hold residuals prior to dewatering, a storage area for dewatered residuals, a supernatant return system and a means for transporting dewatered residuals to the REA.

Figure D-1 Example of sludge lagoon at Clarence Colliery

For the majority of the year, it would be difficult to achieve effective dewatering of the residuals stream through mechanical dewatering systems alone due to the typically low TSS of the raw mine water. Dosing the residuals with a polymer coagulant aid would be required in conjunction with the mechanical process to achieve a high level of dewatering. Polymers are frequently used in water treatment processes to aid flocculation. There is a wide range of commercially available polymers on the market used in the water treatment industry. The use of polymers would require additional chemical storage and dosing facilities located at the water treatment plant site.

The addition of a polymer to the residual management process would also introduce an additional chemical to the REA system with potential transfer to receiving waters. However, increasing the solids content is expected to reduce the volume of water discharge through LDP001 compared to the preferred liquid transfer option.

Dosing of the residuals stream with a polymer prior to mechanical dewatering would potentially achieve a dewatered residuals cake in the range of 10% to 25% solids by weight.

Similar to the sludge lagoons and drying bed system, the supernatant from the dewatered product would need to be returned to the water treatment plant, requiring additional pipeline infrastructure than already approved for the SWTP and would result in an increase in brine requiring management at MPPS. Alternative transport systems for the dewatered cake to the REA at the SCSS would also be required as the dewatered cake would be too thick to transfer to the REA via the residuals pipeline.

Disadvantages of the mechanical dewatering system include:

- Land available at the new water treatment plant site at MPPS is limited and is affected by historical underground mine workings in the area, resulting in the potential for subsidence impacting upon the suitability of the site for the establishment of new infrastructure.

- Removal of dewatered sludge and transport to the REA can be labour intensive compared to the liquid transfer option.
- High additional capital cost is involved (preliminary estimate of $8 to $12 million) based on the size of the dewatering facility involved.
- Additional energy consumption compared to the liquid transfer option will result in a greater greenhouse gas impact.
- Additional polymer chemical dosing would be required which poses a risk of being released to receiving waters.

D.2.2 REA lining

A potential mitigation measure to reduce infiltration from the REA to the historical underground workings would include lining of surface infrastructure at the SCSS, including the new REA and A Pit. However, the majority of the surface infrastructure are already operational and retrospectively lining would be impractical and inefficient considering the extent of surface to groundwater connectivity known to exist.

D.2.3. Springvale Mine water management

Springvale Mine has limited ability to store water underground to allow suspended sediment to settle prior to pumping to the surface water management system. Centennial has undertaken a number of management strategies over the past five years to improve the quality of underground water. Utilisation of temporary underground storages and preferential dewatering from bores that allow for filtration through the coal seam has provided a reduction in turbidity and TSS. Centennial will continue to investigate improved management practices to further reduce suspended solids in mine water dewatered to the SWTP in an effort to further reduce the total residual waste requiring emplacement.

Underground water management at Springvale Mine and Angus Place Colliery does not form part of the day to day operations of Springvale Coal Services site, however regional water management is regularly revised by Centennial at a regional level.

APPENDIX E – Erosion and sediment control plan

E.1 Requirements and guidelines

All erosion and sediment control measures are to be designed and implemented according to the requirements and guidelines provided in:

- Managing Urban Stormwater: Soils and Construction, Volume 1 (Landcom 2004).
- Managing Urban Stormwater: Soils and Construction, Mines and Quarries Volume 2E (DECC 2008).
- Best Practice Erosion and Sediment Control (IECA 2008).

E.2 Disturbance and sediment generating activities

Disturbance and sediment generating activities that are likely to require erosion or sediment controls may include:

- Rehabilitation activities.
- Site reshaping.
- Temporary stockpiles.
- Dewatering activities.
- Temporary open channel diversions.
- Instream watercourse works.

E.3 Erosion risk

Disturbance activities are a function of the daily operations, with the resulting erosion risk varying throughout the year in response to changes in rainfall. The initial erosion risk has been estimated based on the:

- Average monthly rainfall.
- Area of disturbance (considered as the total water management system catchment).
- Soil loss classes (refer to Table 4.2; Landcom 2004).

Typical erosion risk ratings for the western region are provided in Table E-1. The average monthly rainfall is given by IECA (2008) based on rainfall recorded in Bathurst. The initial erosion risk is principally affected by the average rainfall, with *high* erosion risk identified for summer months (i.e. December to February), with the initial erosion risk reducing to *low* during the winter months (i.e. June to August).

When disturbance activities are undertaken within higher risk months, it is recommended that additional management measures be undertaken to ensure that the erosion and sediment controls are capable of operating effectively.

Table E-1 Typical erosion risk

Month	Average rainfall (mm)	Erosion risk rating
January	85.1	High
February	79.1	High
March	65.0	Moderate
April	44.6	Low to moderate
May	49.4	Low to moderate
June	49.0	Low

Month	Average rainfall (mm)	Erosion risk rating
July	50.9	Low
August	64.2	Low
September	52.4	Low to moderate
October	67.1	Moderate
November	72.5	Moderate
December	73.6	High

E.4 Soil landscapes

Table E-2 summarises the various soil landscapes and associated erosion hazard for WCS. The erosion hazard associated with the soil landscapes at WCS varies from a moderate to high erosion hazard.

Table E-2 Applicable soil landscapes for erosion risk

Soil landscape	Typical terrain	Erosion hazard
Cullen Bullen	Hill crests	High
Lithgow	Lower slopes and poorly drained areas	Moderate

E.5 Environmental constraints

Environmental constraints that should be considered when estimating the potential sediment loads associated with a proposed activity are presented in Table E-3.

Table E-3 Environmental constraints and characteristics

Component	Range of parameters
Works period and site sensitivity (DECC 2008)	Greater than three years Downstream environment defined as sensitive
Rainfall factor – R	1,360 to 1,800
Soil erodibility factor – K	0.05 to 0.075
Slope and flow length	Maximum flow length should not exceed 80 m Typical slopes are between 0.5% to 3%
Sediment basin requirement threshold	Predicted soil loss > 150 m^3/year (based on RUSLE equation results)
Sediment basin type for construction	‘Wet Basin’ – Type D, 5 day 95th percentile
Sediment volume allowance for sediment basins	Dependent upon operations and clean out frequency – two to six months
Soil hydrologic type	Type D
Volumetric coefficient of runoff	0.39 to 0.79 (DECC 2008 recommends 0.9 for hardstand areas)

E.6 Typical controls

Prior to any construction activity, temporary erosion and sediment controls shall be installed. The following are temporary erosion and sediment control that are currently being utilised at Centennial's western sites. The installation of these controls should be in accordance with the specification detailed in the *Managing Urban Stormwater, Soils and Construction* (Landcom 2004) standard drawings.

E.6.1 Sediment fence

Sediment fences trap sediment that is mobilised by runoff across a disturbed area. Sediment fences should only be temporary and require regular maintenance to remain effective.

Sediment fences are to be installed along the contour downslope of disturbed areas. Sediment fences are not to be located within (or adjacent to) concentrated flow paths, but in positions that provide adequate vegetative filtering of sheet flows downslope of the disturbed area. Sediment fences shall be installed in accordance with the Sediment Fence Standard Drawing (SD6-8: Landcom 2004).

E.6.2 Inlet pit protection

Where disturbance activities are to be carried out within the vicinity of an existing stormwater drainage network (i.e. a pit and pipe system), it is recommended that inlet pit protection measures are used. Pit protection measures provide a filter for sediment-laden runoff, reducing the risk of stormwater pipes being blocked with accumulated sediment. Inlet pit protection shall be installed in accordance with the Inlet Pit Protection Standard Drawing (SD6-11: Landcom 2004).

E.6.3 Sediment traps and basins

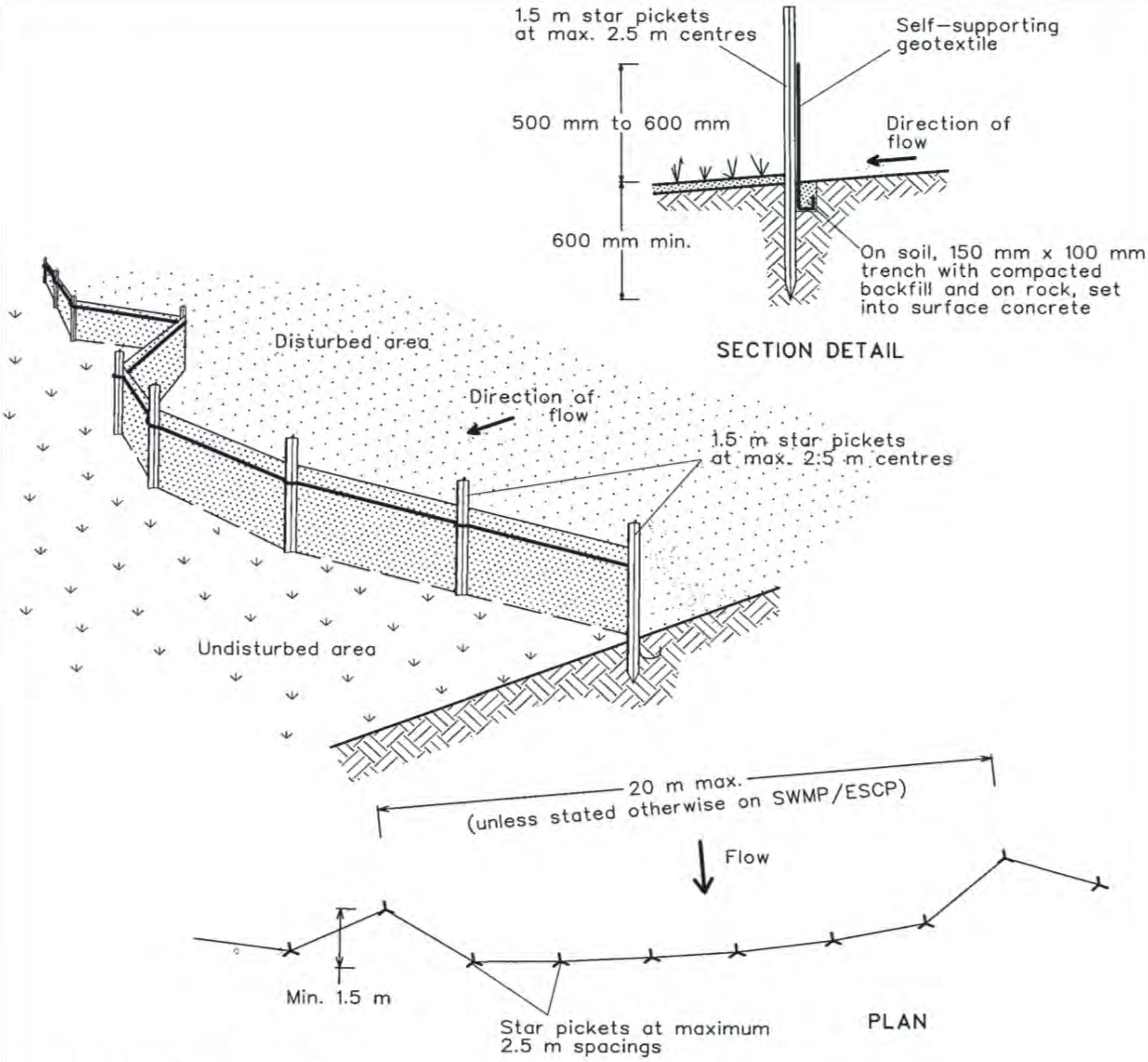
Where disturbance activities exceed the manageable capacity of sediment fences, with respect to duration or extent, it is recommended that sediment traps and/or basins be installed. Sediment traps and basins can be constructed from available construction materials or by shaping an earth embankment. It is expected that sediment traps and basins would be installed and operated similar to a Type D Sediment Basin (SD6-4: Landcom 2004).

E.6.4 Flow breaks (low flow channels)

The use of flow breaks decreases flow velocities within low flow channels, reducing the potential for the low flow channels to erode and scour and reduce the migration of sediment from disturbed areas. Flow breaks can be constructed from earth, natural materials (logs, mulch and so on) or from proprietary products. Breaks should be used in a similar manner to a sediment fence, however flow breaks are typically more porous than sediment fences, allowing water to flow through faster.

E.6.5 Rolled erosion control products

Rolled erosion control products (RECPs) reduce erosion by completely covering the disturbed area. RECPs are easily applied to disturbed areas in an emergency or where the area requires temporary stabilisation for an extended period of time. RECPs typically require little maintenance. RECPs may consist of processed natural or synthetic fibres bound together to form a continuous mat. They may also be used to facilitate vegetation establishment by temporarily or permanently reinforcing the soil surface during and after vegetation maturation.

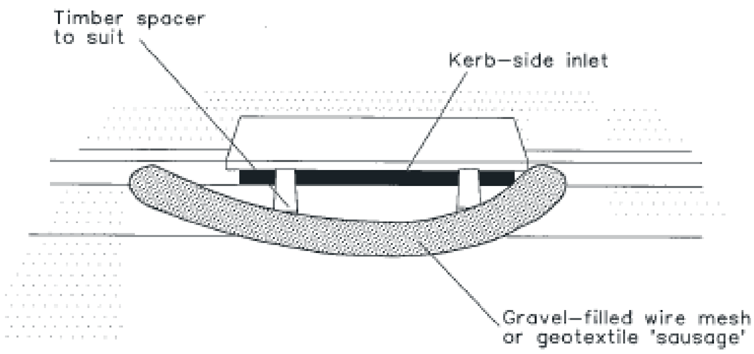


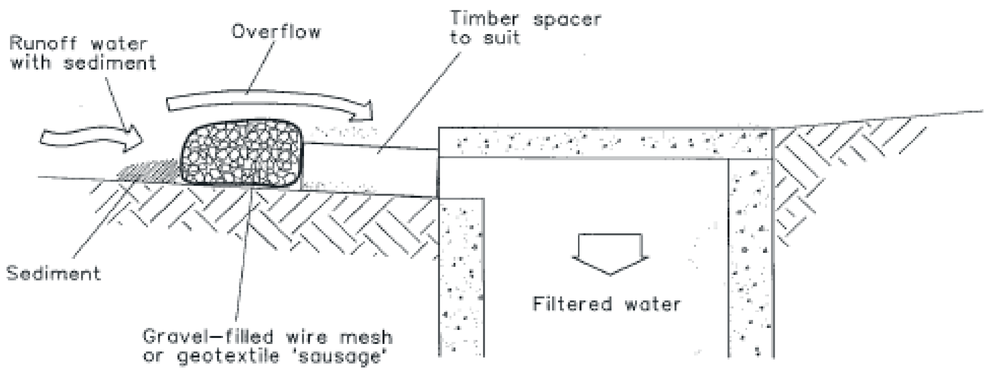
Construction Notes

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

SEDIMENT FENCE **SD 6-8**

Figure E-1 Typical sediment fence (Landcom 2008)





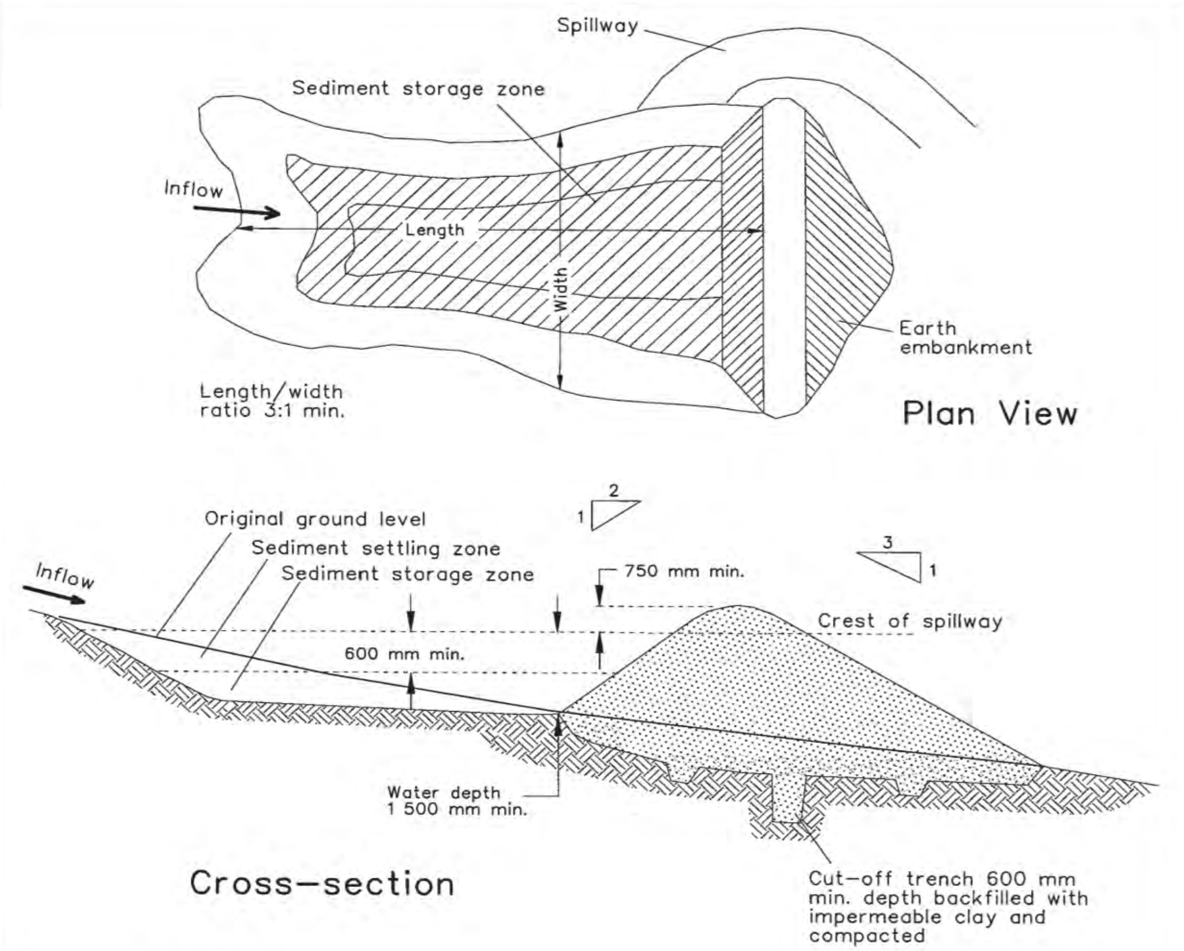
NOTE: This practice only to be used where specified in an approved SWMP/ESCP.

Construction Notes

1. Install filters to kerb inlets only at sag points.
2. Fabricate a sleeve made from geotextile or wire mesh longer than the length of the inlet pit and fill it with 25 mm to 50 mm gravel.
3. Form an elliptical cross-section about 150 mm high x 400 mm wide.
4. Place the filter at the opening leaving at least a 100-mm space between it and the kerb inlet. Maintain the opening with spacer blocks.
5. Form a seal with the kerb to prevent sediment bypassing the filter.
6. Sandbags filled with gravel can substitute for the mesh or geotextile providing they are placed so that they firmly abut each other and sediment-laden waters cannot pass between.

MESH AND GRAVEL INLET FILTER **SD 6-11**

Figure E-2 Typical inlet protection measure (Landcom 2008)



Construction Notes

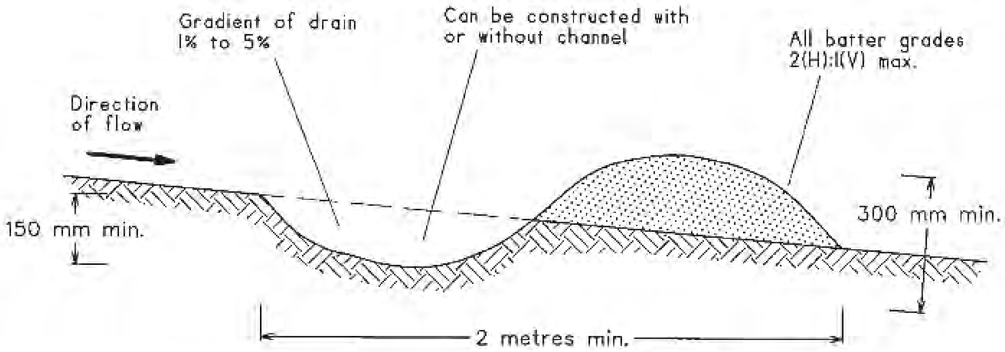
1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest.
3. Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density.
4. Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Construct the emergency spillway.
8. Rehabilitate the structure following the SWMP.

EARTH BASIN - WET

(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)

SD 6-4

Figure E-3 Typical sediment basin (Landcom 2008)



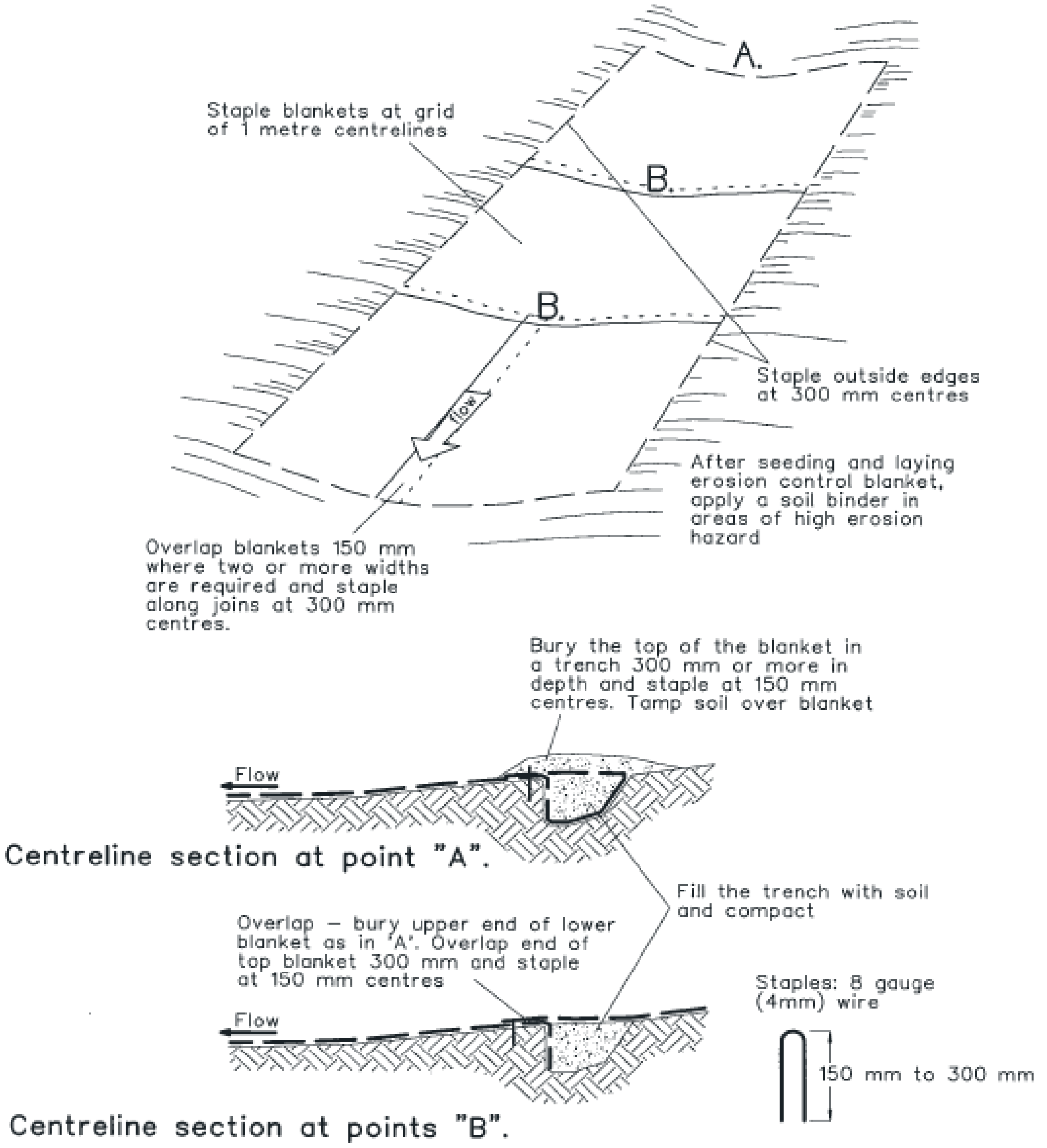
NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

Construction Notes

1. Build with gradients between 1 percent and 5 percent.
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V shaped.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction.

EARTH BANK (LOW FLOW) **SD 5-5**

Figure E-4 Typical diversion channel (Landcom 2008)

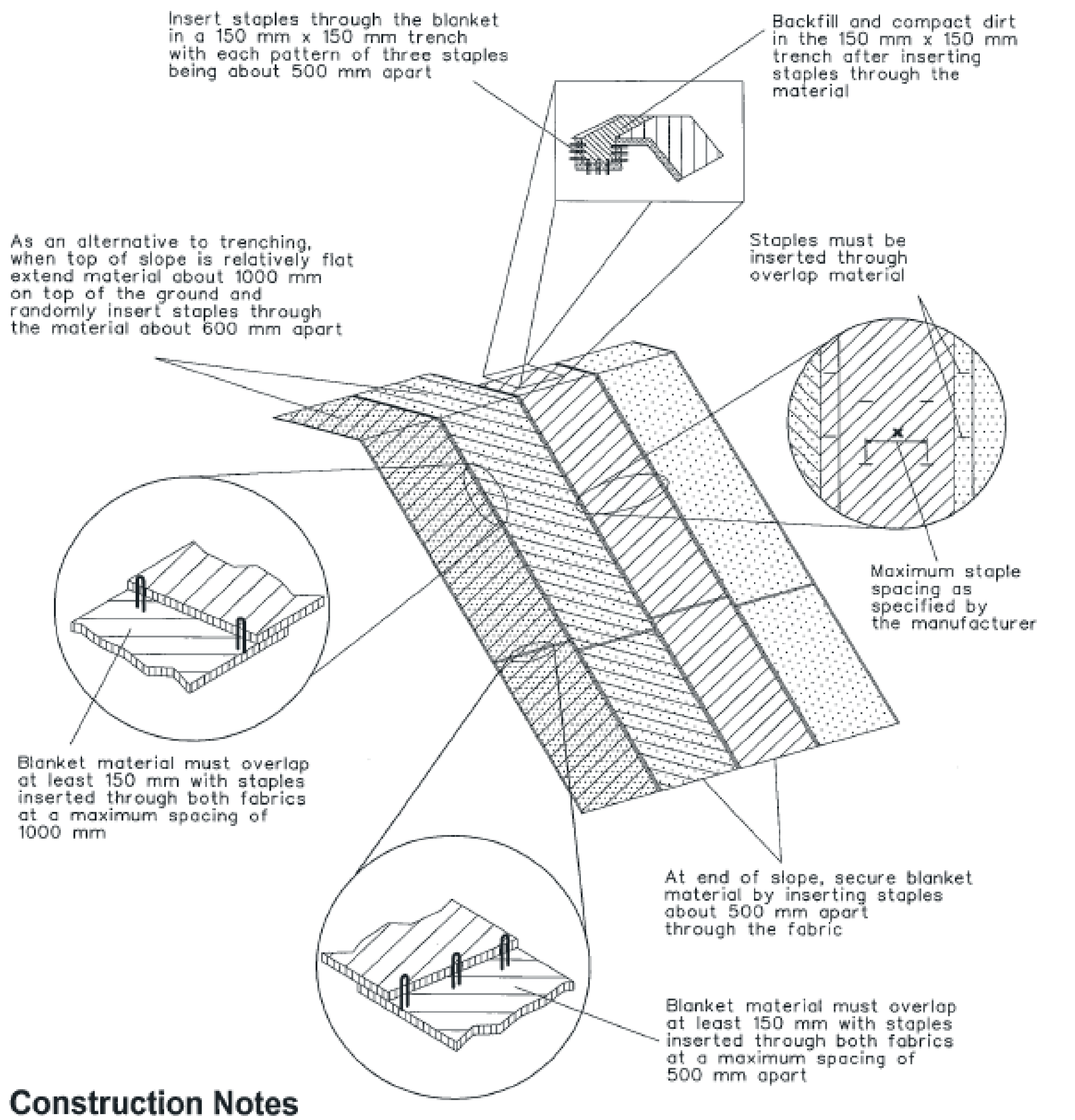


Construction Notes

1. Remove any rocks, clods, sticks or grass from the surface before laying matting
2. Ensure that topsoil is at least 75 mm deep.
3. Complete fertilising and seeding before laying the matting.
4. Ensure fabric will be continuously in contact with the soil by grading the surface carefully first.
5. Lay the fabric in "shingle-fashion", with the end of each upstream roll overlapping those downstream. Ensure each roll is anchored properly at its upslope end (Standard Drawing 5-7b).
6. Ensure that the full width of flow in the channel is covered by the matting up to the design storm event, usually in the 10-year ARI time of concentration storm event.
7. Divert water from the structure until vegetation is stabilised properly.

RECP : CONCENTRATED FLOW **SD 5-7**

Figure E-5 Typical application of rolled erosion control products in channels (Landcom 2004)



Construction Notes

1. Remove any rocks, clods, sticks or grass from the ground surface before laying the matting.
2. Spread topsoil to at least 75 mm depth.
3. Where appropriate, complete fertilising and seeding on a properly prepared seedbed (Standard Drawing 7-1) before laying the matting.
4. Ensure the fabric can be continuously in contact with the soil by grading the surface carefully first.
5. Lay the matting in "shingle-fashion" with the ends of each upstream roll overlapping the next roll downslope.
6. Ensure sufficient staples are used to maintain a good contact between the soil and the matting.

RECP : SHEET FLOW **SD 5-2**

Figure E-6 Typical application of rolled erosion control products on disturbed areas (Landcom 2004)

E.7 Implementation

The typical implementation strategy for managing erosion and sediment controls includes:

- Sediment controls are to be implemented in the area of any ground disturbance, prior to the disturbance activity occurring. A sediment fence or appropriately designed sediment control structure must be erected downslope of the area of disturbance.
- Dirty runoff water should be directed to the sediment controls. Small areas of ground disturbance may be managed in situ by using appropriate sediment source controls.
- Dirty runoff that may be exposed to hydrocarbons must be treated with an oil/water separator, where practicable. The collected hydrocarbon wastes must be disposed off-site by a licensed waste operator. Remote site facilities should be managed on a site by site basis within the confines of the facility.
- Areas where contamination of water by hydrocarbons must be minimised. Servicing of vehicles must be conducted within appropriate areas designed to treat potential hydrocarbon spills.
- Equipment and materials should be cleaned in the designated washdown areas.
- All emergency discharge sites are to include flow dissipaters to reduce scouring directly downstream of the discharge point.
- All erosion and sediment controls are to remain in place until the area of disturbance can be satisfactorily rehabilitated and stabilised.

Table E-4 summarises the acceptable water quality objectives for disturbance activities when works may occur outside the catchment of an LDP.

Table E-4 Water quality objectives

Parameter	Units	Concentration limit
pH	pH units	6.5–8.5
Oil and grease	mg/L	10
Total suspended solids	mg/L	50

APPENDIX F – Communication protocol

This communication protocol has been prepared to guide the coordination and planning of water management at Mount Piper Power Station (managed by EnergyAustralia NSW Pty Ltd) and the Springvale Coal Services site (part of Western Coal Services; managed by Springvale Coal Pty Ltd), with the aim to minimise cumulative impacts on the downstream receiving environment from operations.

Figure F-1 presents the areas associated with Mount Piper Power Station and the Springvale Coal Services site.

F.1 Water management objectives

Shared water management objectives of Mount Piper Power Station and the Springvale Coal Services site include:

- Minimise cumulative impacts of both operations on the receiving surface water and groundwater environments.
- Protect the environmental values of Wangcol Creek as an aquatic ecosystem.
- Maintain or improve the groundwater quality of the shallow aquifer across both sites.
- Improve effectiveness of monitoring and impact assessment through a coordinated and collaborative approach.

F.2 Information and data sharing

F.2.1 Information and data to be shared

The following information and data may be shared between EnergyAustralia NSW Pty Ltd and Springvale Coal Pty Ltd:

- Surface water monitoring data, including water quality, flow and discharge volume data. Monitoring locations nominated for data sharing are presented in Figure F-2 for Mount Piper Power Station and Figure F-3 for Springvale Coal Services site.
- Groundwater monitoring data, including water quality and groundwater level/pressure data. Monitoring locations nominated for data sharing are presented in Figure F-2 for Mount Piper Power Station and Figure F-3 for Springvale Coal Services site.
- Design information in relation to water management infrastructure that may impact neighbouring operations.
- Operational information or data in relation to water management that may impact neighbouring operations, for example moisture levels of ash or reject material, emplacement rates, leachate irrigation rates.
- Relevant results and outcomes of any investigations, for example specialist assessments on surface water and groundwater environments.
- Development assessment documentation submitted to the NSW Department of Planning and Environment (prior to being placed on public exhibition).

F.2.2 Occurrence of information and data sharing

All other information and data can be shared as required, for example when there are major changes to water management that may impact the neighbouring operation or when a water-related incident occurs that requires notification of regulatory authorities.

F.2.3 Format of information and data

All information should be shared electronically either by email or by means of large file transfer (cloud based transfer options). Electronic information will be provided in the most practicable format for the data, for example CADD information provided as DWG files, monitoring data provided as Excel spreadsheets. Where information is to be shared extraordinarily, data should be shared by whatever means are necessary.

F.2.4 Conditions on using information and data provided by others

Information and data should be published publicly by the company for which the information was developed or the data collected for, unless specifically authorised by the respective company.

Specialist consultants engaged by others are not to be directly consulted with unless specifically authorised by the engaging company.

F.3 Joint investigations

In the event that a complaint or exceedance of any performance criteria is likely to have a cumulative impact on downstream receiving environments, EnergyAustralia NSW Pty Ltd and Springvale Coal Pty Ltd will call a joint water management meeting (see section F.4) and will undertake a joint investigation where the complaint or exceedance is determined to be influenced (caused by) a combination of both parties.

F.4 Water management meetings

A Western Water Resources Working group was established in mid-2018. This working group includes key site personnel from Mount Piper Power Station and Springvale Coal Services site and generally meet on a six monthly basis to discuss relevant water management issues. This may include:

- Any relevant changes to operational water management that may impact the neighbouring operation.
- Results of surface water and groundwater monitoring and coordination of future monitoring.
- Review any opportunities for water sharing or transfers between operations.
- Outcomes of any investigations that may potentially have a cumulative impact on the downstream receiving environment.
- Review any opportunities for collaboration on investigations and modelling of surface water and groundwater environments.

F.5 Review

The communication protocol will be reviewed annually by all parties and revised if necessary. Any additional stakeholders identified in the area will be consulted and included in the communication protocol as required, subject to the determination and commencement of other developments in the area.

F.6 Key contacts

Site	Company	Role	Contact
Mount Piper Power Station	Energy Australia NSW Pty Ltd	NSW Environmental Leader	Ben Eastwood ben.eastwood@energyaustraliansw.com.au Ph: 02 6354 8111 Mob: 0478 420 887
Springvale Coal Services site	Springvale Coal Pty Ltd	Environment and Community Graduate	Daniel Cortez Daniel.Cortez@centennialcoal.com.au Ph: 02 6355 9509
Centennial Corporate	Centennial Coal Pty Ltd	General Manager Environmental Social Governance	Chase Dingle Chase Dingle@centennialcoal.com.au

1:20,000 for A4

0 87.5 175 350 525 700
Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

LEGEND

- Project approval area
- Mount Piper Power Station - Site boundary
- Water storage
- Surface water catchment to be managed by Energy Australia
- Watercourse - Non Perennial
- Watercourse - Perennial

LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	refer to scalebar

Western Coal Services
Water Management Plan

Site operation areas

CENTENNIAL
Springvale Coal Services Operation

DATE 23 July 2024

Figure F-1

GIS Filename: \\ghdnet\ghd\AU\Newcastle\Projects\22\0105001\GIS\Maps\Deliverables\Western\WesternCoal\12579944\WMP\12579944_WMP020_CP_OperationalAreas_6.mxd

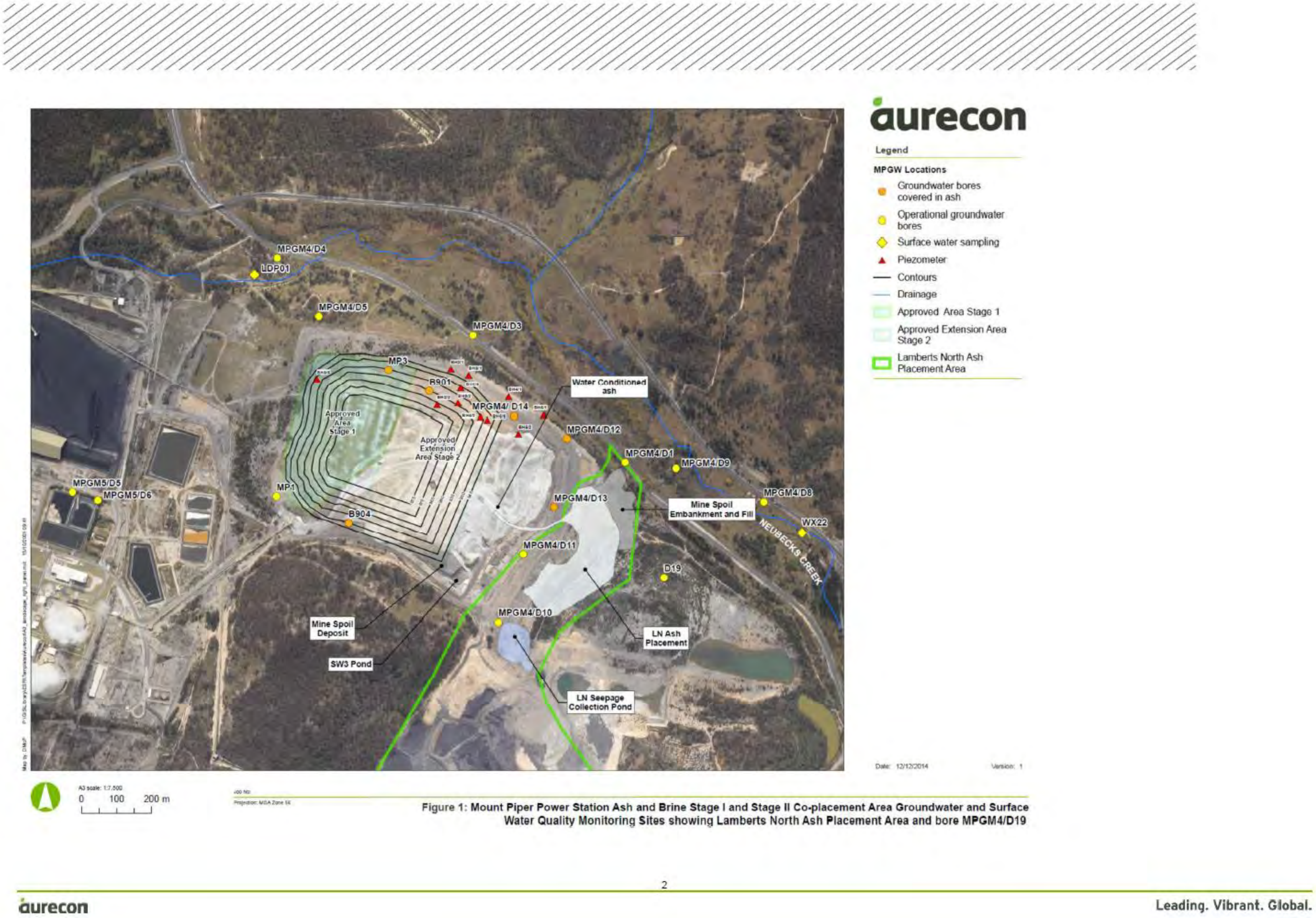


Figure F-2 Water monitoring – Mount Piper Power Station (source: aurecon 2009)

1:20,000 for A4

0 87.5 175 350 525 700

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

LEGEND

- Monitoring borehole
- Discharge locations
- Downstream locations
- Upstream locations
- Surface storage sampling site
- Water storage
- Watercourse - Non Perennial
- Watercourse - Perennial

LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	refer to scalebar

Western Coal Services
Water Management Plan
Water monitoring -
Springvale Coal Services

CENTENNIAL
Springvale Coal Services Operation

DATE 23 July 2024

Figure F-3

GIS Filename: \\ghdnet\ghd\AU\Newcastle\Projects\22\0105001\GIS\Maps\Deliverables\Western\WesternCoal\12579944\WMP\12579944_WMP021_CP_SCSSMonitoring_6.mxd

APPENDIX G – Baseline groundwater data

G.1 Groundwater bore database search

Bore	Licence	Location		Use	Depth (m)	SWL (m bgl)	Salinity	Yield (L/s)
		m N	m E					
GW011892	10WA116181	232547	6296343	Water Supply	5.4	–	–	–
GW030862	–	232011	6305425	Commercial and Industrial	146	–	–	–
GW039443	–	231952	6297313	Irrigation	70	–	–	–
GW047572	10BL141431	778887	6301601	Irrigation	28.9	–	–	–
GW050996	–	230232	6299640	Water Supply	45.7	–	–	–
GW053046	–	229846	6306999	Commercial and Industrial	58.5	–	0–500 ppm	–
GW053071	10BL134354	227433	6300764	Irrigation	15.2	–	–	–
GW053401	–	778055	6302365	Irrigation	25.9	–	1,001–3,000 ppm	–
GW053719	–	228233	6306368	Commercial and Industrial	60	–	Very salty	–
GW054781	10WA116196	232468	6296402	Water Supply	38.1	1.5	Good	0.25
GW055055	10WA116198	232064	6296052	Water Supply	21.3	7.6	–	4.5
GW057365	10WA116205	232726	6296410	Water Supply	30.5	–	–	17.5
GW057380	10BL125180	225236	6298882	Water Supply	42.7	–	–	–

Bore	Licence	Location		Use	Depth (m)	SWL (m bgl)	Salinity	Yield (L/s)
		m N	m E					
GW057399	10WA116209	231850	6296324	Water Supply	18.3	4.6	–	0.63
GW057649	10BL126321	225902	6299117	Water Supply	23.5	–	Fair	–
GW058108	10WA116206	232570	6296467	Water Supply	30.5	–	–	17.5
GW058554	10WA116208	232465	6296526	Water Supply	33.5	9.1	Good	0.63
GW058576	10BL128116	225778	6298928	Water Supply	0	–	–	–
GW060428	–	231162	6296890	Irrigation	15	–	–	–
GW062815	10BL134742	228910	6302103	Water Supply	56.7	–	Fair	–
GW067999	–	221253	6300518	Water Supply	53.3	–	–	–
GW068458	-	221242	6300530	Water Supply	53.3	3.05	–	0.75
GW072713	10BL154771	228517	6302706	Water Supply	15.8	–	Good	–
GW100514	10BL138828	221229	6300410	Water Supply	33	–	–	–
GW101340	10BL158032	225045	6305599	Monitoring	26.4	2.55	–	–
GW101341	10BL158032	224965	6305690	Monitoring	30.6	18.49	–	–
GW101342	10BL158032	224586	6305370	Monitoring	28.7	27.2	–	–
GW101413	10BL158376	779031	6303157	Water Supply	36	22	–	0.63
GW101461	10BL158341	228708	6301416	Water Supply	45	15	–	0.63

Bore	Licence	Location		Use	Depth (m)	SWL (m bgl)	Salinity	Yield (L/s)
		m N	m E					
GW102079	10BL158928	223093	6299654	Water Supply	43	3	Good	1.51
GW102225	10BL142467	221174	6300328	Water Supply	53.4	–	–	–
GW102254	10BL156819	221344	6300719	Water Supply	38.1	6.4	–	0.06
GW102426	–	231546	6299830	Water Supply	70	–	–	–
GW102427	–	231521	6299799	Water Supply	68.45	–	–	–
GW103032	10BL156822	778347	6301555	Irrigation	58	–	–	–
GW103238	–	231463	6299287	Water Supply	68.45	–	–	–
GW105064	10BL164659	230354	6307751	Commercial and Industrial	104	6	–	0.6
GW105235	10BL161212	224097	6299210	Water Supply	72	23.5	–	1.136
GW105294	10BL162989	230337	6307812	Water Supply	16	3	–	0.126
GW105295	10BL162991	230239	6307855	Water Supply	16	3	–	0.126
GW105801	–	227528	6297908	Water Supply	37	–	–	–
GW105973	10BL163783	230354	6307815	Unknown	0	–	–	–
GW106243	10BL163822	229939	6307312	Unknown	0	–	–	–
GW106737	10BL164509	228017	6303098	Water Supply	90	33	–	0.65
GW107329	10BL165224	230020	6307335	Water Supply	48	26	–	0.4

Bore	Licence	Location		Use	Depth (m)	SWL (m bgl)	Salinity	Yield (L/s)
		m N	m E					
GW108613	–	788327	6307462	Water Supply	53	27	Good	5.675
GW109260	–	231949	6301453	Monitoring	9	–	–	–
GW109261	10WM000002	229804	6301350	Monitoring	18.03	9.8	–	–
GW109262	10WM000002	230234	6301699	Monitoring	17.45	3.6	–	–
GW109263	10WM000002	230188	6302356	Monitoring	6	3.5	–	–
GW109264	10WM000002	229631	6302172	Monitoring	14.3	4.5	–	–
GW109265	10WM000002	229380	6301985	Monitoring	14.9	1	–	–
GW110157	10BL165933	227341	6304272	Monitoring	9	–	–	–
GW110158	10BL165933	227594	6304231	Monitoring	9	–	–	–
GW110159	10BL165933	227830	6304284	Monitoring	10.3	–	–	–
GW110160	10BL165933	228222	6304736	Monitoring	43	–	–	–
GW110161	10BL165933	228450	6304256	Monitoring	27.5	–	–	–
GW110162	10BL165933	228445	6304252	Monitoring	12	–	–	–
GW110329	10BL600114	779076	6302271	Water Supply	8	2	–	2.5
GW110437	–	227895	6300507	Monitoring	90	–	–	0.0631
GW110480	10BL603120	229530	6301970	Monitoring	10	–	–	–

Bore	Licence	Location		Use	Depth (m)	SWL (m bgl)	Salinity	Yield (L/s)
		m N	m E					
GW110481	10BL603121	229166	6301607	Monitoring	15.8	–	–	–
GW110482	10BL603122	229153	6303047	Monitoring	33	–	–	–
GW110483	10BL603122	229149	6303043	Monitoring	21	–	–	–
GW110484	10BL603123	229722	6302886	Monitoring	59	–	–	–
GW110485	10BL603123	229732	6301996	Monitoring	65	–	–	–
GW110520	10BL603501	228103	6300812	Commercial and Industrial	12	1.2	–	0.505
GW110861	10BL603591	227055	6303562	Monitoring	24	–	–	–
GW110998	–	225718	6296702	Water Supply	55	–	–	–
GW110999	–	225943	6297777	Water Supply	55	–	–	–
GW111021	–	230615	6306064	Dewatering	360	–	–	–
GW111025	–	233981	6300737	Dewatering	380	–	–	–
GW111026	–	231254	6300484	Dewatering	400	–	–	–
GW111027	–	226988	6303549	Monitoring	24	–	–	–
GW111028	–	226945	6303551	Monitoring	24	–	–	–
GW111029	–	227030	6303584	Monitoring	24	–	–	–
GW111030	–	227070	6303571	Monitoring	24	–	–	–

Bore	Licence	Location		Use	Depth (m)	SWL (m bgl)	Salinity	Yield (L/s)
		m N	m E					
GW111203	–	226800	6306346	Monitoring	84	–	–	–
GW111204	–	228994	6308259	Monitoring	16	–	–	–
GW111205	–	226797	6306348	Monitoring	87	–	–	–
GW111206	–	227132	6306531	Monitoring	38.94	–	–	–
GW111207	–	224813	6306516	Monitoring	50	–	–	–
GW111208	–	228994	6308259	Monitoring	105	–	–	–
GW111334	–	227687	6304308	Monitoring	12	–	–	–
GW111358	–	227122	6299450	Monitoring	6.4	–	–	–
GW111359	–	227111	6299452	Monitoring	6	–	–	–
GW111360	–	227109	6299443	Monitoring	6	–	–	–
GW111471	–	227094	6303739	Monitoring	24	–	–	–
GW111472	–	227053	6303741	Monitoring	23.9	–	–	–
GW111473	–	227298	6303561	Monitoring	80.8	–	–	–
GW111587	10WA112590	227926	6297585	Water Supply	80	8	–	–
GW111746	10BL604869	226055	6306394	Monitoring	53	–	–	–
GW111747	-	226295	6306539	Monitoring	30	7	–	–

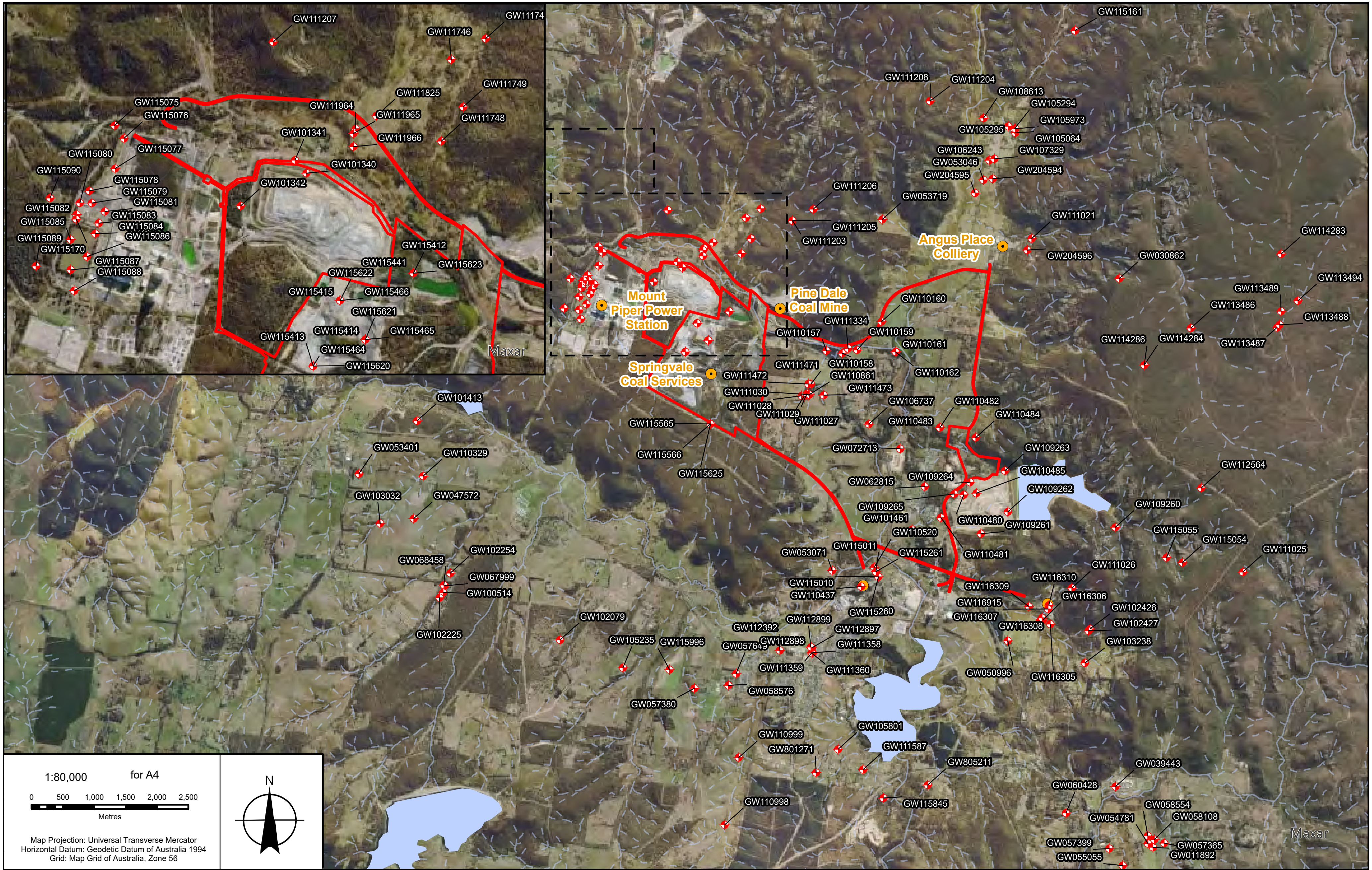
Bore	Licence	Location		Use	Depth (m)	SWL (m bgl)	Salinity	Yield (L/s)
		m N	m E					
GW111748	10BL604868	225986	6305823	Monitoring	30	16.2	–	–
GW111749	-	226139	6306062	Monitoring	57.5	20	–	–
GW111825	10BL604870	225533	6306000	Monitoring	20	–	–	–
GW111964	10BL605162	225389	6305910	Monitoring	2.2	0.53	–	–
GW111965	-	225373	6305876	Monitoring	4.5	0.95	–	–
GW111966	-	225373	6305785	Monitoring	2.9	0.31	–	–
GW112392	10WA116381	226598	6299487	Water Supply	33	8	–	2.93
GW112564	-	233318	6302081	Dewatering	380	–	–	–
GW112897	10BL604619	227111	6299528	Monitoring	5.36	0.5	–	1
GW112898	-	227101	6299529	Monitoring	5.1	0.44	–	1
GW112899	-	227093	6299540	Monitoring	5	0.58	–	1
GW113486	10BL601829	233152	6304633	Monitoring	2.2	–	–	–
GW113487	-	234527	6304641	Monitoring	2	–	–	–
GW113488	-	234566	6304686	Monitoring	2.5	–	–	–
GW113489	-	234591	6304901	Monitoring	2.53	–	–	–
GW113494	-	234859	6305069	Monitoring	2.2	–	–	–

Bore	Licence	Location		Use	Depth (m)	SWL (m bgl)	Salinity	Yield (L/s)
		m N	m E					
GW114283	-	234593	6305817	Monitoring	75	–	–	–
GW114284	-	232410	6304043	Monitoring	110	–	–	–
GW114286	-	232410	6304043	Monitoring	50	–	–	–
GW115010	10BL605720	228170	6300662	Monitoring	7.5	3.85	–	–
GW115011	-	228131	6300744	Monitoring	5	1.64	–	0.5
GW115054	-	233019	6300889	Monitoring	426	–	–	1
GW115055	-	232764	6300969	Monitoring	294	–	–	0.5
GW115075	-	223707	6305932	Monitoring	20	16.5	–	–
GW115076	-	223773	6305842	Monitoring	9.8	–	–	–
GW115077	-	223711	6305632	Monitoring	11	9	–	–
GW115078	-	223531	6305476	Monitoring	22	9.5	–	–
GW115079	-	223548	6305390	Monitoring	8.9	7	–	–
GW115080	-	223464	6305392	Monitoring	5	3	–	–
GW115081	-	223638	6305332	Monitoring	20	–	–	–
GW115082	-	223442	6305311	Monitoring	7	5.5	–	–
GW115083	-	223596	6305250	Monitoring	7.7	5.6	–	–

Bore	Licence	Location		Use	Depth (m)	SWL (m bgl)	Salinity	Yield (L/s)
		m N	m E					
GW115084	-	223573	6305177	Monitoring	10	6.2	–	–
GW115085	-	223400	6305135	Monitoring	6	2.4	–	–
GW115086	-	223514	6305016	Monitoring	20	–	–	–
GW115087	-	223400	6304924	Monitoring	10	5	–	–
GW115088	-	223425	6304779	Monitoring	4	1.5	–	–
GW115089	-	223158	6304951	Monitoring	5	3	–	–
GW115090	-	223257	6305425	Monitoring	4.8	3	–	–
GW115161	-	231305	6309384	Unknown	0	–	–	–
GW115170	-	223439	6305278	Monitoring	20	–	–	–
GW115260	-	228170	6300662	Monitoring	7.5	–	–	–
GW115261	-	228131	6300744	Monitoring	5	–	–	–
GW115412	-	225791	6304901	Monitoring	12	–	–	–
GW115413	-	225092	6304252	Monitoring	36	–	–	–
GW115414	-	225456	6304437	Monitoring	33.5	–	–	–
GW115415	-	225279	6304710	Monitoring	43.4	–	–	–
GW115441	-	225791	6304901	Monitoring	12	–	–	–

Bore	Licence	Location		Use	Depth (m)	SWL (m bgl)	Salinity	Yield (L/s)
		m N	m E					
GW115464	-	225092	6304252	Monitoring	36	–	–	–
GW115465	-	225456	6304437	Monitoring	33.5	–	–	–
GW115466	-	225279	6304710	Monitoring	43.4	–	–	–
GW115565	-	225492	6303102	Monitoring	33	–	–	–
GW115566	-	225492	6303102	Monitoring	33	–	–	–
GW115620	-	225092.4	6304252.5	Monitoring	36	–	–	–
GW115621	-	225456.9	6304437.8	Monitoring	33.5	–	–	–
GW115622	-	225279.9	6304710	Monitoring	43.4	–	–	–
GW115623	-	225791.3	6304901	Monitoring	12	–	–	–
GW115625	-	225492	6303102	Monitoring	33	–	–	–
GW115845	10WA122651	228250	6297130	Stock and Domestic	200	28	–	3
GW115996	10WA123257	224839	6299179	Stock and Domestic	89	–	–	–
GW116305	-	230911	6299906	Monitoring	8.5	–	–	–
GW116306	-	230794	6299972	Monitoring	6.2	–	–	–
GW116307	-	230739	6299946	Monitoring	4	–	–	–
GW116308	-	230780	6300007	Monitoring	7.5	–	–	–

Bore	Licence	Location		Use	Depth (m)	SWL (m bgl)	Salinity	Yield (L/s)
		m N	m E					
GW116309	-	230569	6300187	Monitoring	7.5	–	–	–
GW116310	-	230889	6300209	Monitoring	10.7	–	–	–
GW116915	-	230875	6300148	Monitoring	6	–	–	–
GW204594	-	229992.7	6307016.5	Monitoring	9.5	–	–	–
GW204595	-	229711.3	6306790.3	Monitoring	6	–	–	–
GW204596	-	230545.3	6305878.5	Monitoring	7	–	–	–
GW801271	–	227176	6297536	Water Supply	55	–	–	–
GW805211	-	228956	6297337	Water Supply	0	–	–	–



LEGEND

- Project approval area
- Licensed Groundwater Bore
- Site location
- Waterbody
- Watercourse - Non Perennial
- Watercourse - Perennial

LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	Refer to scalebar

Western Coal Services
Water Management Plan

Groundwater bore search

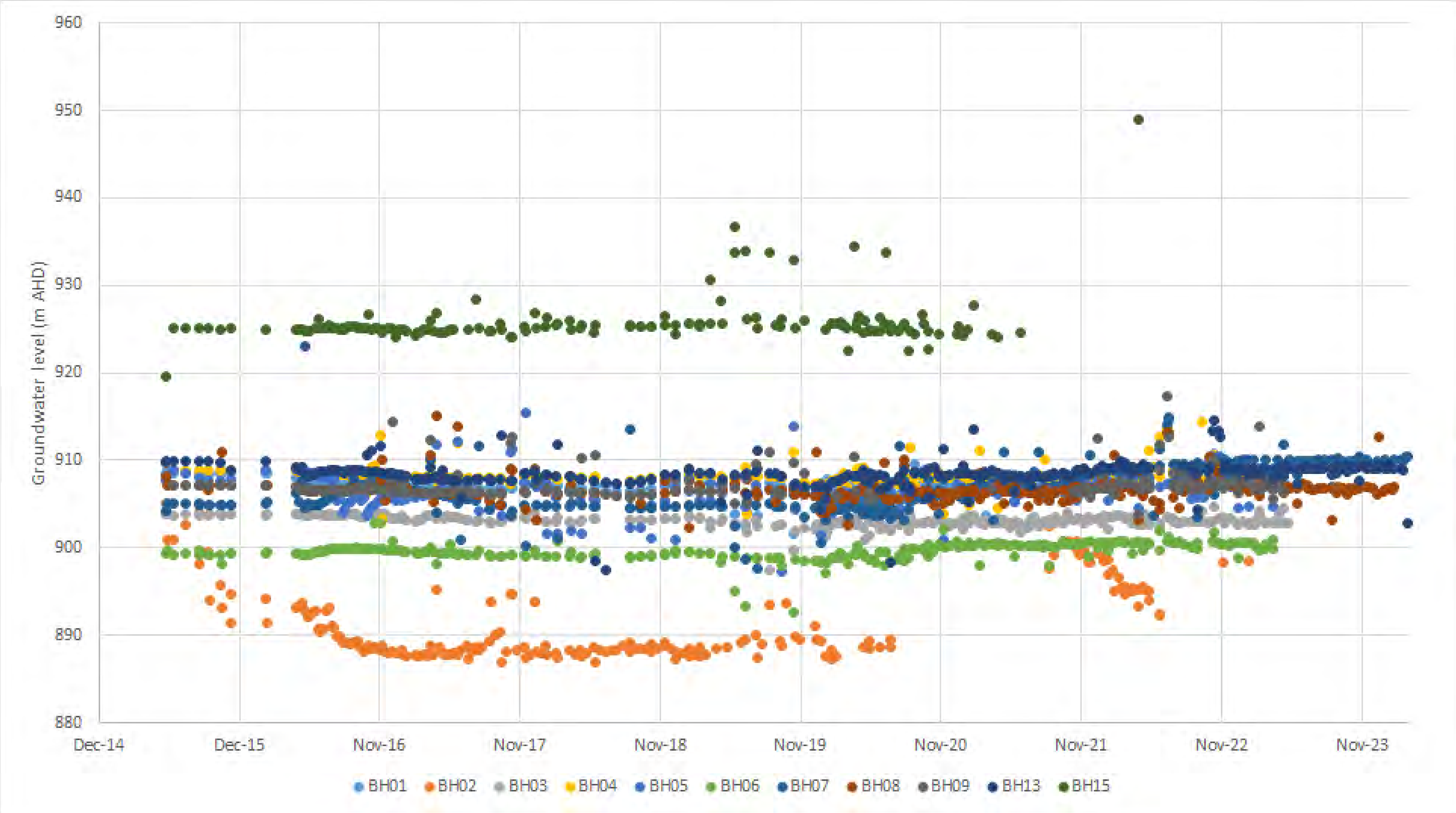
CENTENNIAL
Springvale Coal Services Operation

DATE 7/24/2024

Figure G-1

GIS Filename: \\ghdnet\ghd\AU\Newcastle\Projects\22\0105001\GIS\Maps\Deliverables\Western\WesternCoal\12579944\WMP\12579944_WMP019_GWBoreSearch_5km_6\12579944_WMP019_GWBoreSearch_5km_6.aprx

G.2 Groundwater levels



G.3 Groundwater quality

G.3.1 Statistical summary of water quality results

Parameter	Units	BH01				BH02			
		Count	20th	Median	80th	Count	20th	Median	80th
Physicochemical									
EC	µS/cm	191	2070	3350	4440	128	1024	1324	1468
pH	pH units	181	5.53	5.77	5.90	124	6.40	6.60	6.80
TDS	mg/L	105	1884	3030	3768	59	678	953	1261
TSS	mg/L	104	29	70	232	59	184	4075	17128
Nutrients									
Nitrate	mg/L	105	0.02	0.06	0.16	62	0.06	0.15	0.45
Nitrite	mg/L	105	0.01	0.01	0.01	62	0.01	0.01	0.01
Nitrate + nitrite	mg/L	105	0.02	0.06	0.16	62	0.07	0.15	0.49
Total phosphorus	mg/L	105	0.02	0.04	0.09	62	0.09	1.37	4.02
Major ions									
Bicarbonate alkalinity	mg/L	105	62	87	123	62	216	260	326
Carbonate alkalinity	mg/L	105	1	1	1	62	1	1	1
Hydroxide alkalinity	mg/L	105	1	1	1	62	1	1	1
Total alkalinity	mg/L	105	62	87	123	62	216	260	326
Calcium	mg/L	105	58	125	165	62	107	152	172
Chloride	mg/L	105	213	282	363	62	39	53	71
Magnesium	mg/L	105	144	226	298	62	48	67	72
Potassium	mg/L	105	6	10	14	62	12	15	16
Sodium	mg/L	105	300	379	501	62	28	30	35
Sulfate	mg/L	104	1032	1675	2244	61	128	379	444
Hardness	mg/L	105	733	1300	1660	62	453	653	732
Dissolved metals									
Iron	mg/L	100	0.36	1.43	4.51	57	0.05	0.30	0.66
Manganese	mg/L	96	4.30	6.85	9.90	53	0.29	0.51	0.76
Nickel	mg/L	105	0.529	0.782	1.010	62	0.010	0.026	0.055
Zinc	mg/L	105	0.459	0.691	0.949	62	0.018	0.043	0.088
Total metals									
Aluminium	mg/L	104	0.18	0.68	2.26	61	0.48	7.17	44.80
Boron	mg/L	105	0.35	0.60	0.92	62	0.05	0.08	0.09
Cadmium	mg/L	102	0.0002	0.0003	0.0005	59	0.0001	0.0003	0.0017

Parameter	Units	BH01				BH02			
		Count	20th	Median	80th	Count	20th	Median	80th
Iron	mg/L	104	1.47	3.80	8.20	60	4.46	74.40	310.20
Manganese	mg/L	105	4.70	7.41	10.40	61	0.73	1.46	4.32
Selenium	mg/L	105	0.01	0.01	0.01	61	0.01	0.01	0.02
Zinc	mg/L	105	0.502	0.748	1.020	61	0.094	0.733	1.960

Parameter	Units	BH03				BH04			
		Count	20th	Median	80th	Count	20th	Median	80th
Physicochemical									
EC	µS/cm	196	1004	1230	1377	189	430	457	505
pH	pH units	186	3.58	3.90	4.45	180	6.30	6.50	6.70
TDS	mg/L	106	790	977	1070	100	242	266	305
TSS	mg/L	106	30	58	90	101	24	46	99
Nutrients									
Nitrate	mg/L	107	0.01	0.02	0.39	101	0.02	0.13	0.69
Nitrite	mg/L	107	0.01	0.01	0.01	101	0.01	0.01	0.01
Nitrate + nitrite	mg/L	107	0.01	0.02	0.39	101	0.03	0.13	0.70
Total phosphorus	mg/L	107	0.01	0.02	0.04	101	0.01	0.03	0.06
Major ions									
Bicarbonate alkalinity	mg/L	107	1	1	1	101	166	184	197
Carbonate alkalinity	mg/L	107	1	1	1	101	1	1	1
Hydroxide alkalinity	mg/L	107	1	1	1	101	1	1	1
Total alkalinity	mg/L	107	1	1	1	101	166	184	197
Calcium	mg/L	107	44	52	58	101	38	41	44
Chloride	mg/L	107	42	68	87	101	12	13	14
Magnesium	mg/L	107	46	58	63	101	18	19	20
Potassium	mg/L	107	5	6	6	101	9	10	11
Sodium	mg/L	107	36	47	56	101	16	17	20
Sulfate	mg/L	106	425	562	634	101	25	30	36
Hardness	mg/L	107	302	370	402	101	170	178	192
Dissolved metals									
Iron	mg/L	102	46.82	62.50	77.08	101	0.06	0.93	2.58
Manganese	mg/L	98	5.36	7.01	7.61	101	0.32	0.40	0.50
Nickel	mg/L	107	0.237	0.284	0.316	101	0.007	0.010	0.012

Parameter	Units	BH03				BH04			
		Count	20th	Median	80th	Count	20th	Median	80th
Zinc	mg/L	107	0.762	0.896	1.020	101	0.025	0.036	0.071
Total metals									
Aluminium	mg/L	106	6.27	9.94	12.40	101	0.15	0.38	0.78
Boron	mg/L	107	0.05	0.05	0.05	101	0.05	0.05	0.05
Cadmium	mg/L	104	0.0002	0.0004	0.0005	100	0.0001	0.0001	0.0001
Iron	mg/L	106	54.60	68.35	82.70	100	1.40	3.64	6.06
Manganese	mg/L	107	5.42	7.28	7.88	101	0.33	0.45	0.57
Selenium	mg/L	107	0.01	0.01	0.01	101	0.01	0.01	0.01
Zinc	mg/L	107	0.813	0.952	1.090	101	0.039	0.060	0.120

Parameter	Units	BH05				BH06			
		Count	20th	Median	80th	Count	20th	Median	80th
Physicochemical									
EC	µS/cm	189	479	546	641	195	1617	2180	2660
pH	pH units	180	6.40	6.60	6.81	187	6.10	6.30	6.50
TDS	mg/L	100	272	308	370	110	1267	1696	2010
TSS	mg/L	101	24	59	108	110	20	33	58
Nutrients									
Nitrate	mg/L	101	0.06	0.13	0.54	111	0.01	0.03	0.12
Nitrite	mg/L	101	0.01	0.01	0.01	111	0.01	0.01	0.01
Nitrate + nitrite	mg/L	101	0.07	0.14	0.54	111	0.01	0.03	0.15
Total phosphorus	mg/L	101	0.01	0.03	0.07	111	0.02	0.03	0.06
Major ions									
Bicarbonate alkalinity	mg/L	101	171	209	251	111	95	105	123
Carbonate alkalinity	mg/L	101	1	1	1	111	1	1	1
Hydroxide alkalinity	mg/L	101	1	1	1	111	1	1	1
Total alkalinity	mg/L	101	161	209	251	111	95	105	123
Calcium	mg/L	101	46	49	59	111	96	126	159
Chloride	mg/L	101	23	24	27	111	124	167	195
Magnesium	mg/L	101	19	25	30	111	63	86	103
Potassium	mg/L	101	9	10	12	111	18	20	22
Sodium	mg/L	101	18	19	22	111	193	249	308
Sulfate	mg/L	101	26	28	38	110	669	839	1042

Parameter	Units	BH05				BH06			
		Count	20th	Median	80th	Count	20th	Median	80th
Hardness	mg/L	101	179	224	269	111	499	660	826
Dissolved metals									
Iron	mg/L	101	0.05	0.05	0.57	106	4.31	7.68	10.00
Manganese	mg/L	101	0.07	0.34	0.98	102	1.81	2.38	3.12
Nickel	mg/L	101	0.007	0.014	0.029	111	0.092	0.111	0.148
Zinc	mg/L	101	0.021	0.041	0.074	111	0.038	0.058	0.079
Total metals									
Aluminium	mg/L	101	0.16	0.41	0.79	108	0.09	0.18	0.31
Boron	mg/L	101	0.05	0.05	0.05	111	0.48	0.62	0.71
Cadmium	mg/L	100	0.0001	0.0001	0.0001	108	0.0001	0.0001	0.0001
Iron	mg/L	100	0.59	1.44	3.56	110	7.11	9.57	12.22
Manganese	mg/L	101	0.13	0.44	1.11	111	1.89	2.52	3.32
Selenium	mg/L	101	0.01	0.01	0.01	111	0.01	0.01	0.01
Zinc	mg/L	101	0.036	0.070	0.116	111	0.055	0.076	0.100

Parameter	Units	BH07				BH08			
		Count	20th	Median	80th	Count	20th	Median	80th
Physicochemical									
EC	µS/cm	196	1528	1889	3500	197	3164	4060	5478
pH	pH units	187	5.55	6.00	6.51	188	5.90	6.10	6.40
TDS	mg/L	114	1179	1521	3024	111	2740	3438	4770
TSS	mg/L	114	41	92	215	111	20	37	61
Nutrients									
Nitrate	mg/L	115	0.02	0.08	0.35	112	0.02	0.08	0.28
Nitrite	mg/L	115	0.01	0.01	0.03	112	0.01	0.01	0.01
Nitrate + nitrite	mg/L	115	0.02	0.08	0.49	112	0.02	0.08	0.28
Total phosphorus	mg/L	115	0.02	0.04	0.12	112	0.01	0.01	0.04
Major ions									
Bicarbonate alkalinity	mg/L	115	40	122	235	112	85	110	154
Carbonate alkalinity	mg/L	115	1	1	1	112	1	1	1
Hydroxide alkalinity	mg/L	115	1	1	1	112	1	1	1
Total alkalinity	mg/L	115	40	122	235	112	85	110	154
Calcium	mg/L	115	140	197	317	112	136	191	278

Parameter	Units	BH07				BH08			
		Count	20th	Median	80th	Count	20th	Median	80th
Chloride	mg/L	115	32	38	123	112	240	305	462
Magnesium	mg/L	115	83	131	233	112	105	148	224
Potassium	mg/L	115	7	18	20	112	44	56	69
Sodium	mg/L	115	24	30	85	112	481	583	827
Sulfate	mg/L	114	625	837	1986	111	1480	1940	2760
Hardness	mg/L	115	819	934	1740	112	773	1070	1618
Dissolved metals									
Iron	mg/L	110	5.95	19.10	126.40	107	0.50	1.33	3.40
Manganese	mg/L	106	0.52	2.40	4.92	103	3.47	4.94	8.76
Nickel	mg/L	115	0.012	0.117	0.752	112	0.328	0.462	0.719
Zinc	mg/L	115	0.034	0.294	2.714	112	0.219	0.307	0.409
Total metals									
Aluminium	mg/L	109	0.27	0.66	2.09	109	0.12	0.21	0.44
Boron	mg/L	115	0.05	0.05	0.06	112	1.05	1.48	2.04
Cadmium	mg/L	112	0.0001	0.0001	0.0007	109	0.0001	0.0002	0.0004
Iron	mg/L	114	8.76	19.65	118.00	111	1.99	3.86	6.34
Manganese	mg/L	115	0.53	2.06	4.39	112	3.39	5.19	9.08
Selenium	mg/L	115	0.01	0.01	0.01	112	0.01	0.01	0.01
Zinc	mg/L	115	0.065	0.335	2.506	112	0.246	0.353	0.451

Parameter	Units	BH09				BH11			
		Count	20th	Median	80th	Count	20th	Median	80th
Physicochemical									
EC	µS/cm	143	2649	3850	5742	122	1125	1460	1829
pH	pH units	134	5.98	6.10	6.36	113	6.50	6.69	6.80
TDS	mg/L	76	2200	3155	5410	68	773	1064	1523
TSS	mg/L	77	17	38	210	69	24	56	80
Nutrients									
Nitrate	mg/L	76	0.02	0.05	0.32	68	0.02	0.07	0.40
Nitrite	mg/L	76	0.01	0.01	0.01	68	0.01	0.01	0.01
Nitrate + nitrite	mg/L	76	0.02	0.05	0.32	68	0.02	0.07	0.40
Total phosphorus	mg/L	76	0.01	0.02	0.04	68	0.01	0.02	0.04
Major ions									
Bicarbonate alkalinity	mg/L	76	95	115	148	68	247	271	304
Carbonate alkalinity	mg/L	76	1	1	1	68	1	1	1

Parameter	Units	BH09				BH11			
		Count	20th	Median	80th	Count	20th	Median	80th
Hydroxide alkalinity	mg/L	76	1	1	1	68	1	1	1
Total alkalinity	mg/L	76	95	115	148	68	247	271	304
Calcium	mg/L	76	116	174	281	68	136	157	225
Chloride	mg/L	76	181	279	529	68	24	47	78
Magnesium	mg/L	76	90	140	231	68	49	61	84
Potassium	mg/L	76	36	51	72	68	19	20	23
Sodium	mg/L	76	392	552	916	68	22	26	100
Sulfate	mg/L	76	1160	1865	2860	68	270	514	749
Hardness	mg/L	76	664	1008	1630	68	545	656	894
Dissolved metals									
Iron	mg/L	76	0.46	3.42	13.90	68	0.05	0.22	1.27
Manganese	mg/L	76	1.83	4.16	7.87	68	0.07	0.10	0.15
Nickel	mg/L	76	0.237	0.368	0.716	68	0.003	0.009	0.028
Zinc	mg/L	76	0.154	0.267	0.496	68	0.016	0.045	0.101
Total metals									
Aluminium	mg/L	76	0.09	0.24	0.90	68	0.15	0.28	0.53
Boron	mg/L	76	0.77	1.21	2.13	68	0.05	0.07	0.11
Cadmium	mg/L	77	0.0001	0.0002	0.0004	68	0.0001	0.0001	0.0001
Iron	mg/L	76	2.44	8.72	81.20	67	0.81	1.84	3.78
Manganese	mg/L	77	1.91	4.58	8.55	68	0.08	0.12	0.18
Selenium	mg/L	77	0.01	0.01	0.01	68	0.01	0.01	0.01
Zinc	mg/L	77	0.221	0.332	0.926	68	0.037	0.077	0.127

Parameter	Units	BH13			
		Count	20th	Median	80th
Physicochemical					
EC	µS/cm	180	2402	3250	4228
pH	pH units	171	6.20	6.31	6.50
TDS	mg/L	95	1886	2510	3540
TSS	mg/L	96	35	77	230
Nutrients					
Nitrate	mg/L	96	0.01	0.04	0.20
Nitrite	mg/L	96	0.01	0.01	0.01
Nitrate + nitrite	mg/L	96	0.01	0.04	0.20
Total phosphorus	mg/L	96	0.02	0.05	0.16

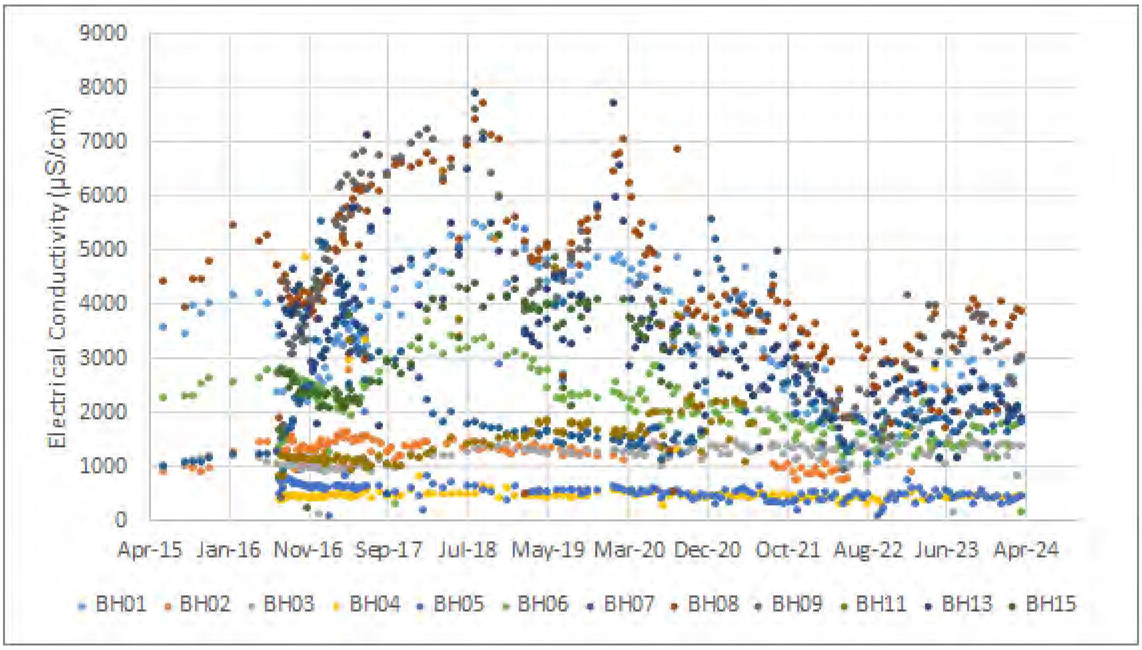
Parameter	Units	BH13			
		Count	20th	Median	80th
Major ions					
Bicarbonate alkalinity	mg/L	96	195	333	543
Carbonate alkalinity	mg/L	96	1	1	1
Hydroxide alkalinity	mg/L	96	1	1	1
Total alkalinity	mg/L	96	195	333	543
Calcium	mg/L	96	112	141	207
Chloride	mg/L	96	131	201	336
Magnesium	mg/L	96	110	163	245
Potassium	mg/L	96	25	34	48
Sodium	mg/L	96	291	420	545
Sulfate	mg/L	96	880	1355	1930
Hardness	mg/L	96	750	1025	1480
Dissolved metals					
Iron	mg/L	96	2.48	5.68	10.50
Manganese	mg/L	96	4.55	6.25	8.76
Nickel	mg/L	96	0.176	0.270	0.406
Zinc	mg/L	96	0.088	0.124	0.193
Total metals					
Aluminium	mg/L	95	0.19	0.60	1.81
Boron	mg/L	96	0.57	0.89	1.48
Cadmium	mg/L	94	0.0001	0.0002	0.0003
Iron	mg/L	94	4.29	8.98	19.28
Manganese	mg/L	95	4.69	6.37	9.18
Selenium	mg/L	95	0.01	0.01	0.01
Zinc	mg/L	95	0.114	0.162	0.304

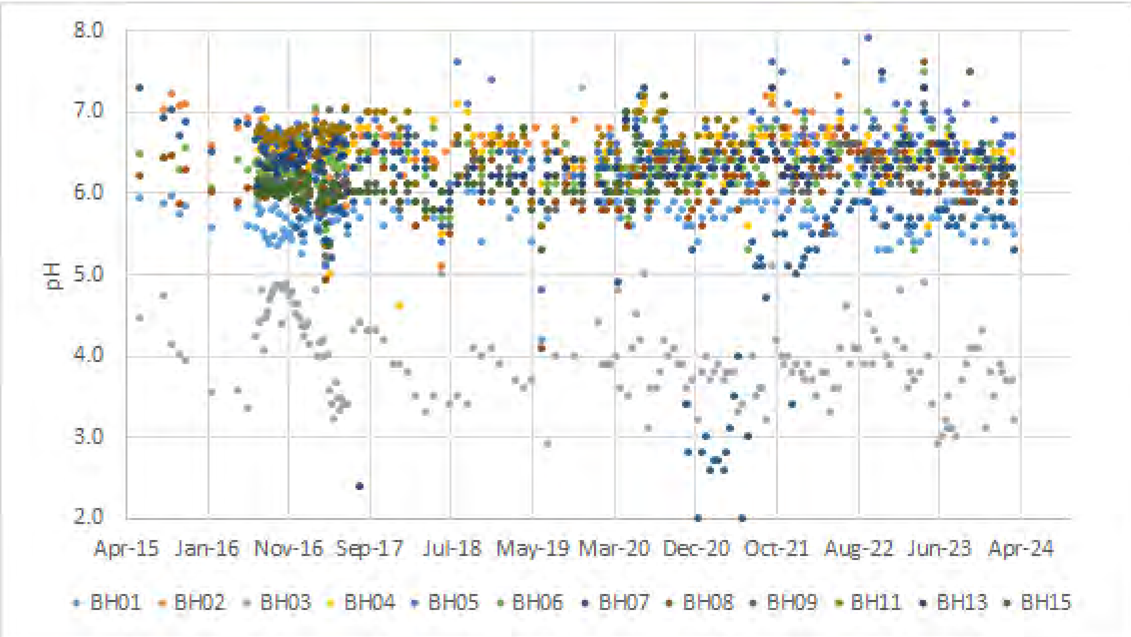
20^{th} = 20^{th} percentile

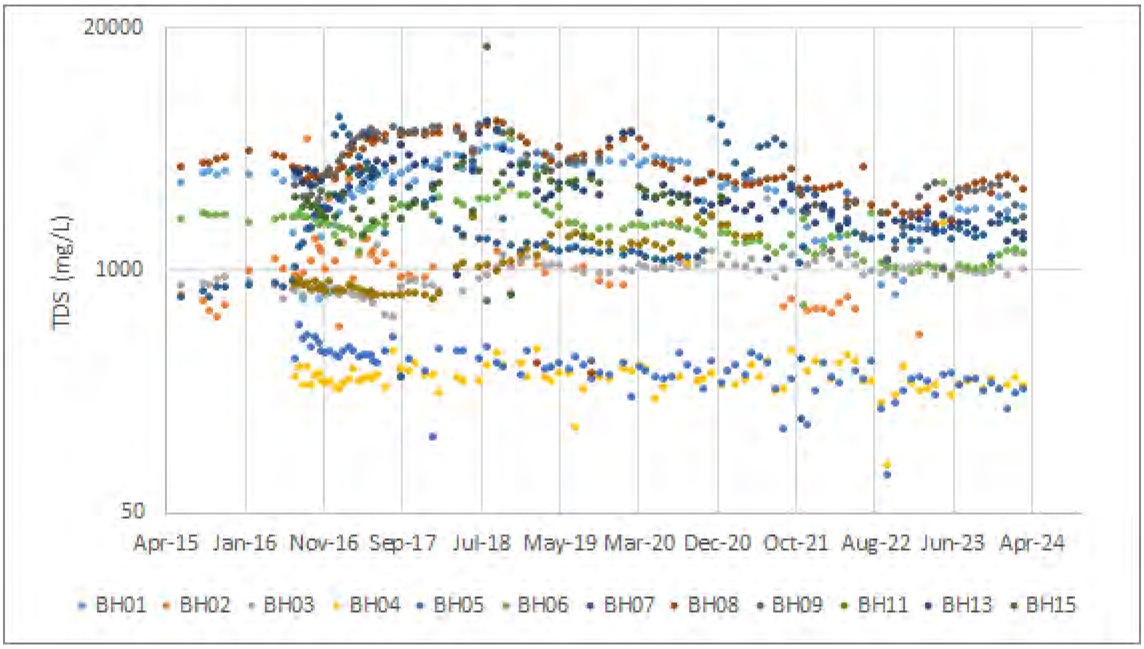
80^{th} = 80^{th} percentile

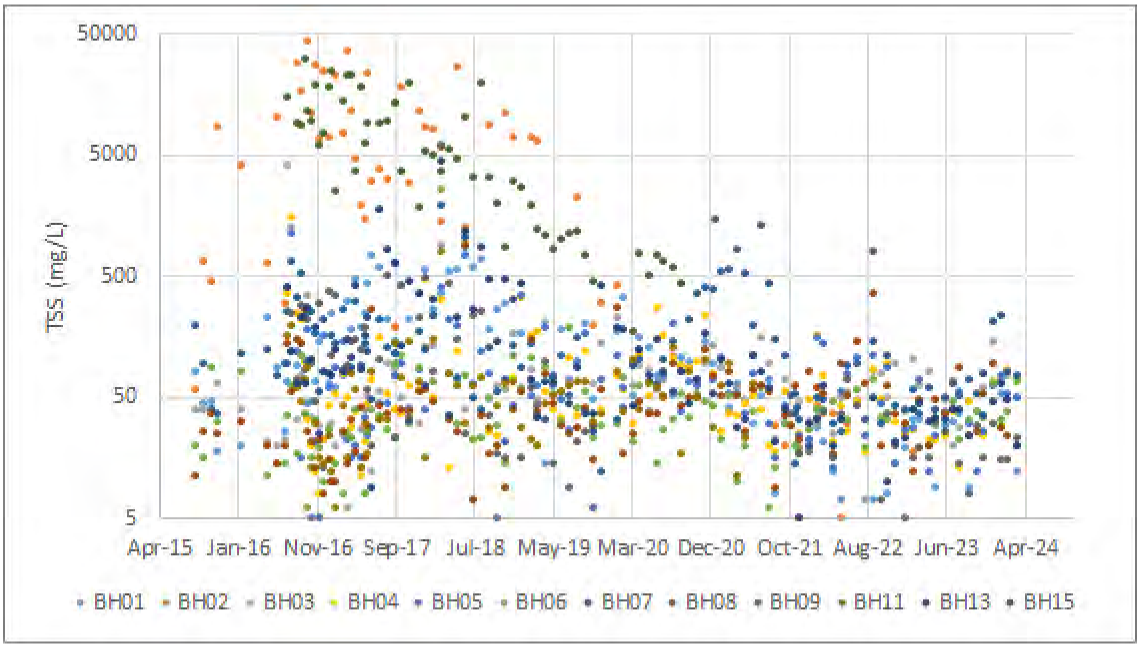
G.3.2 Time series graphs of water quality results

Physicochemical parameters

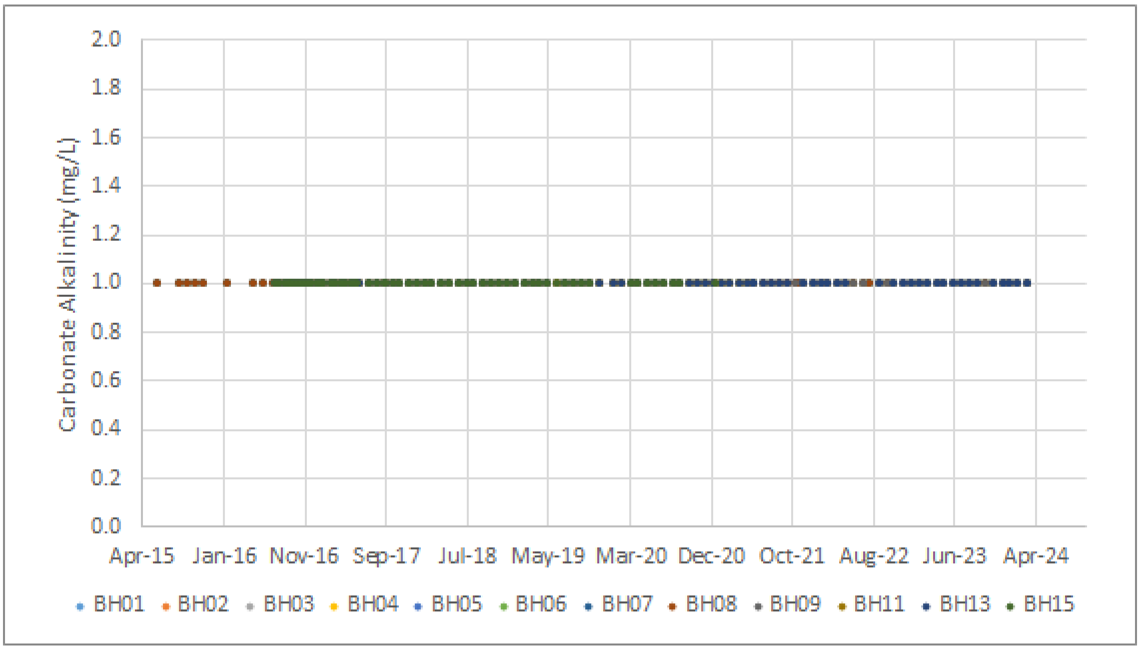




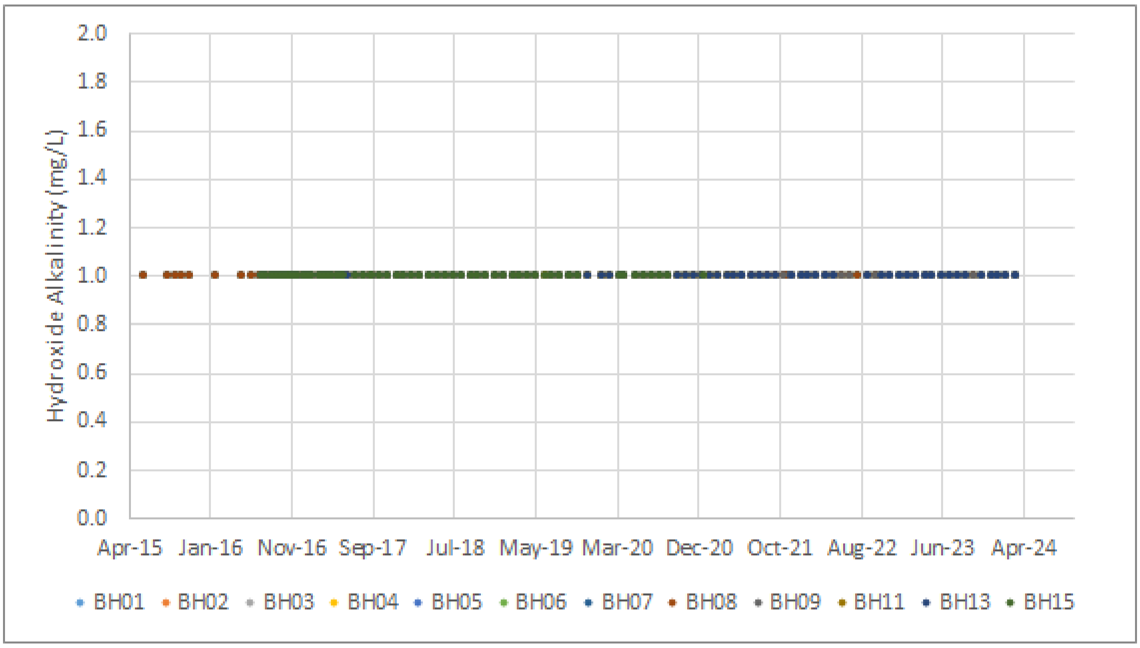

20000
1000
50
TDS (mg/L)
Apr-15
Jan-16
Nov-16
Sep-17
Jul-18
May-19
Mar-20
Dec-20
Oct-21
Aug-22
Jun-23
Apr-24
BH01
BH02
BH03
BH04
BH05
BH06
BH07
BH08
BH09
BH11
BH13
BH15


50000
5000
500
50
5
TSS (mg/L)
Apr-15
Jan-16
Nov-16
Sep-17
Jul-18
May-19
Mar-20
Dec-20
Oct-21
Aug-22
Jun-23
Apr-24
BH01
BH02
BH03
BH04
BH05
BH06
BH07
BH08
BH09
BH11
BH13
BH15

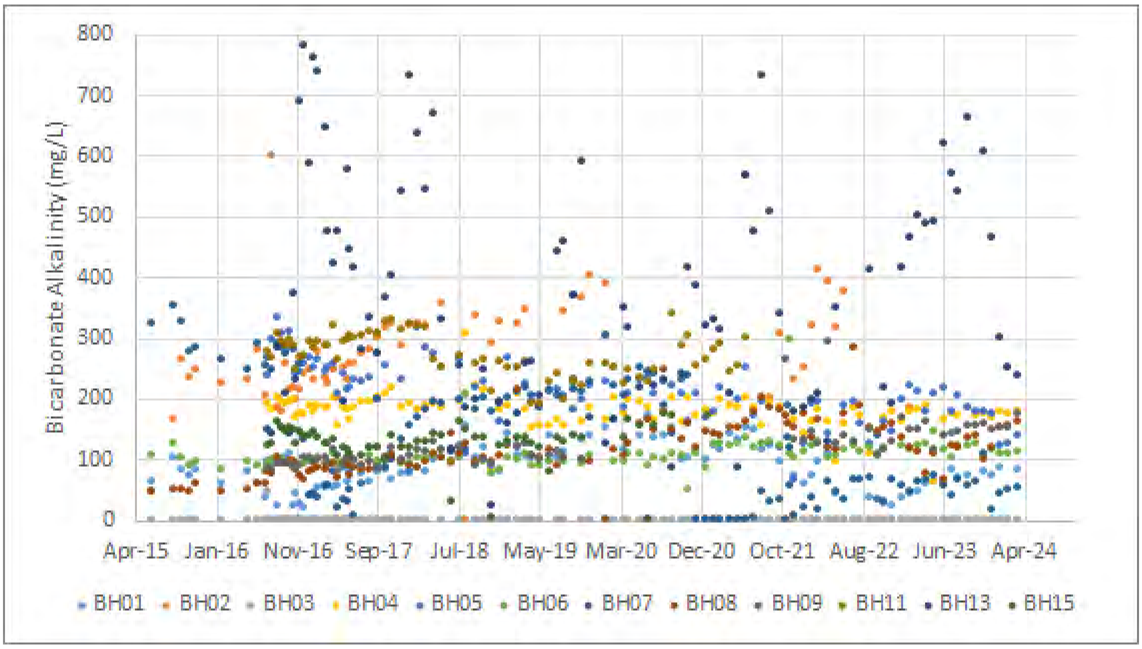
Major ions



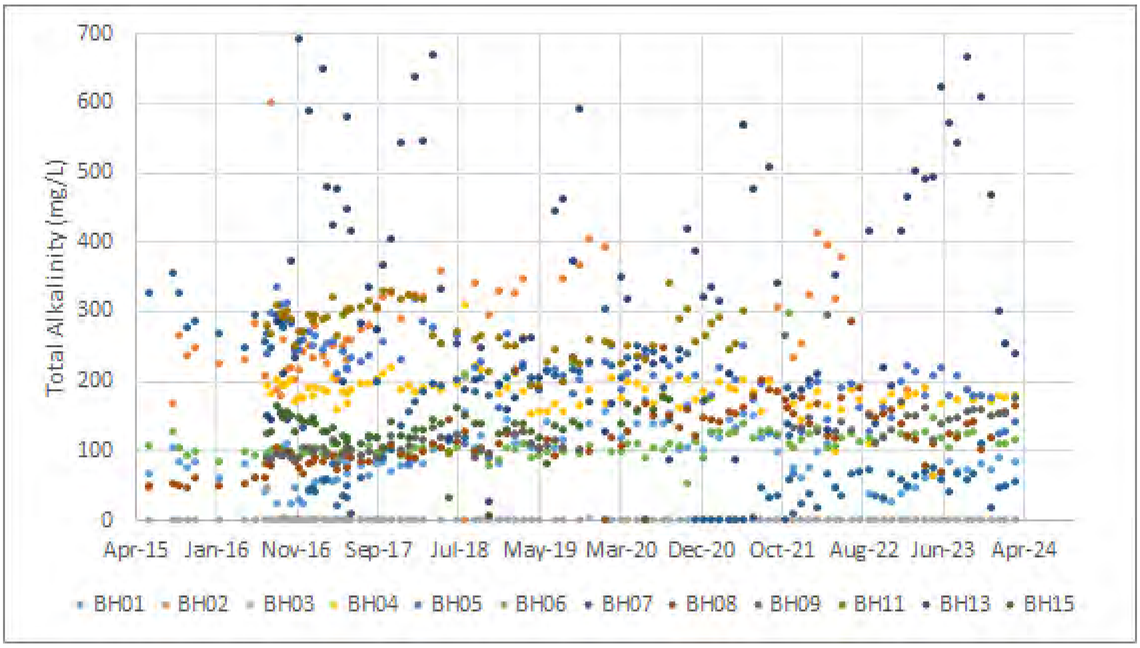
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Carbonate Alkalinity (mg/L)
Apr-15
Jan-16
Nov-16
Sep-17
Jul-18
May-19
Mar-20
Dec-20
Oct-21
Aug-22
Jun-23
Apr-24
BH01
BH02
BH03
BH04
BH05
BH06
BH07
BH08
BH09
BH11
BH13
BH15



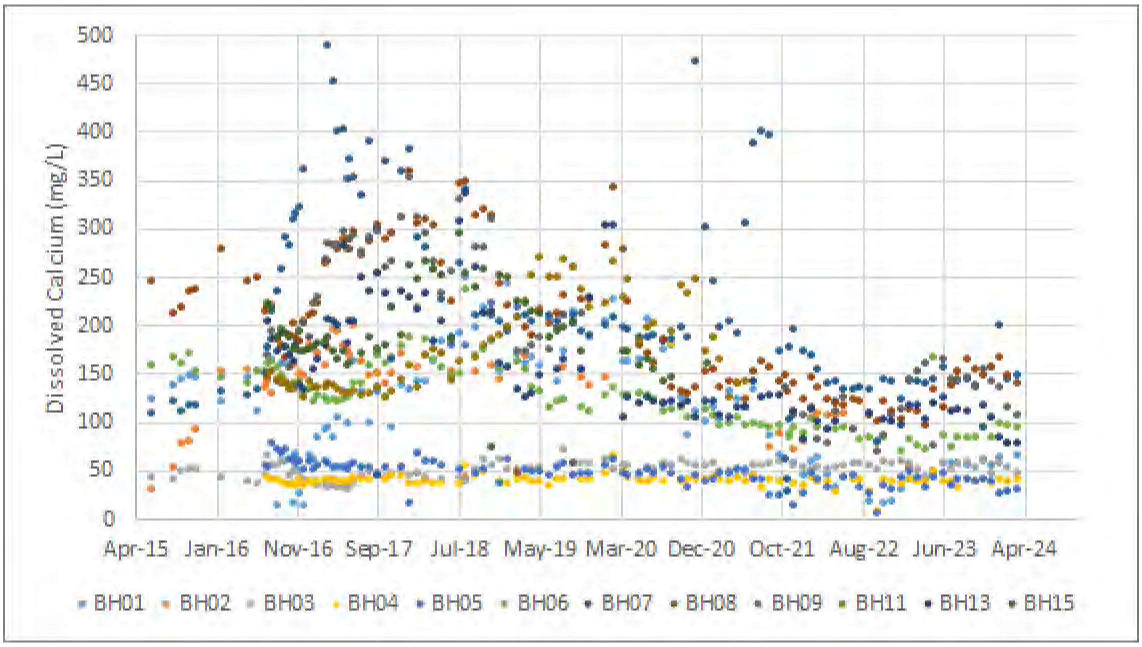
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Hydroxide Alkalinity (mg/L)
Apr-15
Jan-16
Nov-16
Sep-17
Jul-18
May-19
Mar-20
Dec-20
Oct-21
Aug-22
Jun-23
Apr-24
BH01
BH02
BH03
BH04
BH05
BH06
BH07
BH08
BH09
BH11
BH13
BH15

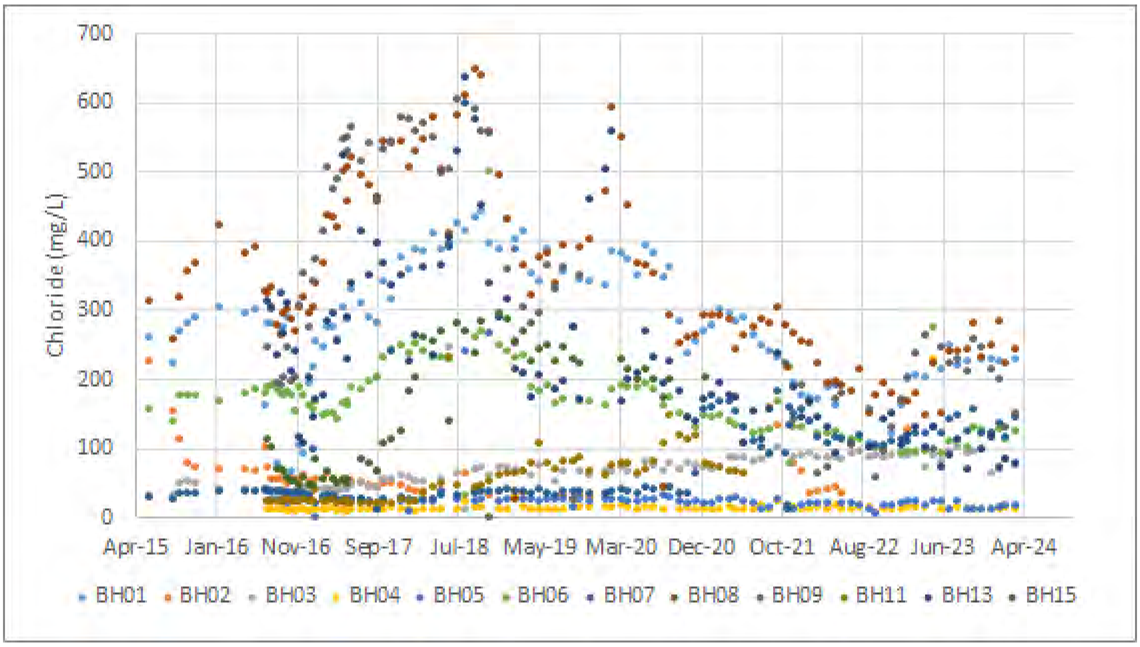


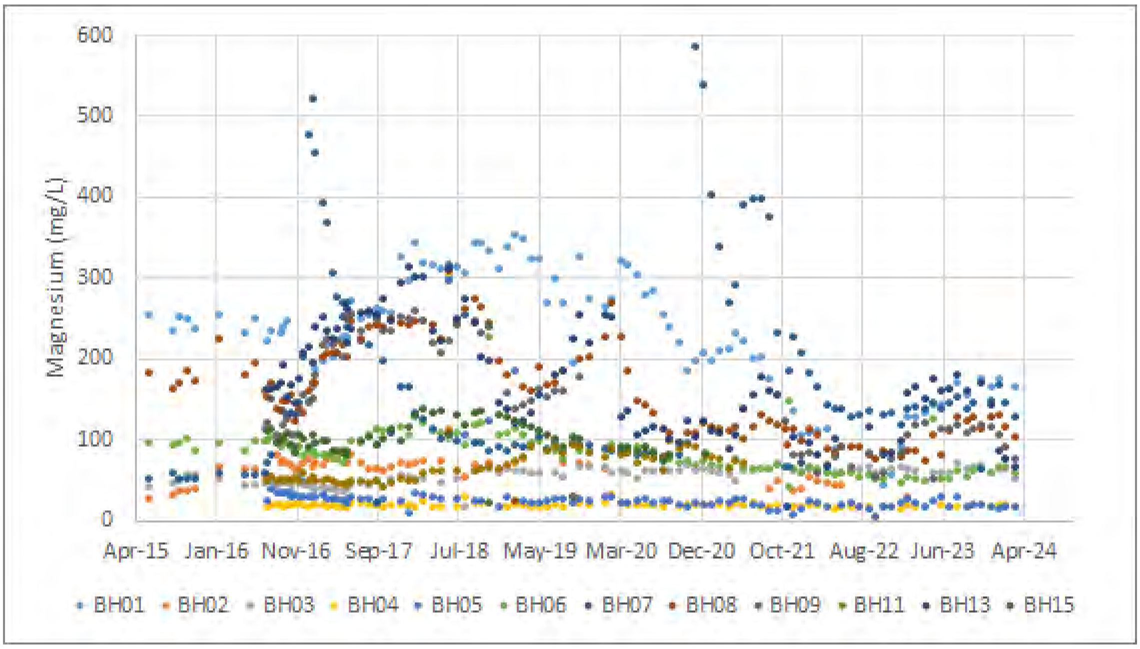
Bicarbonate Alkalinity (mg/L)
800
700
600
500
400
300
200
100
0
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15

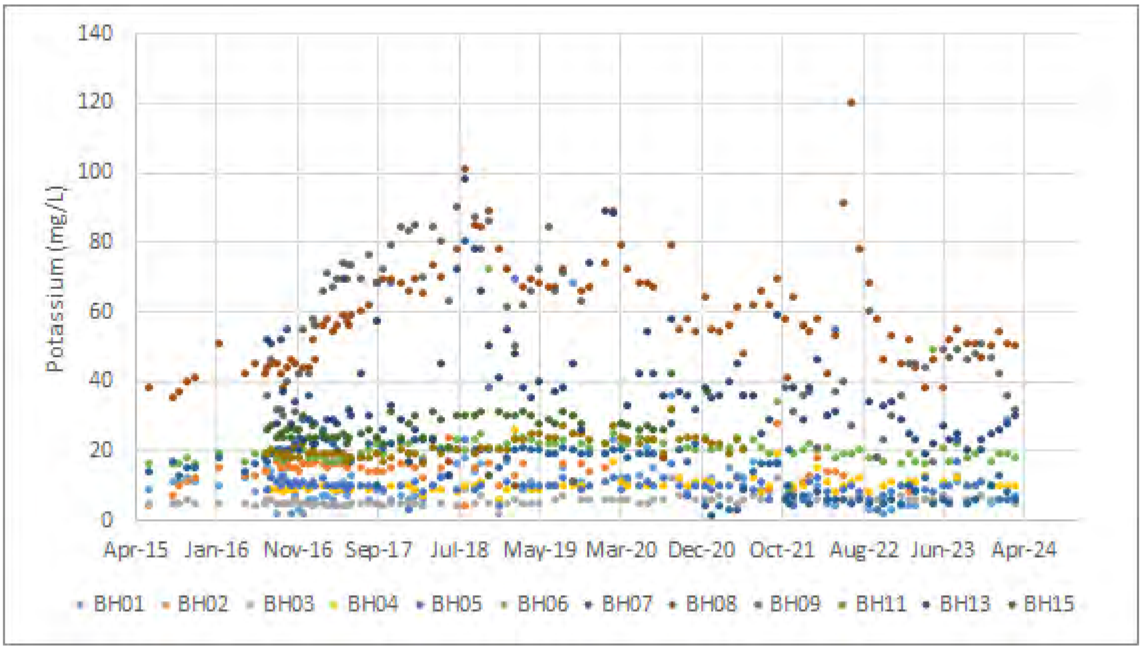


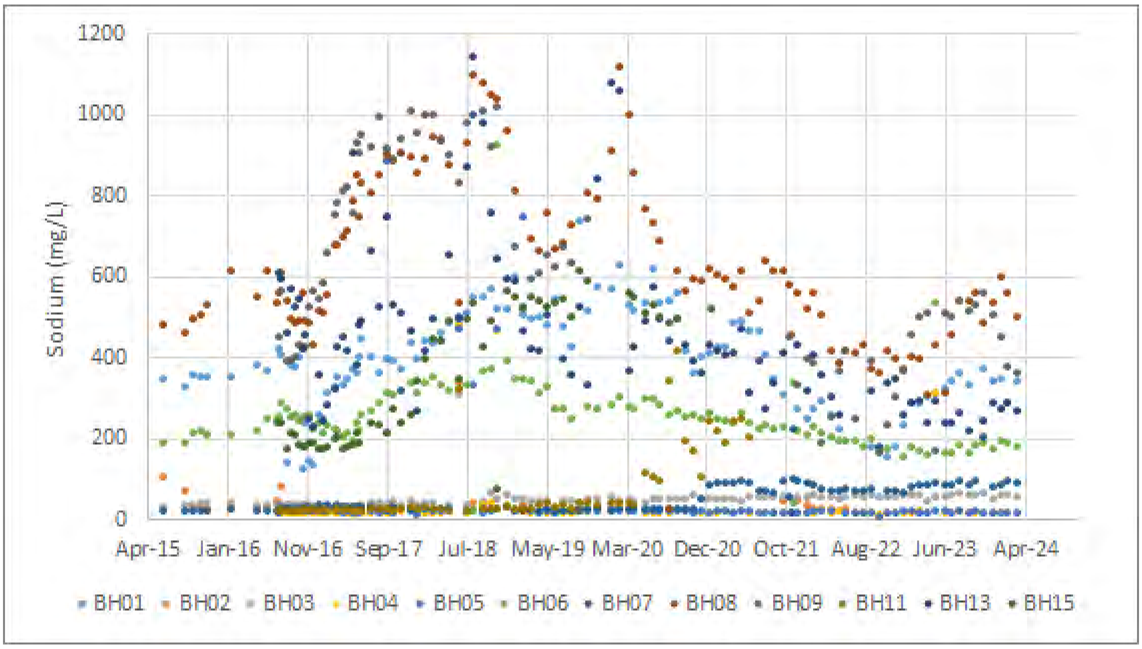
Total Alkalinity (mg/L)
700
600
500
400
300
200
100
0
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15


Dissolved Calcium (mg/L)
500
450
400
350
300
250
200
150
100
50
0
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15

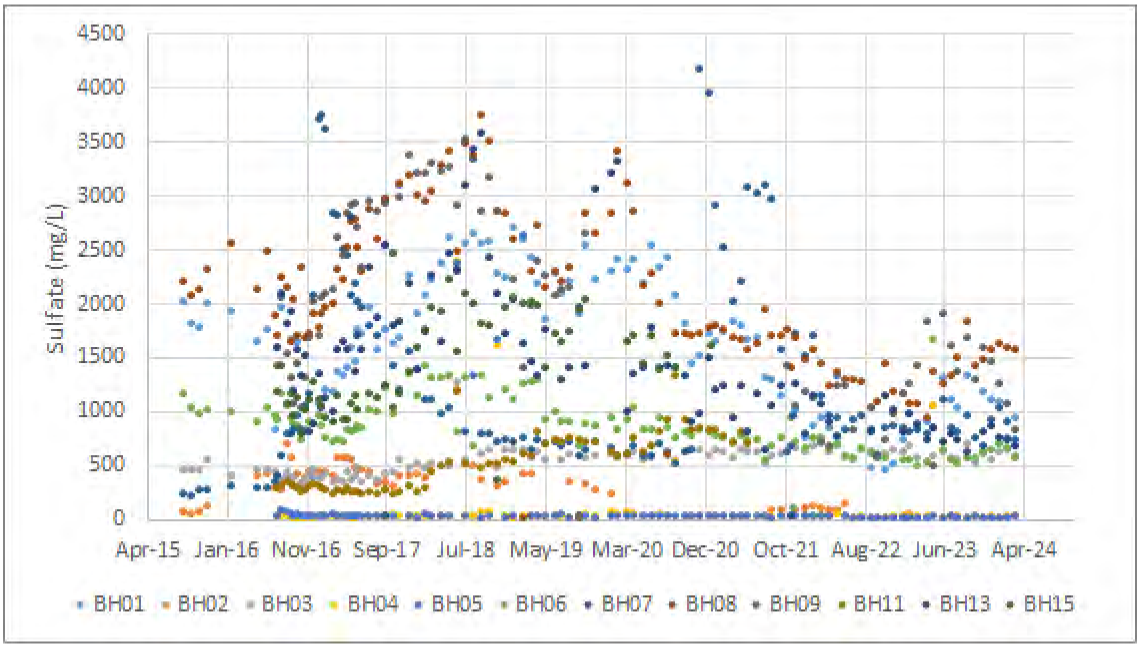

Chloride (mg/L)
700
600
500
400
300
200
100
0
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15


600
500
400
300
200
100
0
Magnesium (mg/L)
Apr-15
Jan-16
Nov-16
Sep-17
Jul-18
May-19
Mar-20
Dec-20
Oct-21
Aug-22
Jun-23
Apr-24
BH01
BH02
BH03
BH04
BH05
BH06
BH07
BH08
BH09
BH11
BH13
BH15

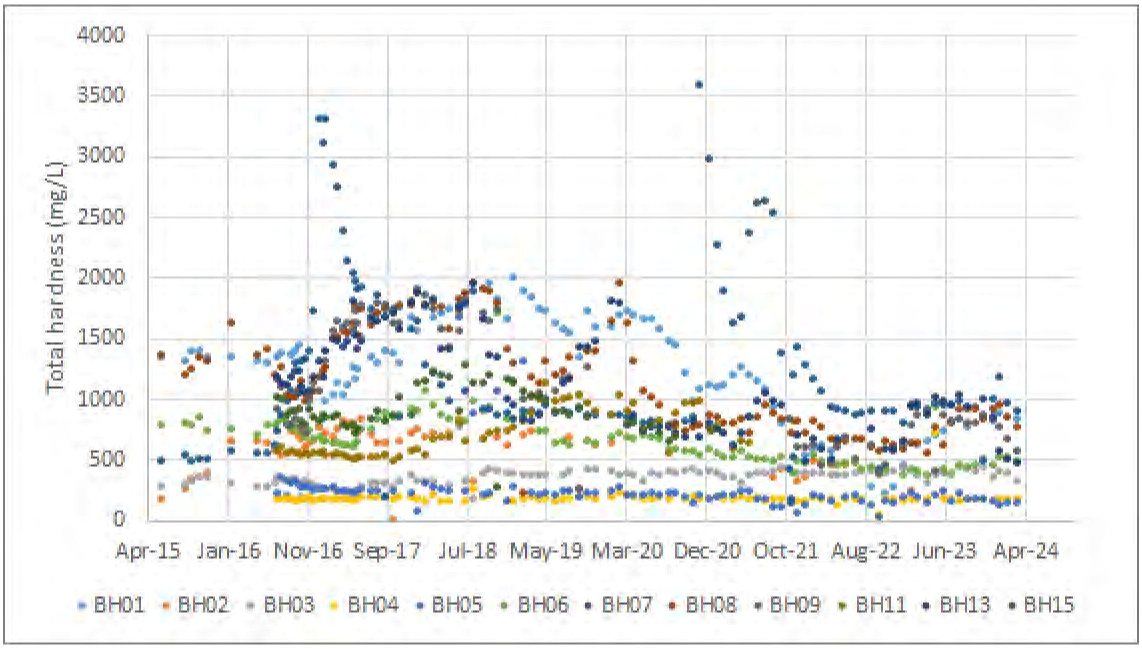

140
120
100
80
60
40
20
0
Potassium (mg/L)
Apr-15
Jan-16
Nov-16
Sep-17
Jul-18
May-19
Mar-20
Dec-20
Oct-21
Aug-22
Jun-23
Apr-24
BH01
BH02
BH03
BH04
BH05
BH06
BH07
BH08
BH09
BH11
BH13
BH15



Sodium (mg/L)
1200
1000
800
600
400
200
0
Apr-15
Jan-16
Nov-16
Sep-17
Jul-18
May-19
Mar-20
Dec-20
Oct-21
Aug-22
Jun-23
Apr-24
BH01
BH02
BH03
BH04
BH05
BH06
BH07
BH08
BH09
BH11
BH13
BH15

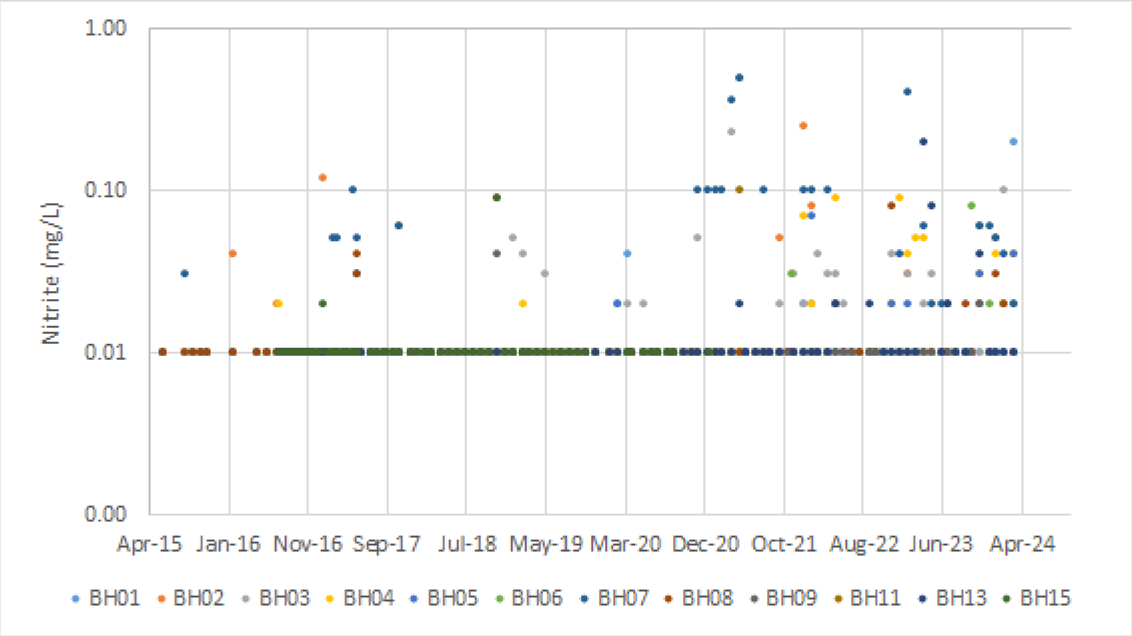


Sulfate (mg/L)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Apr-15
Jan-16
Nov-16
Sep-17
Jul-18
May-19
Mar-20
Dec-20
Oct-21
Aug-22
Jun-23
Apr-24
BH01
BH02
BH03
BH04
BH05
BH06
BH07
BH08
BH09
BH11
BH13
BH15

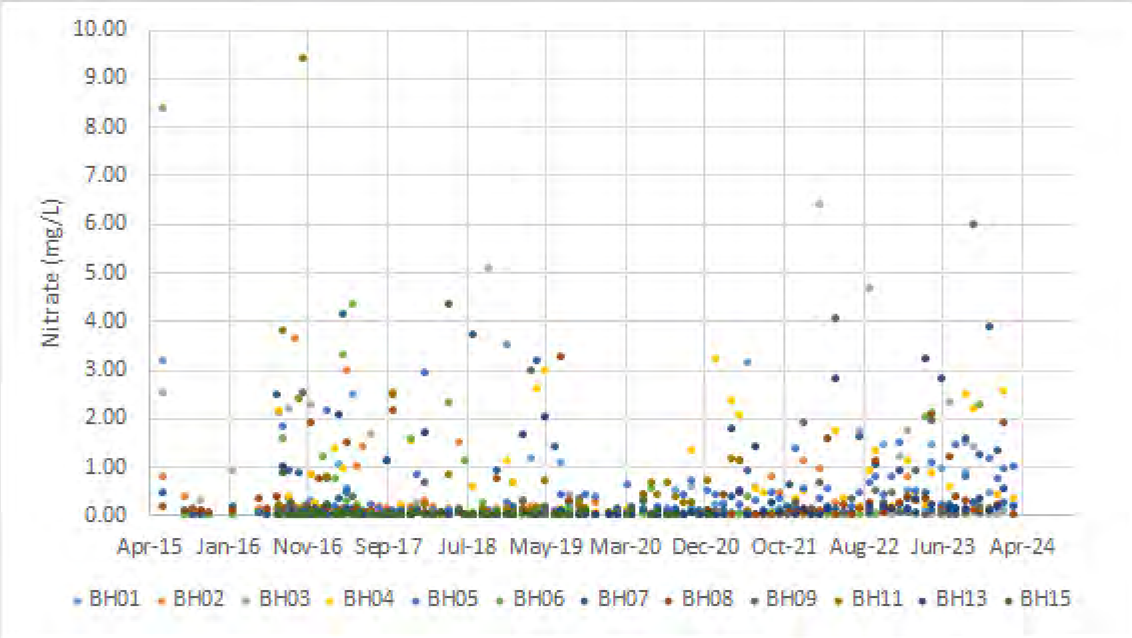


Total hardness (mg/L)
4000
3500
3000
2500
2000
1500
1000
500
0
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15

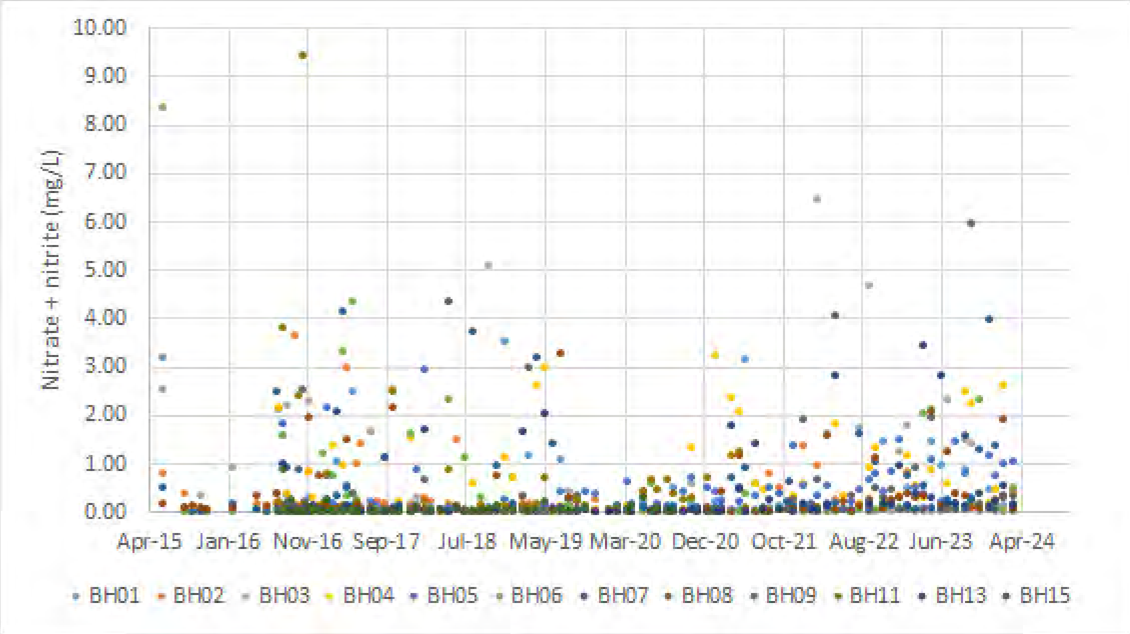
Nutrients



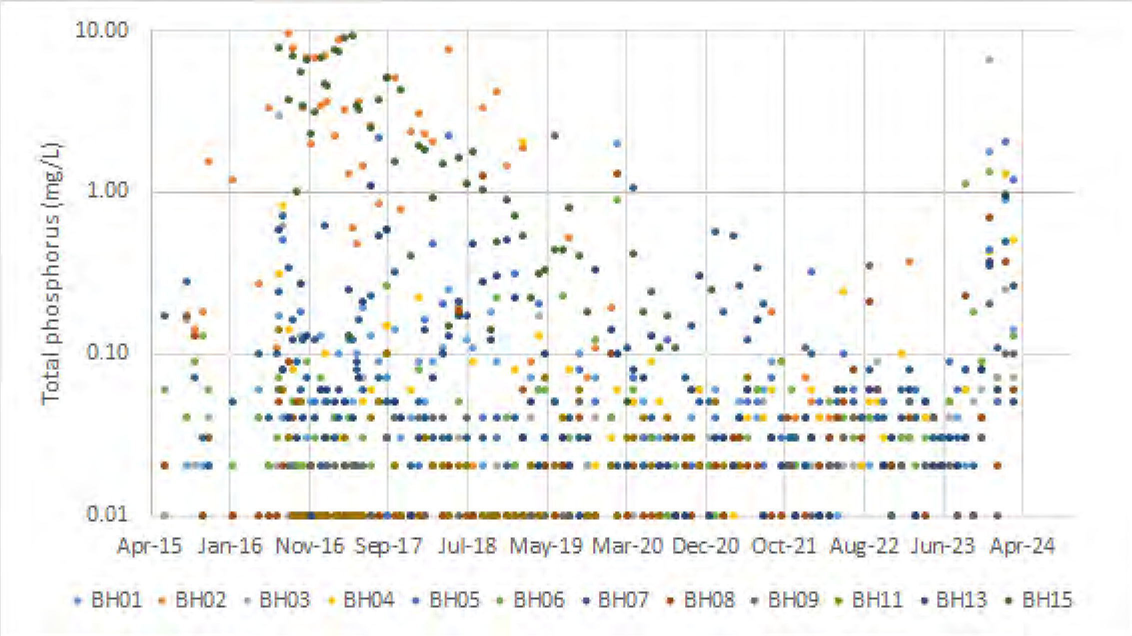
Nitrite (mg/L)
1.00
0.10
0.01
0.00
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15



Nitrate (mg/L)
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15

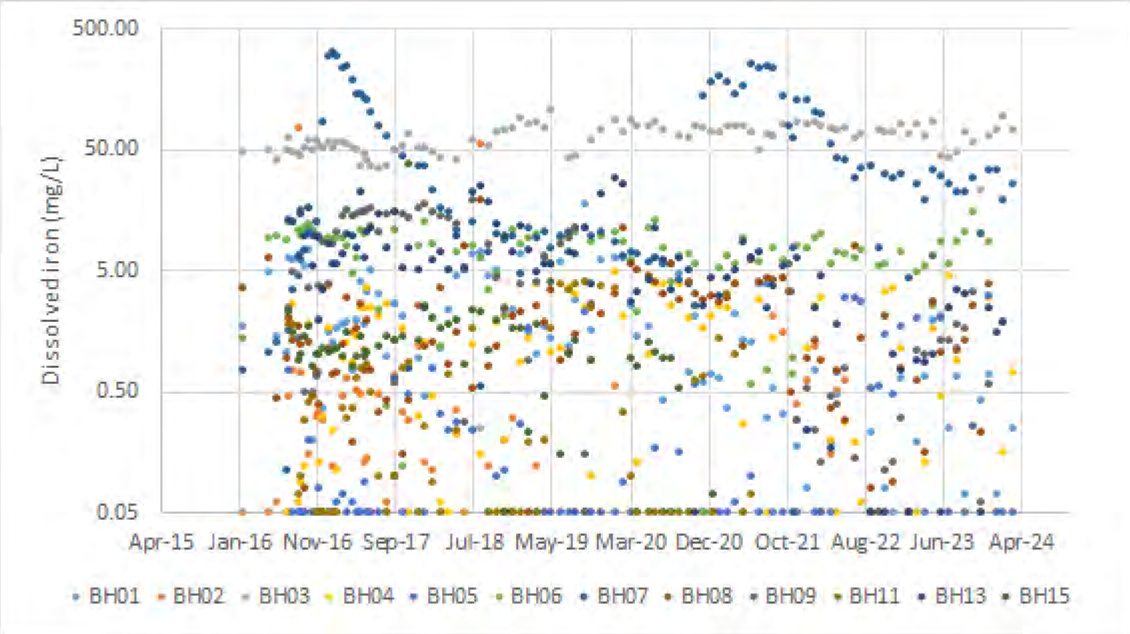


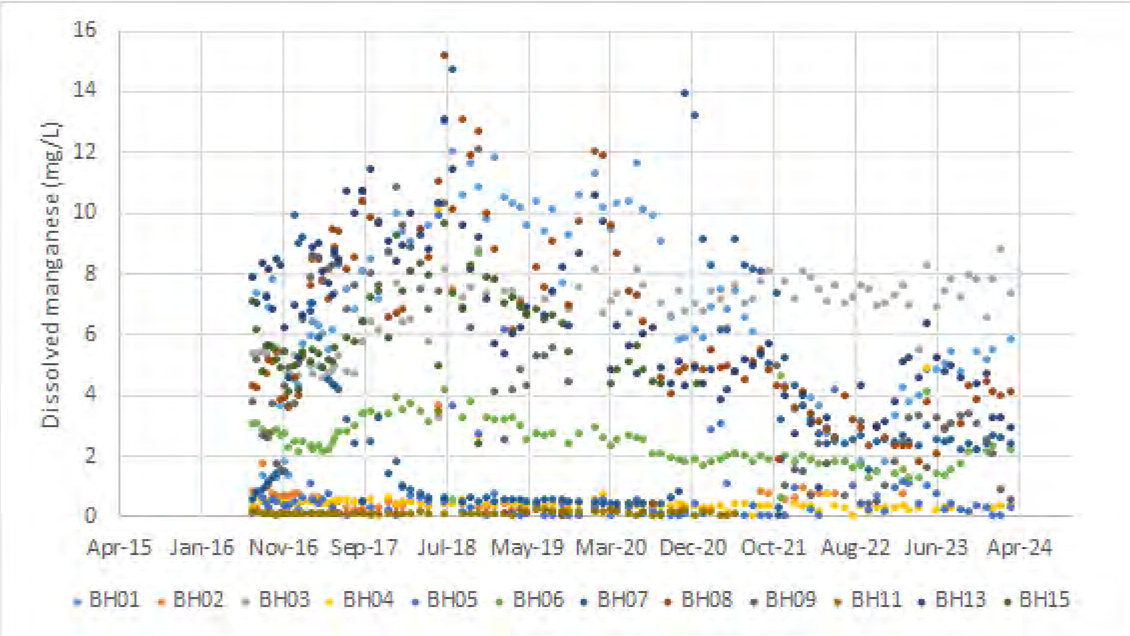
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Nitrate + nitrite (mg/L)
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15

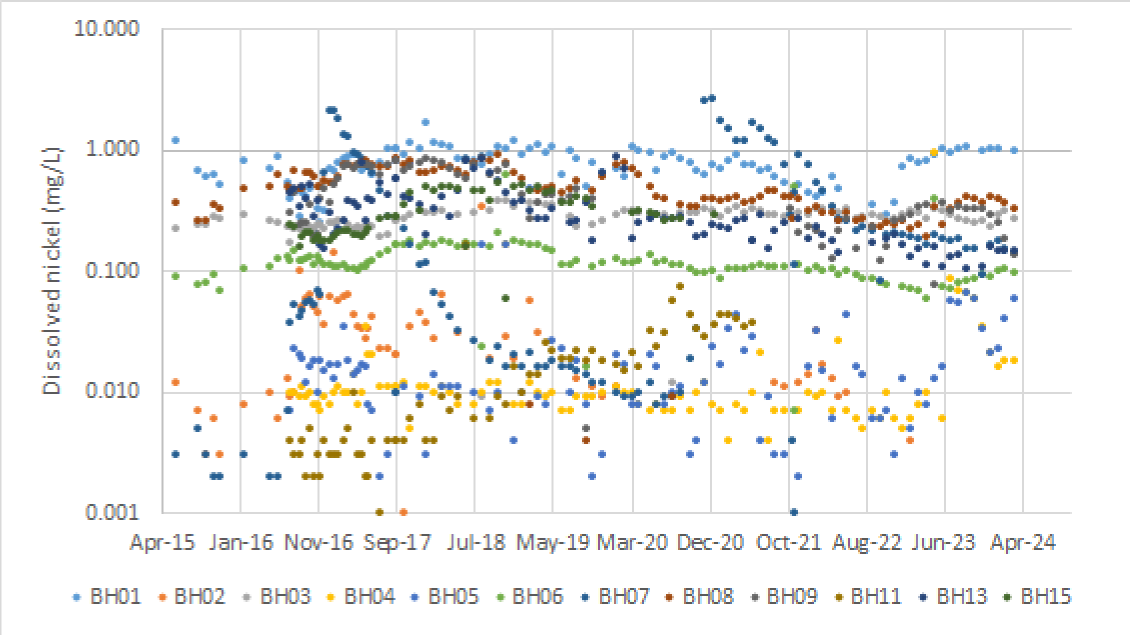


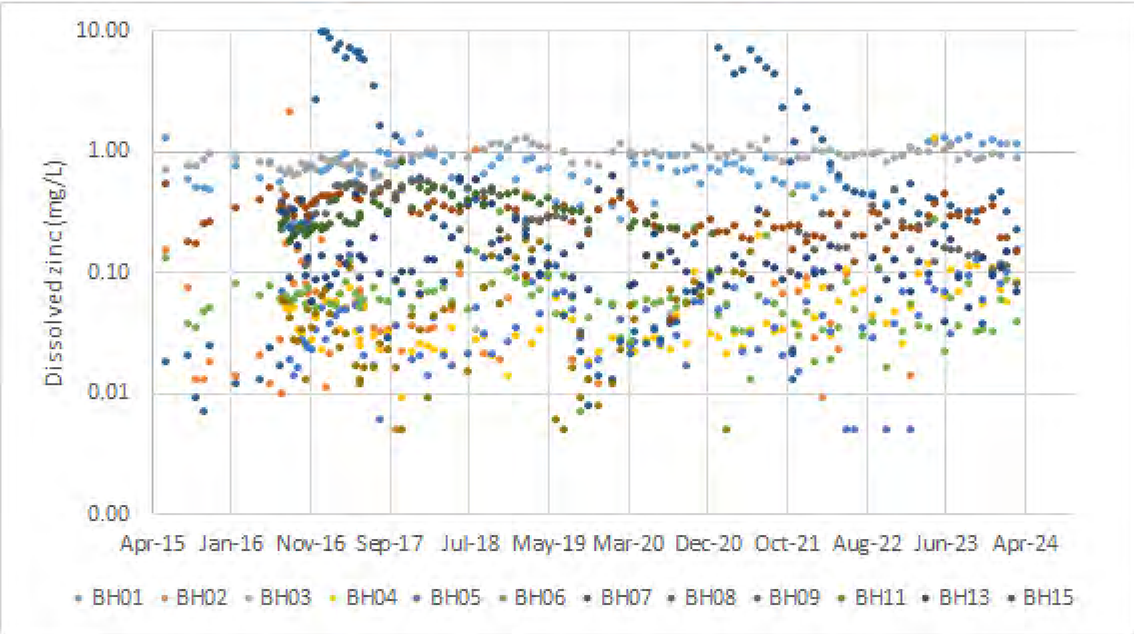
10.00
1.00
0.10
0.01
Total phosphorus (mg/L)
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15

Dissolved metals

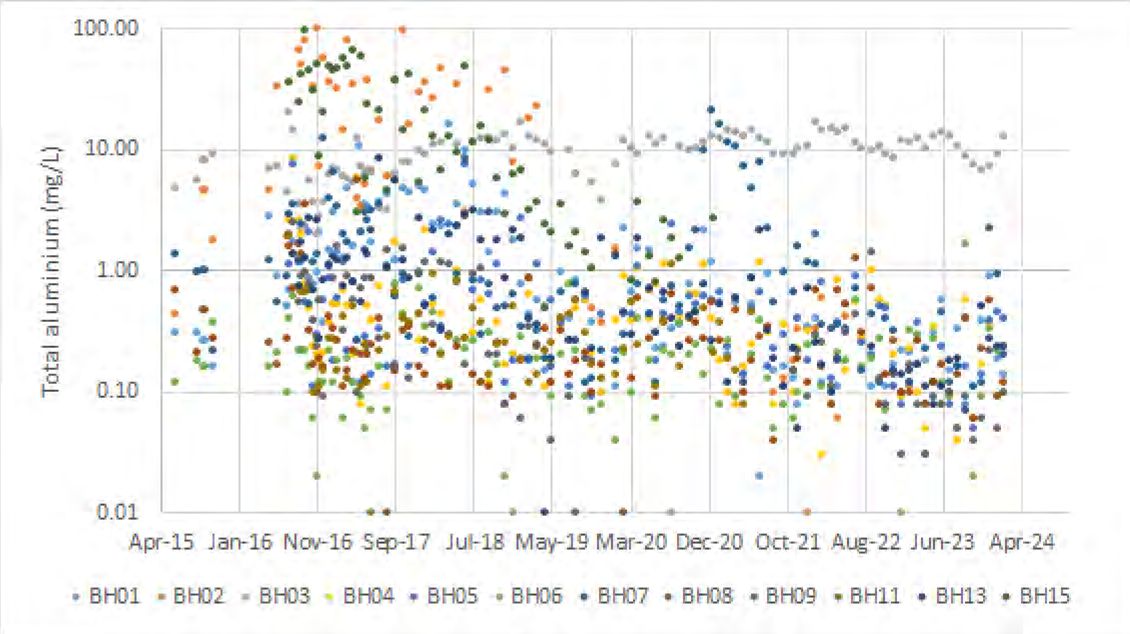


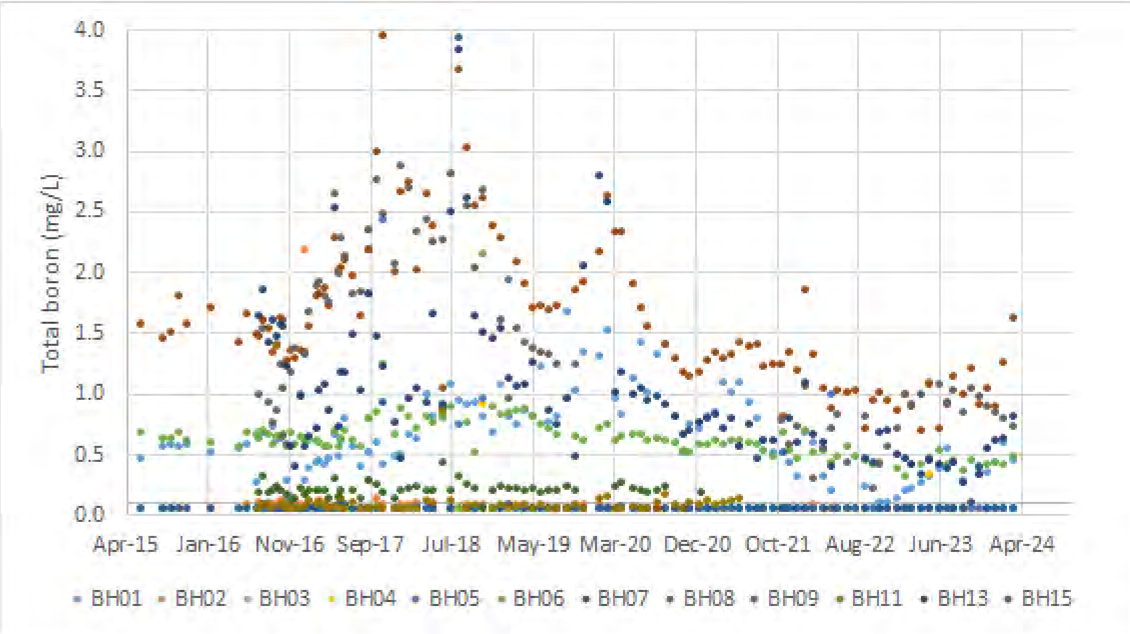


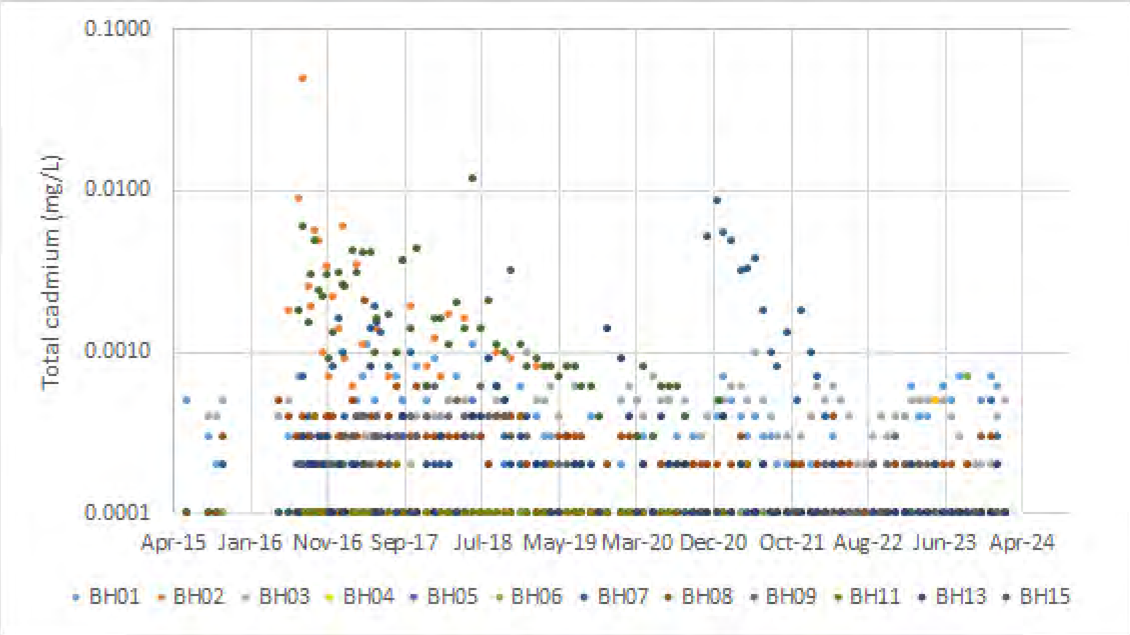

10.000
1.000
0.100
0.010
0.001
Dissolved nickel (mg/L)
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15

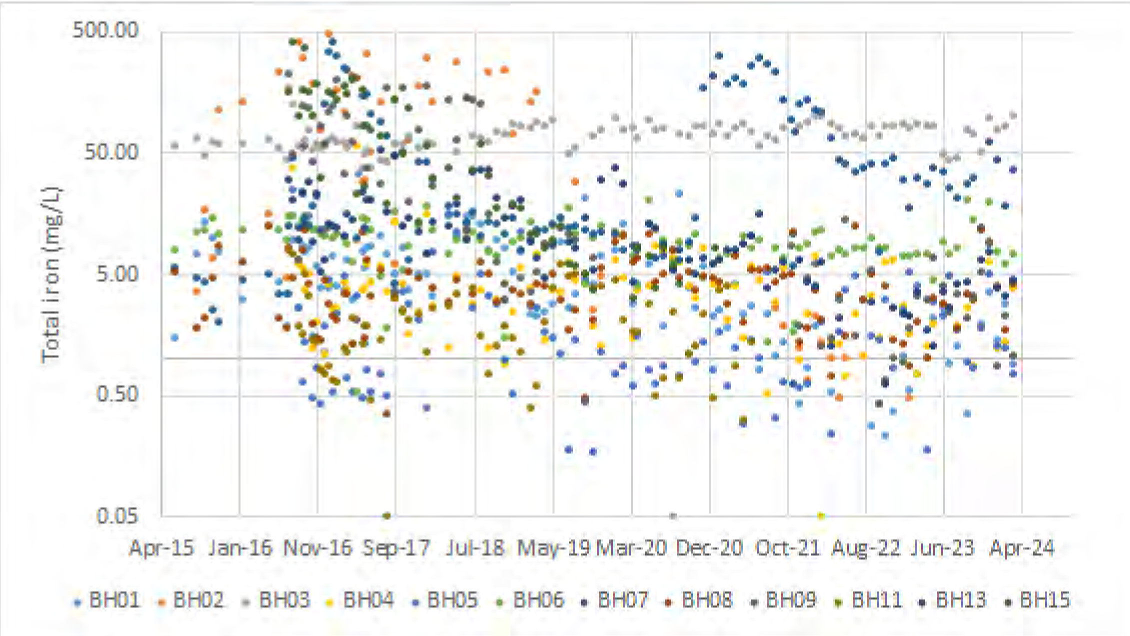

10.00
1.00
0.10
0.01
0.00
Dissolved zinc (mg/L)
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15

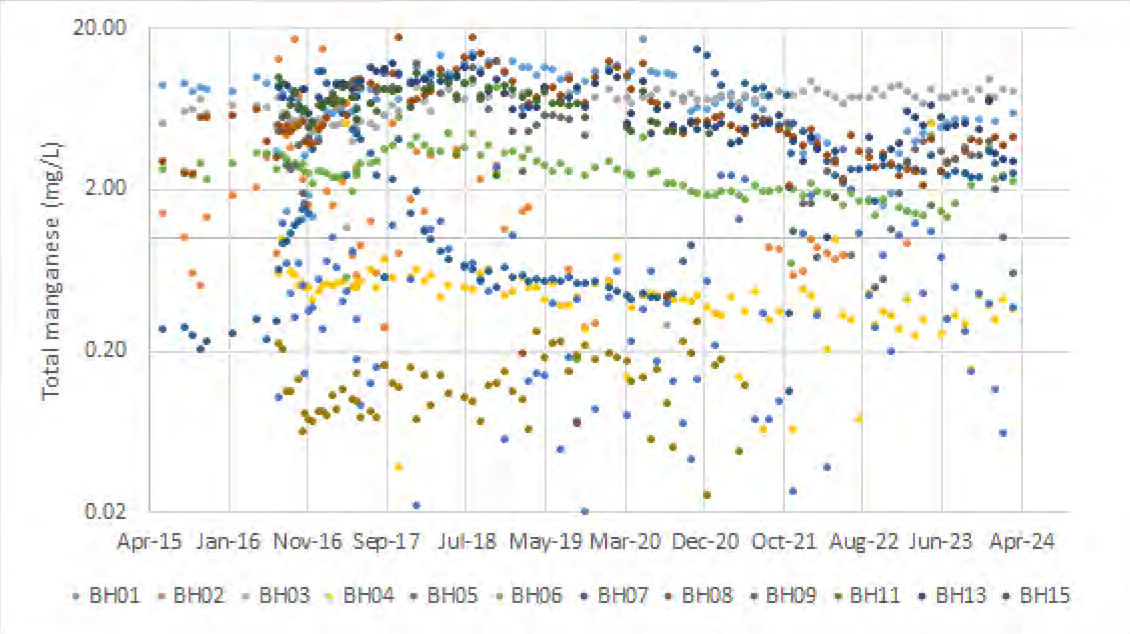
Total metals

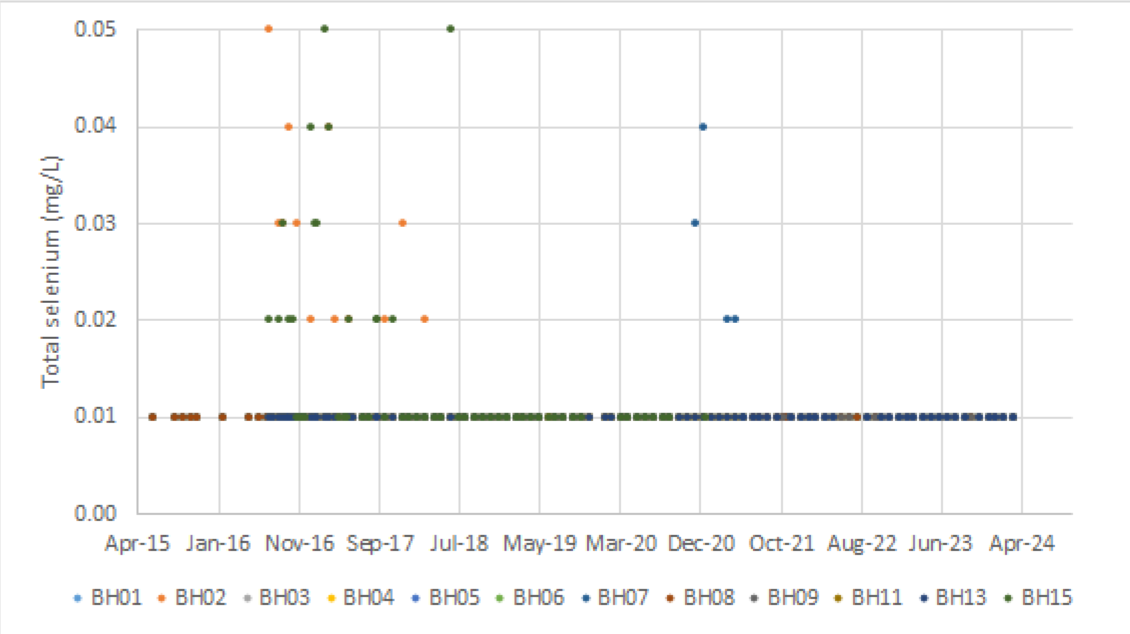


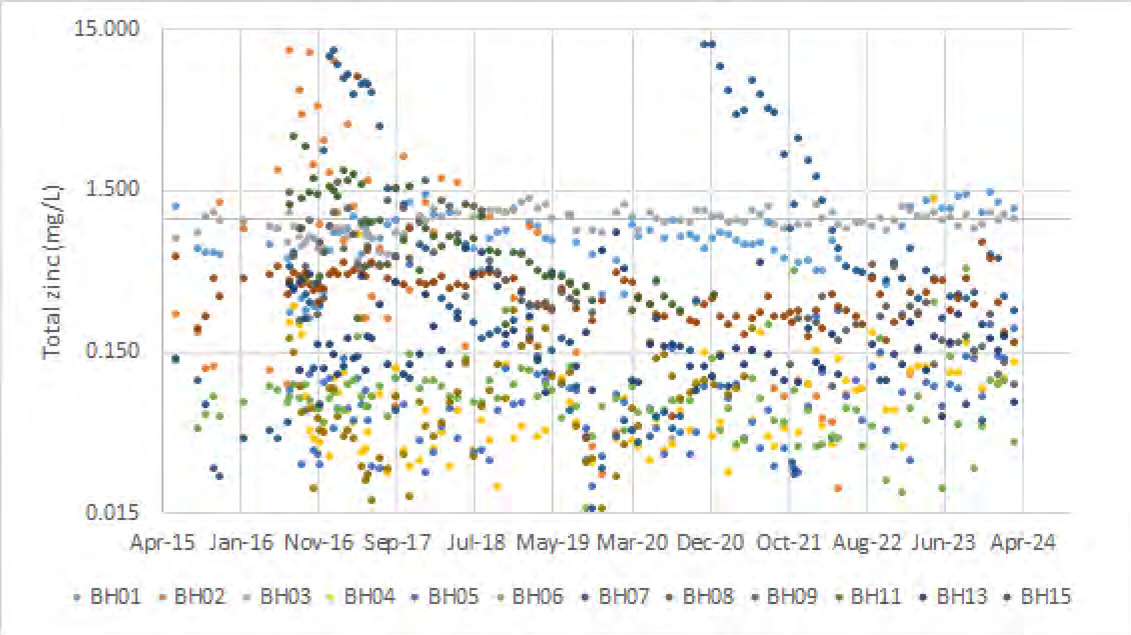



0.1000
0.0100
0.0010
0.0001
Total cadmium (mg/L)
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15

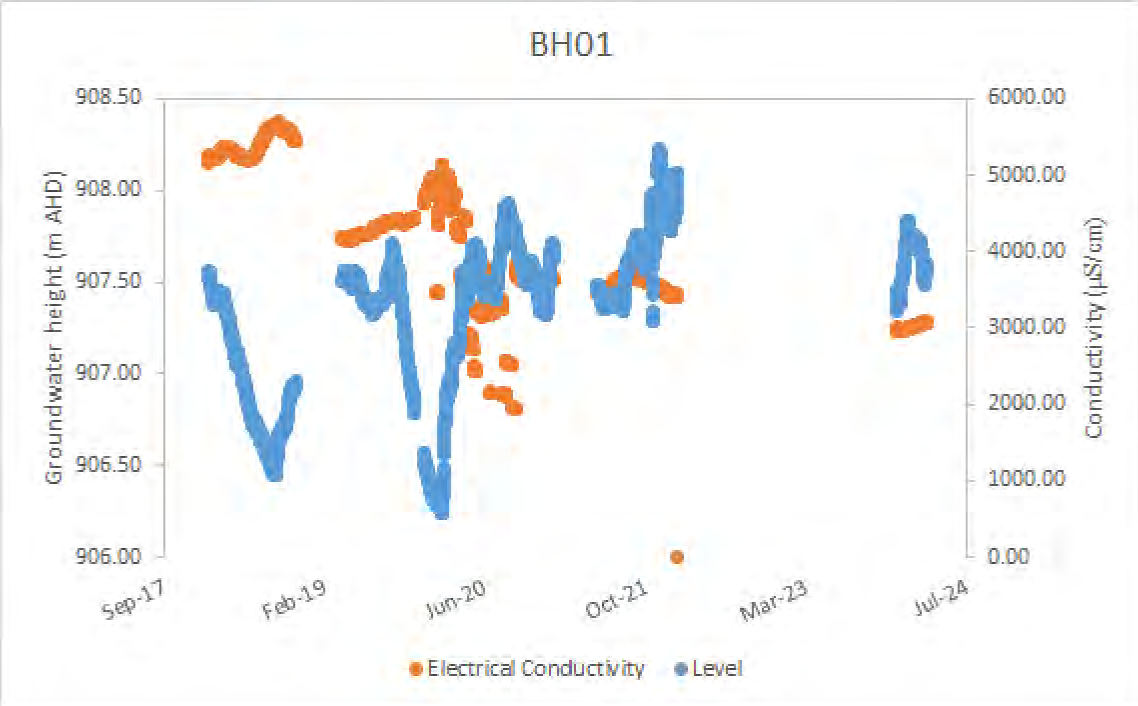

500.00
50.00
5.00
0.50
0.05
Total iron (mg/L)
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15

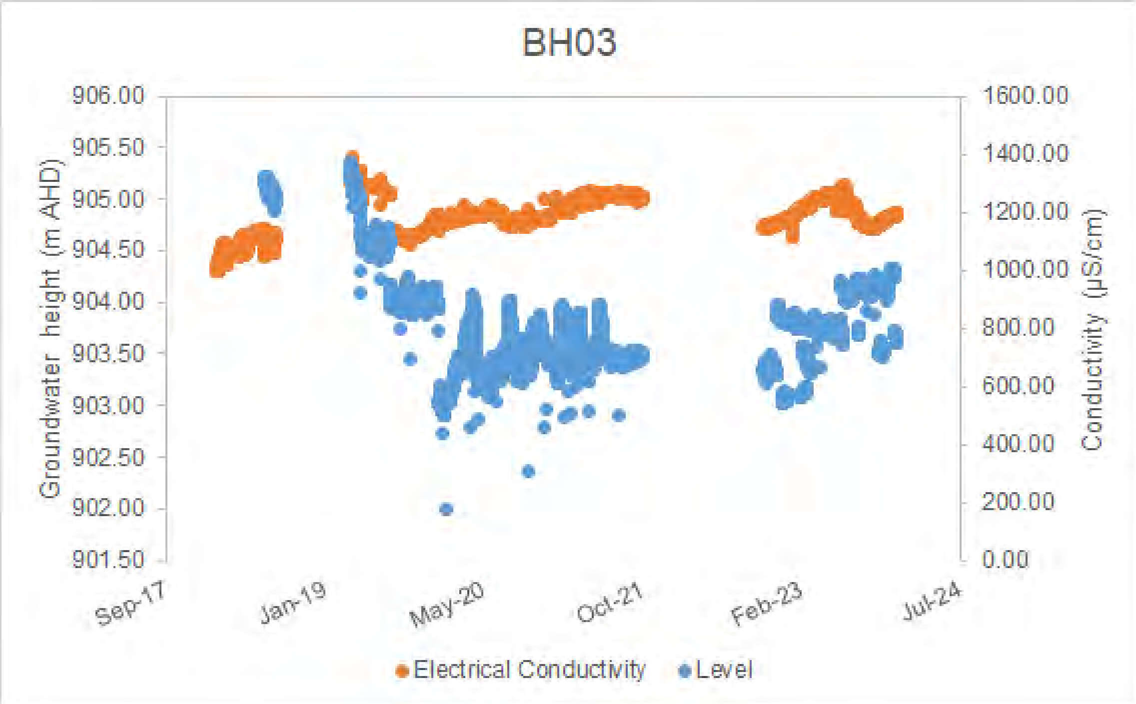

20.00
2.00
0.20
0.02
Total manganese (mg/L)
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15

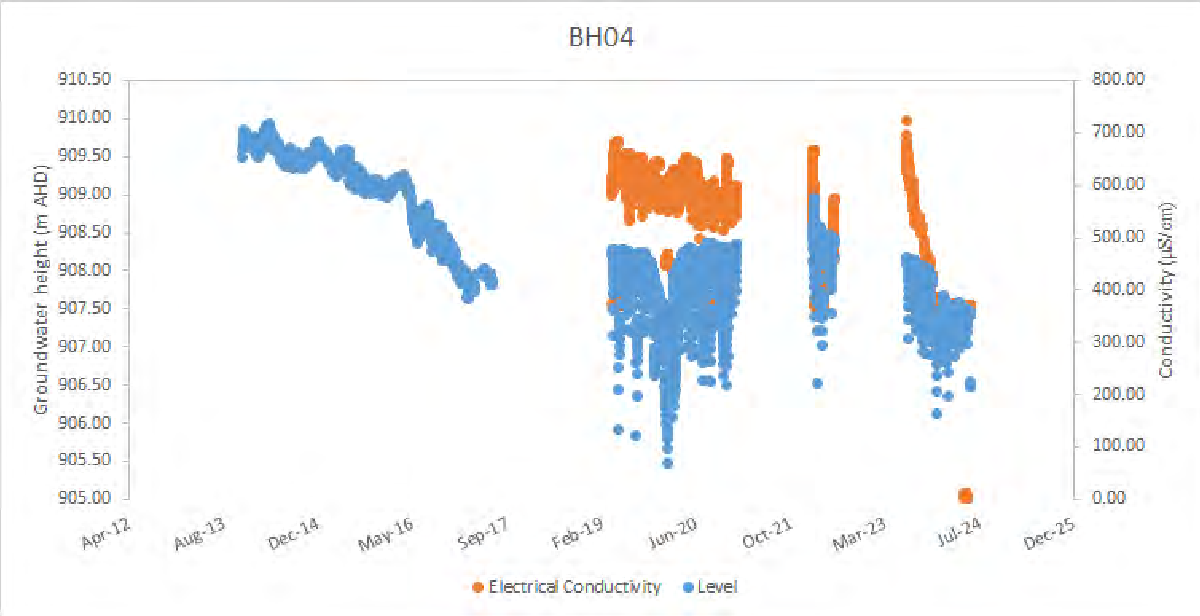

0.05
0.04
0.03
0.02
0.01
0.00
Total selenium (mg/L)
Apr-15 Jan-16 Nov-16 Sep-17 Jul-18 May-19 Mar-20 Dec-20 Oct-21 Aug-22 Jun-23 Apr-24
BH01 BH02 BH03 BH04 BH05 BH06 BH07 BH08 BH09 BH11 BH13 BH15


15.000
1.500
0.150
0.015
Total zinc (mg/L)
Apr-15
Jan-16
Nov-16
Sep-17
Jul-18
May-19
Mar-20
Dec-20
Oct-21
Aug-22
Jun-23
Apr-24
BH01
BH02
BH03
BH04
BH05
BH06
BH07
BH08
BH09
BH11
BH13
BH15

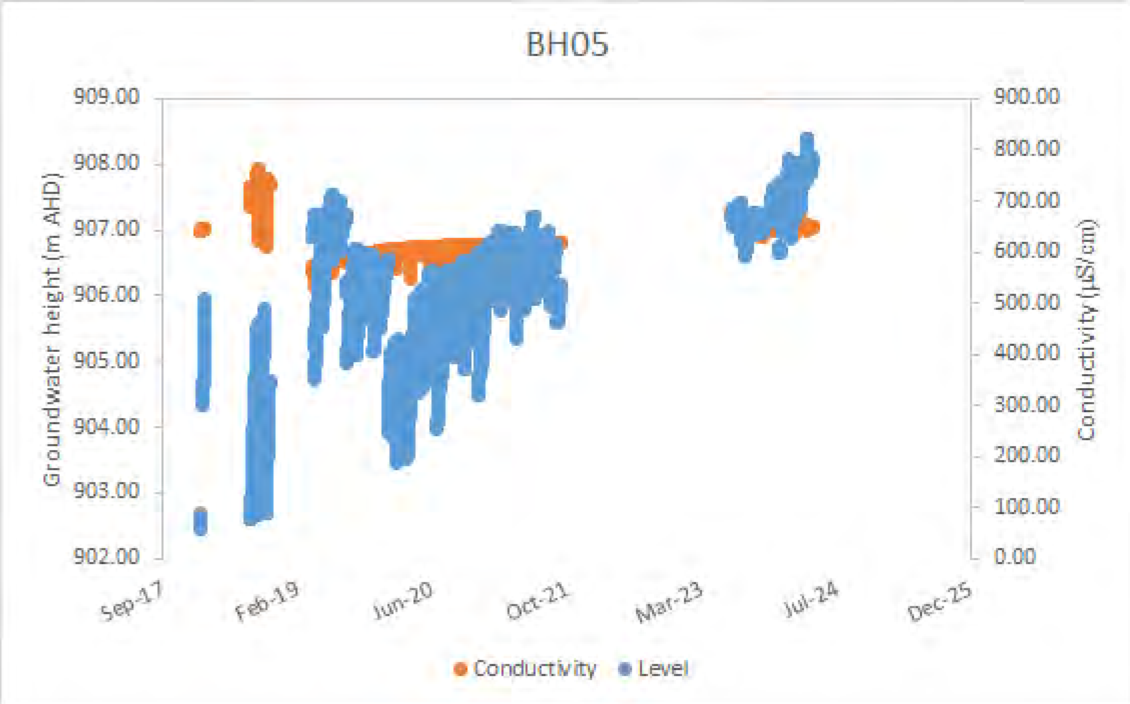
G.3.3 Time series graphs of groundwater loggers



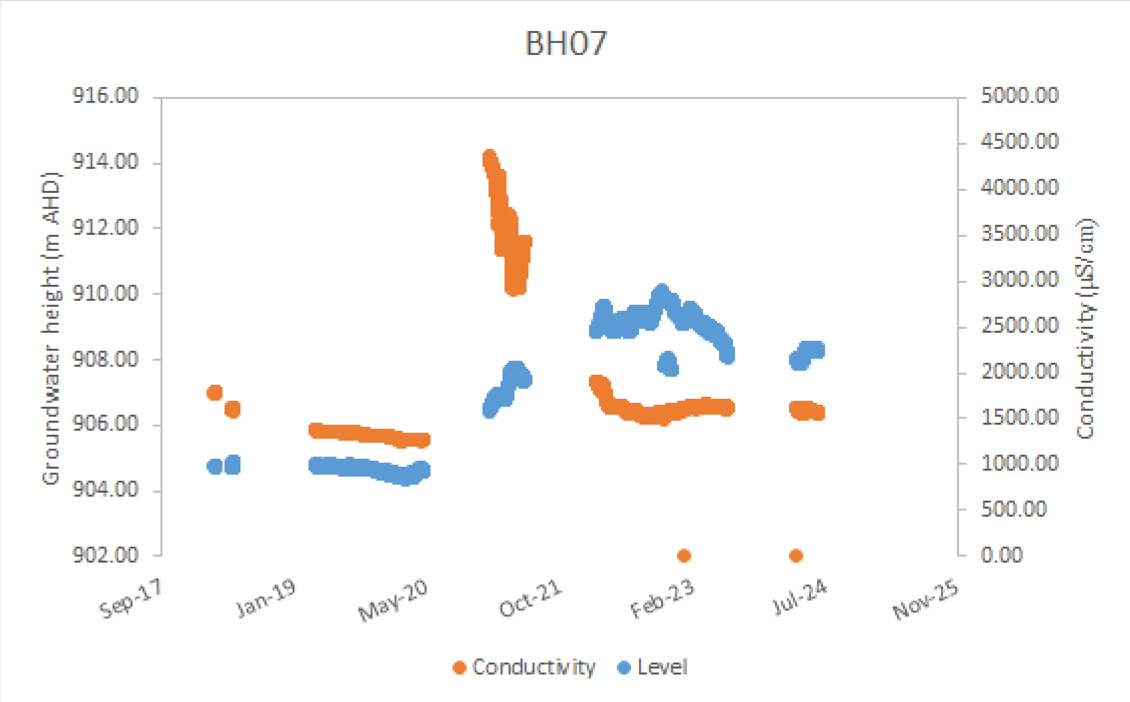




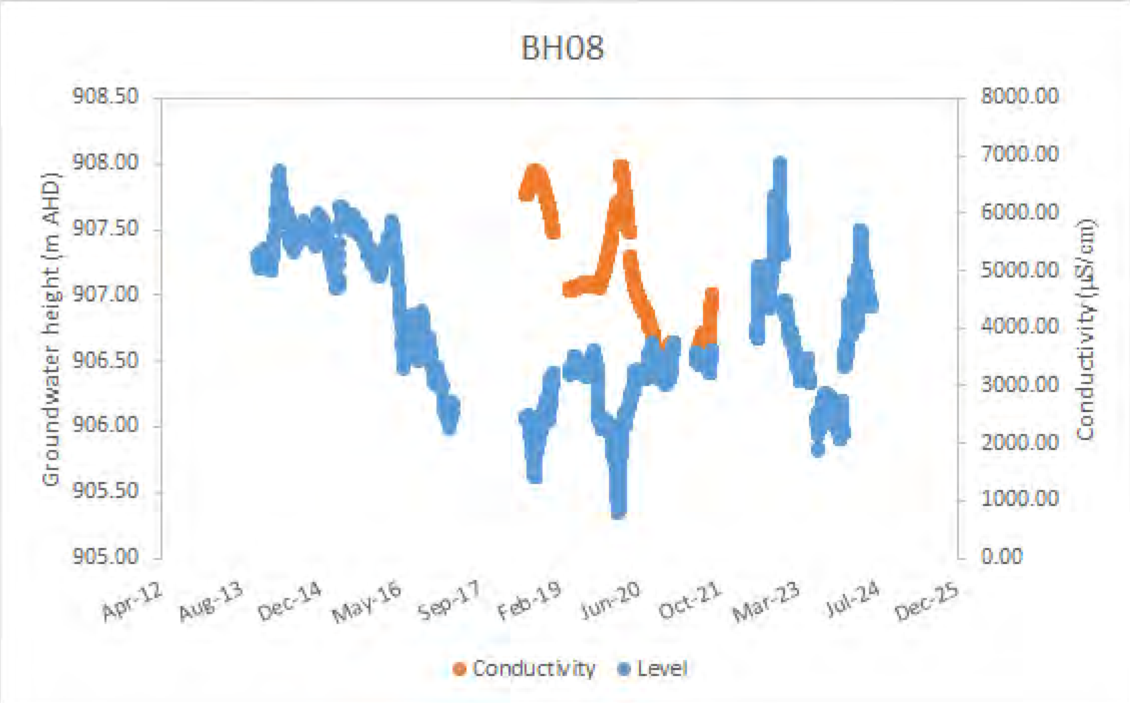
BH04
Groundwater height (m AHD)
910.50
910.00
909.50
909.00
908.50
908.00
907.50
907.00
906.50
906.00
905.50
905.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Conductivity (µS/cm)
Apr-12
Aug-13
Dec-14
May-16
Sep-17
Feb-19
Jun-20
Oct-21
Mar-23
Jul-24
Dec-25
Electrical Conductivity
Level



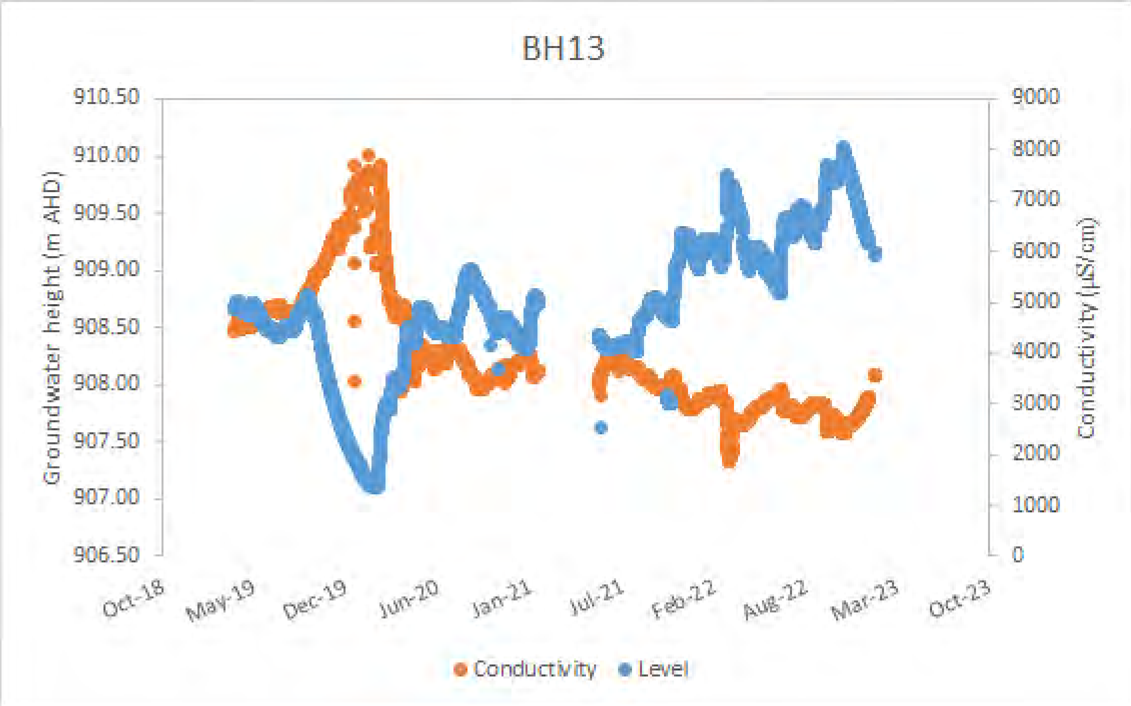
BH05
Groundwater height (m AHD)
909.00
908.00
907.00
906.00
905.00
904.00
903.00
902.00
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Conductivity (µS/cm)
Sep-17
Feb-19
Jun-20
Oct-21
Mar-23
Jul-24
Dec-25
Conductivity
Level



BH07
916.00
914.00
912.00
910.00
908.00
906.00
904.00
902.00
Groundwater height (m AHD)
5000.00
4500.00
4000.00
3500.00
3000.00
2500.00
2000.00
1500.00
1000.00
500.00
0.00
Conductivity (µS/cm)
Sep-17
Jan-19
May-20
Oct-21
Feb-23
Jul-24
Nov-25
Conductivity
Level



BH08
908.50
908.00
907.50
907.00
906.50
906.00
905.50
905.00
Groundwater height (m AHD)
8000.00
7000.00
6000.00
5000.00
4000.00
3000.00
2000.00
1000.00
0.00
Conductivity (µS/cm)
Apr-12
Aug-13
Dec-14
May-16
Sep-17
Feb-19
Jun-20
Oct-21
Mar-23
Jul-24
Dec-25
Conductivity
Level



G.3.4 Derivation of site-specific guideline values

As per Groundwater Investigation Levels (GILs) guidelines, groundwater quality trigger values have been developed for selected parameters in accordance with ANZG (2018) methodology for deriving site specific guideline values. Trigger values are based on a comparison of 80th percentile historical concentrations (20th percentile for lower pH), and DGVs for stressors (ANZECC 2000) and toxicants (ANZG 2018). The highest value is chosen to represent the natural fluctuations in the groundwater source. Table G.3.1 shows the raw 80th and 20th percentile, median and count historical baseline data and for the selected parameters. DGVs are given in Table H-2.

APPENDIX H – Baseline surface water data

H.1 On-site storages

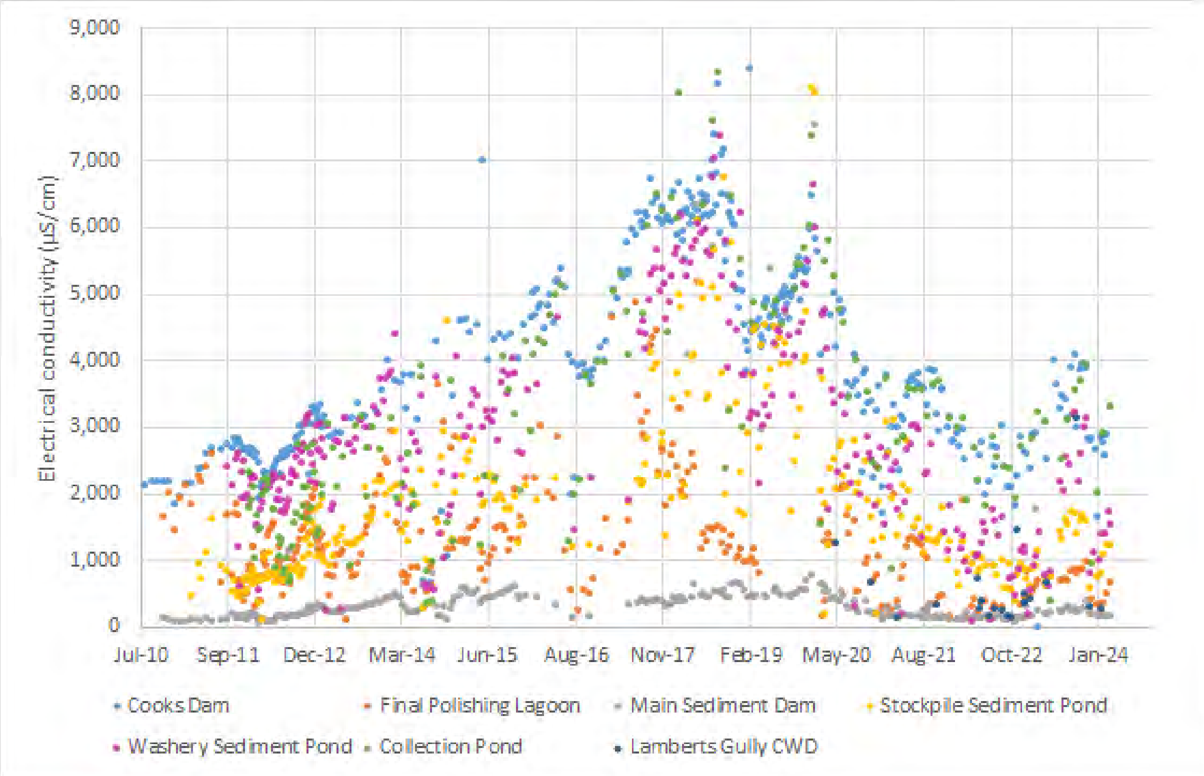
H.1.1 Statistical summary of water quality results

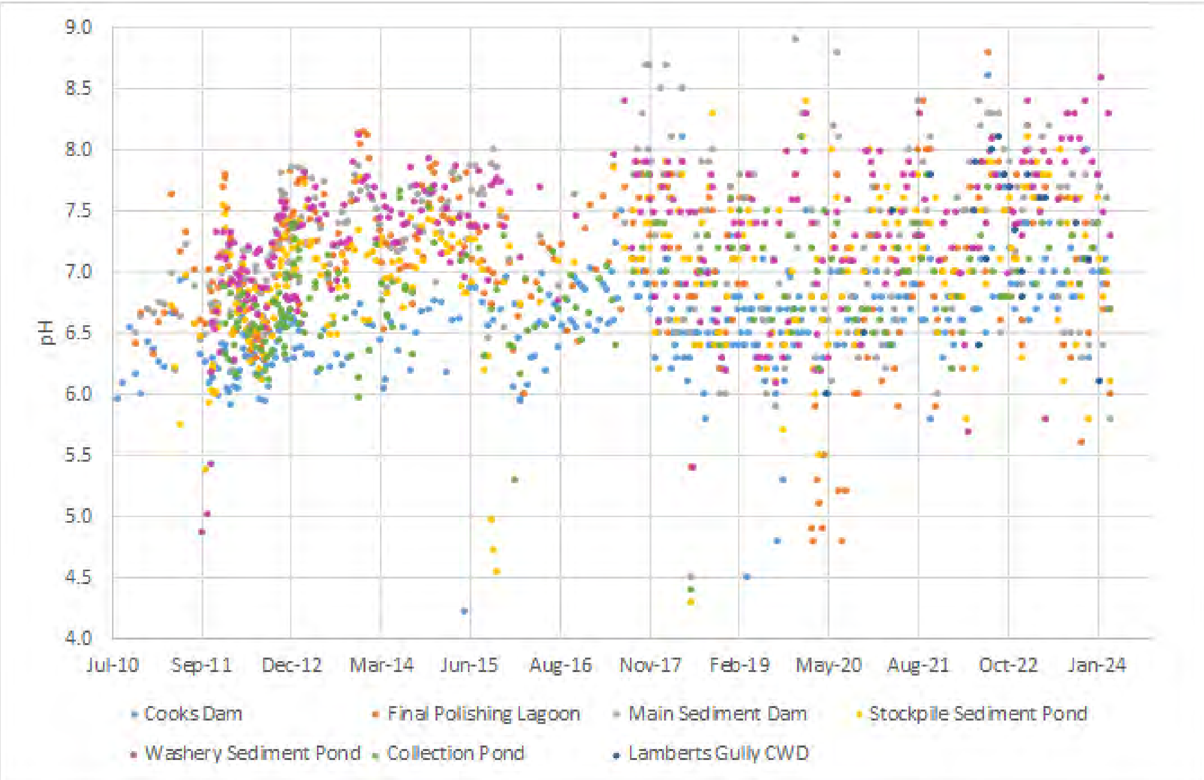
Parameter	Units	Cooks Dam		Final Polishing Lagoon		Main Sediment Dam		Stockpile Sediment Pond		Washery Sediment Pond		Collection Pond	
		Count	Median	Count	Median	Count	Median	Count	Median	Count	Median	Count	Median
Physicochemical													
EC	µS/cm	377	3760	305	1130	311	270	304	1508	292	2635	173	2750
pH	pH units	376	6.60	306	7.12	311	7.27	304	7.05	292	7.39	198	6.80
TSS	mg/L	371	5	280	7	265	8	268	6	256	5	167	5
Turbidity	NTU	330	10	265	15	285	18	282	12	276	7	170	9
Nutrients													
Nitrate	mg/L	224	0.07	-	-	-	-	-	-	-	-	-	-
Nitrite	mg/L	223	0.01	-	-	-	-	-	-	-	-	-	-
Nitrate + nitrite	mg/L	137	0.08	-	-	-	-	-	-	-	-	-	-
Major ions													
Bicarbonate alkalinity	mg/L	224	62	-	-	-	-	-	-	-	-	-	-
Carbonate alkalinity	mg/L	224	1	-	-	-	-	-	-	-	-	-	-
Hydroxide alkalinity	mg/L	224	1	-	-	-	-	-	-	-	-	-	-
Total alkalinity	mg/L	224	62	-	-	-	-	-	-	-	-	-	-
Calcium	mg/L	224	218	-	-	-	-	-	-	-	-	-	-
Chloride	mg/L	221	286	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	224	163	-	-	-	-	-	-	-	-	-	-

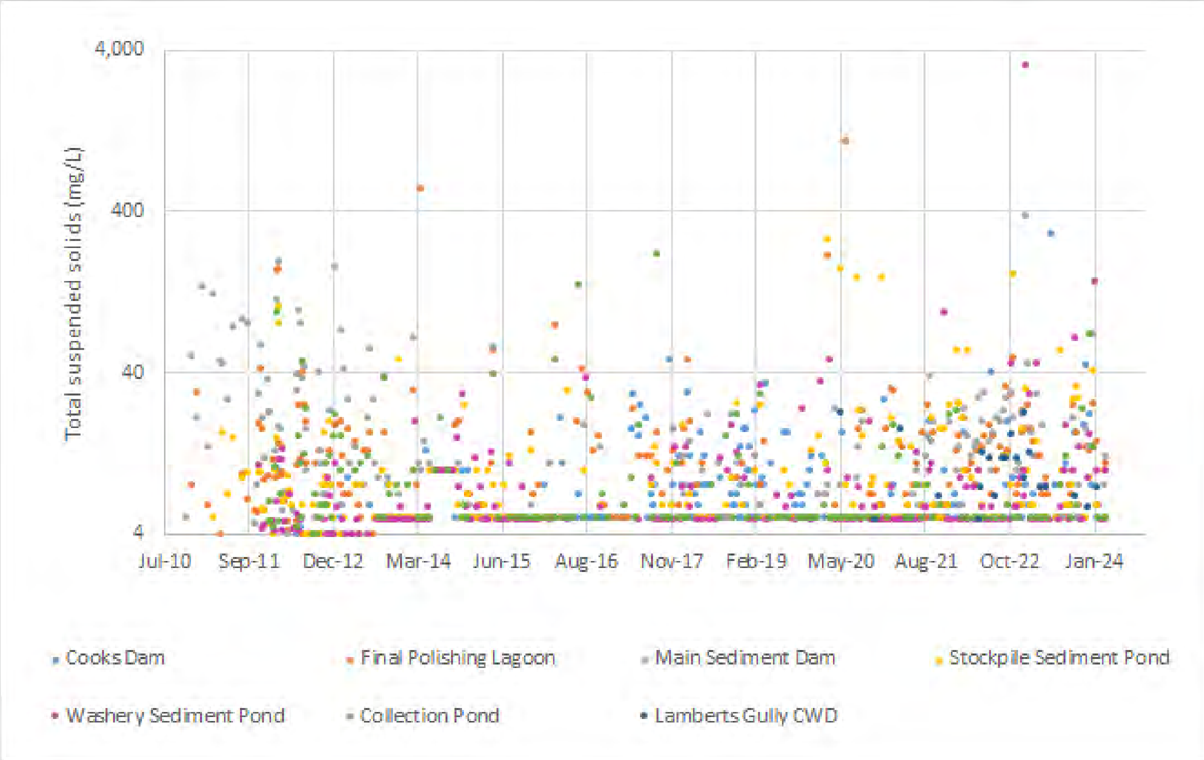
Parameter	Units	Cooks Dam		Final Polishing Lagoon		Main Sediment Dam		Stockpile Sediment Pond		Washery Sediment Pond		Collection Pond	
		Count	Median	Count	Median	Count	Median	Count	Median	Count	Median	Count	Median
Potassium	mg/L	224	41	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	224	492	-	-	-	-	-	-	-	-	-	-
Sulphate	mg/L	106	2585	-	-	-	-	-	-	-	-	-	-
Total hardness	mg/L	224	1230	-	-	-	-	-	-	-	-	-	-
Dissolved metals													
Aluminium	mg/L	220	0.01	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	137	1.52	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	221	0.0002	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	350	0.29	71	0.12	80	0.13	80	0.05	78	0.05	163	0.29
Manganese	mg/L	364	4.07	71	0.71	80	5.00	80	2.66	78	1.66	164	2.68
Nickel	mg/L	224	0.36	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	224	0.01	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	224	0.25	-	-	-	-	-	-	-	-	-	-
Other													
Oil and grease	mg/L	323	5	210	5	213	5	199	5	192	5	140	5

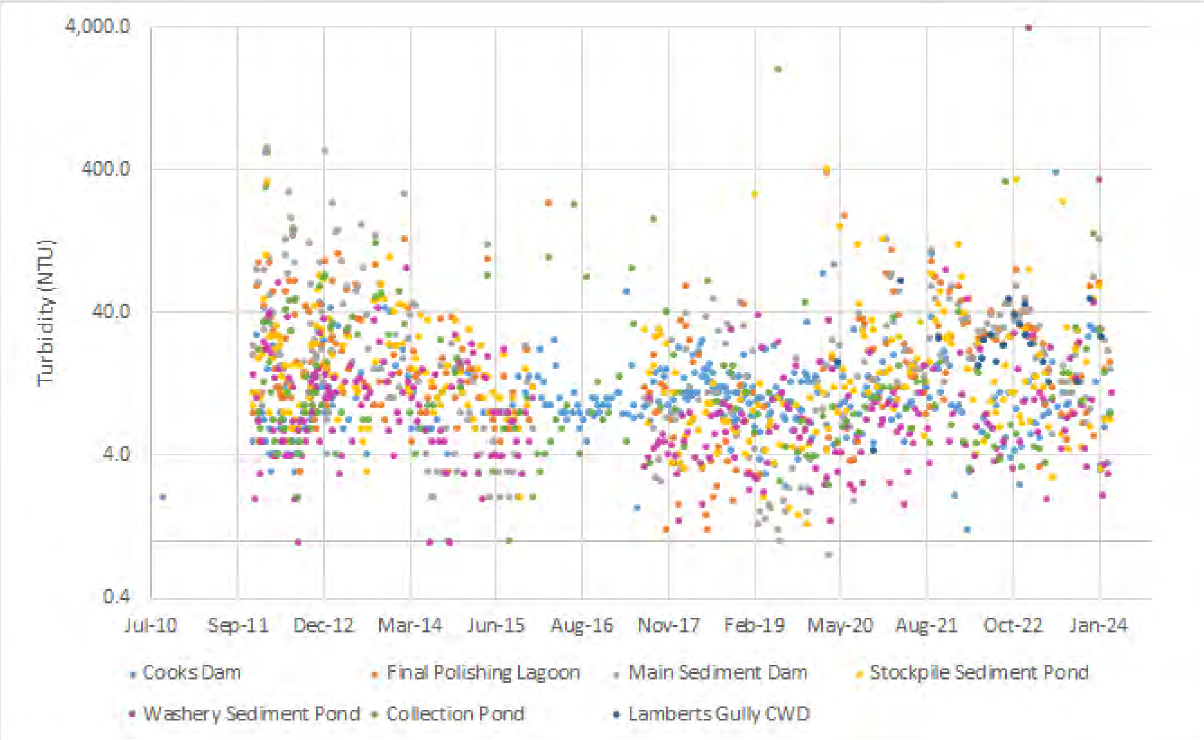
H.1.2 Time series graphs of water quality results

Physicochemical parameters

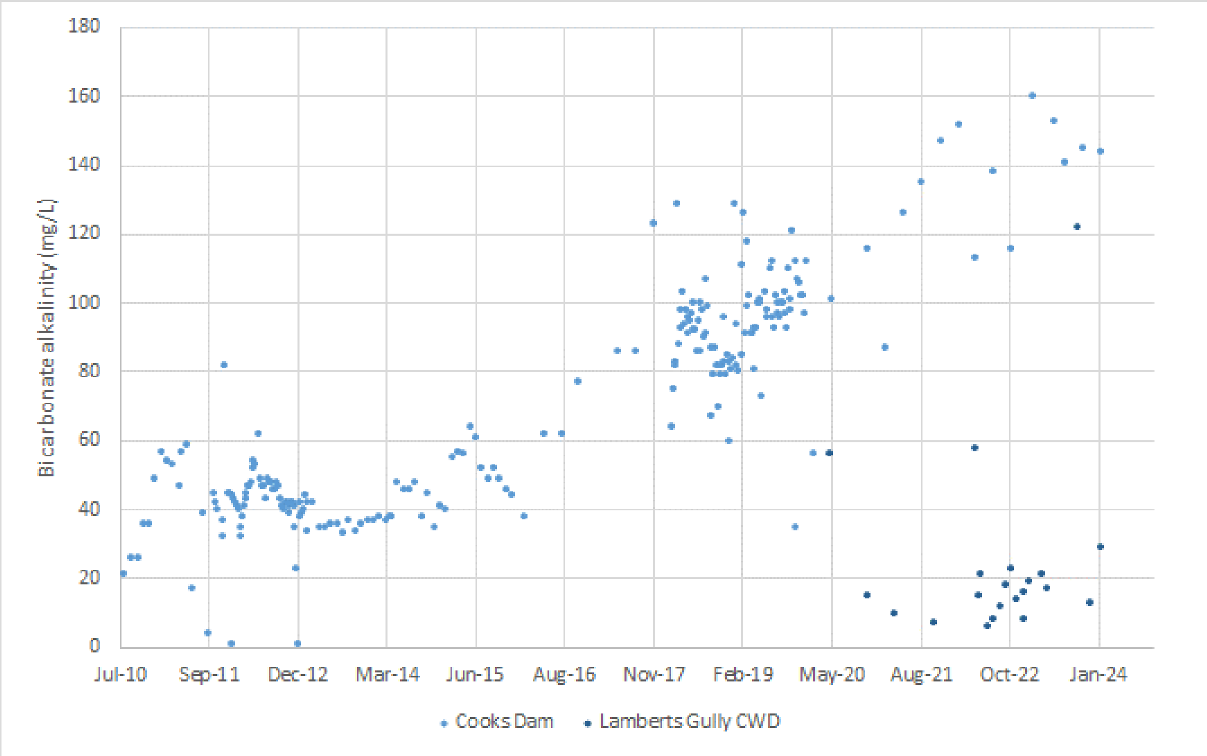




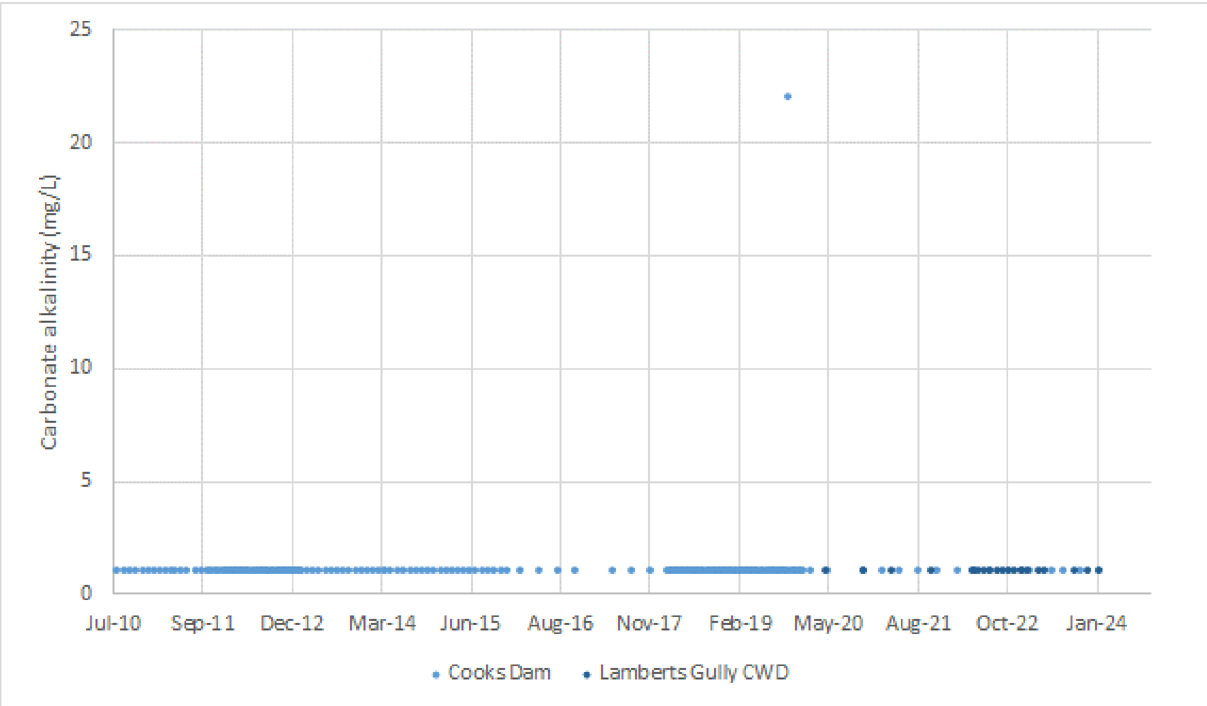

4,000
400
40
4
Total suspended solids (mg/L)
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Final Polishing Lagoon
Main Sediment Dam
Stockpile Sediment Pond
Washery Sediment Pond
Collection Pond
Lamberts Gully CWD


4,000.0
400.0
40.0
4.0
0.4
Turbidity (NTU)
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Final Polishing Lagoon
Main Sediment Dam
Stockpile Sediment Pond
Washery Sediment Pond
Collection Pond
Lamberts Gully CWD

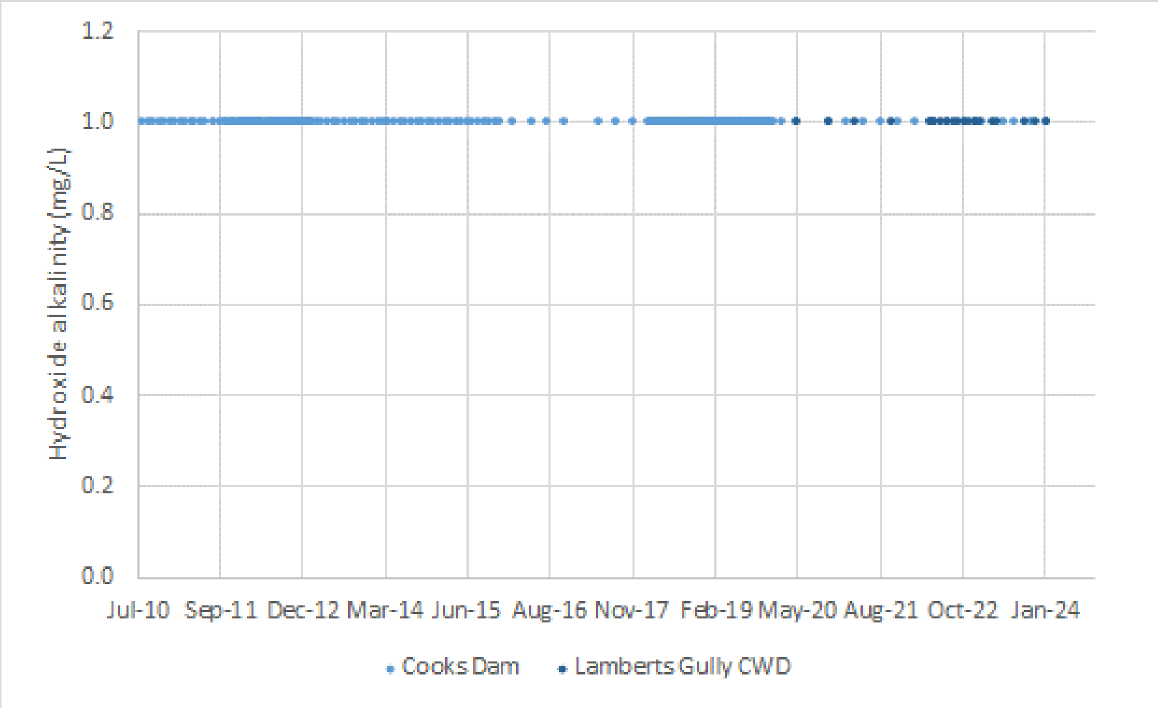
Major ions



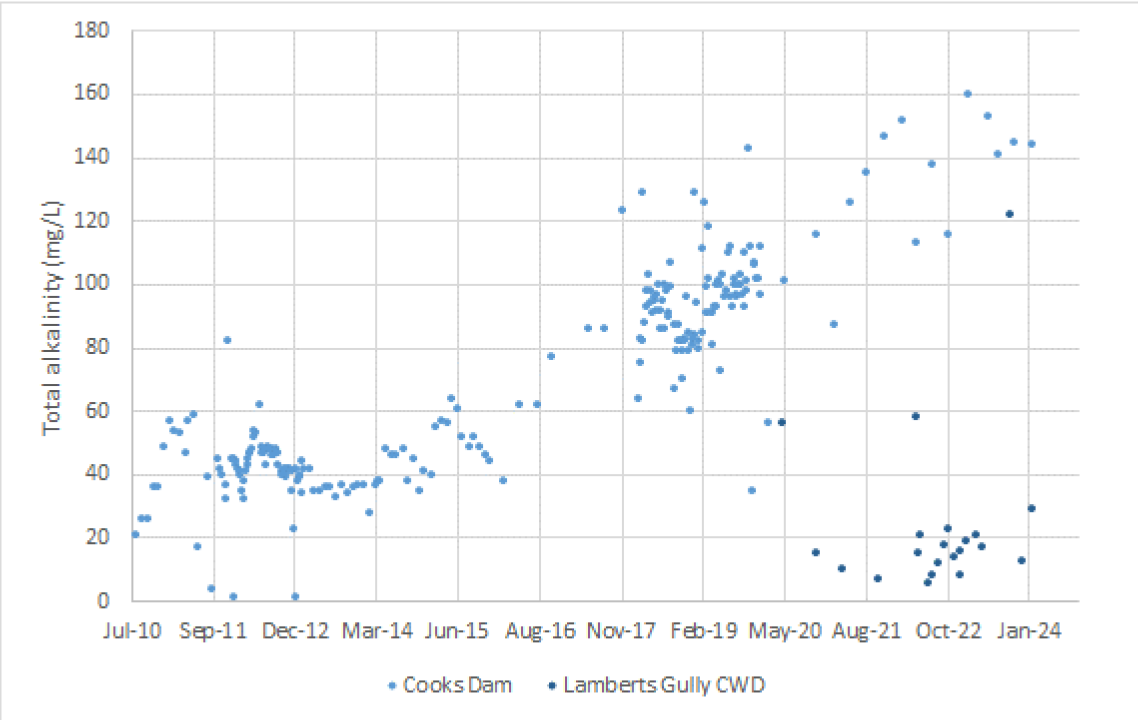
Bicarbonate alkalinity (mg/L)
180
160
140
120
100
80
60
40
20
0
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Lamberts Gully CWD



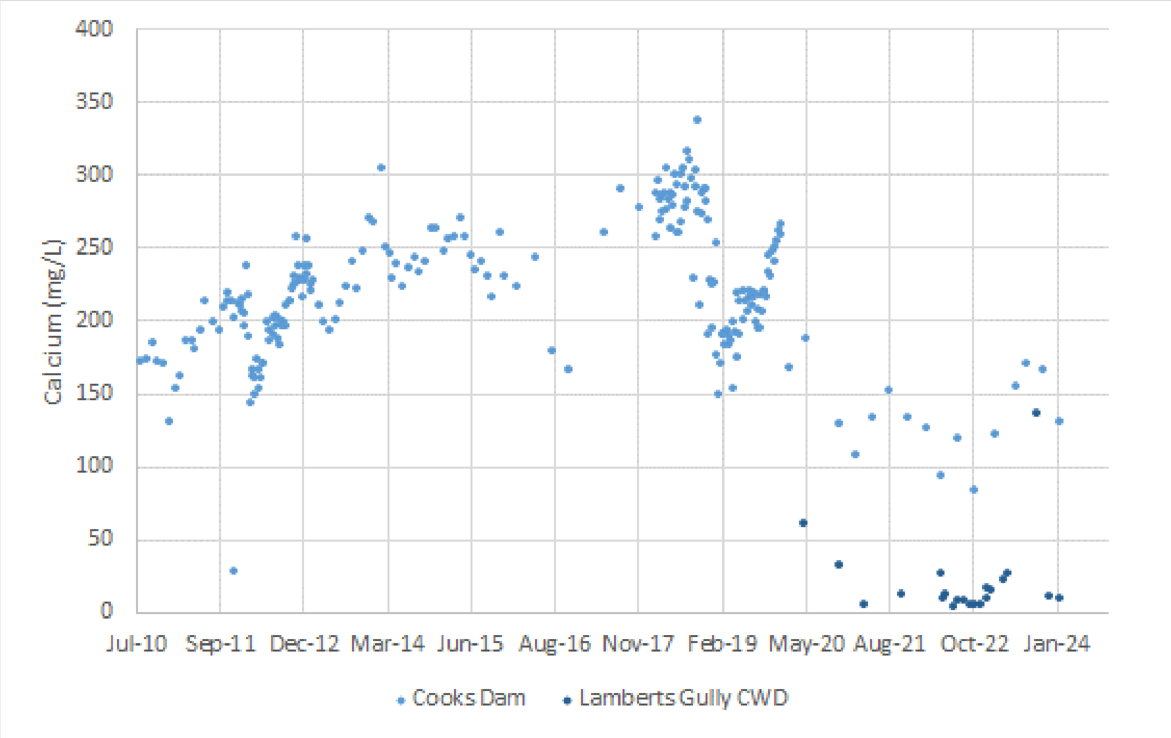
Carbonate alkalinity (mg/L)
25
20
15
10
5
0
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Lamberts Gully CWD

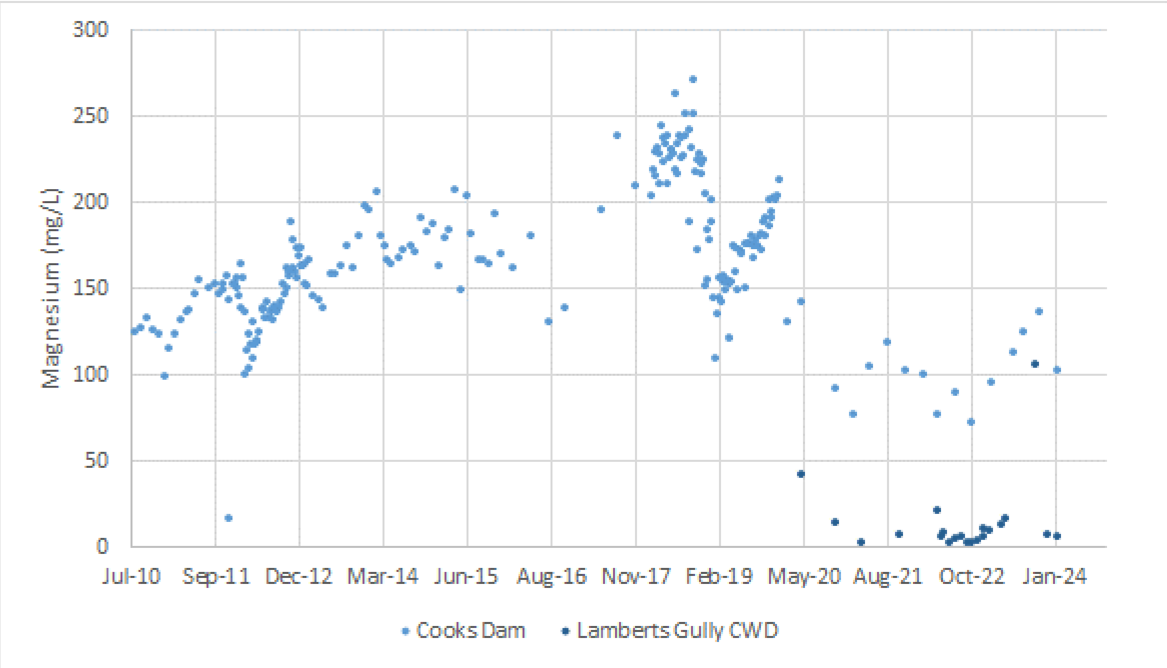


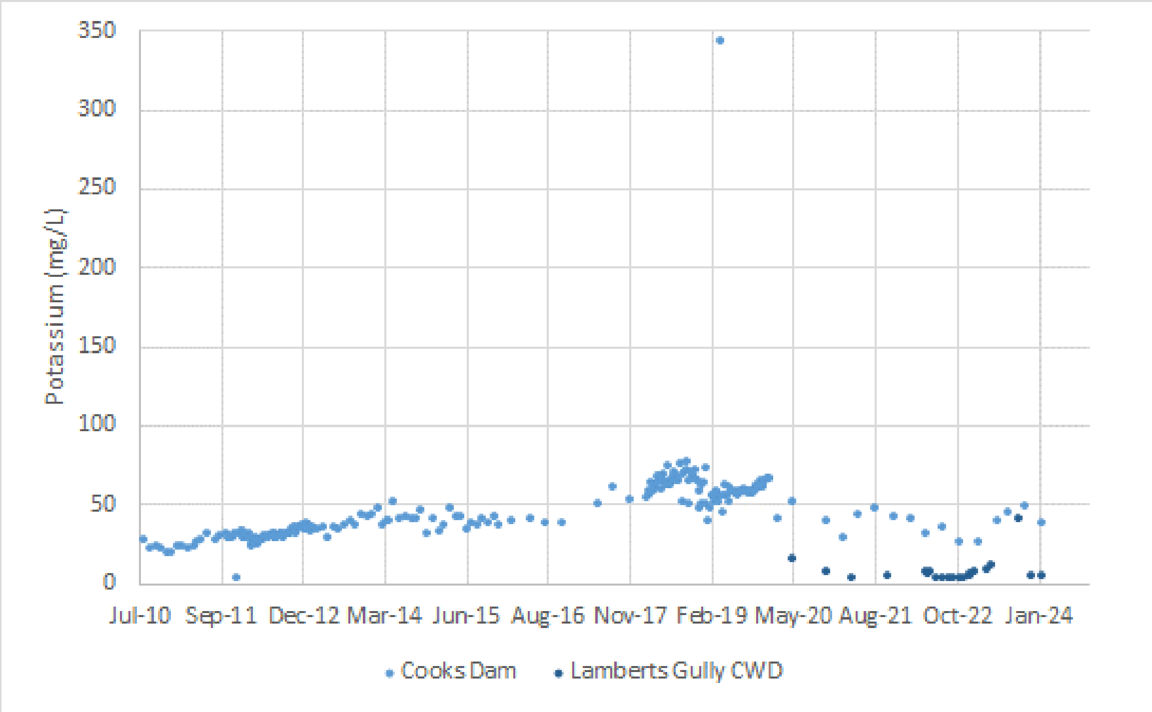
Hydroxide alkalinity (mg/L)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Jul-10 Sep-11 Dec-12 Mar-14 Jun-15 Aug-16 Nov-17 Feb-19 May-20 Aug-21 Oct-22 Jan-24
Cooks Dam
Lamberts Gully CWD



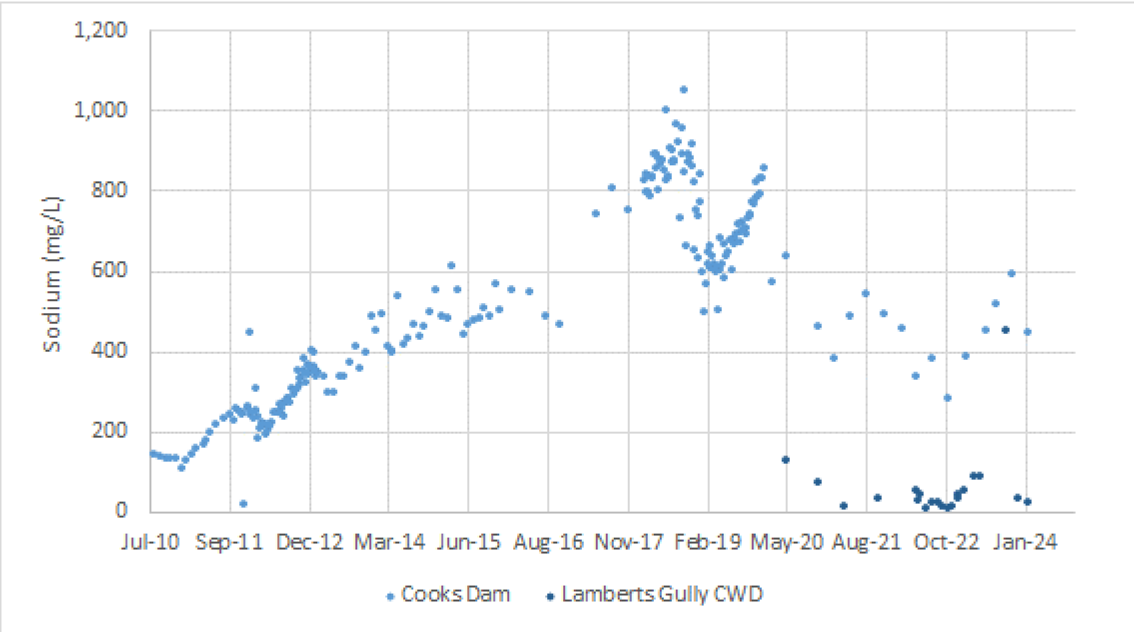
Total alkalinity (mg/L)
180
160
140
120
100
80
60
40
20
0
Jul-10 Sep-11 Dec-12 Mar-14 Jun-15 Aug-16 Nov-17 Feb-19 May-20 Aug-21 Oct-22 Jan-24
Cooks Dam
Lamberts Gully CWD


400
350
300
250
200
150
100
50
0
Calcium (mg/L)
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Lamberts Gully CWD

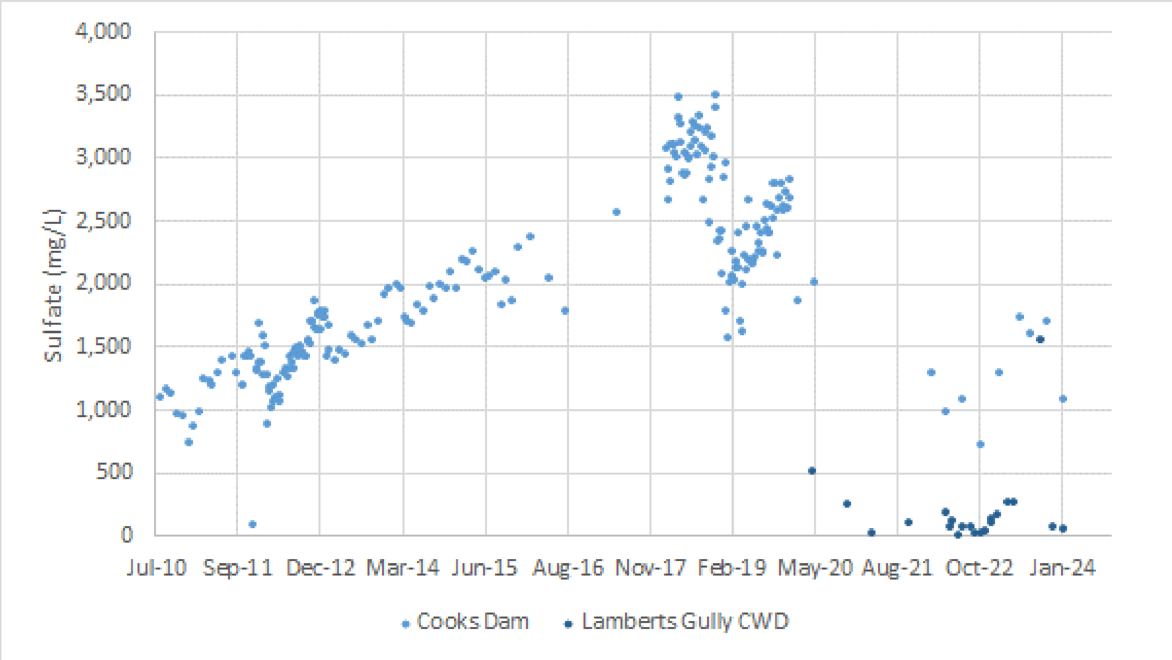

300
250
200
150
100
50
0
Magnesium (mg/L)
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Lamberts Gully CWD



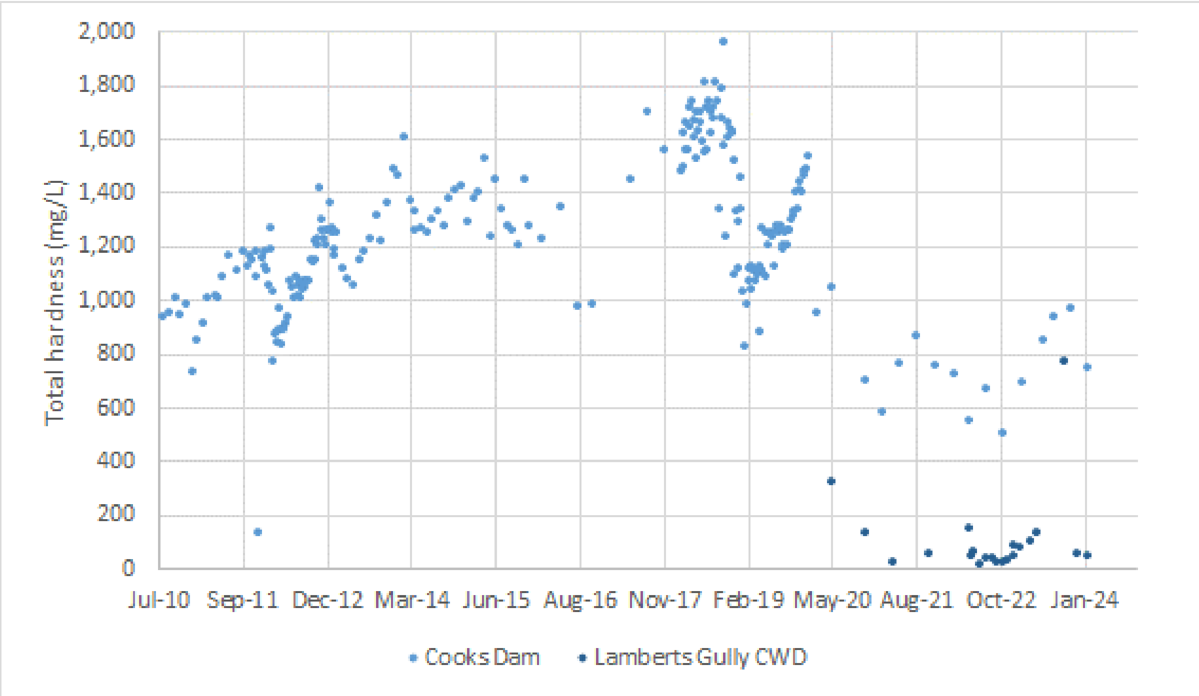
350
300
250
200
150
100
50
0
Potassium (mg/L)
Jul-10 Sep-11 Dec-12 Mar-14 Jun-15 Aug-16 Nov-17 Feb-19 May-20 Aug-21 Oct-22 Jan-24
Cooks Dam
Lamberts Gully CWD



1,200
1,000
800
600
400
200
0
Sodium (mg/L)
Jul-10 Sep-11 Dec-12 Mar-14 Jun-15 Aug-16 Nov-17 Feb-19 May-20 Aug-21 Oct-22 Jan-24
Cooks Dam
Lamberts Gully CWD

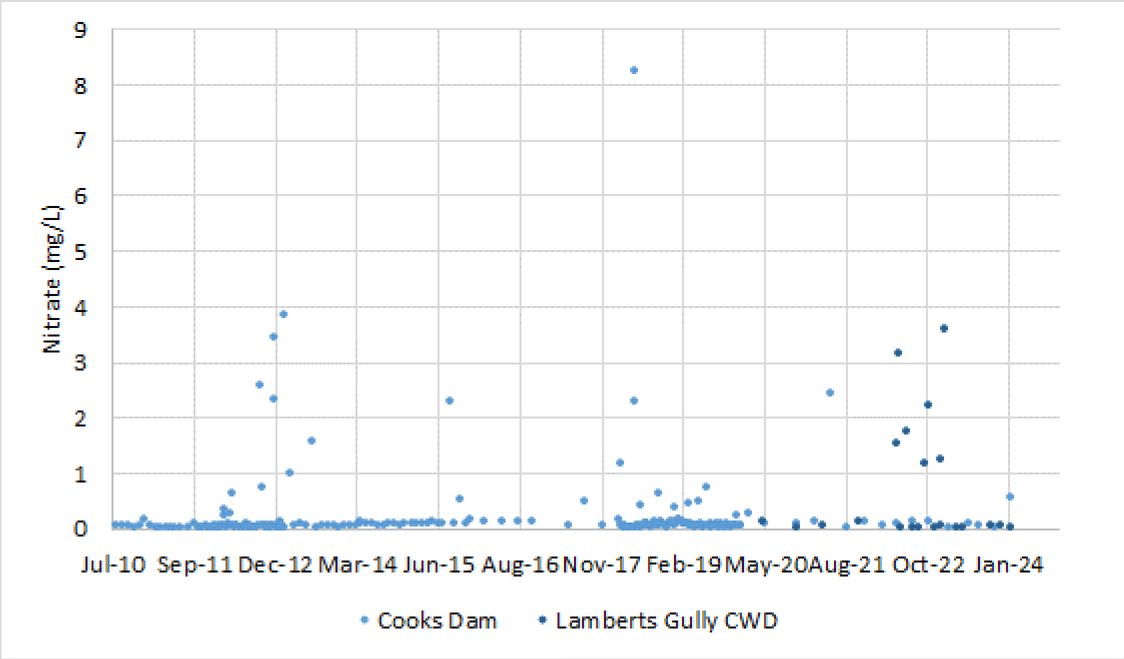


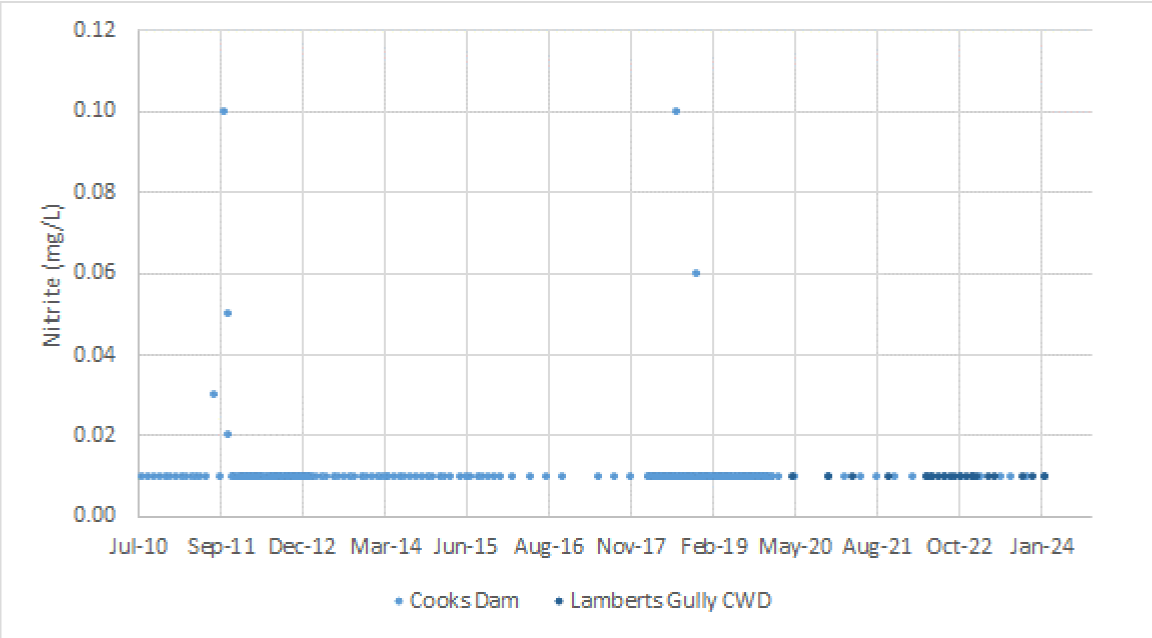
Sulfate (mg/L)
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Lamberts Gully CWD

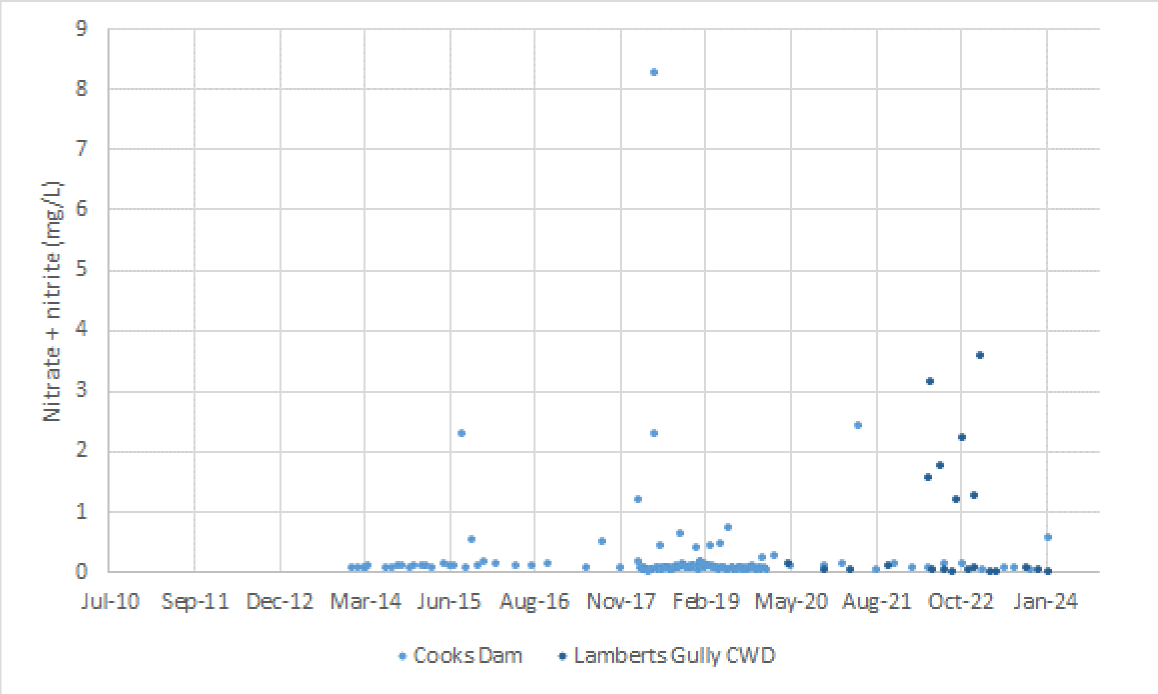


Total hardness (mg/L)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Lamberts Gully CWD

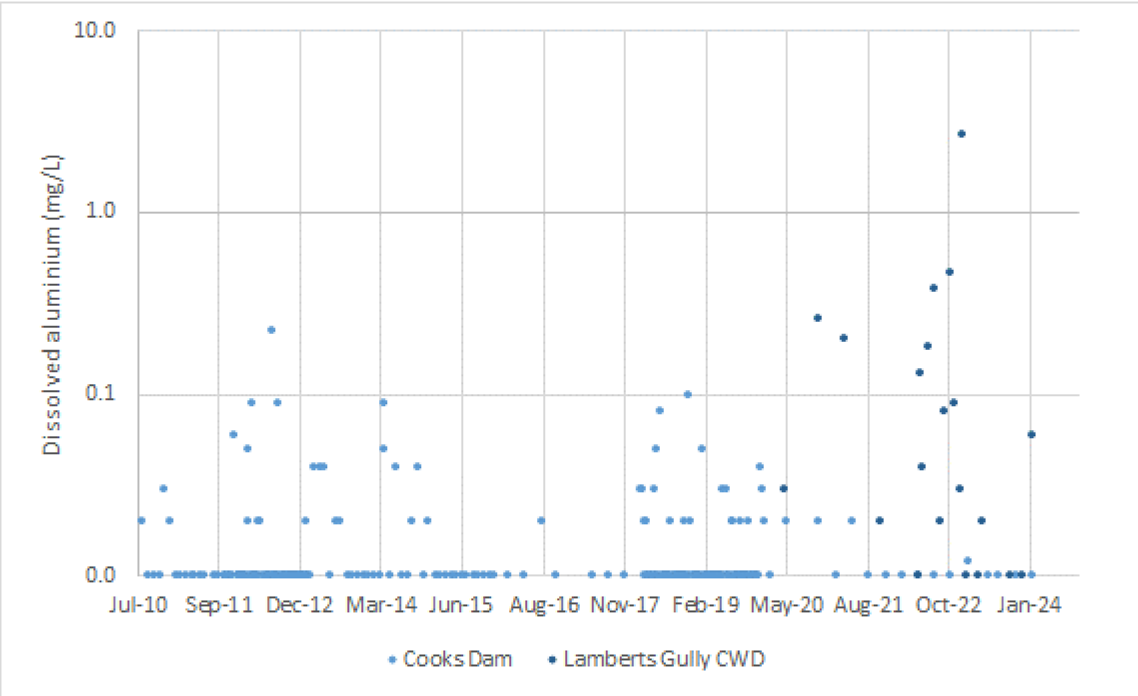
Nutrients

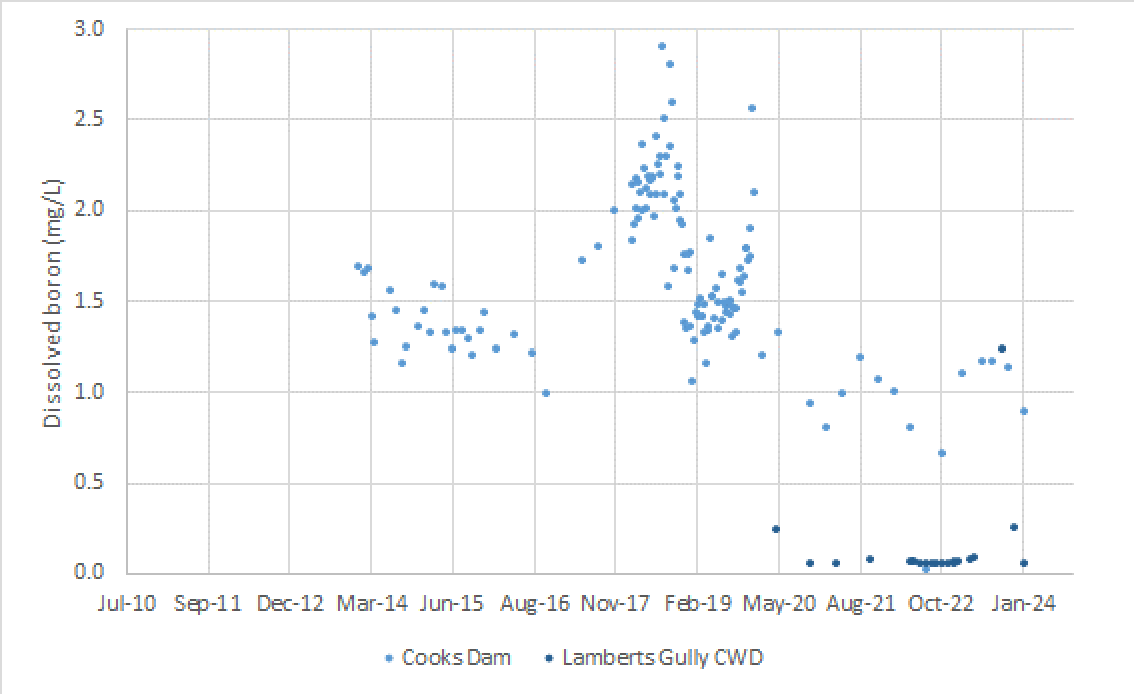

Nitrate (mg/L)
9
8
7
6
5
4
3
2
1
0
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Lamberts Gully CWD

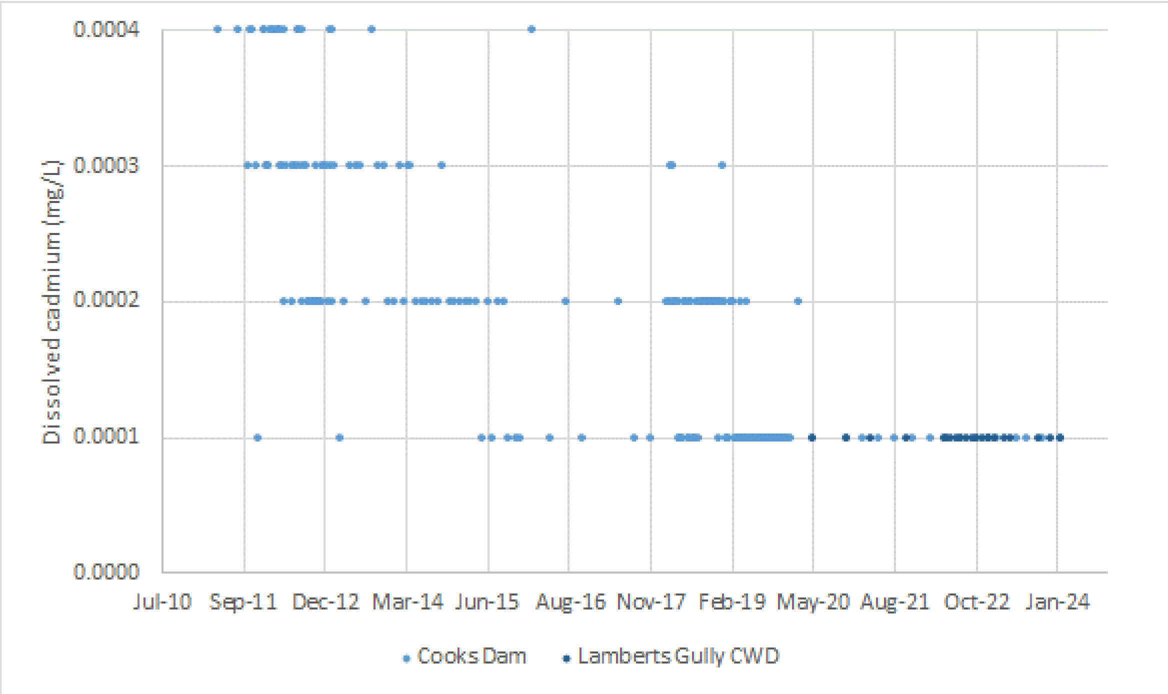

Nitrite (mg/L)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Lamberts Gully CWD

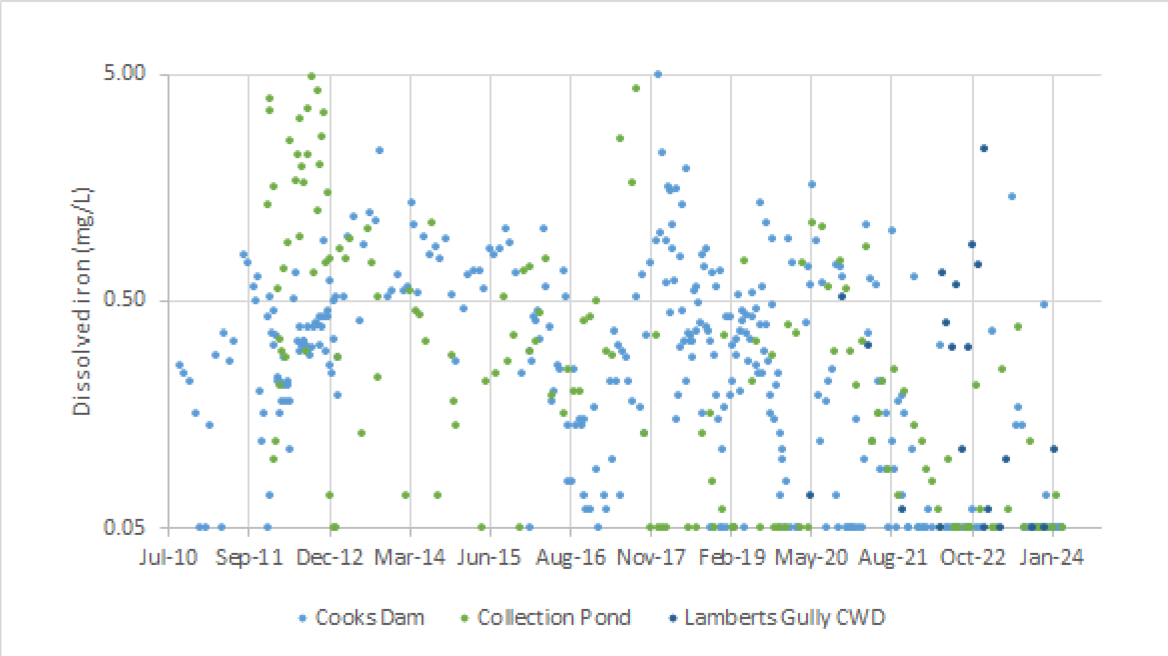


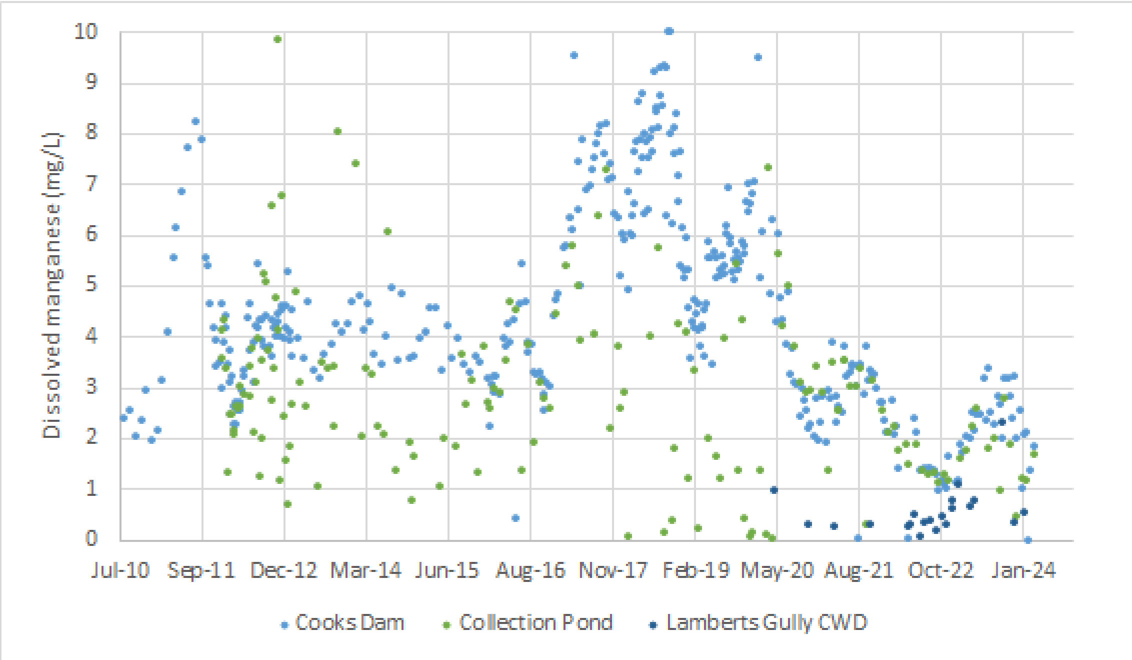
Dissolved metals

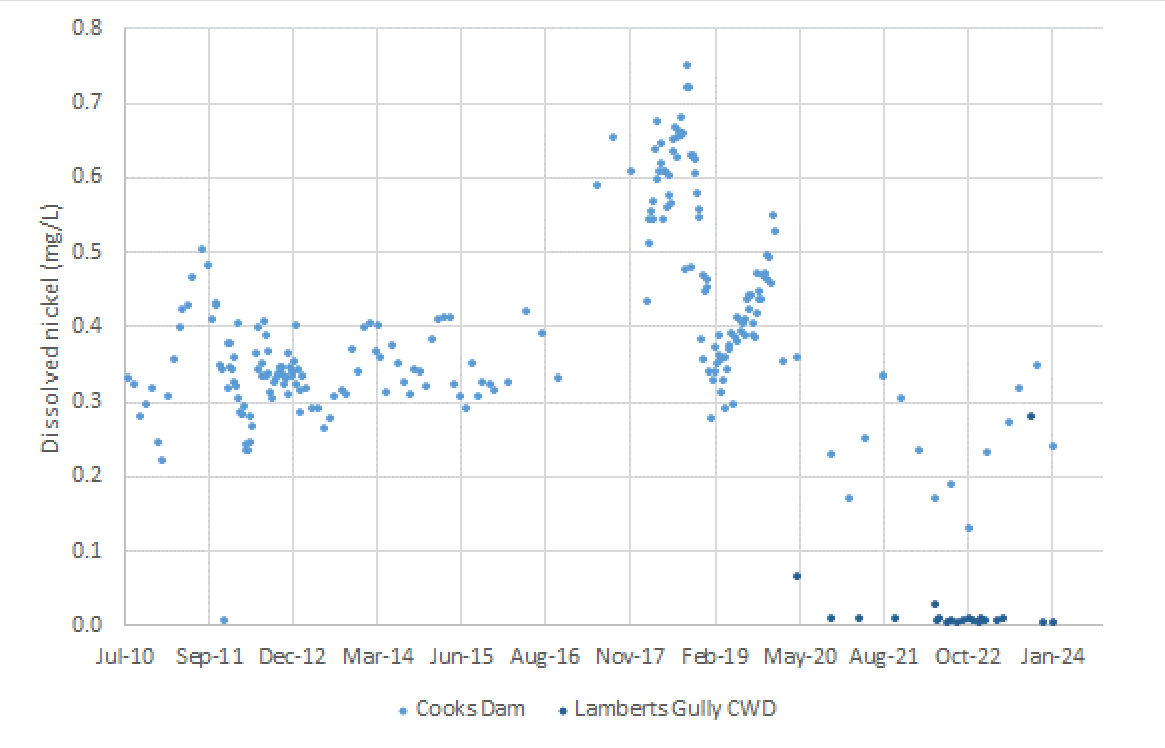



Dissolved boron (mg/L)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Lamberts Gully CWD

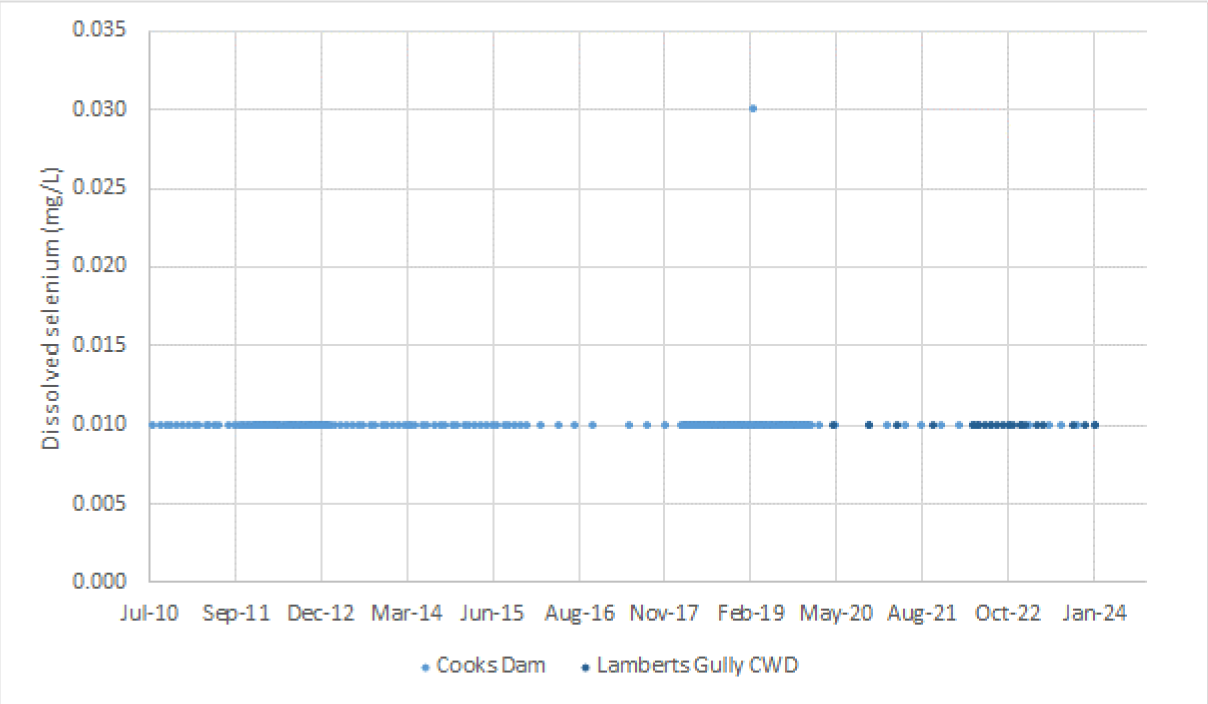

Dissolved cadmium (mg/L)
0.0004
0.0003
0.0002
0.0001
0.0000
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Lamberts Gully CWD


5.00
0.50
0.05
Dissolved iron (mg/L)
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Collection Pond
Lamberts Gully CWD

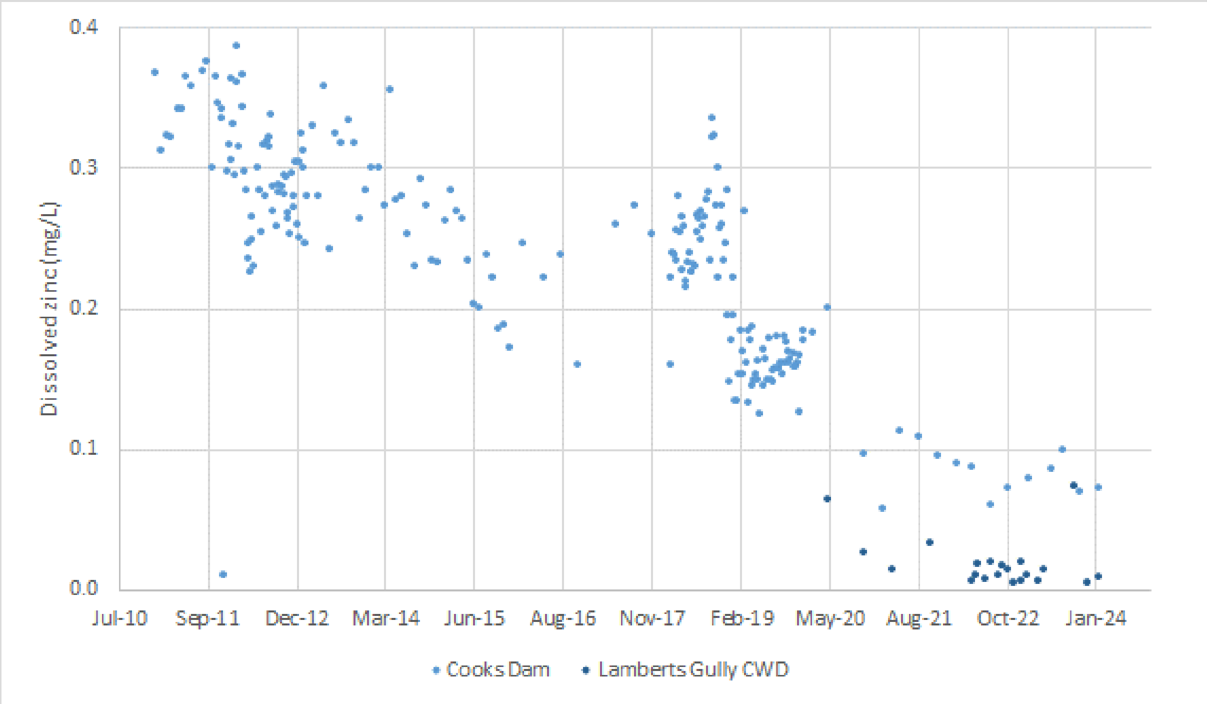

10
9
8
7
6
5
4
3
2
1
0
Dissolved manganese (mg/L)
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Collection Pond
Lamberts Gully CWD



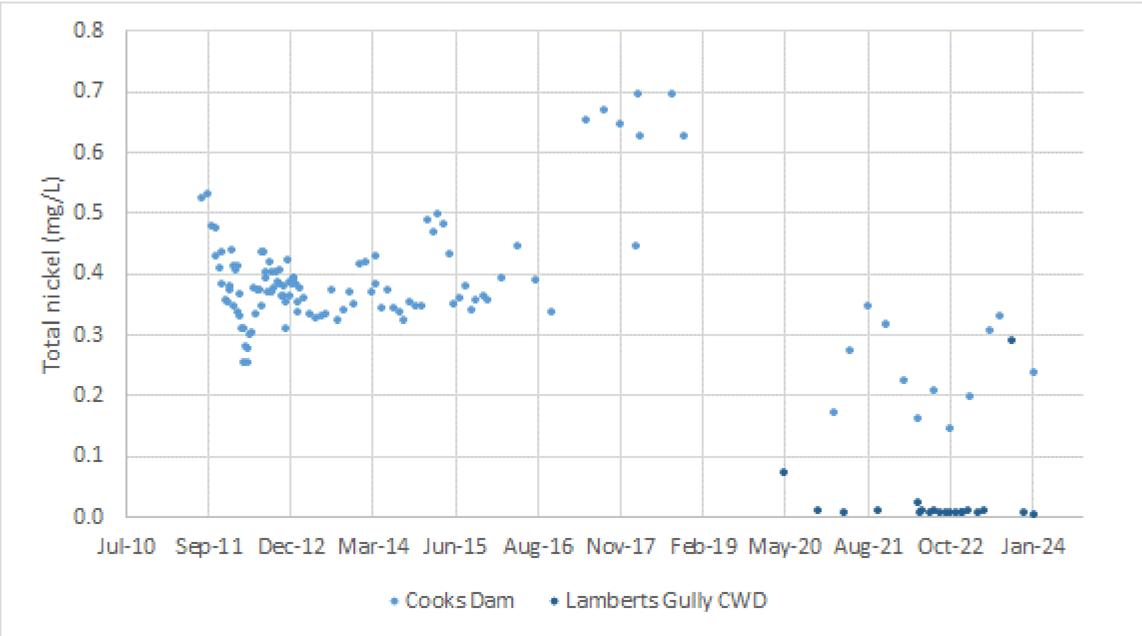
Dissolved nickel (mg/L)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Jul-10 Sep-11 Dec-12 Mar-14 Jun-15 Aug-16 Nov-17 Feb-19 May-20 Aug-21 Oct-22 Jan-24
Cooks Dam
Lamberts Gully CWD

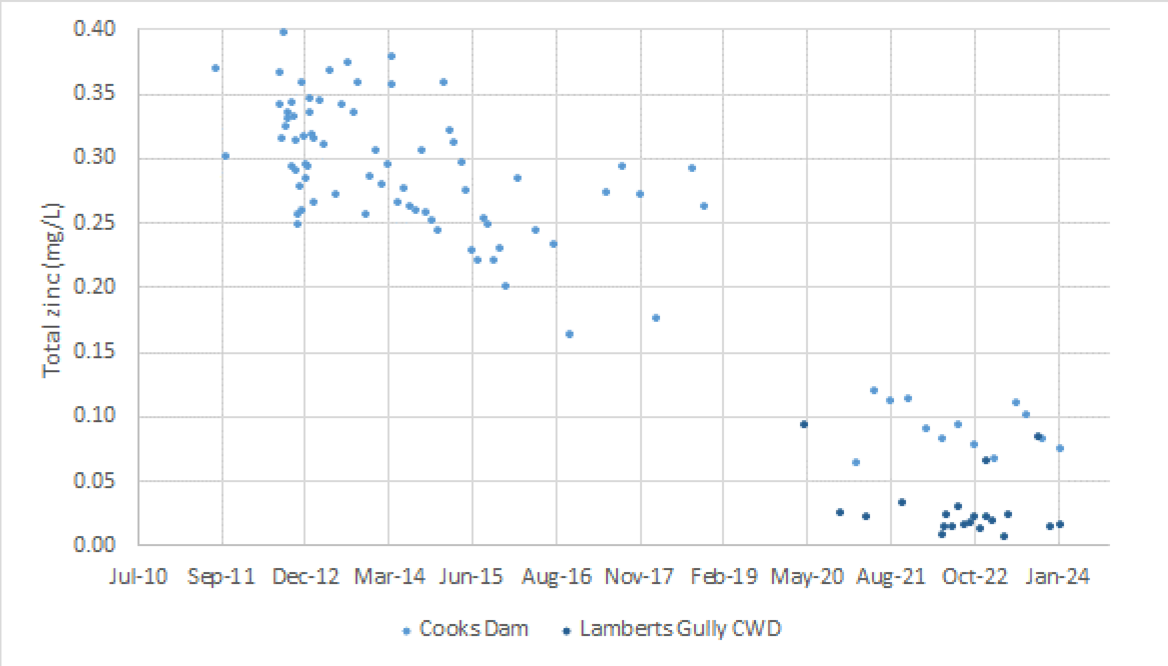


Dissolved selenium (mg/L)
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
Jul-10 Sep-11 Dec-12 Mar-14 Jun-15 Aug-16 Nov-17 Feb-19 May-20 Aug-21 Oct-22 Jan-24
Cooks Dam
Lamberts Gully CWD

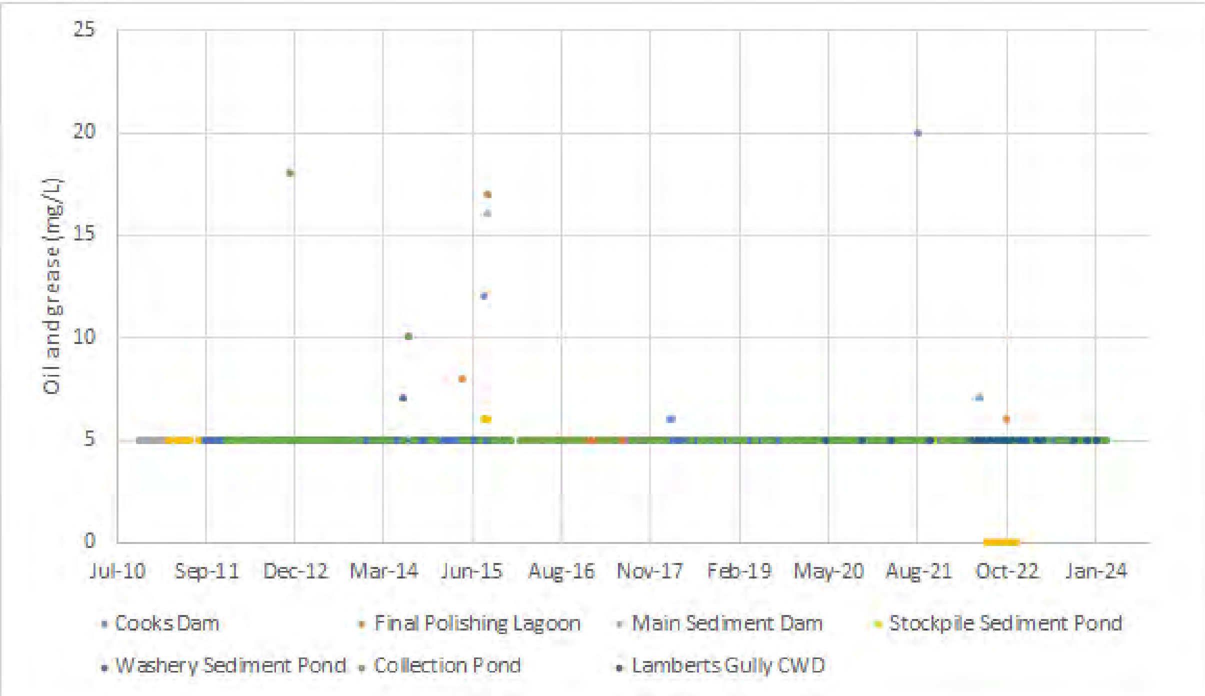


Total metals




0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Total zinc (mg/L)
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Lamberts Gully CWD

Other


25
20
15
10
5
0
Oil and grease (mg/L)
Jul-10
Sep-11
Dec-12
Mar-14
Jun-15
Aug-16
Nov-17
Feb-19
May-20
Aug-21
Oct-22
Jan-24
Cooks Dam
Final Polishing Lagoon
Main Sediment Dam
Stockpile Sediment Pond
Washery Sediment Pond
Collection Pond
Lamberts Gully CWD

.

H.2 Wangcol Creek

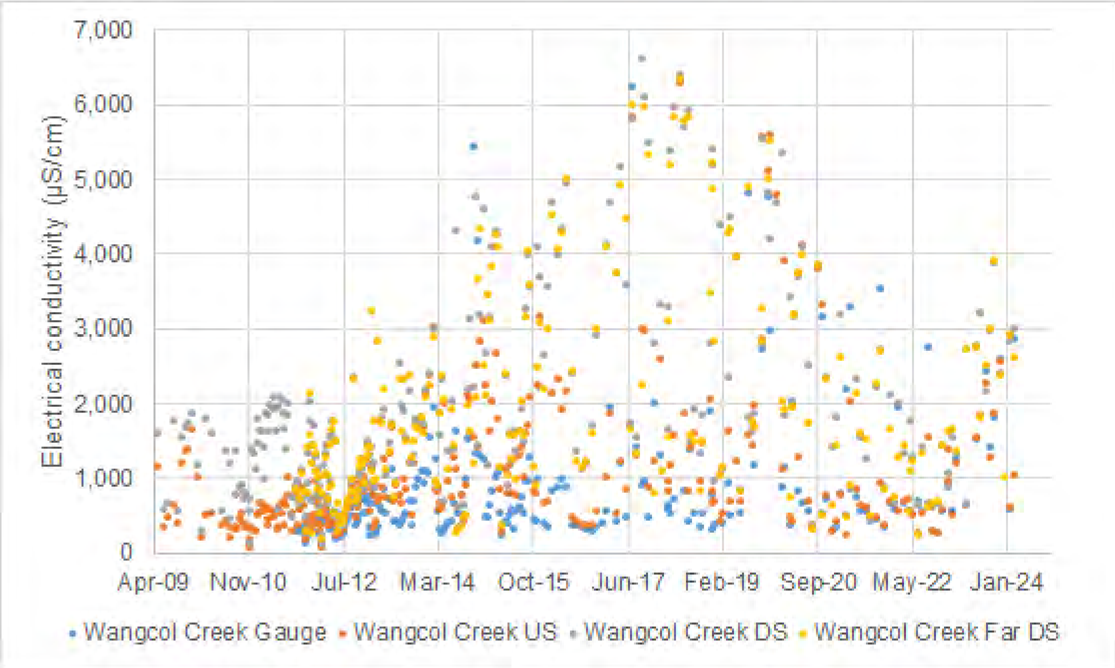
H.2.1 Statistical summary of water quality results

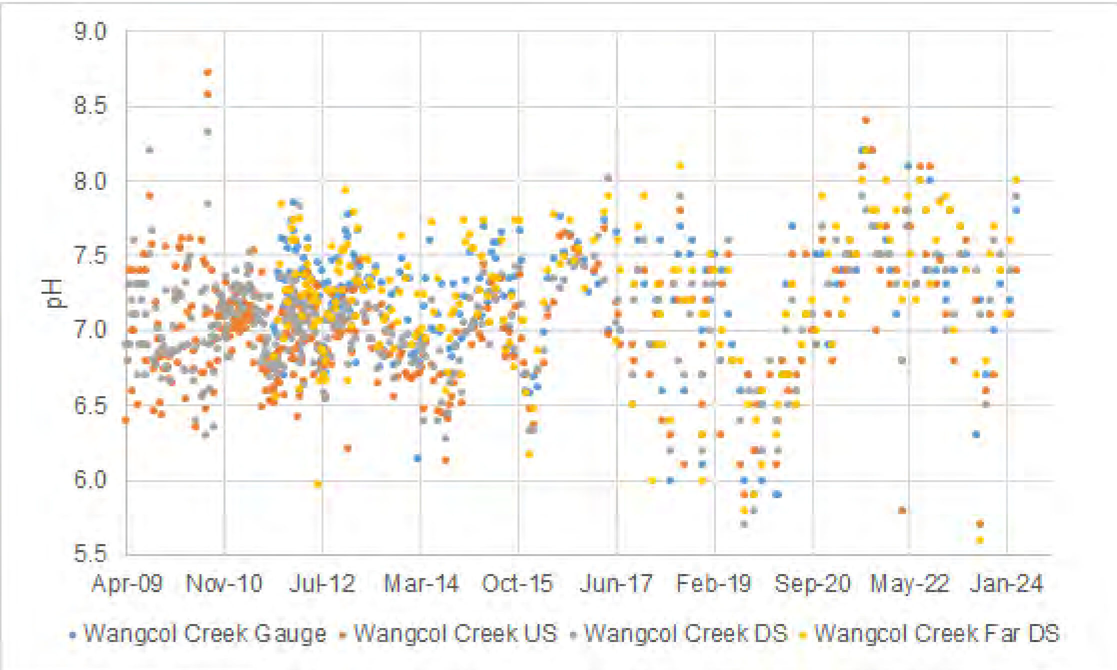
Parameter	Units	Wangcol Creek Gauge				Wangcol Creek US		Wangcol Creek DS		Wangcol Creek Far DS	
		Count	20th	Median	80th	Count	Median	Count	Median	Count	Median
Physicochemical											
EC	µS/cm	240	348	558	1185	397	758	397	1230	240	1550
pH	pH units	46	6.90	7.27	7.50	840	6.90	840	7.00	240	7.26
TDS	mg/L	231	232	390	752	247	588	247	1160	231	1124
TSS	mg/L	237	3	5	6	312	5	312	5	237	5
Turbidity	NTU	230	2	4	16	233	3	232	3	233	3
Nutrients											
Ammonia	mg/L	104	0.01	0.01	0.03	105	0.01	105	0.02	109	0.02
Nitrate	mg/L	233	0.01	0.02	0.06	247	0.01	247	0.03	234	0.03
Nitrite	mg/L	229	0.01	0.01	0.01	243	0.01	243	0.01	230	0.01
Nitrate + nitrite	mg/L	144	0.01	0.02	0.07	145	0.02	145	0.04	148	0.04
Total Kjeldahl nitrogen	mg/L	105	0.2	0.2	0.4	106	0.2	106	0.2	110	0.2
Total nitrogen	mg/L	140	0.1	0.2	0.4	141	0.2	141	0.2	144	0.2
Total Phosphorus	mg/L	231	0.01	0.01	0.02	245	0.01	245	0.01	232	0.01
Major ions											
Bicarbonate alkalinity	mg/L	233	42	58	81	247	57	247	55	233	49
Carbonate alkalinity	mg/L	233	1	1	1	247	1	247	1	233	1

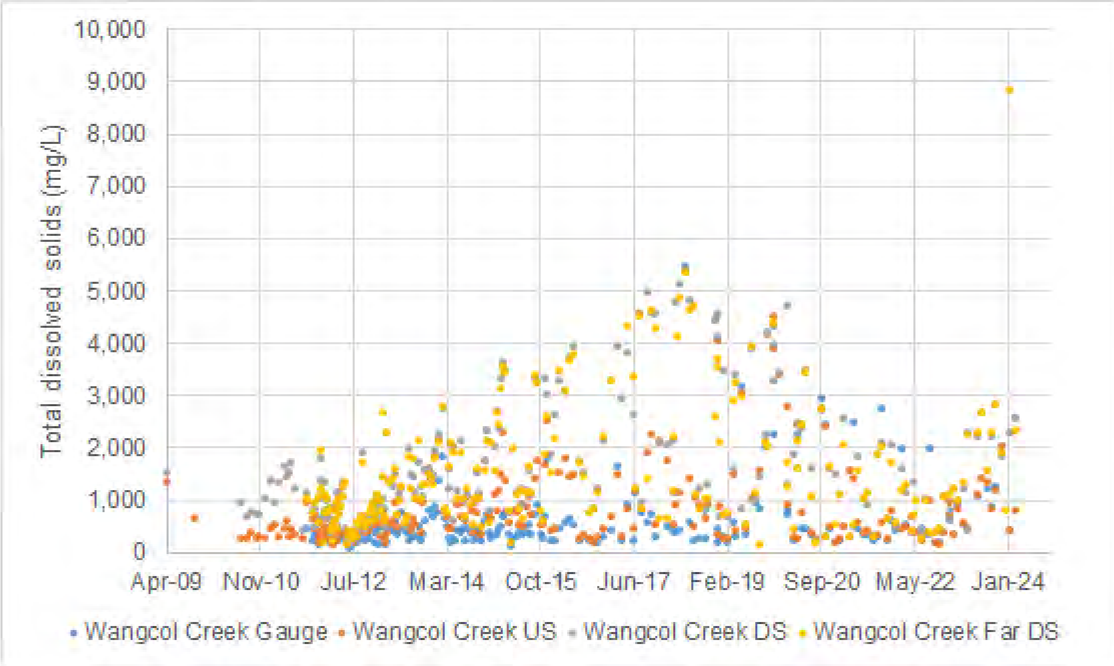
Parameter	Units	Wangcol Creek Gauge				Wangcol Creek US		Wangcol Creek DS		Wangcol Creek Far DS	
		Count	20th	Median	80th	Count	Median	Count	Median	Count	Median
Hydroxide alkalinity	mg/L	233	1	1	1	247	1	247	1	233	1
Total alkalinity	mg/L	148	43	65	91	148	62	149	65	151	57
Calcium	mg/L	233	25	39	76	247	51	247	89	234	87
Chloride	mg/L	225	15	29	61	245	42	229	76	233	90
Magnesium	mg/L	233	16	26	54	247	39	247	68	234	65
Potassium	mg/L	233	4	6	11	247	7	247	15	234	14
Sodium	mg/L	233	26	43	93	247	61	247	141	234	147
Sulphate	mg/L	11	338	618	991	14	376	14	806	11	1040
Total hardness	mg/L	227	131	206	411	247	292	247	505	232	487
Dissolved metals											
Aluminium	mg/L	231	0.01	0.01	0.04	245	0.01	245	0.01	234	0.03
Boron	mg/L	144	0.06	0.10	0.27	145	0.20	145	0.54	149	0.51
Cadmium	mg/L	230	0.0001	0.0001	0.0001	243	0.0001	243	0.0001	231	0.0001
Iron	mg/L	222	0.05	0.09	0.19	285	0.12	292	0.13	229	0.06
Manganese	mg/L	231	0.169	0.388	1.080	294	0.520	294	0.975	233	1.060
Nickel	mg/L	233	0.01	0.02	0.06	238	0.02	238	0.07	231	0.06
Selenium	mg/L	232	0.01	0.01	0.01	237	0.01	237	0.01	230	0.01
Zinc	mg/L	233	0.01	0.02	0.04	247	0.02	247	0.04	234	0.04
Other											
Oil and grease	mg/L	233	5	5	5	304	5	304	5	234	5

H.2.2 Time series graphs of water quality results

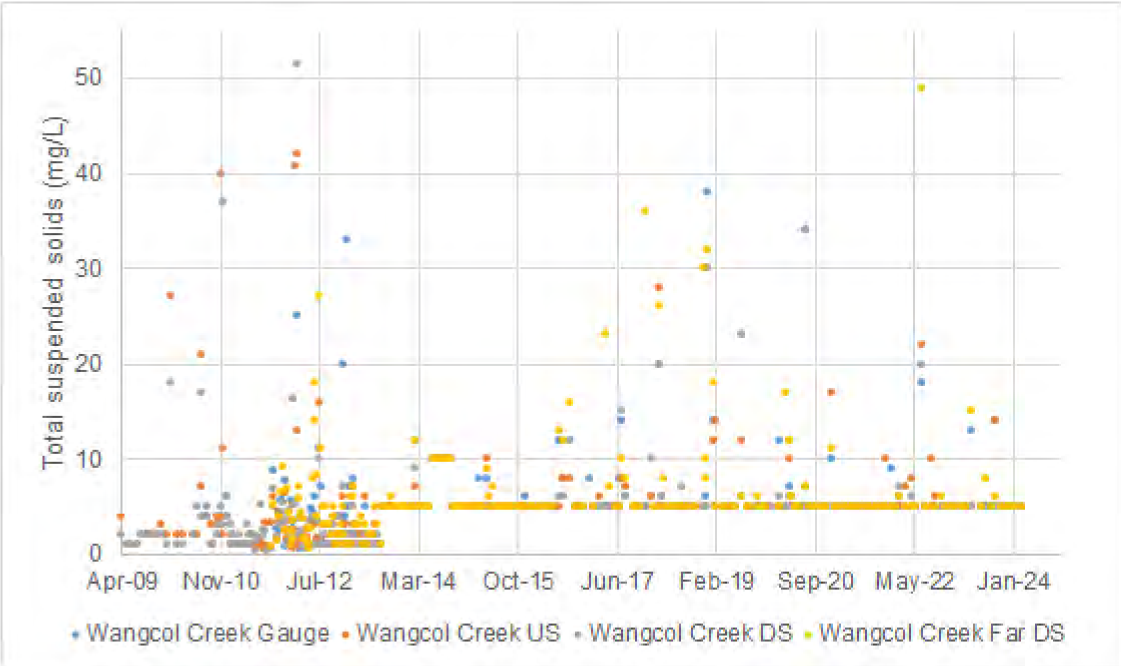
Physicochemical parameters



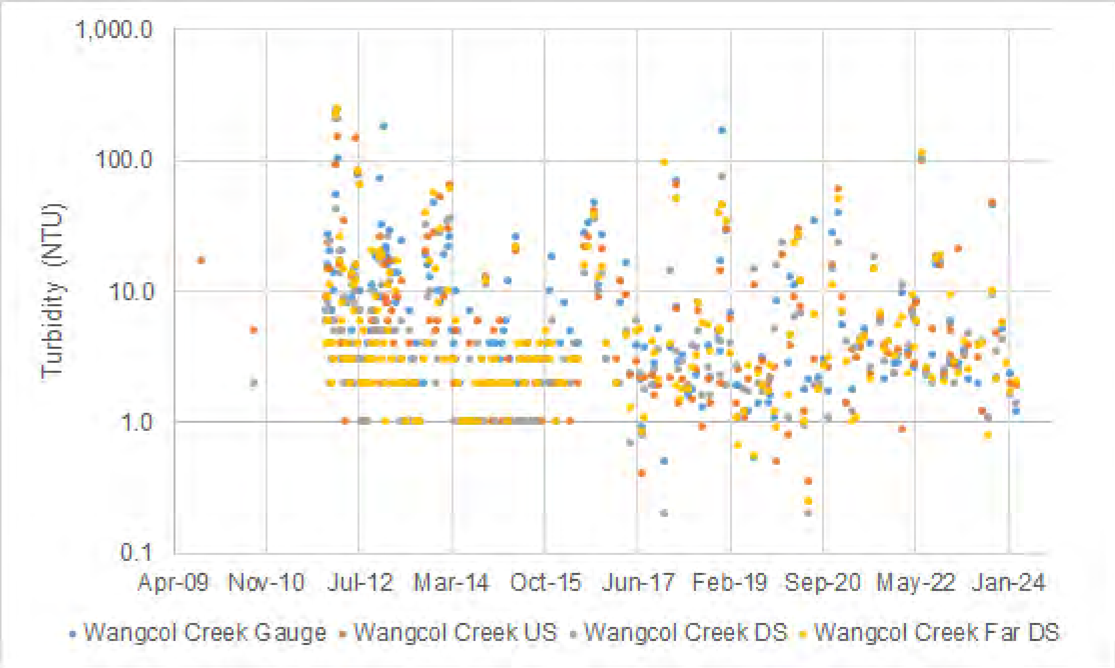




Total dissolved solids (mg/L)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

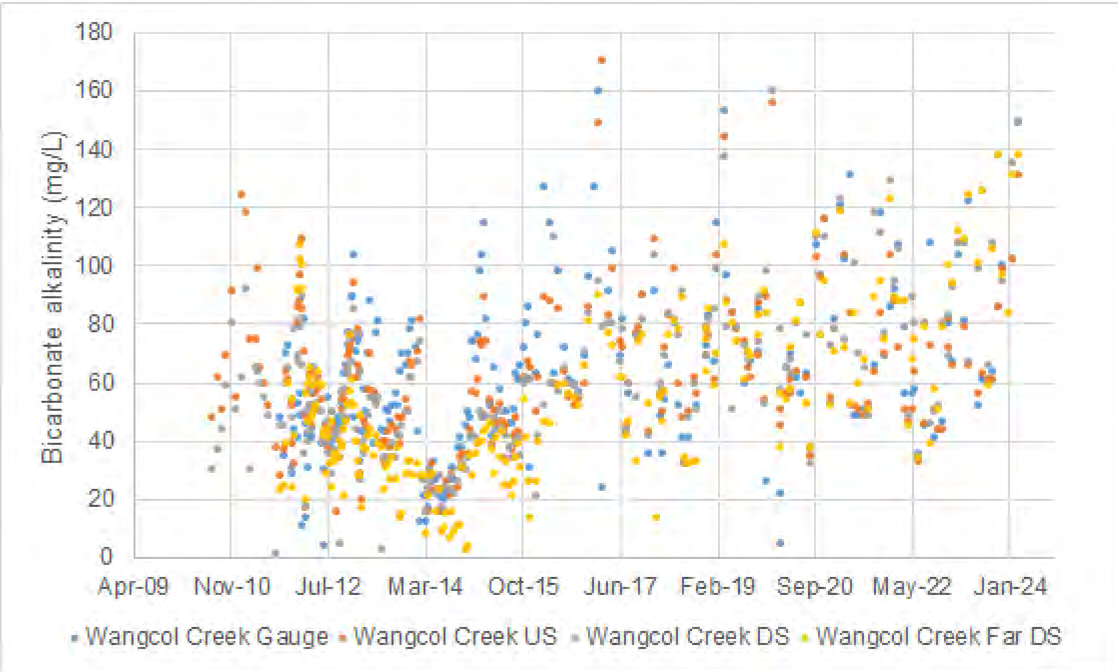


Total suspended solids (mg/L)
50
40
30
20
10
0
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

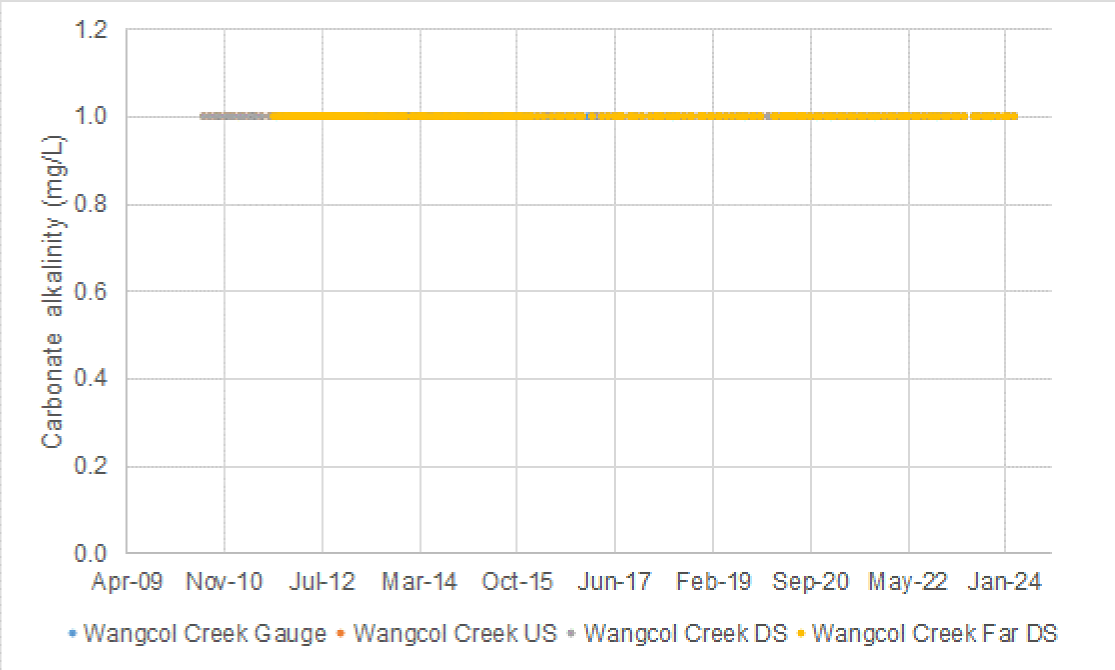


1,000.0
100.0
10.0
1.0
0.1
Turbidity (NTU)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

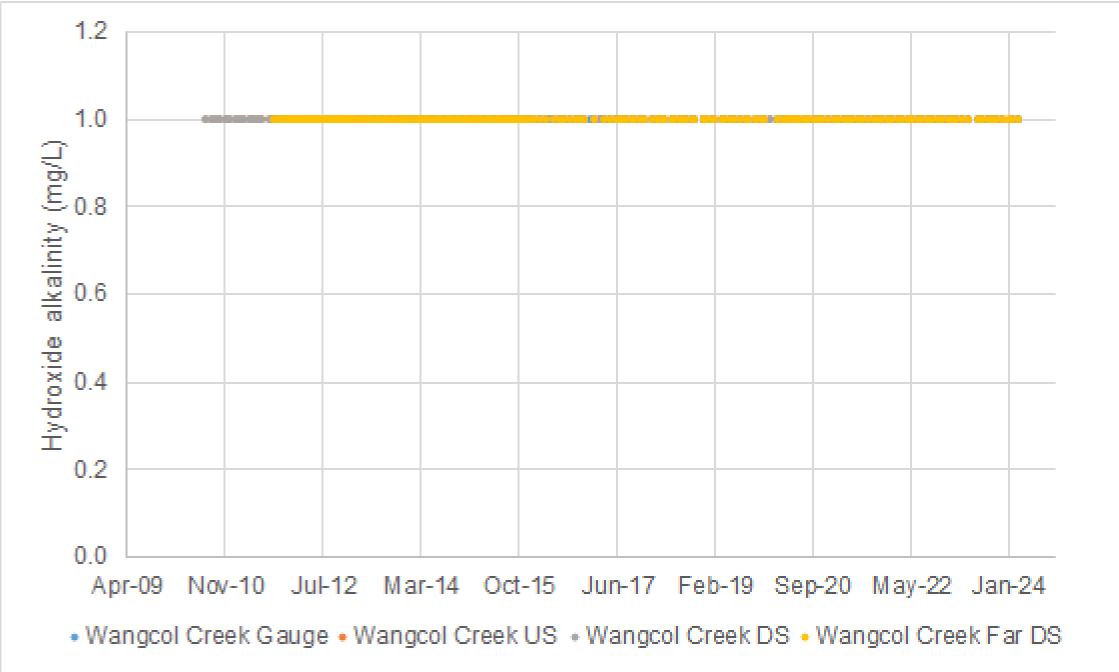
Major ions



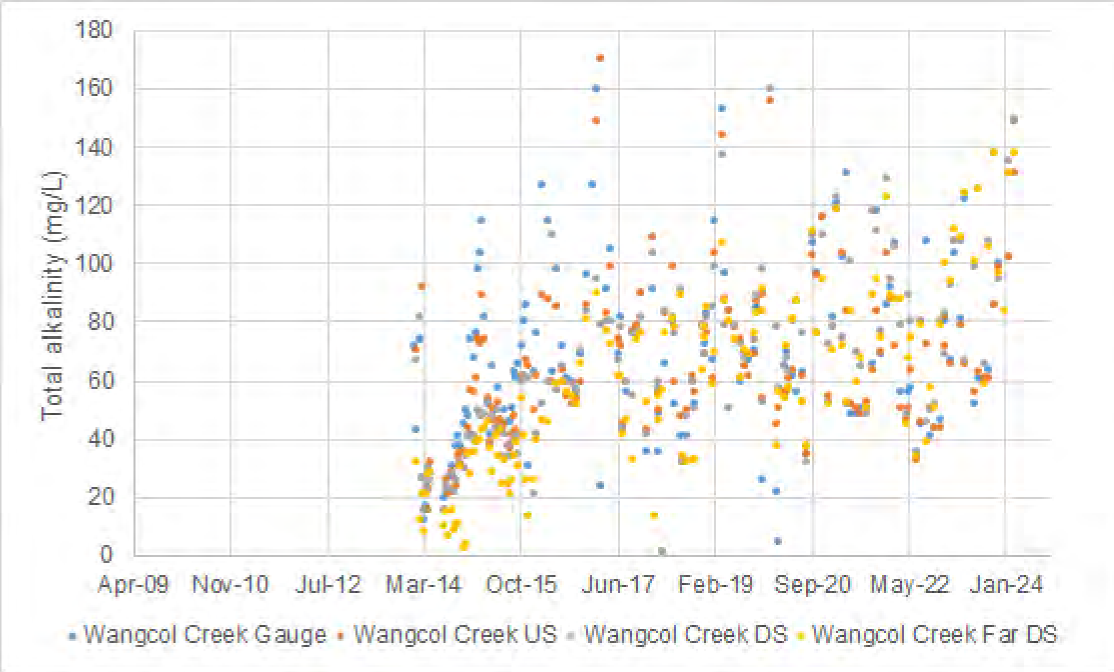
180
160
140
120
100
80
60
40
20
0
Bicarbonate alkalinity (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

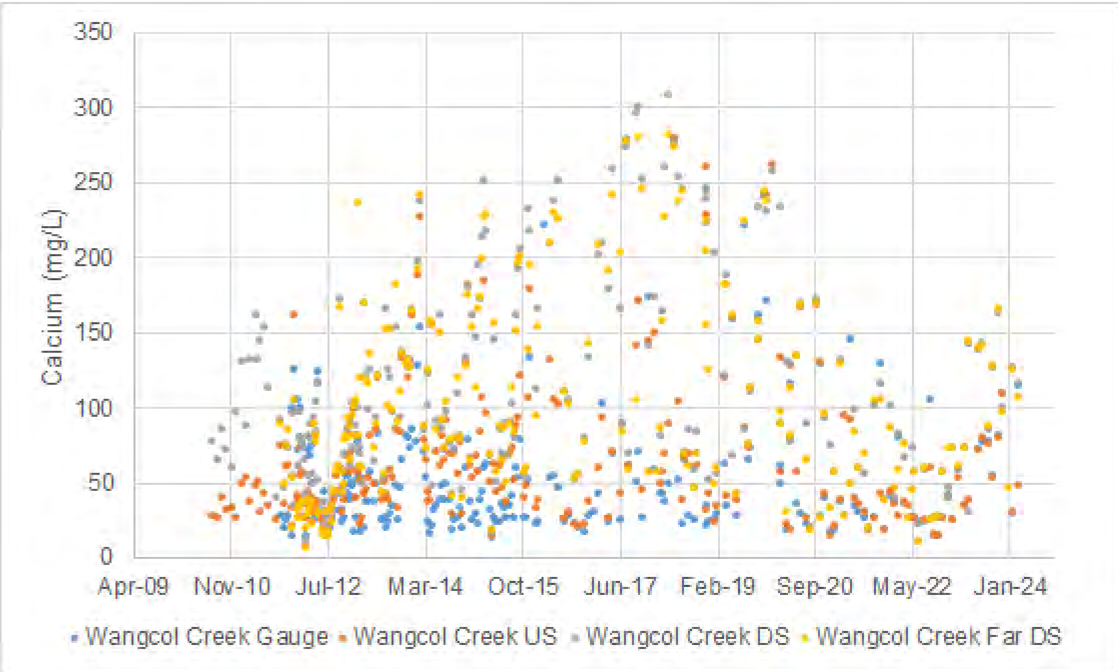


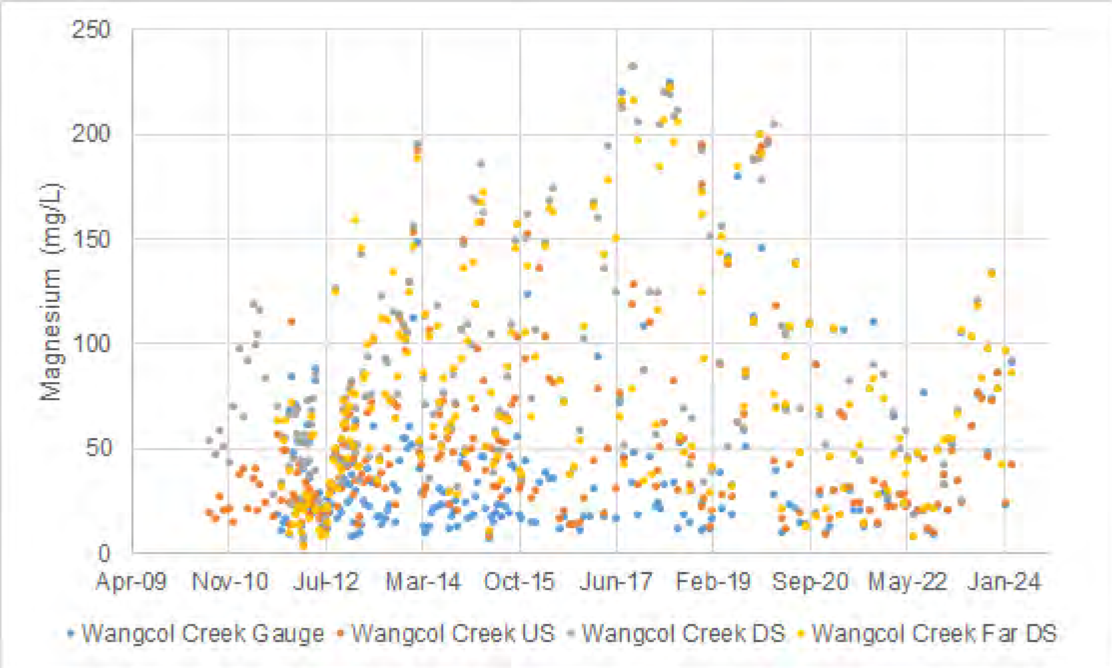
Carbonate alkalinity (mg/L)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS



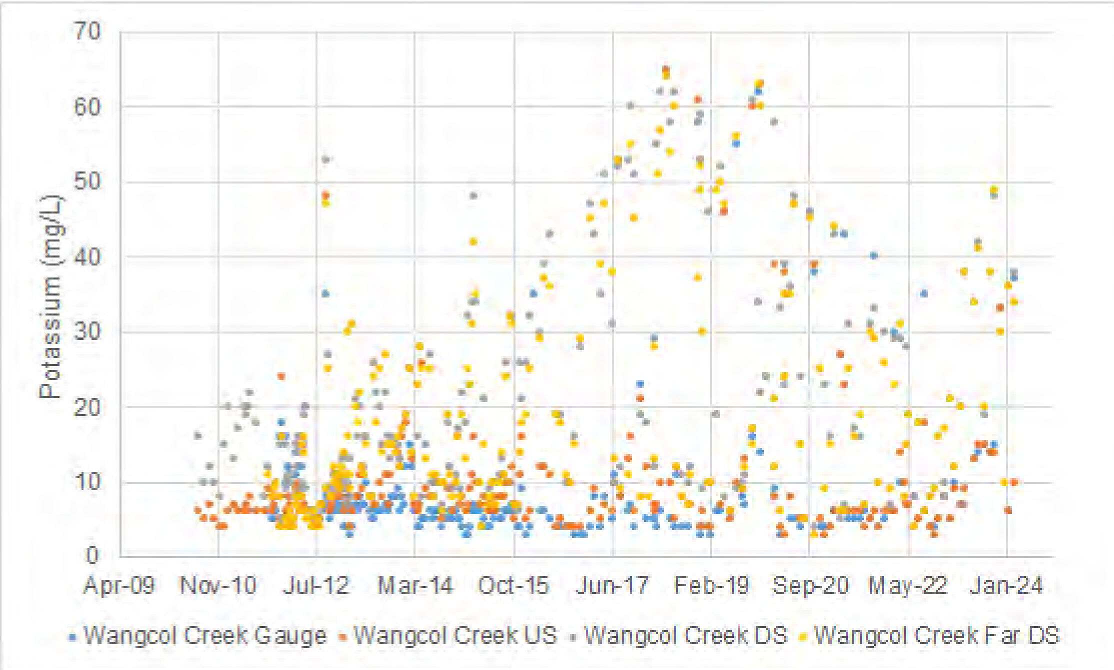
Hydroxide alkalinity (mg/L)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS


Total alkalinity (mg/L)
180
160
140
120
100
80
60
40
20
0
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

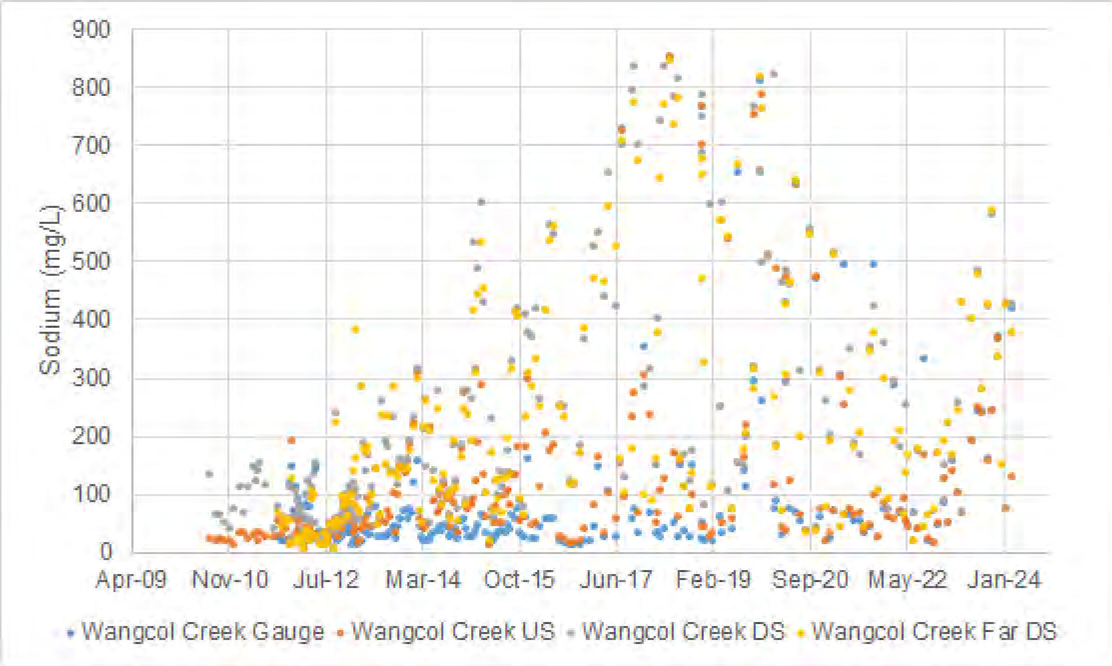

Calcium (mg/L)
350
300
250
200
150
100
50
0
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS



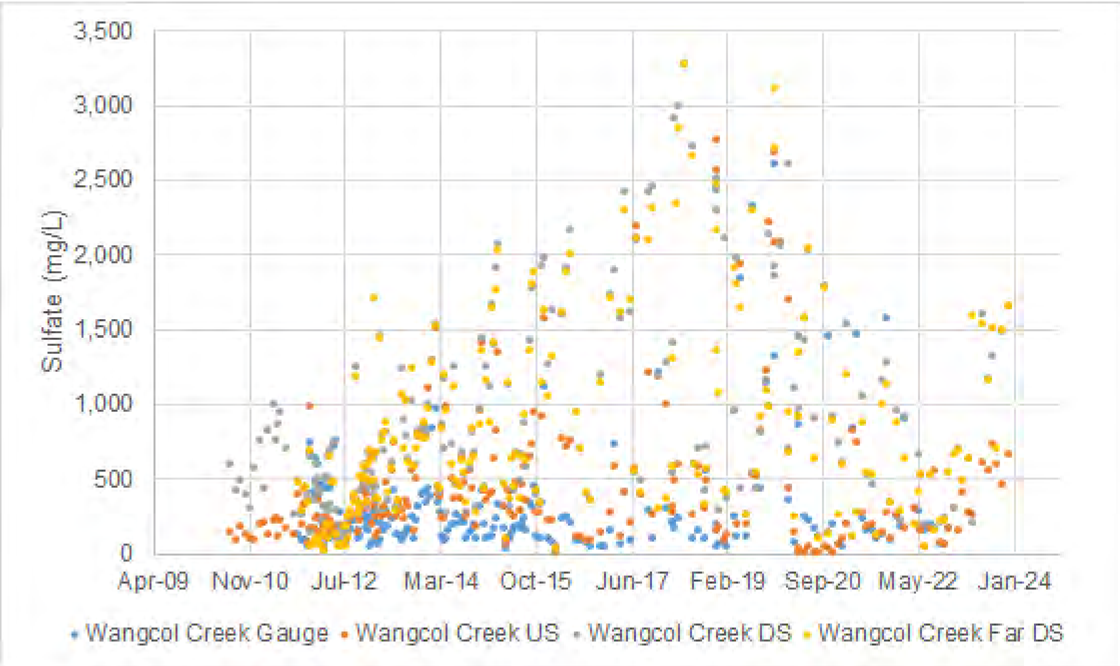
Magnesium (mg/L)
250
200
150
100
50
0
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS



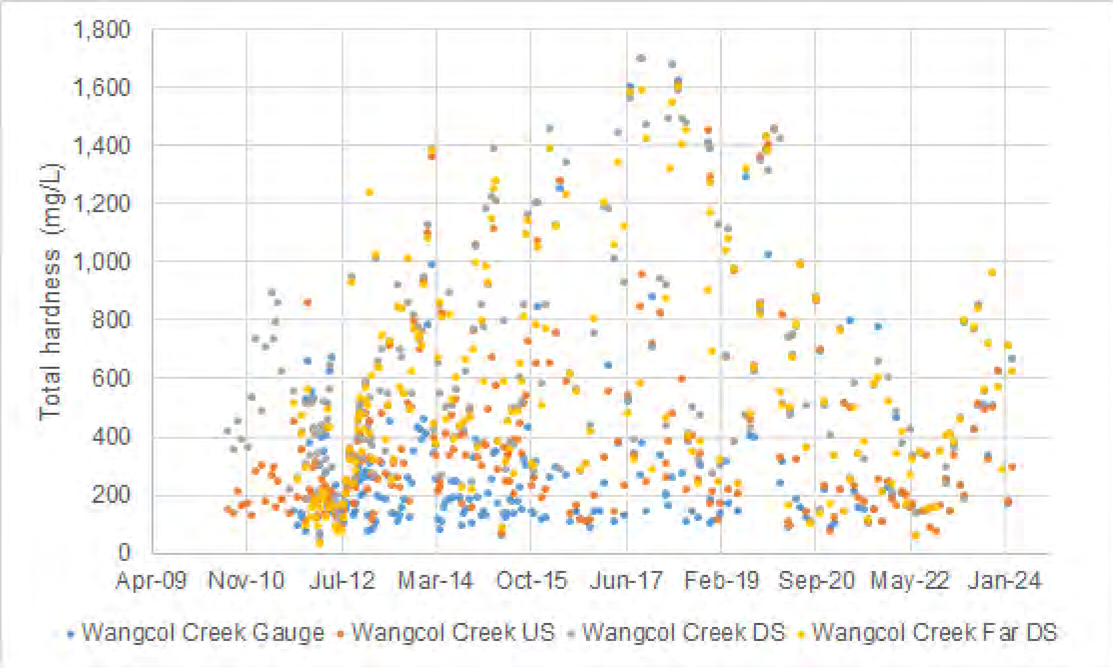
Potassium (mg/L)
70
60
50
40
30
20
10
0
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS



900
800
700
600
500
400
300
200
100
0
Sodium (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

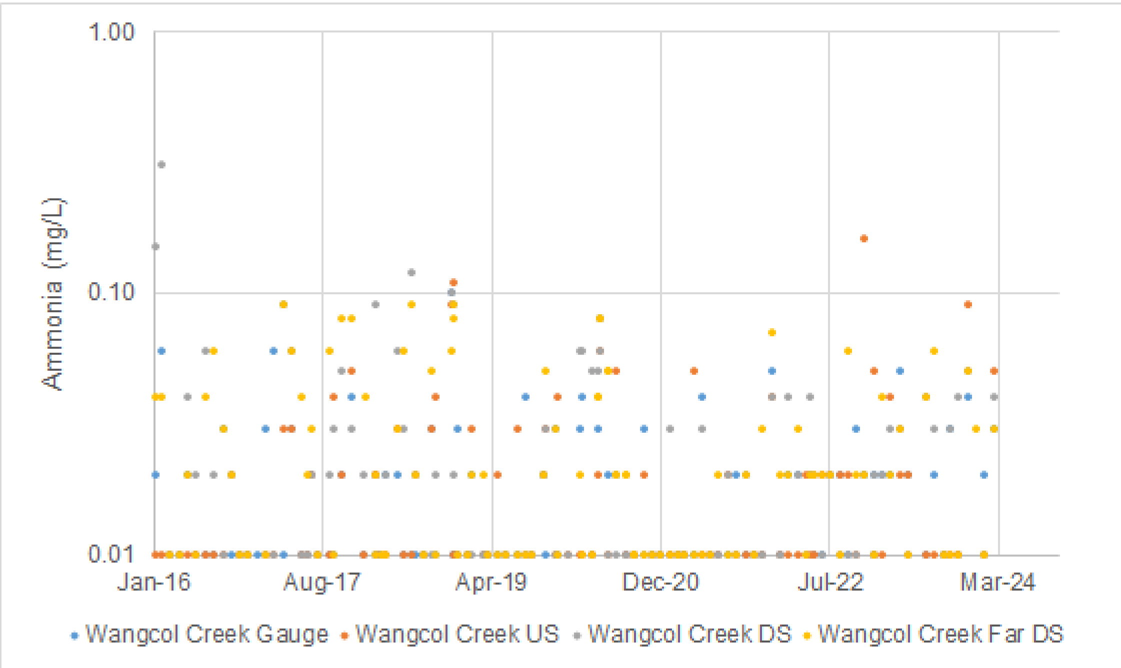


3,500
3,000
2,500
2,000
1,500
1,000
500
0
Sulfate (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

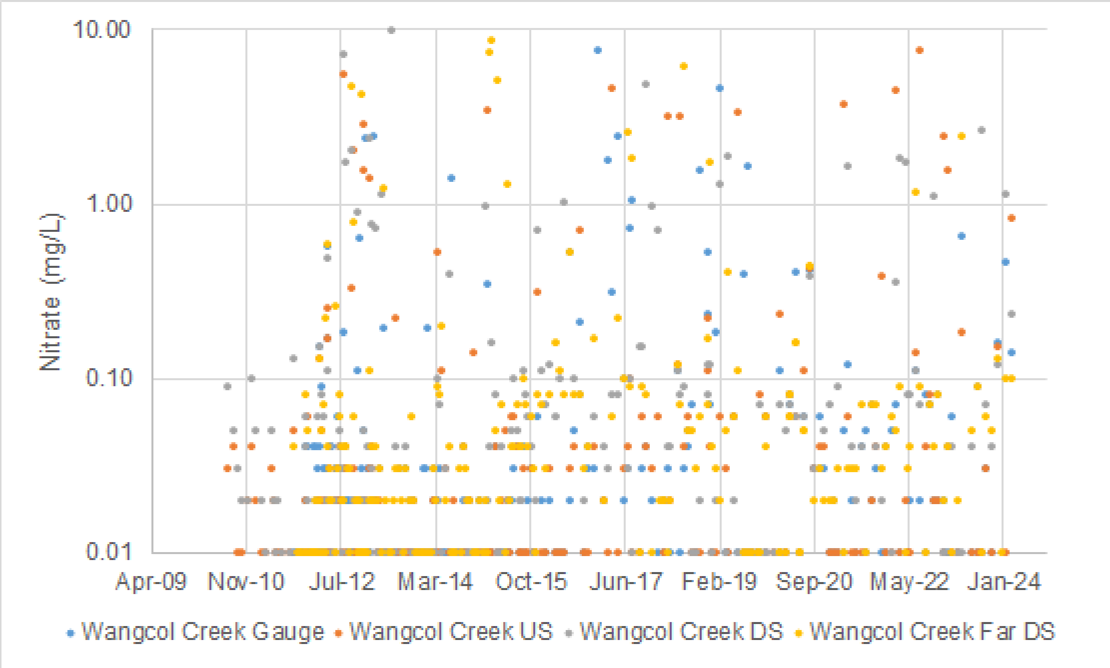


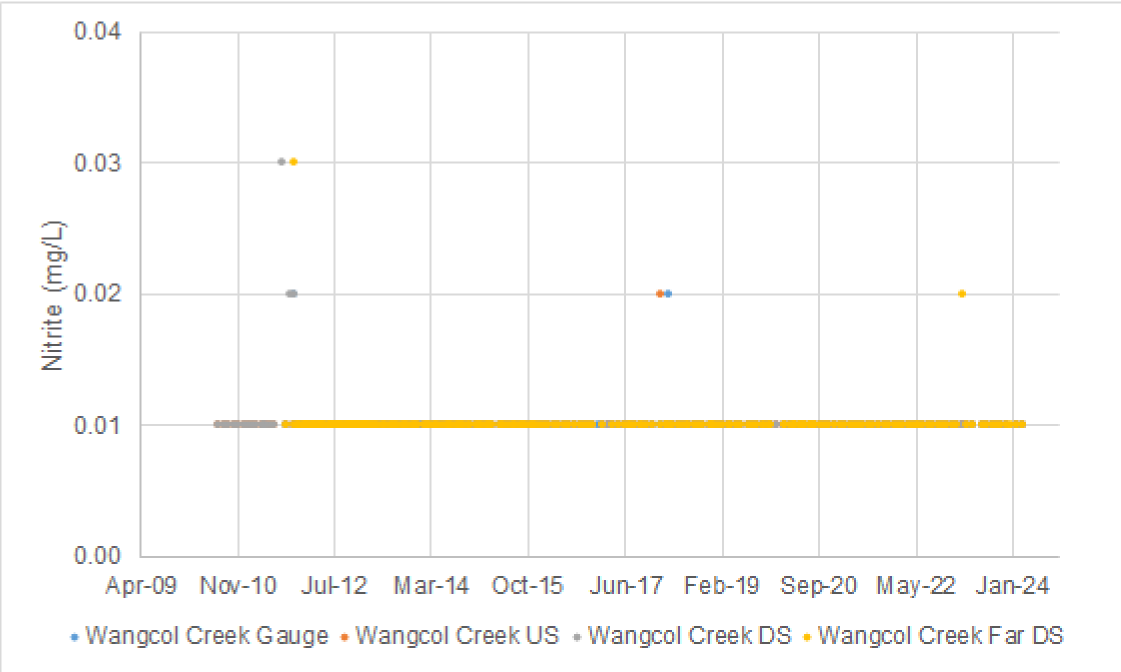
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
Total hardness (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

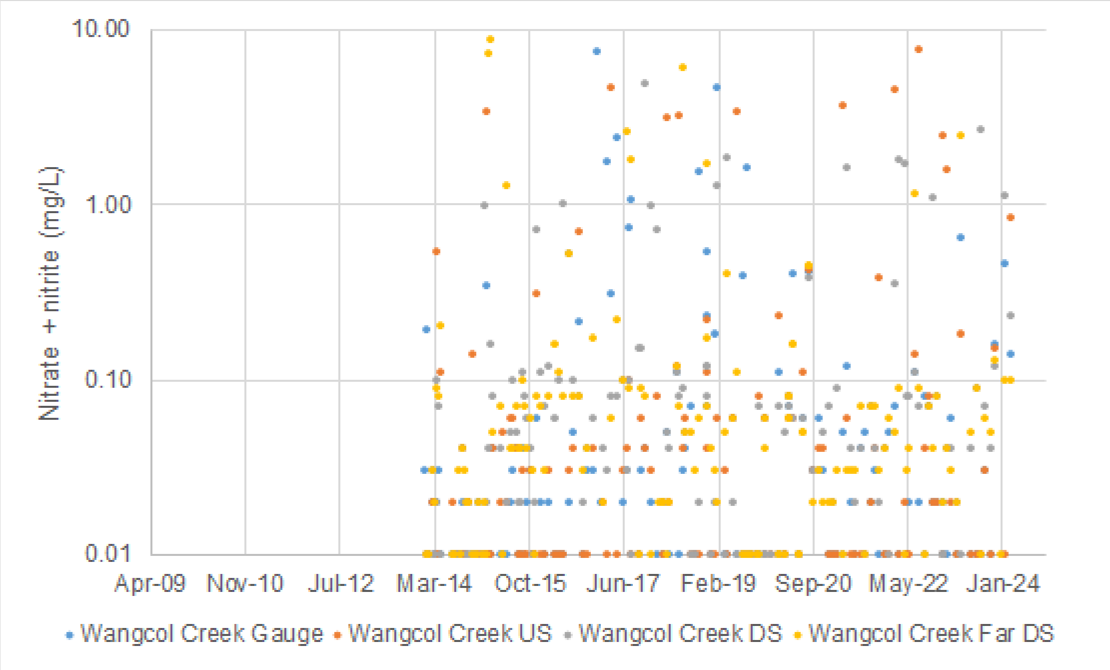
Nutrients

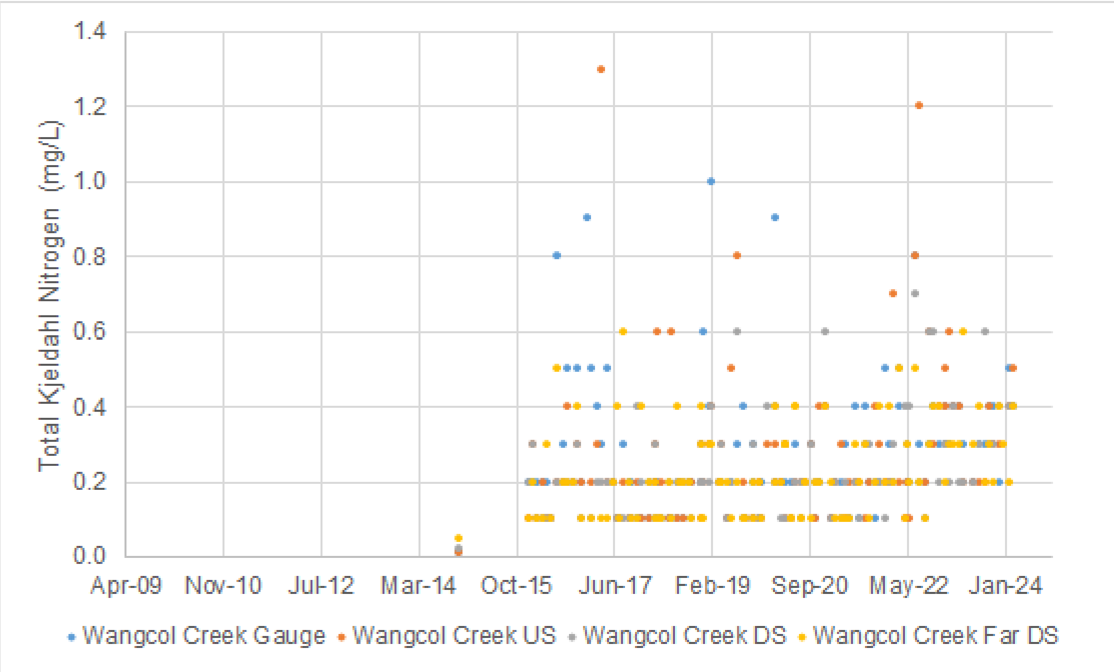


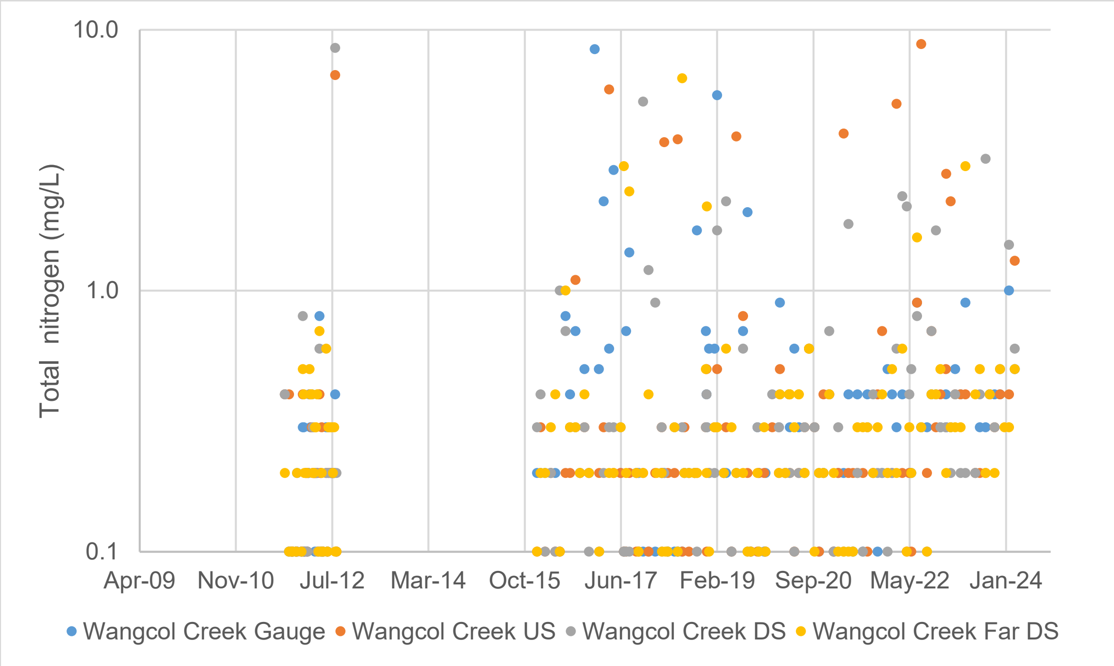
1.00
0.10
0.01
Ammonia (mg/L)
Jan-16
Aug-17
Apr-19
Dec-20
Jul-22
Mar-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

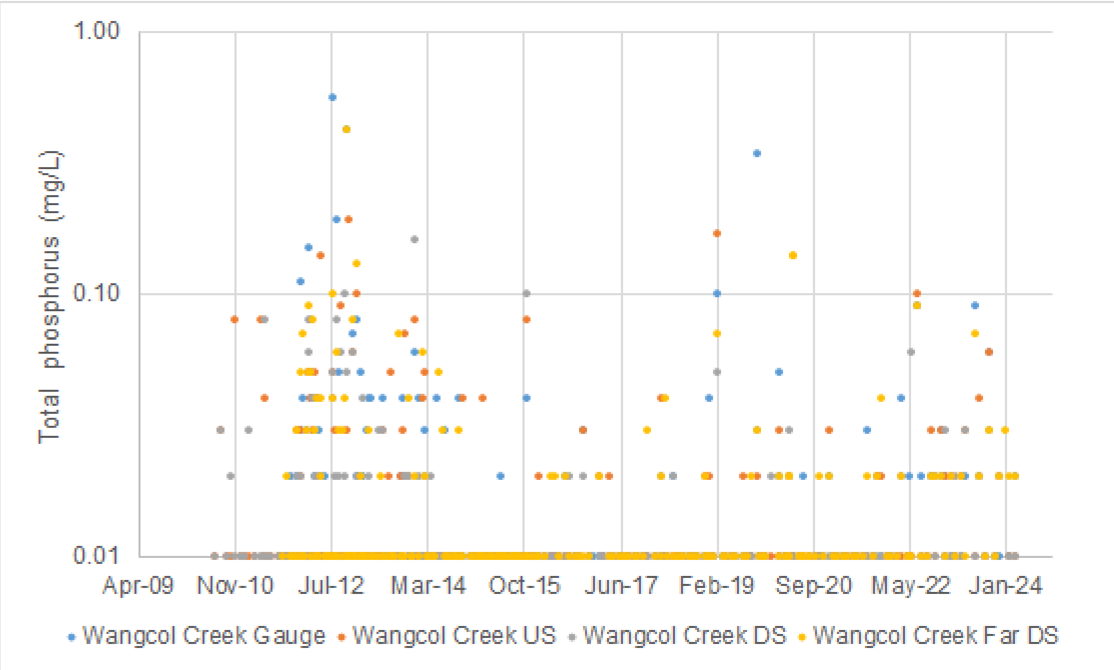

10.00
1.00
0.10
0.01
Nitrate (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS


0.04
0.03
0.02
0.01
0.00
Nitrite (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

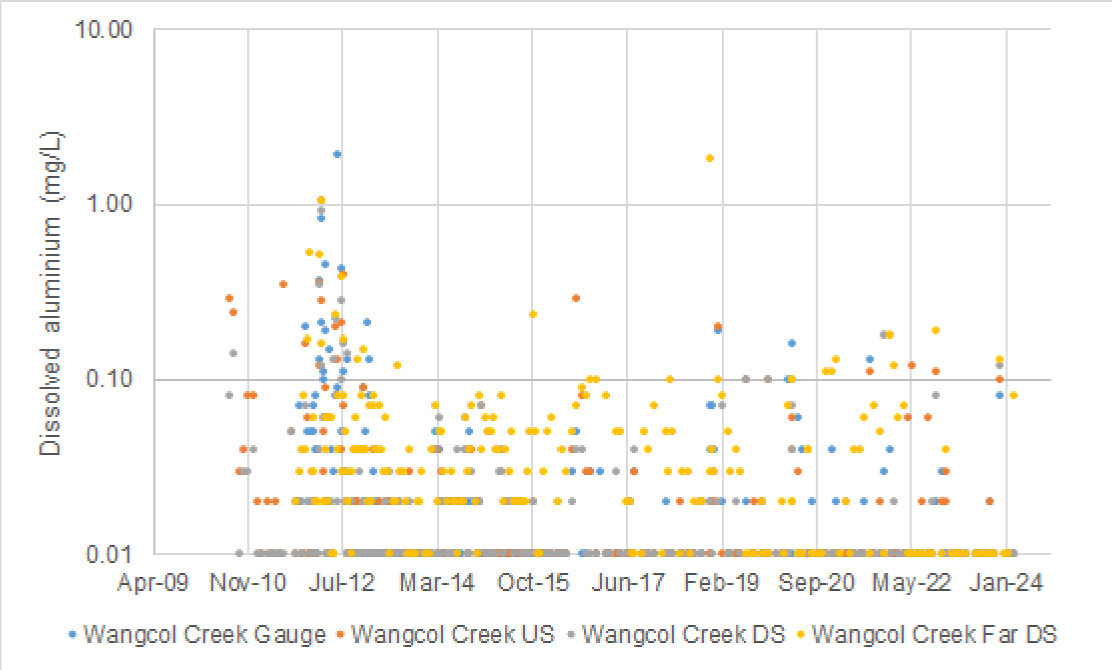

10.00
1.00
0.10
0.01
Nitrate + nitrite (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

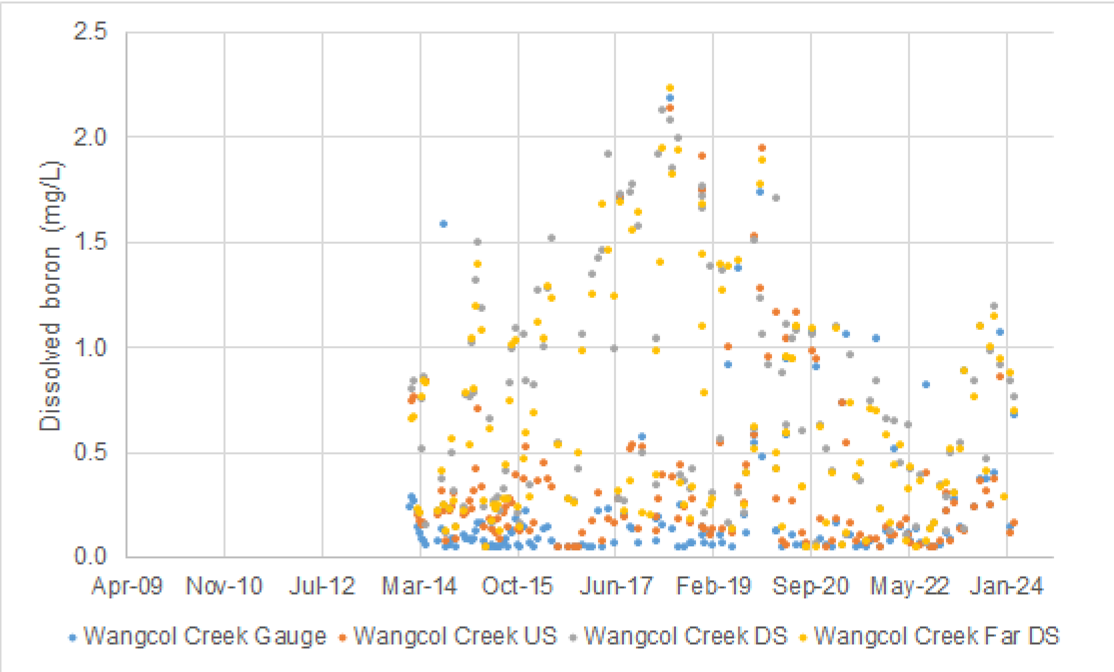

1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Total Kjeldahl Nitrogen (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

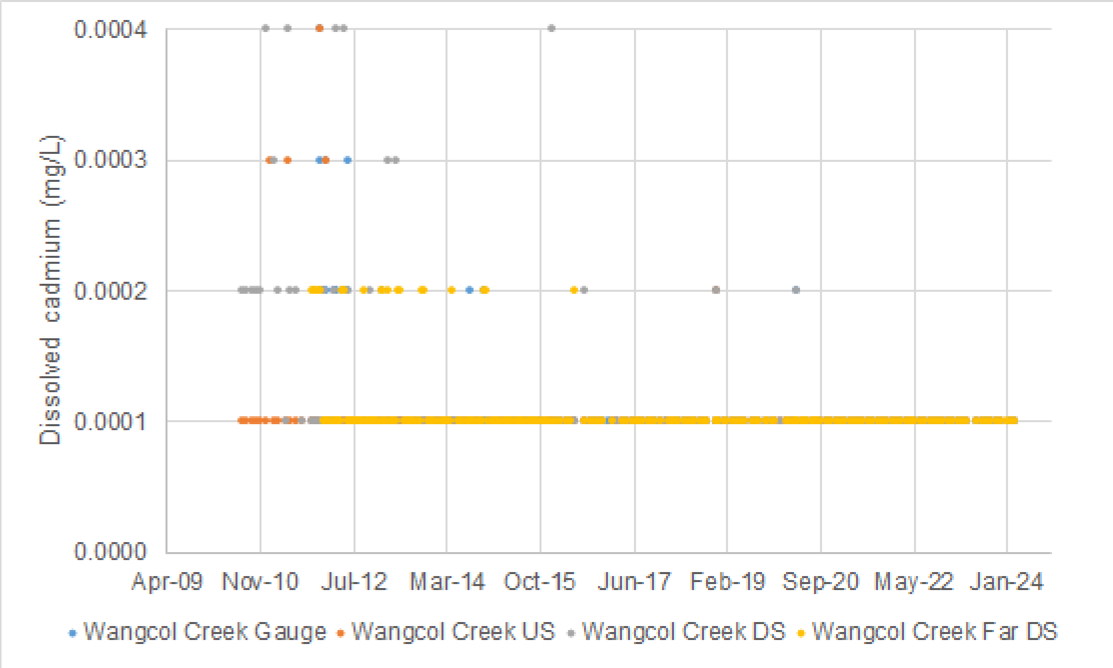

10.0
1.0
0.1
Total nitrogen (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS


1.00
0.10
0.01
Total phosphorus (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

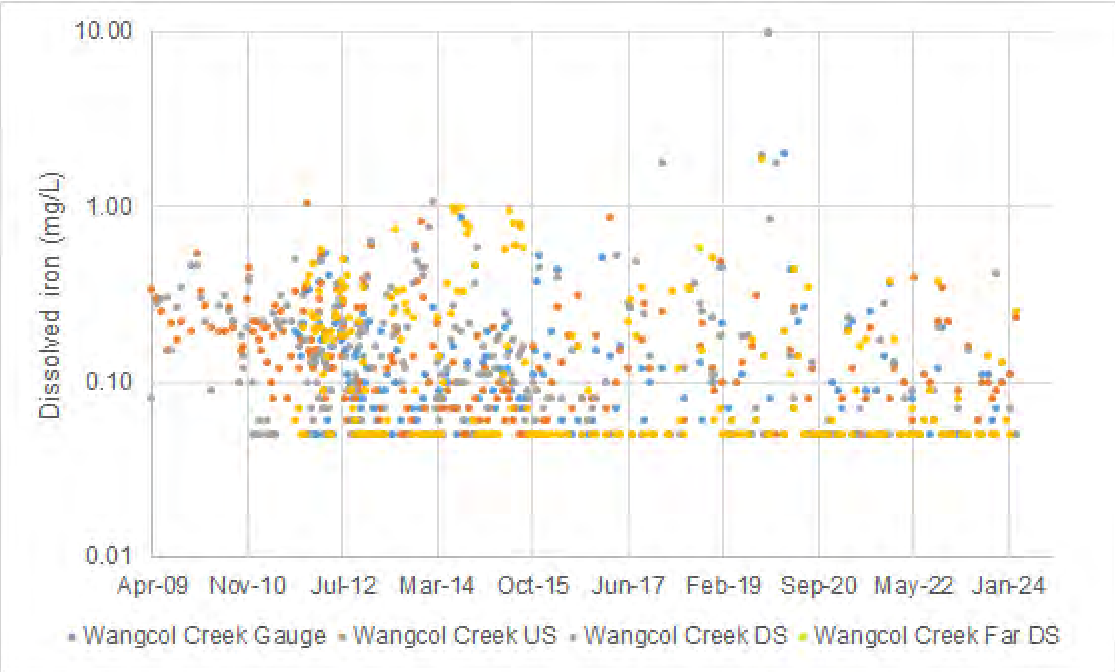
Dissolved metals



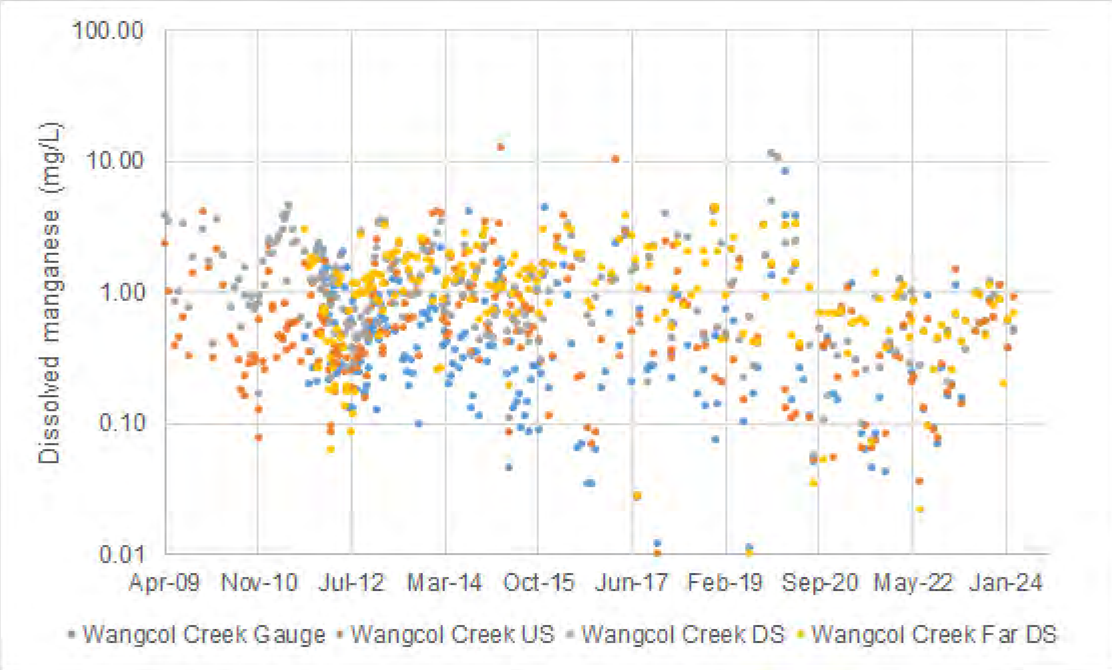


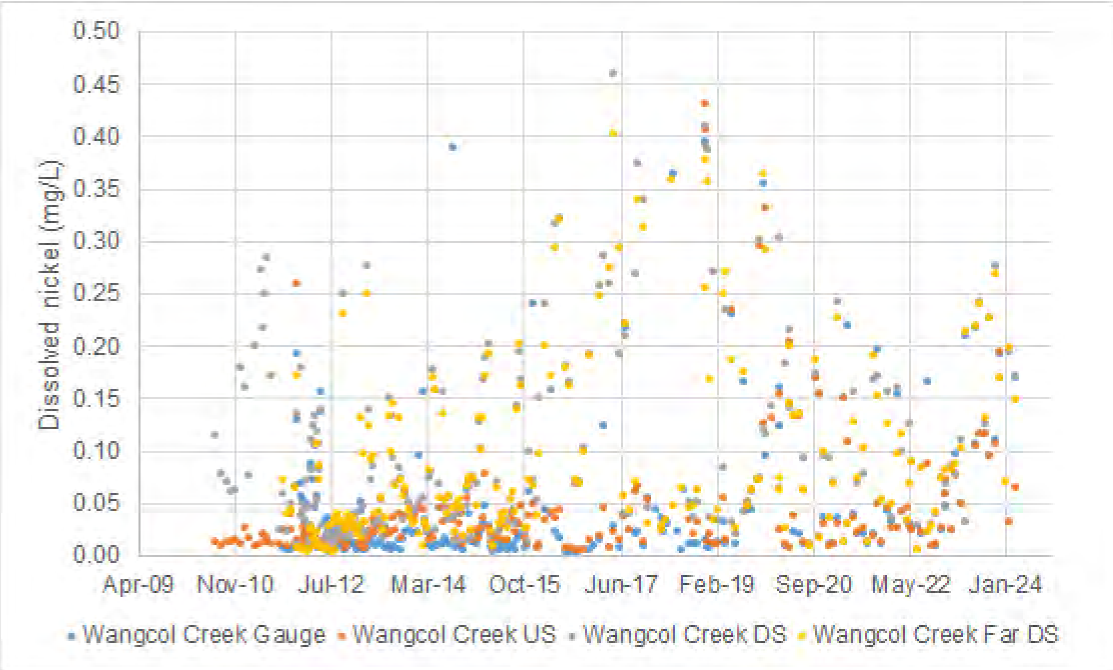


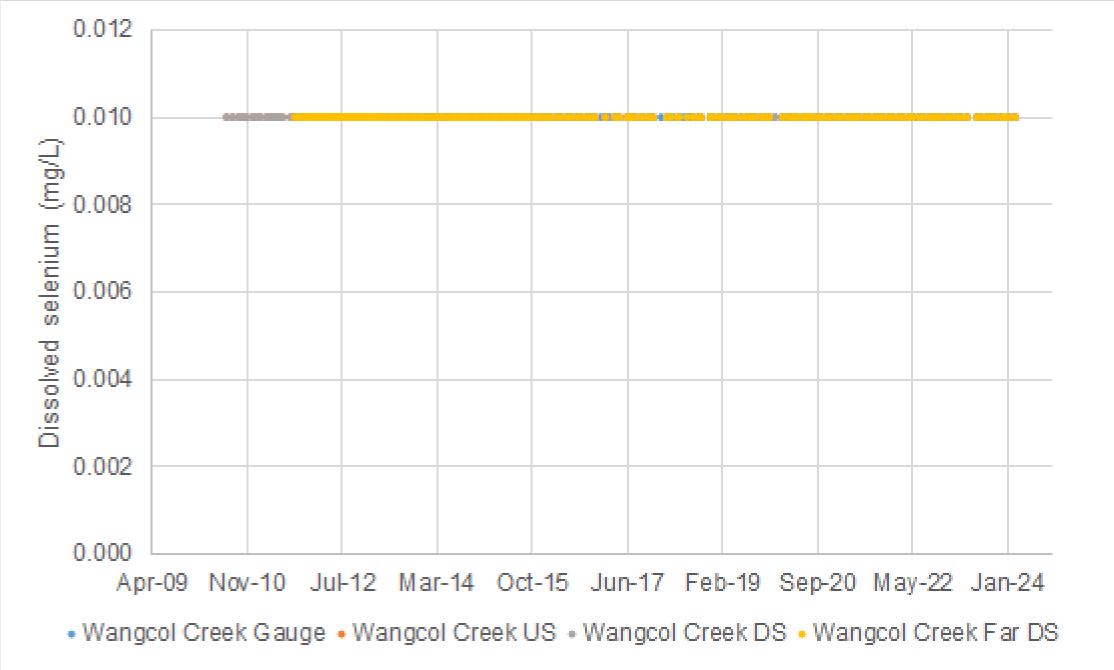
0.0004
0.0003
0.0002
0.0001
0.0000
Dissolved cadmium (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

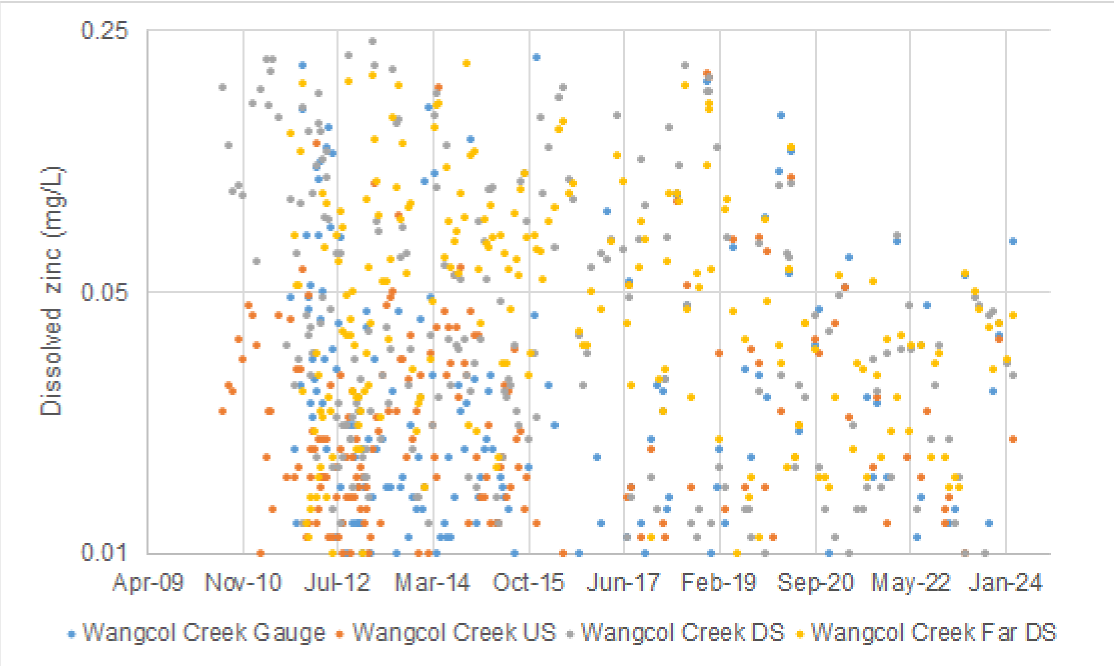


10.00
1.00
0.10
0.01
Dissolved iron (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

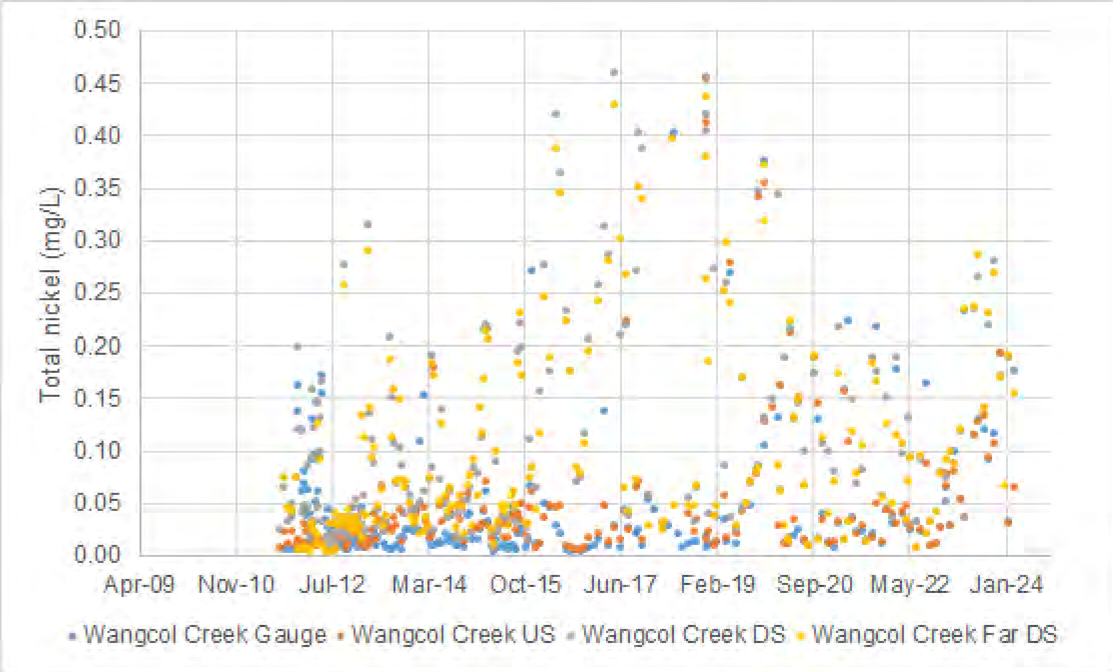

100.00
10.00
1.00
0.10
0.01
Dissolved manganese (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

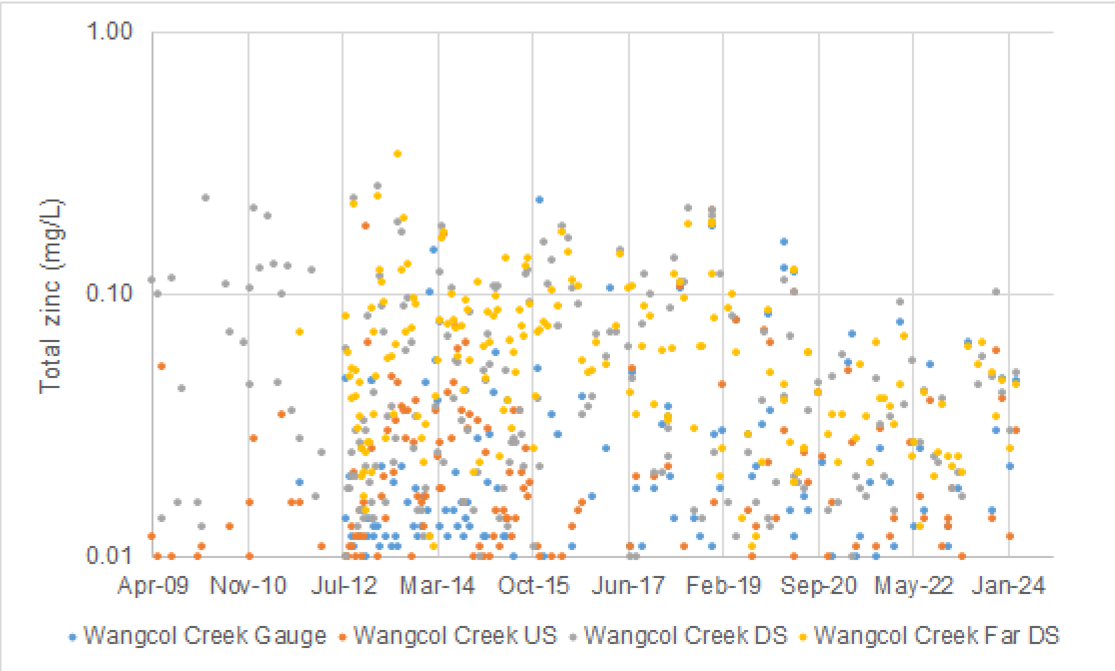

0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Dissolved nickel (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS


0.012
0.010
0.008
0.006
0.004
0.002
0.000
Dissolved selenium (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

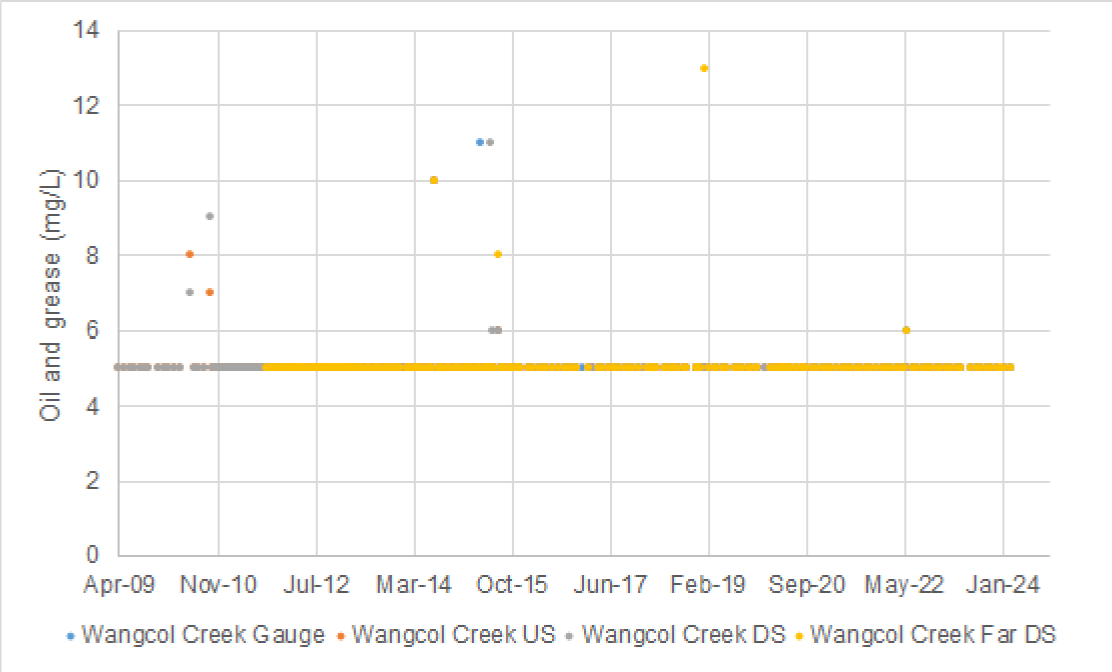

0.25
0.05
0.01
Dissolved zinc (mg/L)
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

Total metals





Other



Oil and grease (mg/L)
0
2
4
6
8
10
12
14
Apr-09
Nov-10
Jul-12
Mar-14
Oct-15
Jun-17
Feb-19
Sep-20
May-22
Jan-24
Wangcol Creek Gauge
Wangcol Creek US
Wangcol Creek DS
Wangcol Creek Far DS

H.3 Derivation of surface water quality triggers

H.3.1 Data requirements

ANZG (2018) recommends that, for the purpose of deriving ambient concentrations and SSGVs, a sufficient amount of data needs to be collected and that it should characterise seasonal variations:

"Data collected over 2 years of monthly sampling are regarded as sufficient to indicate ecosystem variability and therefore suitable for guideline value derivation."

H.3.2 Guideline values

Threshold guideline values may be derived from:

- ANZG (2018) default values (consistent with NSW water quality objectives) with reference to ANZECC (2000) default guideline values for stressors in freshwater ecosystems.
- Limits specified in relevant EPLs and development consents.
- SSGVs derived or recommended using site-specific water quality monitoring data.
- Local ecotoxicity testing.

ANZG (2018) references the ANZECC (2000) definition of guideline values as:

"The concentrations (or loads) of the key performance indicators measured for the ecosystem, below which there exists a low risk that adverse biological (ecological) effects will occur. They indicate a risk of impact if exceeded and should 'trigger' some action, either further ecosystem specific investigations or implementation of management/remedial actions."

H.3.3 Water quality objectives

Environmental values associated with the waterways and water sources within the area surrounding the SCSS include primary industry, aquatic ecosystems, recreational users, irrigation and stock watering. In this assessment, the guideline values from the ANZG (2018) and ANZECC (2000) guidelines for the protection of 95% of aquatic species have been used, as they are considered to be the most sensitive and, regardless of the current water quality present within the receiving environment, foster an improved water quality standard in the future.

H.3.4 Ecosystem condition

The ANZG (2018) guidelines recognise the following three categories of ecosystem condition, with a level of protection assigned to each:

- High conservation/ecological value systems.
- Slightly to moderately disturbed systems.
- Highly disturbed systems.

Wangcol Creek is considered to be a 'slightly to moderately disturbed' system, as the waterway has been adversely affected by human activities by a small to measurable degree. This is predominately due to the diversion of Wangcol Creek within its lower reaches and a lack of suitable riparian vegetation.

H.3.5 Reference site

Monitoring site SW1, located on Neubecks Creek at the Mount Piper Haul Road culvert, upstream of the Neubecks Creek and Wangcol Creek confluence, has been selected as the most appropriate reference site to provide background data to derive SSGVs (refer to Figure H-1). This site is located within the Wangcol Creek catchment and is not measurably impacted by mining or power generation activities.

H.3.6 Default guideline values

Guideline values for many parameters are recommended by ANZG (2018), which are usually derived from background assessments (physicochemical parameters and nutrients) and ecotoxicity studies (toxicants) and are not specific to the site studied. These guideline values should be considered as DGVs and their suitability should be verified by establishing local background conditions. DGVs were selected from the ANZG (2018) guidelines, with state derived guideline values preferred to regionally derived guideline values.

Within the ANZG (2018) guidelines, Wangcol Creek falls into two different categories of ecosystem protection depending on the parameter reviewed, as identified in Table H-1.

Table H-1 ANZECC (2000) and ANZG (2018) protection categories

Parameter	Category
Physicochemical parameters and nutrients	NSW upland river (ANZECC 2000; Table 8.2.2 to 8.2.12)
Metals and toxicants	Freshwater category (ANZG 2018), with 95% species protection for slightly-moderately disturbed ecosystems.

A list of the DGVs recommended by ANZG (2018) to assess water quality in the absence of adequate reference site monitoring data is presented in Table H-2. The available data for water quality within Wangcol Creek indicates that the water is ‘extremely hard’ (ANZECC 2000; Table 3.4.4). As such, hardness correction factors have been applied to the guideline values for dissolved cadmium, lead, nickel and zinc, as recommended by ANZG (2018).

Table H-2 ANZG (2018) and ANZECC (2000) default guideline values for stressors and toxicants in water

Parameter	Units	DGV	Comments
Physicochemical			
pH	pH units	6.5–9.0	NSW upland river (Table 8.2.8).
TSS	mg/L	25	NSW upland river (Table 8.2.12).
Turbidity	NTU	25	NSW upland river (Table 8.2.11).
Nutrients			
Ammonia	mg/L	0.04	NSW upland river (Table 8.2.7).
Total nitrogen	mg/L	0.2	NSW upland river (Table 8.2.2).
Total phosphorus	mg/L	0.02	NSW upland river (Table 8.2.3).
Dissolved metals			
Aluminium	mg/L	0.055	Freshwater guideline for 95% species protection. Applies for pH>6.5.
Boron	mg/L	0.37	Freshwater guideline for 95% species protection.
Cadmium	mg/L	0.0026[a]	Freshwater guideline for 95% species protection.

Parameter	Units	DGV	Comments
Iron	mg/L	0.3	Canadian guideline as recommended by ANZECC (2000; Section 8.3.7.1).
Manganese	mg/L	1.9	Freshwater guideline for 95% species protection.
Nickel	mg/L	0.125[a]	Freshwater guideline for 95% species protection.
Selenium	mg/L	0.011	Freshwater guideline for 99% species protection.
Zinc	mg/L	0.091[a]	Freshwater guideline for 95% species protection.

[a] Guideline value modified for hardness.

H.3.7 Data below the limit of reporting

When the analytical result was below the limit of reporting for a particular parameter, then the detection limit was included in the calculation. This is one of the approaches recommended by ANZG (2018). Table H-3 identifies the limit of reporting for each water quality parameter monitored at SW1 used to derive SSGVs.

Table H-3 Limit of reporting for water quality parameters

Parameter	Units	Limit of reporting
Physicochemical		
pH	pH units	0.1
TSS	mg/L	5
Turbidity	NTU	1
Nutrients		
Ammonia	mg/L	0.01
Total nitrogen	mg/L	0.1
Total phosphorus	mg/L	0.01
Dissolved metals		
Aluminium	mg/L	0.01
Boron	mg/L	0.05
Cadmium	mg/L	0.0001
Iron	mg/L	0.05
Manganese	mg/L	0.001
Nickel	mg/L	0.001
Zinc	mg/L	0.005

H.3.8 Derivation of site-specific guideline values

SSGVs were derived based on the methodology outlined by ANZG (2018), by calculating the 80th percentile of data collected at the reference site (20th percentile for parameters reported as a range, i.e., pH). Derived data was compared against ANZG (2018) DGVs for stressors (ANZECC 2000) and toxicants (ANZ 2018). The 80th percentile values for water quality data at SW1 have been calculated from the entire dataset available between March 2012 and February 2015. Table H-4 presents the surface water quality data for reference site SW1. As samples have been collected for over two years, the dataset covers a range of seasonal, climatic and flow conditions. Where the analytical result was below the LOR for a particular parameter, then the detection limit was used in the calculation. Table H-5 presents the DGVs recommended by ANZECC (2000), 80th percentile values for SW1 and the recommended SSGV.

Table H-4 Statistical analysis of SW1 water quality results

Parameter	Units	Count	80th percentile
Physicochemical			
pH	pH units	60	6.4[a]–7.1
TSS	mg/L	60	12
Turbidity	NTU	60	35
Nutrients			
Ammonia	mg/L	59	0.03
Total nitrogen	mg/L	60	0.5
Total phosphorus	mg/L	60	0.08
Dissolved metals			
Aluminium	mg/L	60	0.24
Boron	mg/L	60	0.05[b]
Cadmium	mg/L	60	0.0001[b]
Iron	mg/L	60	0.31
Manganese	mg/L	60	0.150
Nickel	mg/L	60	0.003
Zinc	mg/L	60	0.032

[a] 20th percentile value.

[b] Limit of reporting.

The 80th percentile values for water quality data collected at the reference site SW1 were then compared with the DGVs recommended by ANZG (2018), presented in Table H-2.

Table H-5 Recommended site specific guideline values

Parameter	Units	DGV (ANZECC 2000)	SW1 80th percentile	Recommended SSGV
Physicochemical				
pH	pH units	6.5–9.0	6.4[a]–7.1	6.5–9.0
TSS	mg/L	25	12	25
Turbidity	NTU	25	35	35
Nutrients				
Ammonia	mg/L	0.04	0.03	0.04
Total nitrogen	mg/L	0.2	0.5	0.5
Total phosphorus	mg/L	0.02	0.08	0.08
Dissolved metals				
Aluminium	mg/L	0.055	0.24	0.24
Boron	mg/L	0.37	0.05[c]	0.37
Cadmium	mg/L	0.0026[b]	0.0001[c]	0.0026
Iron	mg/L	0.3	0.31	0.31
Manganese	mg/L	1.9	0.150	1.9
Nickel	mg/L	0.125[b]	0.003	0.125
Selenium	mg/L	0.011	–	0.011
Zinc	mg/L	0.091[b]	0.032	0.091

[a] 20th percentile value.
[b] Guideline value modified for hardness.
[c] Limit of reporting.

1:20,000 for A4

0 87.5 175 350 525 700

Metres

Map Projection: Universal Transverse Mercator
Horizontal Datum: Geodetic Datum of Australia 1994
Grid: Map Grid of Australia, Zone 56

N

LEGEND

- Project approval area
- Water storage
- Discharge locations
- Downstream locations
- Upstream locations
- Watercourse - Non Perennial
- Watercourse - Perennial
- Road

LOCATION	WCS
SEAM	Lithgow
DRAWN	GHD
CHECKED	TT
APPROVED	SG
SCALE	refer to scalebar

Western Coal Services
Water Management Plan

Reference water quality monitoring site location

CENTENNIAL
Springvale Coal Services Operation

DATE 23 July 2024

Figure H-1

GIS Filename: \\ghdnet\ghd\AU\Newcastle\Projects\22\0105001\GIS\Maps\Deliverables\Western\WesternCoal\12579944\WMP\12579944_WMP018_AppendixSCSSMonitoring_6.mxd

© LPI: DTDB, 2012. LIDAR: Imagery, 2015; Centennial: Boundary, site features

H.3.9 Derivation of surface water quality trigger values

Surface water quality trigger values have been developed for selected parameters in accordance with ANZG (2018) methodology for deriving site specific guideline values. Trigger values are based on a comparison of Wangcol Creek Gauge 95th percentile historical concentrations (95th percentile for upper pH and 5th percentile for lower pH), and DGVs for stressors (ANZECC 2000) and toxicants (ANZG 2018). Where the baseline data was below the DGV, the higher value was chosen, excepting lower pH which was chosen based on the lowest value. Table H-6 presents the 95th percentile, median and count data. Table H-2 presents the DGVs recommended by ANZG (2018). The adopted surface water quality triggers are provided in Table 6-1.

Table H-6 Statistical analysis of Wangcol Creek Gauge

Parameter	Units	Count	Median	Wangcol Creek gauge 95%ile
Physicochemical				
pH lower	pH units	36	NA	5.9
pH upper	pH units	36	7.05	9.0
EC	µS/cm	36	801	4,063
TDS	mg/L	36	570	3,173
TSS	mg/L	36	5	11
Turbidity	NTU	36	3	30
Nutrients				
Ammonia	mg/L	36	0.01	0.04
Total nitrogen	mg/L	36	0.3	0.8
Total phosphorus	mg/L	36	0.01	0.04
Dissolved metals				
Aluminium	mg/L	36	0.01	0.11
Boron	mg/L	36	0.12	1.15
Cadmium	mg/L	36	0.0001	0.0001
Iron	mg/L	36	0.09	0.80
Manganese	mg/L	36	0.326	3.81
Nickel	mg/L	36	0.041	0.207
Selenium	mg/L	36	0.01	0.01
Zinc	mg/L	36	0.016	0.108

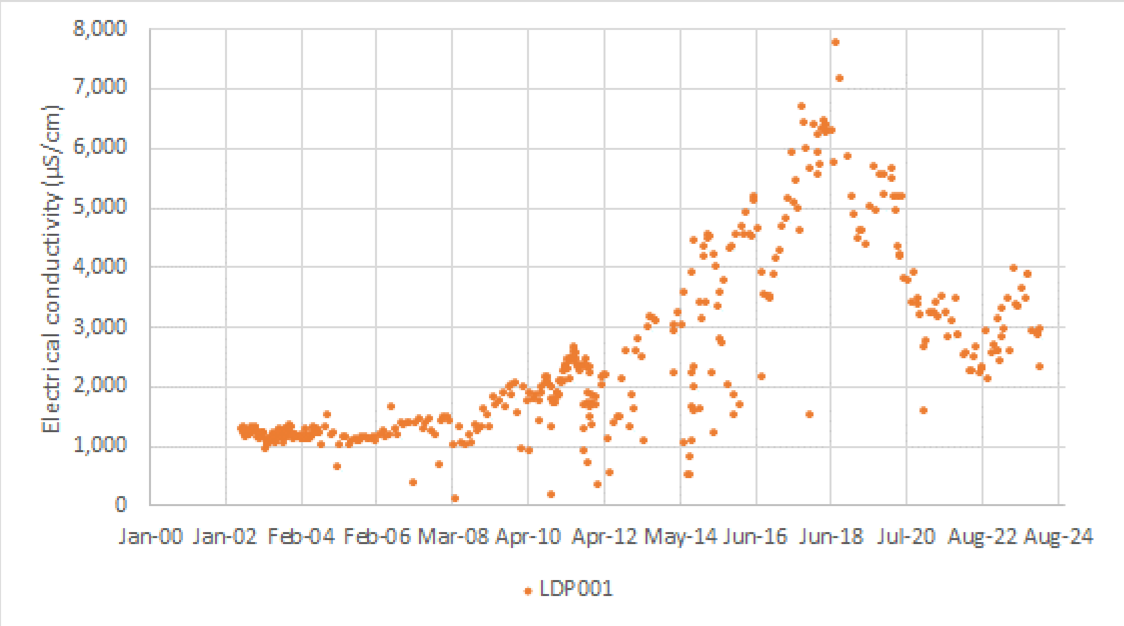
APPENDIX I – Baseline discharge water data

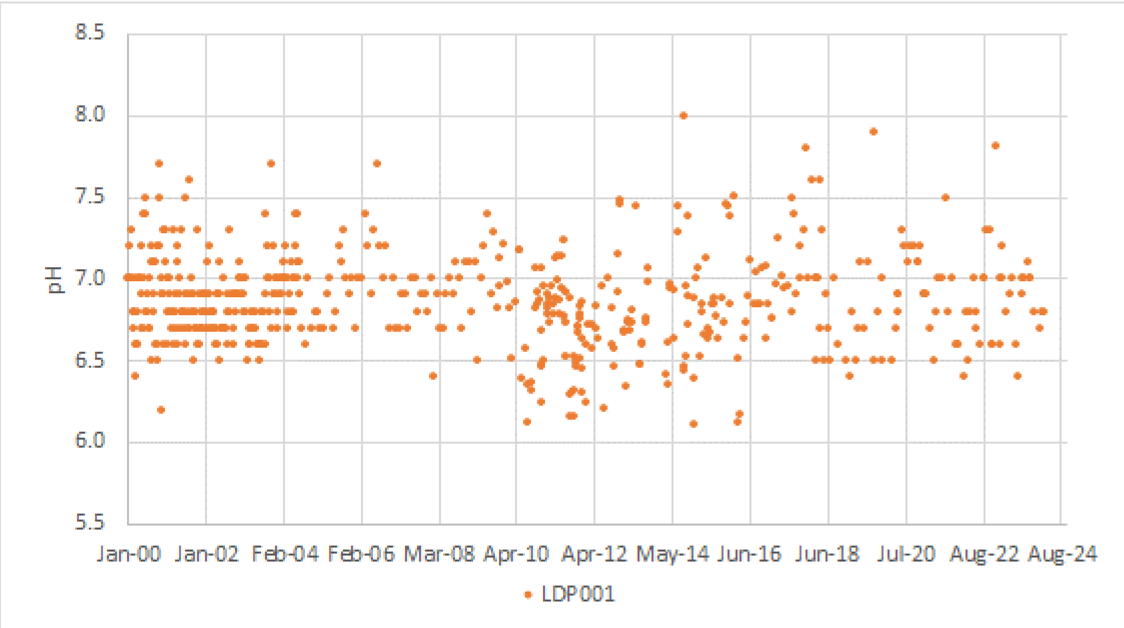
I.1 Statistical summary of discharge water quality results

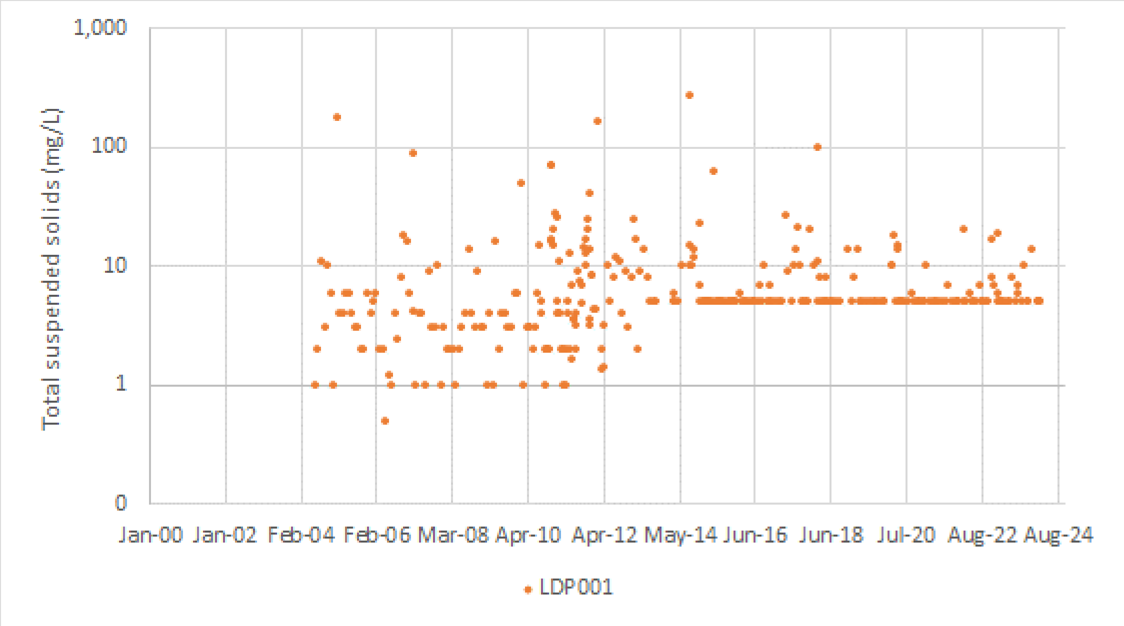
Parameter	Units	LDP001		
		Count	Median	EPL 21229 limit
Physicochemical				
EC	µS/cm	406	1,900	–
pH	pH units	543	6.85	6.5-8.5
TSS	mg/L	313	5	30
Turbidity	NTU	209	9.8	50
Dissolved metals				
Iron	mg/L	280	0.26	–
Manganese	mg/L	287	2.83	–
Nickel	mg/L	127	0.251	–
Zinc	mg/L	148	0.144	–
Other				
Oil and grease	mg/L	284	5	10

I.2 Time series graphs of discharge water quality results

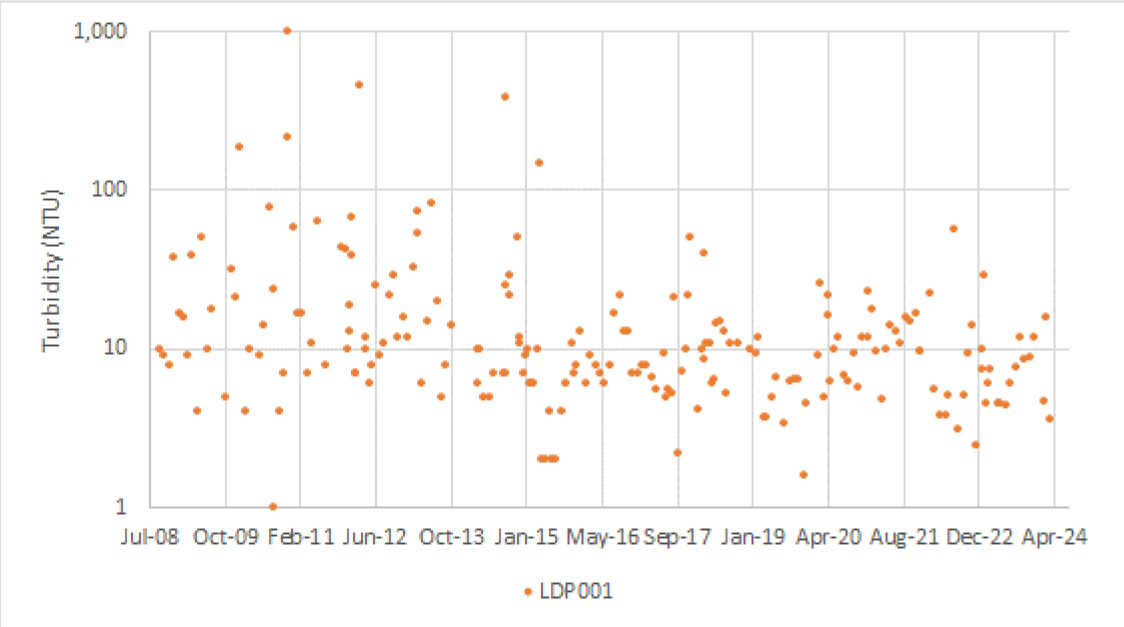
I.2.1 Physicochemical





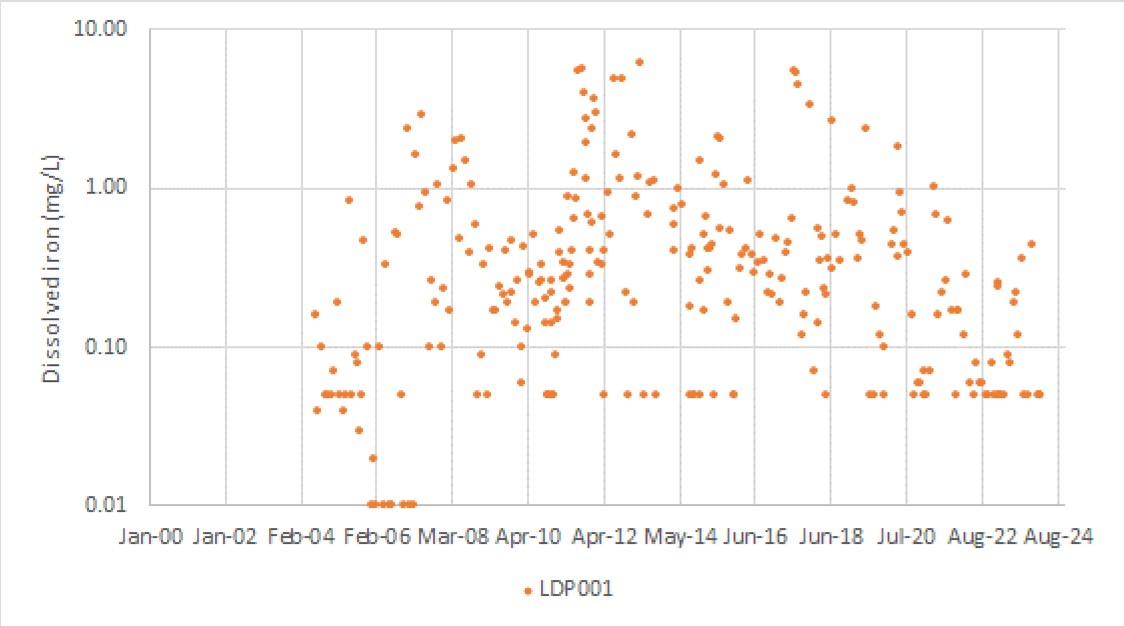


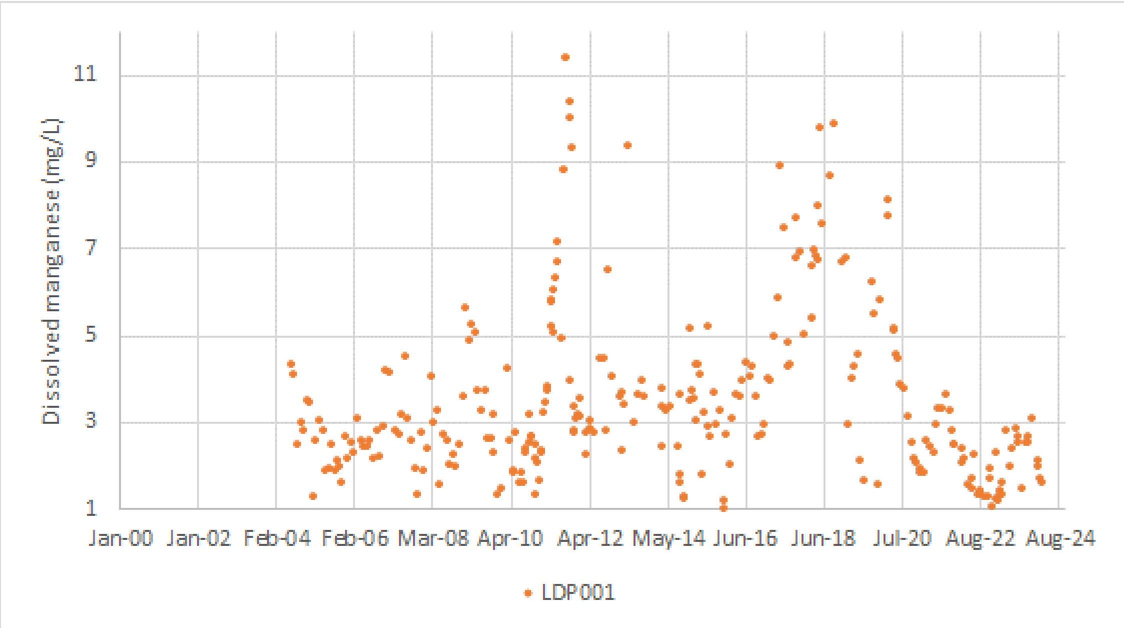
1,000
100
10
1
0
Total suspended solids (mg/L)
Jan-00 Jan-02 Feb-04 Feb-06 Mar-08 Apr-10 Apr-12 May-14 Jun-16 Jun-18 Jul-20 Aug-22 Aug-24
LDP001

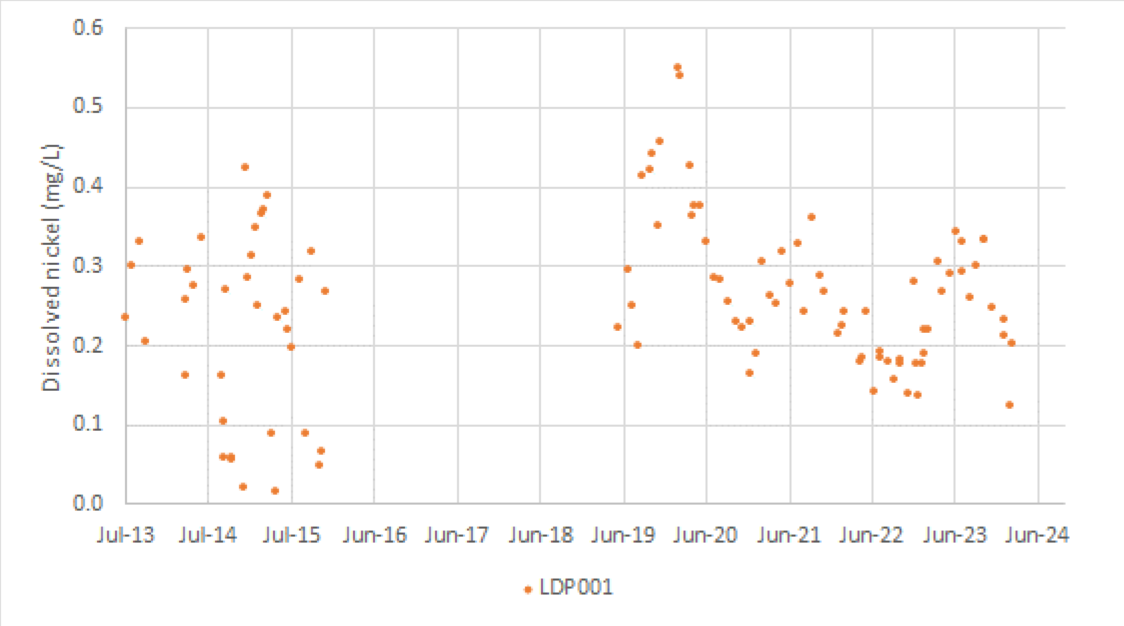


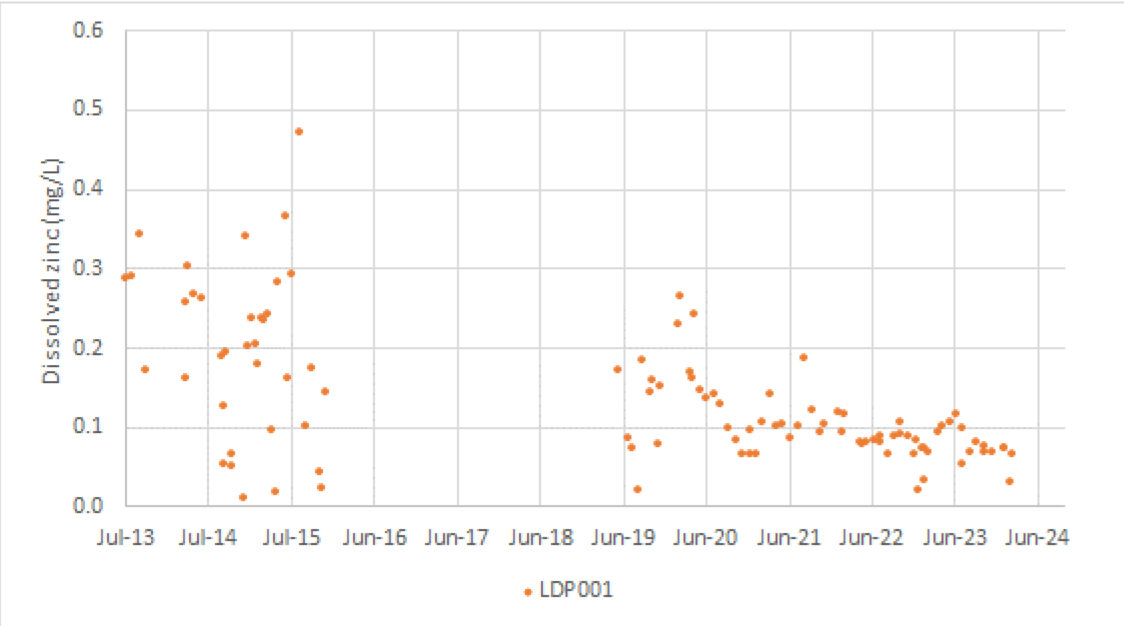
1,000
100
10
1
Turbidity (NTU)
Jul-08 Oct-09 Feb-11 Jun-12 Oct-13 Jan-15 May-16 Sep-17 Jan-19 Apr-20 Aug-21 Dec-22 Apr-24
LDP001

I.2.4 Dissolved metals

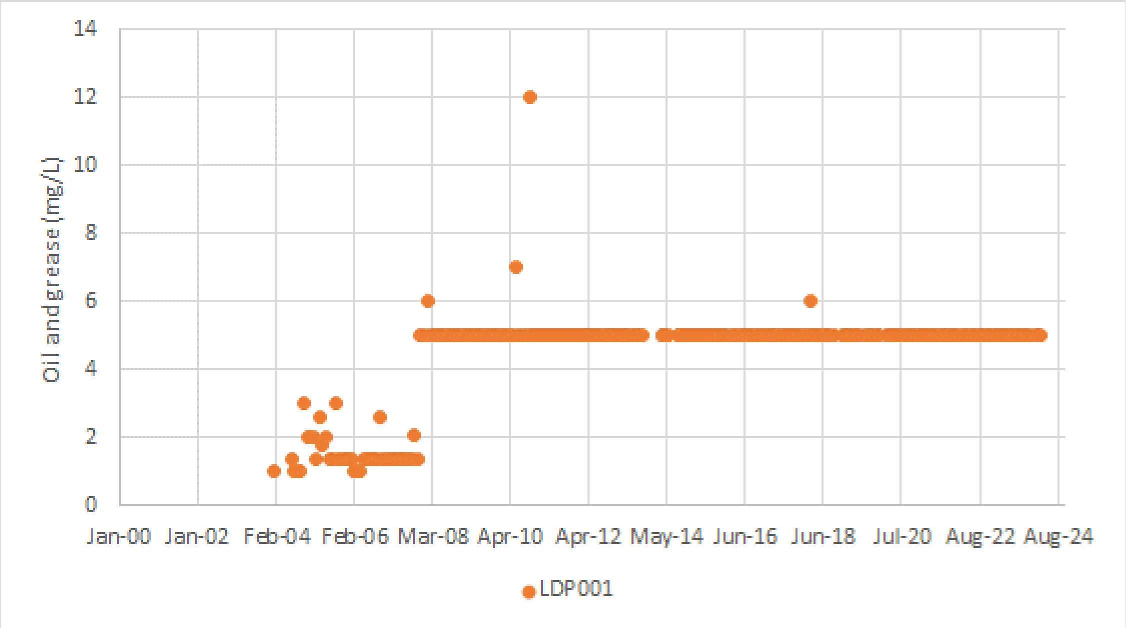





0.6
0.5
0.4
0.3
0.2
0.1
0.0
Dissolved nickel (mg/L)
Jul-13
Jul-14
Jul-15
Jun-16
Jun-17
Jun-18
Jun-19
Jun-20
Jun-21
Jun-22
Jun-23
Jun-24
LDP001

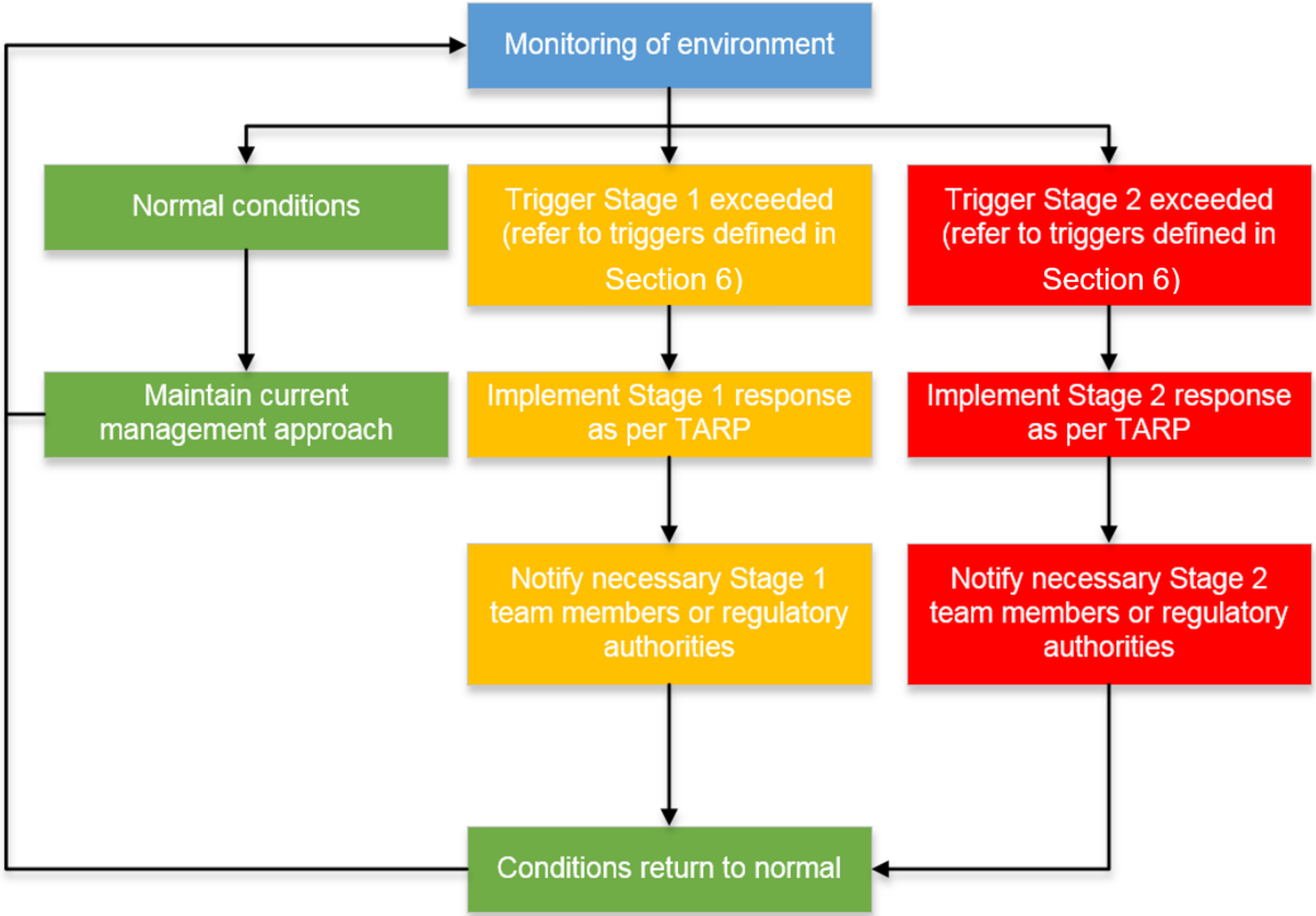

0.6
0.5
0.4
0.3
0.2
0.1
0.0
Dissolved zinc (mg/L)
Jul-13
Jul-14
Jul-15
Jun-16
Jun-17
Jun-18
Jun-19
Jun-20
Jun-21
Jun-22
Jun-23
Jun-24
LDP001

I.2.6 Other



Oil and grease (mg/L)
0
2
4
6
8
10
12
14
Jan-00
Jan-02
Feb-04
Feb-06
Mar-08
Apr-10
Apr-12
May-14
Jun-16
Jun-18
Jul-20
Aug-22
Aug-24
LDP001

APPENDIX J – Trigger action response plans



Note that trigger information is located in Section 6 of this Plan.

Site surface operations

Aspect	Normal	Stage 1	Stage 2	Notifications
Surface water storage volume.	Storage captures events up to and including the design criteria.	**Trigger:** Storage is not dewatered appropriately following storm event, or Storage is not desilted in accordance with design criteria and procedures. **Action:** Investigate storage operation and dewatering options. Dewater or desilt if required to maintain design capacity freeboard. Increase inspection frequency as required. Education for staff.	**Trigger:** Storage is discharging as a result of a storm event less than design criteria with potential impacts offsite. **Action:** Investigate storage operation, dewatering and desilting options. Increase inspection frequency as required. Undertake water quality sampling of discharge and add flocculant if there is a risk of an offsite impact. Undertake water quality sampling of downstream sites if there is a risk of an offsite impact.	**Stage 1:** Notify Environment and Community Team and Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements immediately if there is actual or the potential for material harm to environment to occur.

Aspect	Normal	Stage 1	Stage 2	Notifications
Clean water diversion.	Clean water diverted around dirty water areas.	**Trigger:** Clean water enters the dirty water system above clean water design criteria. **Action:** Review catchment plan. Review design capacity of clean water system. Appropriately treat and manage dirty water.	**Trigger:** Clean water creates flooding problems through site. **Action:** Evacuate site if danger exists. Protect equipment and infrastructure. Utilise portable pumps to dewater flooded areas into sediment basins.	**Stage 1:** Notify Environment and Community Team and Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements immediately if there is actual or the potential for material harm to environment to occur.
Erosion and sediment control.	All controls are appropriately in place and well maintained. No unstable disturbance areas or migration of sediment away from designated development areas.	**Trigger:** One or more areas of surface erosion in the form of rilling, bank erosion or other movement of sediment from an area of disturbance with no offsite migration. **Action:** Isolate the area through diverting contributing surface flows to another appropriate control structure. Seek to stabilise the area to stop the erosion process. This can include the use of groundcover or other temporary measures. Investigate works undertaken prior to the disturbance activities.	**Trigger:** Rainfall event leads to sediment migrating off site. **Action:** Isolate the area through diverting contributing surface flows to another appropriate control structure. Seek to stabilise the area to stop the erosion process. This can include the use of groundcover or other temporary measures.	**Stage 1:** Notify Environment and Community Team and Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements immediately if there is actual or the potential for material harm to environment to occur.

Aspect	Normal	Stage 1	Stage 2	Notifications
Hydrocarbon management.	All hydrocarbon materials are stored appropriately.	**Trigger:** Minor spill occurs on site. **Action:** Take action to control, contain and clean up the spill. Utilise spill kit.	**Trigger:** Major spill occurs on site. **Action:** Take action to control, contain and clean up the spill. Isolate area and divert contributing surface flows. Investigate potential for contamination of waterways. Implement procedures in the PIRMP.	**Stage 1:** Notify Environment and Community Team and Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements immediately if there is actual or the potential for material harm to environment to occur.

Watercourses

Aspect	Normal	Stage 1	Stage 2	Notifications
Water quality.	Water quality at Lamberts Gully CWD and Wangcol Creek Far DS monitoring sites is within or below the values specified in Table 6-1.	**Trigger:** Water quality at Lamberts Gully CWD and Wangcol Creek Far DS monitoring sites are outside or above the values specified in Table 6-1 for at least one parameter for two consecutive sampling events. **Action:** Review recent monitoring results for adjacent sites and any relevant operational data (e.g. operational activities, clearing activities, meteorological data). Investigate the source of the exceedance and develop corrective/preventative actions based on outcomes.	**Trigger:** Investigation into Stage 1 trigger identifies that trigger exceedance is due to an operational activity. Community complaint to Centennial regarding surface water quality. Loss of water supply to any adjacent landholders due to operational activities. **Action:** Determine if an incident has potentially occurred and investigate the source of the exceedance. Increase monitoring frequency and undertake additional monitoring (e.g. water quality, aquatic ecology) where relevant. Implement corrective/preventative actions if required, based on the outcomes of the investigation and/or additional monitoring. Prioritise actions based on the risk to the environment and likelihood of further impact. Loss of water supply to any adjacent landholders due to operational activities will need to be replaced by Centennial.	**Stage 1:** Notify Environment and Community Team and Mine Manager immediately. **Stage 2:** Investigate if the PIRMP is required to be activated - if there is actual or the potential for material harm to environment to occur. Notify relevant agencies, DPHI, DCCEEW-Water and EPA as soon as practicable if PIRMP is not triggered.

Discharge management

Aspect	Normal	Stage 1	Stage 2	Notifications
LDP discharge quality.	Discharge quality is within limits defined by EPL 21229.	**Trigger:** Water quality parameters are equal to discharge limits, or exceed discharge limits and conditions L2.5 or L2.6 of EPL 21229 apply. **Action:** Undertake investigation.	**Trigger:** Water quality parameters exceed discharge limits for one or more parameters, and conditions L2.5 or L2.6 of EPL 21229 do not apply. **Action:** Undertake review of water management on site. Undertake incident investigation to determine the cause of the exceedance. Investigate if additional monitoring is required to determine if there is environmental harm.	**Stage 1:** Notify Environment and Community Team Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements immediately if there is actual or the potential for material harm to environment to occur. Notify appropriate regulatory authorities, DPHI, DCCEEW-Water and EPA as soon as practicable if PIRMP is not triggered.
LDP discharge volume.	Discharge volume is within predictions of the site water balance.	**Trigger:** Discharge volume exceeds predictions for no more than one day. **Action:** Undertake investigation. Review monitoring equipment on discharge volume.	**Trigger:** Discharge volume exceeds predictions for more than two days. **Action:** Undertake review of water management on site. Review on site transfers and predictions of hydrogeological model/site water balance model. Update models as required.	**Stage 1:** Notify Environment and Community Team Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements immediately if there is actual or the potential for material harm to environment to occur.

Aspect	Normal	Stage 1	Stage 2	Notifications
Unlicensed discharges.	No discharges from unlicensed locations.	All unlicenced discharges are considered Stage 2 triggers.	**Trigger:** A discharge from a non-EPL defined, emergency discharge location. **Action:** Undertake review of water management on site. Undertake incident investigation, including ecotoxicology and aquatic ecology monitoring if appropriate.	**Stage 1:** NA **Stage 2:** Notify Environment and Community Team Manager immediately. Notify relevant agencies in accordance with PIRMP requirements immediately if there is actual or the potential for material harm to environment to occur. Notify WaterNSW, EPA and DPHI as soon as practicable.

Groundwater environment

Aspect	Normal	Stage 1	Stage 2	Notifications
Groundwater level.	Groundwater level below triggers specified in Table 6-3.	**Trigger**: Groundwater level is above the triggers specified in Table 6-3 for two consecutive monitoring events at one or more monitoring locations. **Action**: Undertake investigation to determine if the change in groundwater level is due to operational activities.	**Trigger**: Investigation into Stage 1 trigger identifies that trigger exceedance was due to operational activities. Community complaint to Centennial regarding groundwater levels. **Action**: Undertake investigation to determine if the change in groundwater level is due to operational activities. Verify whether monitoring results are consistent with hydrogeological/site water balance model predictions. Update the models as required. If environmental impacts are unacceptable and/or if the beneficial use of the groundwater changes, remediation options will be considered. Loss of water supply to any adjacent landholder due to operational activities will need to be replaced by Centennial.	**Stage 1**: Notify Environment and Community Team and Manager immediately. **Stage 2**: Notify relevant agencies in accordance with PIRMP requirements immediately if there is actual or the potential for material harm to the environment has occurred.

Aspect	Normal	Stage 1	Stage 2	Notifications
Groundwater quality.	Groundwater quality within or below triggers specified in Table 6-4.	**Trigger**: Groundwater quality is outside or above triggers specified in Table 6-4 for at least one parameter for two consecutive sampling events. **Action**: Undertake investigation to determine if the change in groundwater quality is due to operational activities.	**Trigger**: Investigation into Stage 1 trigger identifies that trigger exceedance was due to operational activities. Community complaint to Centennial regarding groundwater quality. **Action**: Undertake investigation to determine if the change in groundwater quality is due to operational activities. If environmental impacts are unacceptable and/or if the beneficial use of the groundwater changes, remediation options will be considered. Loss of water supply to any adjacent landholder due to operational activities will need to be replaced by Centennial.	**Stage 1:** Notify Environment and Community Team and Manager immediately. **Stage 2:** Notify relevant agencies in accordance with PIRMP requirements immediately if there is actual or the potential for material harm to the environment has occur.

Stream health

Aspect	Normal	Stage 1	Stage 2	Notifications
Geomorphic condition and watercourse stability				
Watercourse instabilities	Watercourse monitoring indicates no areas of instabilities.	**Trigger**: Monitoring indicates a declining stability trend. **Action**: Review historical monitoring records. Investigate the factors contributing to the instability, which may include advice from technical specialists. Implement corrective actions as required as soon as practicable to stabilise the surface and/or watercourses based on the outcomes of the investigation. Increase monitoring frequency and undertake additional monitoring (e.g. water quality, aquatic ecology) where relevant.	**Trigger**: Monitoring indicates a declining stability trend likely caused by site operations. **Action**: Immediately isolate areas of instability and implement corrective actions to stabilise the surface and/or watercourses. Investigate the factors contributing to the instability, which may include advice from technical specialists. Increase monitoring frequency and undertake additional monitoring (e.g. water quality, aquatic ecology) where relevant. Implement corrective/preventative actions based on the outcomes of the investigation and/or additional monitoring. Prioritise actions based on the risk to the environment and likelihood of further impact.	**Stage 1**: Notify Environment and Community Team and Manager immediately. **Stage 2**: Notify relevant agencies immediately if the change was caused by site operations.

Aspect	Normal	Stage 1	Stage 2	Notifications
			Review WMP and related procedures to prevent reoccurrence.	
Aquatic ecology				
Instream vegetation	No significant variation in vegetation extent or quality when compared with reference sites and previous monitoring results.	**Trigger**: Visual inspections show change in extent and density of vegetation not specific to season. Introduction or increased number of exotic species. **Action**: Review activities likely to influence instream vegetation. Review flow monitoring and rainfall data. Consider using River Condition Index measure to quantify change from historical results.	**Trigger**: Visual inspections show significant change in extent and density of instream vegetation as a result of clearing or impact. **Action**: Increase monitoring frequency and undertake additional monitoring (e.g. water quality, watercourse stability) where relevant. Undertake water quality monitoring to determine potential impact on in situ conditions. Stabilise watercourse banks as necessary.	**Stage 1**: Notify Environment and Community Team and Manager immediately. **Stage 2**: Notify relevant agencies immediately if the change was caused by site operations.

Aspect	Normal	Stage 1	Stage 2	Notifications
Macroinvertebrate community condition	Assessment of macroinvertebrate metrics (taxa richness, EPT richness and SIGNAL-2) and multivariate analyses of macroinvertebrate data (including MDS, Cluster analysis, ANOSIM and SIMPER) indicates no impairment attributable to licensed discharges from the site.	**Trigger**: Assessment indicates community impairment directly attributable to licensed discharges at one of the downstream sites. **Action**: Investigate possible causes for the macroinvertebrate community impairment. Report on findings in the annual aquatic ecology monitoring report.	**Trigger**: Assessment indicates community impairment directly attributable to licensed discharges at all Wangcol Creek sites downstream of LDP001. **Action**: Investigate possible causes for the macroinvertebrate community impairment. Report on findings in the annual aquatic ecology monitoring report. Undertake follow up monitoring for the full suite of water quality parameters.	**Stage 1**: Notify Environment and Community Team and Manager immediately. **Stage 2**: Notify relevant agencies immediately if the change was caused by site operations.

Residuals management

Aspect	Normal	Stage 1	Stage 2	Notifications
Management of the REA.	The REA is a declared dam under the Dam Safety Act 2015. Management and Risks associated with the REA are managed by the relevant documents required under the Dam Safety Act 2015.	N/A	N/A	Notify relevant agencies in accordance with PIRMP requirements immediately if there is actual or the potential for material harm to the environment has occur.
Surface water quality of decant water from REA.	Decant water quality is within or below values specified in Table 6-6.	**Trigger**: Water quality is outside or above the values specified in Table 6-6 for at least one parameter for two consecutive sampling events. **Action**: Review recent monitoring results for other water storages on site and any relevant data (e.g. operational activities, meteorological data). Investigate the source of the exceedance and develop corrective/preventative actions based on outcomes.	**Trigger**: Investigation into Stage 1 trigger identifies that trigger exceedance is due to an operational activity. **Action**: Determine if an incident has potentially occurred and investigate the source of the exceedance. Increase monitoring frequency and undertake additional monitoring where relevant. Implement corrective/preventative actions, in consultation with relevant agencies, based on the outcomes of the investigation and/or additional monitoring. Prioritise actions based on the risk to the environment and likelihood of further impact.	**Stage 1**: Notify Environment and Community Team and Manager. **Stage 2**: Notify relevant agencies in accordance with PIRMP requirements immediately if there is actual or the potential for material harm to the environment has occur.

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