LIDDELL

GLENCORE

CRITICAL CONTROL

Water Management

Plan

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Table of Contents

1. Introduction

Liddell Coal Operations (LCO) is an established open-cut mine located at Ravensworth, approximately 25 kilometres (km) north-west of Singleton in the Upper Hunter Valley of New South Wales. LCO is operated and managed by Liddell Coal Operations Pty Limited, a wholly owned subsidiary of Glencore Coal Pty Limited (Glencore), on behalf of a joint venture between Glencore (67.5 percent (%)) and Mitsui Matsushima Australia (32.5%).

LCO operates under Development Consent DA 305-11-01. Approval for a modification to DA 305-11-01 (Modification 5 (Mod 5)) was granted by the then Department of Planning and Environment (DP&E), now the Department of Planning, Industry and Environment (DPIE) on 1 December 2014, which allowed for the then extension of both the Entrance Pit and South Pit, and mining of the Mine Infrastructure Area (MIA) Pit towards the end of mine life. LCO subsequently received approval (referral 2013/6908) from the then Australian Government Department of the Environment (DoE), now the Australian Government Department of Agriculture, Water and the Environment (DAWE), under section 130(1) and 133 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) on 24 December 2014 for Mod 5 (EPBC 2013/6908). Further modification of DA305-11-01 (MOD 6) was approved by the NSW DP&E on 16 February 2016 and approves construction and operation of a tailings pipeline from the Coal Handling and Preparation Plants (CHPPs) at Ravensworth Operations and Liddell Colliery to the West Pit Void at Ravensworth East Mine. LCO received approval for DA305-11-01 Modification 7 (Mod 7) on 12 February 2019. This modification comprised of minor amendments to facilitate required remediation works on a portion of the Mountain Block Offset Area. The minor amendments also sought to facilitate improved operational efficiencies at LCO whilst providing the necessary flexibility required for the development of the final landform to the established rehabilitation objectives established for LCO.

The LCO Water Management Plan (WMP) documents the processes and responsibilities of all aspects of the site water management system. This WMP has been compiled to satisfy the relevant requirements of DA 305-11-01 (as modified), as well as condition's 12, 13, 14, 15 and 16 of the EPBC approval. In addition, the WMP has also been prepared consistent with the requirements of the Glencore Coal Assets Australia (GCAA) Water Management Plan requirements as outlined in 11.03 Water Management Protocol.

In accordance with Schedule 3, Condition 23(a) of DA 305-11-01 the WMP has been prepared by suitably qualified and experienced persons whose appointment has been approved by the Secretary.

1.1 Purpose

The purpose of this WMP is to document the structured approach to managing water capture, supply, consumption, storage, disposal and hydrological interception at LCO. Specifically, the WMP:

a) Guides the management of surface and groundwater resources throughout the construction and operational life of the mine;

b) Addresses the relevant conditions of the development consent such as:

   i. documenting the water balance for the development;

   ii. provides reference to detailed baseline surface water and groundwater flow and quality information contained in the Environmental Assessment (EA) prepared to accompany the application for Mod 5 (SLR, 2013a);

   iii. describing the water management system including design objectives and performance criteria;

iv. outlining investigations and options in relation to the most appropriate method for the treatment and/or disposal of brine;

v. detailing the surface water, groundwater and treated effluent assessment criteria and trigger levels / performance indicators;

vi. documenting management actions and mitigation measures to minimise the impact of the development;

vii. outlining surface water and groundwater monitoring and reporting requirements;

viii. documenting the process of water balance model and groundwater model validation and independent review;

ix. outlining a contingency plan to respond to unpredicted impacts and exceedances of assessment criteria;

x. outlining a protocol prepared in consultation with the owners of nearby mines to minimise cumulative impacts and to review water sharing and monitoring data sharing opportunities

xi. outlining the reporting and reviewing requirements; and

xii. detailing the accountabilities and responsibilities associated with implementation of the WMP; as well as

c) Addresses legislative requirements and guidelines relevant to the WMP.

1.2 Scope

The scope of the WMP includes all activities associated with the management of water at LCO (inclusive of the open cut and old underground operations) with the exception of the potable water supply. The extent of this area is presented on ***Figure 1.*** The potable water supply is sourced from the Singleton/Muswellbrook town water supply system and is not included in the scope of this WMP.

The scope of the LCO WMP includes describing the existing water management system at the commencement of DA 305-11-01 Mod 5 approval and EPBC 2013/6908. It further describes the future changes and developments of the Integrated Water Management System (IWMS) as the active mining progresses to completion.

1.3 Objectives

The objectives of the WMP are to:

a) minimise the contamination of clean water runoff from catchment areas upstream of the operations by directing clean water around the disturbance footprint where possible;

b) minimise the potential effects of erosion and its associated impacts as a result of mining operations changing flows or conditions downstream;

c) prevent the discharge of pollutants from the disturbed area except where discharges are licenced, or where the discharge will not cause environmental harm such as water suitable for release from rehabilitated areas;

d) manage the mine water drawn from underground workings and maximise the reuse of mine water to meet on site water consumption requirements;

e) manage the disposal of excess water in line with relevant licence and Hunter River Salinity Trading Scheme (HRSTS) conditions when excess water volumes are stored on site beyond projected future requirements.

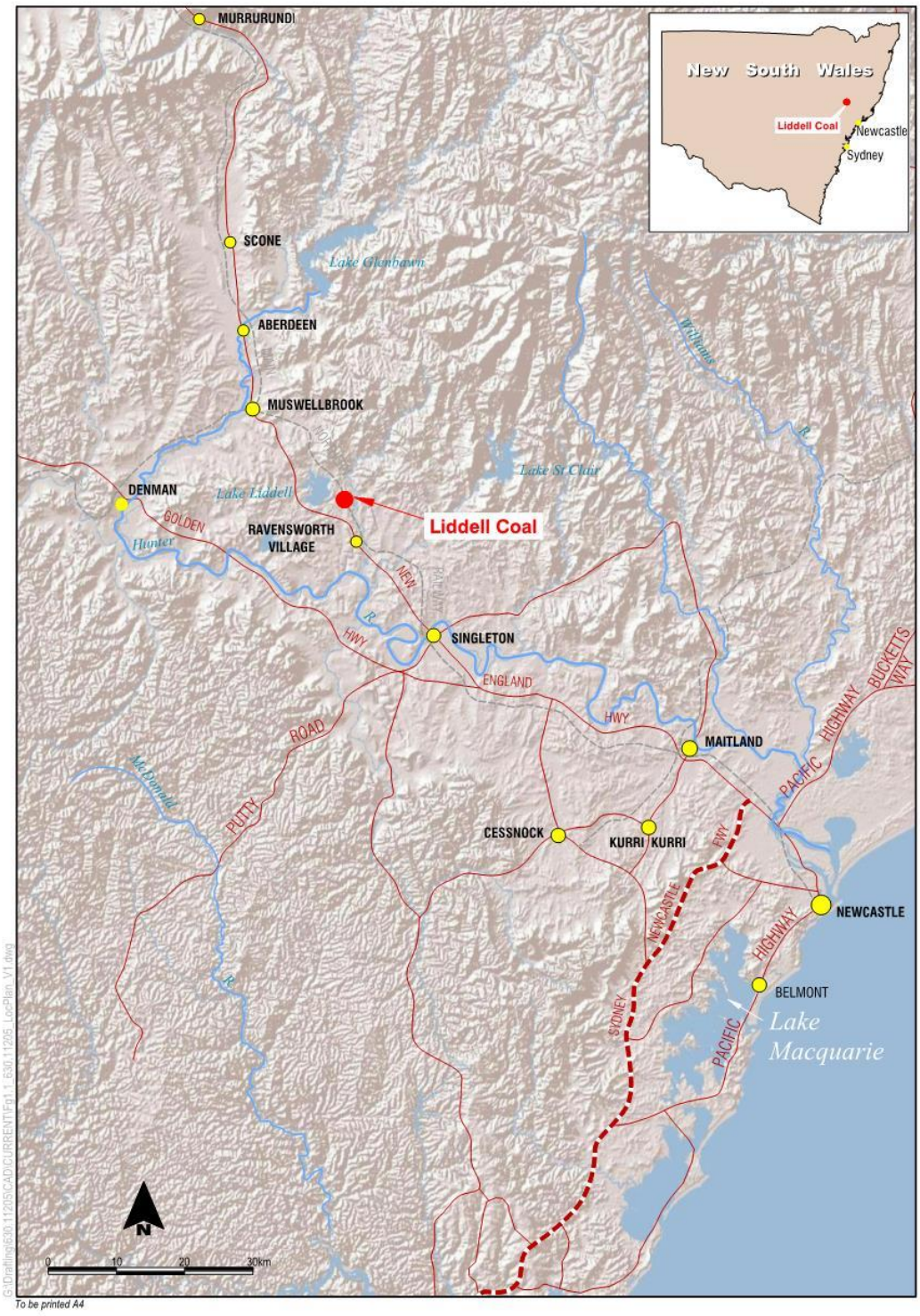


Figure 1 Locality Plan

1.4 Commitments Table

A summary of the commitments outlined in this Water Management Plan are presented in ***Table 1***.

Table 1 Summary of Water Management Plan Commitments

Number	Commitment	Relevant Section of WMP
1	**Licenced Discharge Points** A maximum discharge of 100 ML per day is stipulated for LDP 6 in EPL 2094 which is the Hunter River Salinity Trading Scheme (HRSTS) monitoring point.	2.4
2	**Site Water Balance Model** Initial model calibration of the site water balance will occur by the end of 2015, with validation to occur by mid-2016, and every three years thereafter.	7.4
3	The site water balance will be reviewed annually using the monitored volumes and data collected as part of the water monitoring program, and will be reported on as part of the LCO Annual Review.	7.5
4	**Erosion and Sediment Control** All erosion and sediment control (ESC) activities are to be undertaken in accordance with the following guidelines: • *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) and *Volumes 2A - Installation of Services, 2C - Unsealed Roads, and 2E - Mines and Quarries* (DECC, 2008) (the Blue Book). • Glencore's internal standard CAA HSEC PLC 0025 11.06 Erosion and Sediment Control (Glencore, 2015).	8.4
5	ESC structures and measures will be inspected regularly and monitored monthly as part of the sites environmental inspection program. Additional inspections will be carried out after high rainfall events to ensure the effectiveness of the controls	8.8.1
6	**Ground Disturbance Permit and ESC Plans** Prior to any disturbance activities being undertaken at LCO, a Ground Disturbance Permit (GDP) (CAA-HSEC-PER-0004) is required to be completed. As part of completing the GDP, an ESCP is required to be developed for the proposed works and the controls must be implemented prior to the main disturbance activity occurring.	8.4
7	**Surface Water Monitoring** Surface water quality is monitored as detailed in **Section 9.1.1**. All of these sites will be monitored monthly in accordance with condition 12(b)(i) of the EPBC Approval, refer to **Section 9.1.1**. In addition, HRSTS monitoring is currently conducted at LDP6 in accordance with EPL 2094.	9.1.1
8	Results from the water quality monitoring program will be compared against the trigger levels stipulated in **Section 9.1.3** Impact Assessment Criteria. If exceedances are identified then the TARP outlined in **Section 10** will be implemented.	10.1
9	Monitoring of channel stability and riparian vegetation health within Bowmans and Bayswater Creeks will be undertaken using the Riparian Channel and Environmental (RCE) inventory in accordance with the procedures outlined in the ***LCO Biodiversity Management Plan***.	9.1.1.2

Number	Commitment	Relevant Section of WMP
10	The RCE scores obtained during each biennial monitoring event will be reviewed against the baseline condition of Bowmans and Bayswater Creeks, as documented in the EA for Mod 5 (SLR, 2013). A substantial decrease in the total score (by 10 points) will trigger further investigation.	9.1.3.3
11	Treated effluent generated from the waste water treatment plant and aerated sewage treatment plant is tested in accordance with EPL2094, every four weeks for E.coli.	9.1.1.4
12	**Groundwater Monitoring** Groundwater monitoring is undertaken as detailed in **Section 9.2.1.**	9.2.1
13	Groundwater level and quality is monitored as detailed in **Section 9.2.1** and results are to be compared against the trigger levels detailed in **Section 9.2.3.**	9.2.3
14	Pumping data from the open cut pits and extraction volumes recorded from the operational dewatering bores via flow meters will be compared to predicted inflow rates from the numerical groundwater model on an annual basis and assessed against current licensed approvals to extract from the hard rock aquifer.	9.2.1.1
15	Stygofauna monitoring is undertaken at LCO in accordance with the procedures outlined in the ***Biodiversity Management Plan***.	9.2.1.3
16	Where monitoring results triggers the 2 metre drawdown threshold as detailed in **Section 9.2.3**, this will be reported to the Department of the Environment as per **Section 10.2.**	10.2
17	**Groundwater Model** The validity of the numerical groundwater model will be assessed by a suitably qualified, experienced and independent reviewer to assess the efficacy of the existing model and compare its prediction results with the monitored data every three years.	9.3
18	**Reporting** Within three months of each 12 month anniversary of the commencement of the action (activities approved by Mod 5 and within the referral areas as shown on ***Figure 6-1***) LCO will publish a report on the website addressing compliance with this management plan, in accordance with Condition 19 of EPBC 2013/6908. This report will also be provided to the DAWE.	11.1
19	All monitoring records are kept by LCO within the Glencore Environmental Monitoring Database. Typically these results are presented in the monthly EPL compliance report and reported in the Annual Review. Both reports are available on the LCO external website.	11.1
20	Each discharge event is recorded. An annual report of activity under the HRSTS is forwarded to the EPA.	11.1
21	This management plan will be published on the LCO website within one month of being approved, and will remain on the website for the lifetime of the approval.	11.1
22	**Cumulative Impacts** LCO, in conjunction with neighbouring Glencore operations, will develop a Cumulative Water Management Protocol to document a procedure to minimise cumulative impacts with respect to water resources.	13

Number	Commitment	Relevant Section of WMP
23	**Review** This document shall be reviewed in accordance with condition 10 Schedule 5 of DA 305-11-01, and if necessary revised, within three months of the following: • The submission of an Annual Review; • The submission of an incident report under the Surface and Groundwater Response Plan (refer to Section 10) • The submission of an independent environmental audit; and • Following any modification to the LCO approvals.	14
24	**Auditing** An Independent Environmental Audit will be undertaken every three years (or as otherwise required by the DPIE or DAWE) by an audit team whose appointment has been endorsed by the Director-General of the DPIE.	15

1.5 Acronyms

Acronyms used throughout the WMP are presented below.

Annual Review	Annual Environmental Management Report
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
AWBM	Australian Water Balance Model
BOM	Bureau of Meteorology
CCL	Consolidated Coal Lease
CHPP	Coal Handling and Preparation Plant
DAWE	Department of Agriculture, Water and the Environment – the Australian Government Department administering the EPBC Act.
DPIE	NSW Department of Planning, Industry and Environment
DPIE – Planning and Assessment	NSW Department of Planning, Industry and Environment – Planning and Assessment Division
DPI - Water	NSW Department of Primary Industries
DPIE - Water	Department of Planning, Industry and Environment – Water Division
EA	Environmental Assessment
EC	Electrical Conductivity
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*

EPL	Environment Protection Licence
ESCP	Erosion and Sediment Control Plan
GDP	Ground Disturbance Permit
GRWSS	Greater Ravensworth Water Sharing System
ha	Hectare
HRSTS	Hunter River Salinity Trading Scheme
IWMS	Integrated water management system
kL	Kilolitre
kL/day	Kilolitres per day
km	Kilometre
LCO	Liddell Coal Operations
LDP	Licensed Discharge Point
L/s	Litres per second
m	Metre
mg	Milligram
mm	Millimetre
ML	Megalitre/Mining Lease
ML/day	Megalitres per day
MIA	Mine Infrastructure Area
MOP	Mining Operations Plan
BCD	NSW Department of Planning, Industry and Environment – Biodiversity and Conservation Division
POEO Act	*Protection of the Environment Operations Act 1997*
PIRMP	Pollution Incident Management Plan required under POEO Act
RWTV	Raw water transfer void
SLR	SLR Consulting Australia Pty Ltd
TDS	Total dissolved solids
TSS	Total suspended solids
WMP	Water Management Plan
µS/cm	Microsiemens per centimetre

1.6 Authority Consultation

In accordance with Schedule 3 Condition 23 (a) of DA305-11-01, this WMP has been prepared in consultation with the then NSW Dept. Of Planning, Industry and Environment – Water (DPIE-Water) and the NSW Environment Protection Authority (EPA). Correspondence relating to this is contained in **Appendix A** and **Appendix B** respectively. DPIE-Water supplied review outcomes on 22 February 2021 including updates to share links between Water Access Licences (Table 5) and referencing of approval condition conditions (Table 2). These have been addressed in this plan version.

The WMP has also been reviewed and approved by the then Department of Agriculture, Water and the Environment (formally Department of Environment) (the Australian Government Department administering the EPBC Act) on the 26 July 2017. Correspondence relating to this is contained in **Appendix C**.

2. Planning Requirements

2.1 Overview

LCO is regulated by a range of leases, licences and approvals.

As described in Section 1, LCO operates under Development Consent DA 305-11-01 (as modified), as well as the conditions documented in the EPBC approval 2013/6908 granted by the DAWE. The requirements of these consents that are relevant to the WMP are outlined in Table 3.

In addition to these Development Consents, LCO operates within the following leases, ML 1313, ML1597, Cumnock Sublease ML 1552 and CCL 708. The requirements of these leases that are relevant to the WMP are outlined in Section 2.3.

2.2 Development Consent Conditions

The relevant development consent conditions and section they are addressed in this WMP for both MOD 5 and the EPBC approval are listed in ***Table 2*** below.

Table 2 Relevant Water Management Conditions

Condition	Requirement	Section Addressed
Relevant Water Management Conditions from EPBC approval 2013/6908		
12.	To protect water resources and threatened species the approval holder must submit a Water Management Plan (WMP) for approval by the Minister prior to commencement of the action which provides for the avoidance and mitigation of impacts to water resources and threatened species. The plan must include:	
12.a	Management action, mitigation measures and practices designed to limit impacts of the proposal on surface and groundwater resources. Management actions, mitigation measures and practices prescribed by the plan must be clear, measurable, auditable and time bound;	Sections 5, 8, 9 and 10
12 b.	Surface and groundwater monitoring program, that must be implemented for the life of the action, to monitor the success of the management actions in the WMP, define measureable targets of management actions and performance indicators, and provide an adaptive management framework for the duration of the action's impact on water resources. This program must include:	Section 9

Condition	Requirement	Section Addressed
12 b. (i)	Surface water quality, including pH, electrical conductivity, total suspended solids and total dissolved solids, in Bayswater Creek and Bowmans Creek each month, at each of the sites specified in Figure 9.11 of the Preliminary Documentation;	Section 9.1
12 b. (ii)	Groundwater quality at least every two months and groundwater pressures and levels at least monthly at each location depicted in figure 2-13 of the Groundwater Impact Assessment (annexure A) and	Section 9.2
12 b. (iii)	Documentation of the reference value against which the 2 metre drawdown trigger for the Bowmans Creek alluvium will be assessed and a justification of this reference value.	Section 9.2
12 c.	Clear objectives and performance indicators, timeframes for the completion of all actions outlined in the Plan as well as corrective actions for circumstances where a management action, mitigation measure or practice fails to meet its prescribed objective or performance indicator.	Section 4.2 and 10
13.	The approved Water Management Plan must be implemented.	NA
14.	The **approval holder** must only discharge water into the Hunter River or its tributaries in accordance with the Hunter River Salinity Trading Scheme.	Section 5.5
15.	If monitoring of surface water quality identifies an exceedance of the **Trigger Values** for surface water. The **approval holder** must:	
15 a.	Keep a written record of the exceedance;	Section 9.1,10 and 11
15 b.	Report the exceedance to the **Department** within 5 business days of the monitored exceedance if the exceedance has the potential to result in environmental harm;	Section 10 and 11
15 c.	Unless agreed otherwise by the **Department** in writing, complete an investigation into the potential for environmental harm for any exceedance described in condition 15b. and provide a written report to the **Department** within 30 calendar days of receiving the result, including:	Section 10 and 11
15 c. (i)	A description of the investigations carried out;	Section 10 and 11
15 c. (ii)	A statement of the cause and extent of the exceedance;	Section 10 and 11
15 c. (iii)	An assessment of the potential for environmental harm;	Section 10 and 11
15 c. (iv)	Actions taken to prevent environmental harm, if required; and	Section 10 and 11
15 c. (v)	Actions taken to prevent exceedance from re-occurring in the future.	Section 10 and 11
16.	If groundwater monitoring identifies groundwater drawdown in the alluvium of Bowmans Creek of more than 2 metres, the **approval holder** must:	
16 a.	Report this to the **Department** within 5 business days of the monitored exceedance;	Section 9.2, 10 and 11
16 b.	Unless agreed otherwise by the **Department** in writing, complete an investigation into the potential for environmental harm for any exceedance described in condition 15b. and provide a written report to the **Department** within 30 calendar days of receiving the result, including:	Section 10 and 11

Condition	Requirement	Section Addressed
16 b. (i)	A description of the investigations carried out;	Section 10 and 11
16 b. (ii)	A statement of the cause and extent of the drawdown;	Section 10 and 11
16 b. (iii)	Actions taken to prevent environmental harm; and	Section 10 and 11
16 b. (iv)	Actions taken to prevent exceedance from re-occurring in the future.	Section 10 and 11
Relevant Water Management Conditions from DA 305-11-01 Modification (as modified)		
Schedule 3		
21.	The Applicant must ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of mining operations to match its available water supply, to the satisfaction of the Secretary. *NOTE: The Applicant is required to obtain all necessary water licences and approvals for the development under the Water Act 1912 and/or Water Management Act 2000.*	Section 7.3
21A.	Unless an EPL or the EPA authorises otherwise, the Applicant must comply with Section 120 of the POEO Act and the Protection of the *Environmental Operations (Hunter River Salinity Trading Scheme) Regulation 2002.*	Section 4.2
21B.	The Applicant must ensure that treated effluent from the wastewater treatment plant does not exceed the discharge limits in Table 6, unless otherwise agreed by the EPA.	9.1
21C.	The Applicant must monitor the quality of treated effluent to be discharged from the wastewater treatment plant (by sampling and obtaining results by analysis) as specified in Table 6, or as otherwise agreed by the EPA.	Section 9.1
22.	Prior to the construction of the desalination unit, the Applicant must conduct investigations and identify options concerning the most appropriate method for the treatment and/or disposal of brine, to the satisfaction of the Secretary, DoI and EPA.	Section 5.7
23.	The Applicant shall prepare and implement a Water Management Plan for the development to the satisfaction of the Secretary. This Plan must:	This document
23. a	Be prepared in consultation with DoI and EPA by suitably qualified and experienced persons whose appointment has been approved by the Secretary;	Section 1
23. b	Be submitted to the Secretary for approval by the end of May 2015, unless the Secretary agrees otherwise;	NA
23. c	This plan must include a:	
23 c. (i)	<u>Site Water Balance</u> that: • Includes details of: - Sources and security of water supply, including contingency planning for future reporting periods; - Water use and management on site; - Reporting procedures. Including the preparation of a site water balance for each calendar year;	Section 7
23 c. (i)	• Describes the measures that would be implemented to minimise clean water use on site;	Section 5 and 6
23 c. (ii)	<u>Erosion and Sediment Control Plan</u> that: • Is consistent with the requirements of *Managing Urban Stormwater; Soils and Construction, Volume 1, 4th Edition, 2004* (Landcom), or its latest version;	Section 8

Condition	Requirement	Section Addressed
	• Identifies activities that could cause soil erosion, generate sediment or effect flooding;	Section 8
	• Describes measures to minimise soil erosion and the potential for the transport of sediment to downstream waters, and manage flood risk; and	Section 8
	• Describe what measures would be implemented to maintain the structures over time;	Section 8
23 c. (iii)	Surface Water Management Plan, that includes: • Reference to detailed baseline data on water flows and quality contained in the EA;	Section 9.1.2
23 c. (iii)	• A detailed description of the water management system on site;	Section 5 and 6
23 c. (iii)	• Design objectives and performance criteria for the: - Design and management of final voids; - Design and management for sodic and dispersible soils and acid or sulphate generating materials; - Reinstatement of drainage lines on the rehabilitated areas of the site; and - Control of any potential water pollution form the rehabilitated areas of the site;	Section 4
23 c. (iii)	• Surface water assessment criteria, including trigger levels for investigating any potentially adverse impacts for the following: - The water management system, including mine water storages and sediment dams; - Downstream surface water quality; and - Stream and riparian vegetation health;	Section 9.1.3
23 c. (iii)	• A program to monitor and report on: - The effectiveness of the water management system; - Surface water flows and quality, stream and riparian vegetation health in the watercourses that could be affected by the development; and - Stream health and channel stability;	Section 9.1.1
23 c. (iii)	• Reporting procedures for the results of the monitoring program;	Sections 11
23 c. (iii)	• A plan to respond to any exceedances of the performance criteria, and mitigate and adverse surface water impacts of the development including: - A protocol for the investigation, notification and mitigation of any exceedances; - Measures to mitigate and/or compensate potentially affected landowners for the loss of surface flows in Bowmans Creek downstream of the development resulting from the development; and - The procedures that would be followed if any unforeseen impacts are detected during the development.	Section 10
23 c. (iv)	Groundwater Management Plan, that includes: • Reference to baseline data on groundwater levels, yield and quality contained in the EA;	Section 9.2.2

Condition	Requirement	Section Addressed
23 c. (iv)	• A detailed description of the groundwater management system on site;	Section 5 and 6
23 c. (iv)	• Design objectives and performance criteria, for the: - Emplacement areas for tailings, acid forming materials, and saline and sodic materials; - Final voids;	Section 4
23 c. (iv)	• Groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts beyond those predicted in the EA for Mod 5;	Section 9.2.3
23 c. (iv)	• Measures to minimise, prevent or offset groundwater leakage from the Bowmans Creek alluvial aquifer in excess of the drawdown predicted in the EA for Mod 5;	Section 10.2
23 c. (iv)	• Measures to mitigate any direct hydraulic connection between the backfilled open cuts and the Bowmans Creek alluvium if the potential for adverse impacts is detected;	Section 10.2
23 c. (iv)	• A program to monitor and report on: - Groundwater inflows to the mining operations; - The seepage/ leachate from water storages, emplacements and final voids; - Background changes in groundwater yield/ quality against mine-induced changes; - Impacts of the development on: o Regional and local (including alluvial) aquifers; o Groundwater dependent ecosystems and riparian vegetation; o The seepage/ leachate from water storages, emplacements, backfilled voids and final voids; o Impacts on the Bowmans Creek alluvial aquifer;	Section 9.2 10 and 11
23 c. (iv)	• Procedures for the verification of the groundwater model;	Section 9.3
23 c. (iv)	• A review of existing network to identify additional monitoring locations for the alluvial system focusing on areas where additional drawdown is predicted;	Section 9.2
23 c. (iv)	• Reporting procedures for the results of the monitoring program and model verification;	Section 11
23 c. (iv)	• A plan to respond to any exceedances of the predicted groundwater impacts, and mitigation of any unpredicted adverse groundwater impacts of the development;	Section 10
23 c. (v)	A program to validate the water balance and groundwater model for the development every 3 years, and compare monitoring results with modelled predictions; and	Section 12
23 c. (vi)	A protocol that has been prepared in consultation with the owners of any nearby mines to: • Minimise cumulative water quantity and quality impacts;	Section 13
23 c. (vi)	• Review opportunities of water sharing between the mines;	Section 13
23 c. (vi)	• Share water monitoring data where practicable;	Section 13

Condition	Requirement	Section Addressed
23 c. (vi)	• Undertakes joint investigation/ studies in relation to complaints/ exceedances of trigger levels where cumulative impacts are considered likely; and	Section 13
23 c. (vi)	• Where practicable, co-ordinate modelling programs for validation, re-calibration and re-running of water models.	Section 13
23 c. (vi)	The Applicant must implement the management plan as approved by the Secretary.	
Schedule 5		
10.	Within 3 months of: (a) the submission of an Annual Review under condition 3 above; (b) the submission of an incident report under condition 11 below; (c) the submission of an audit under condition 4 above; or (d) any modification to the conditions of this consent, the Applicant shall review, and if necessary revise, the strategies, plans, and programs required under this consent to the satisfaction of the Secretary. Where this review leads to revisions in any such document, then within 2 months of the review the revised document must be submitted to the Secretary for approval, unless the conditions in Schedule 3 provide for an alternative timing and/or the Secretary agrees otherwise. *Note: This is to ensure the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the development.*	Section 14

2.3 Mining Leases

The requirements of mining leases, ML1313, ML1597, Cumnock Sublease ML 1552 and CCL 708 that are relevant to the WMP are outlined in ***Table 3.***

Table 3 Mining Leases

Mining Lease	Item	Requirement	Section addressed
ML 1313	14	*Settling dams or other dams constructed or to be constructed on the subject area shall be constructed, maintained and sealed to the satisfaction of the Inspector.*	Section 8
	15	*The lease holder shall provide and maintain efficient means to prevent contaminated waters discharging or escaping from the subject area onto surrounding areas*	Section 6 and 8
	29	*Where the lease holder intends to conduct operations in or adjacent to any river, stream, creek, tributary, lake, dam or reservoir the subject of a proclamation under the Fisheries and Oyster Farms Act, 1935, relating to or prohibiting the taking of species of fish, the lease holder shall, not less than seven (7) days before commencement of such operations give notice in writing to the District Inspector of Fisheries setting out details of such operations and the river, stream, creek, tributary, lake, dam or reservoir that shall or may be affected thereby*	Not applicable

Mining Lease	Item	Requirement	Section addressed
	30	*The lease holder shall provide and maintain to the satisfaction of the Minister efficient means to prevent contamination, pollution, erosion or siltation of any river, stream, creek, tributary, lake, dam, reservoir, watercourse or catchment area or any undue interference to fish or their environment and shall observe any instruction given or which may be given by the Minister with a view to preventing or minimising the contamination, pollution, erosion or siltation of any river, stream, creek, tributary, lake, dam, reservoir, watercourse or catchment area, or any undue interference to fish or their environment.*	Section 6 and 8
	56	*The lease holder shall maintain an underground reserve of water of a minimum of 2,000 megalitres in disused underground mine workings of the land hereby demised and shall at all times permit Novacoal Australia Pty Ltd and Mitsubishi Development Pty Ltd and their respective successors and assigns to have access to that underground reserve for the purpose of obtaining water for use in connection with the operations of the Howick Joint Venture.*	Section 6
	35	*The lease holder shall conduct operations in such a manner as not to cause or aggravate soil erosion and the lease holder shall observe and perform any instructions given or which may be given by the Minister with a view to minimising or preventing soil erosion.*	Section 8
	37	*The lease holder shall ensure that the run off from any disturbed area including the overflow from any depression or ponded area is discharged in such a manner that it will not cause erosion*	Section 8
ML 1597	18	*Operations must be carried out in a manner that does not cause or aggravate air pollution, water pollution (including sedimentation) or soil contamination or erosion, unless otherwise authorised by a relevant approval, and in accordance with an accepted Mining Operation Plan. For the purpose of this condition, water shall be taken to include any watercourse, waterbody or groundwaters. The lease holder must observe and perform any instructions given by the Director-General in this regard.*	Section 6 and 8
	32	*The lease holder shall maintain an underground reserve of water of a minimum of 2,000 megalitres in disused underground mine workings of the land hereby demised and shall at all times permit Coal and Allied Operations Pty Ltd and it's successors and assigns to have access to that underground reserve for the purpose of obtaining water for use in connection with the operations of the Hunter Valley Mine.*	-
ML 1552	16	*Operations must be carried out in a manner that does not cause or aggravate air pollution, water pollution (including sedimentation) or soil contamination or erosion, unless otherwise authorised by a relevant approval, and in accordance with an accepted Mining Operations Plan. For the purpose of this condition, water shall be taken to include watercourse, waterbody or groundwaters. The lease holder must observe and perform any instructions given by the Director-General in this regard.*	Section 6 and 8
CCL 708	27	*The registered holder shall provide and maintain to the satisfaction of the Minister efficient means to prevent contamination, pollution, erosion or siltation of any stream or watercourse or catchment area or any undue interference to fish or their environment and shall observe any instruction which may be given by the Minister with a view to preventing or minimising the contamination, pollution, erosion or siltation of any stream, watercourse or catchment area, or any undue interference to fish or their environment.*	Section 6 and 8

2.4 Environmental Protection Licence

LCO operates under a single Environment Protection Licence (EPL 2094). EPL 2094 contains two Licenced Discharge Points (LDPs), LDP 5 and LDP 6. A maximum discharge of 100 ML per day is stipulated for LDP 6 which is the HRSTS monitoring point. Details of each LDP and associated water quality limits are outlined in ***Table 4*** below. Refer to ***Figure 2***for the location of the LDPs. Additionally, EPL 2094 contains four discharge to pipeline points, 11 ambient water quality monitoring locations and one discharge to utilisation area. Table 4 below also outlines the various EPL points, site reference names and monitoring parameters required.

Table 4 EPL Points

EPL Point	Site Information	Point Type	Parameter	Units of Measure	Frequency	100 percentile concentration limit
5	MIA treatment plant	Discharge quality monitoring Effluent quality monitoring	E. coli	Colony forming units per 100 millilitres	Once a month	100
			pH	pH	Once a month	-
6	HRSTS discharge point to Bayswater Creek adjacent CHPP	Discharge Quality Volume Monitoring	pH	pH	Daily when wastes discharged	6.5 – 9.0
			Total suspended solids	milligrams per litre	Daily when wastes discharged	120
			Flow	megalitres per day		100
			Conductivity	Microsiemens per centimetre	Continuous during discharge	-
			Turbidity	Nephelometric turbidity units	Continuous during discharge	-
16	Mine water transfer to Ravensworth Mine	Discharge to pipeline	-	-	-	-
17	Mine water transfer to Mt Owen mine	Discharge to pipeline	-	-	-	-
18	Mine water transfer to HV Operations Mine	Discharge to pipeline	-	-	-	-
19	BCK1	Ambient water quality monitoring	Conductivity	Microsiemens per centimetre	Monthly	-
			pH	pH	Monthly	-

EPL Point	Site Information	Point Type	Parameter	Units of Measure	Frequency	100 percentile concentration limit
			Total suspended solids	milligrams per litre	Monthly	-
			Turbidity	Nephelometric turbidity units	Monthly	-
20	BCK1a	Ambient water quality monitoring	Conductivity	Microsiemens per centimetre	Monthly	-
			pH	pH	Monthly	-
			Total suspended solids	milligrams per litre	Monthly	-
			Turbidity	Nephelometric turbidity units	Monthly	-
21	BCK2	Ambient water quality monitoring	Conductivity	Microsiemens per centimetre	Monthly	-
			pH	pH	Monthly	-
			Total suspended solids	milligrams per litre	Monthly	-
			Turbidity	Nephelometric turbidity units	Monthly	-
22	BCK2a	Ambient water quality monitoring	Conductivity	Microsiemens per centimetre	Monthly	-
			pH	pH	Monthly	-
			Total suspended solids	milligrams per litre	Monthly	-
			Turbidity	Nephelometric turbidity units	Monthly	-
23	BCK3	Ambient water quality monitoring	Conductivity	Microsiemens per centimetre	Monthly	-
			pH	pH	Monthly	-
			Total suspended solids	milligrams per litre	Monthly	-
			Turbidity	Nephelometric turbidity units	Monthly	-
24	BCK4	Ambient water quality monitoring	Conductivity	Microsiemens per centimetre	Monthly	-
			pH	pH	Monthly	-
			Total suspended solids	milligrams per litre	Monthly	-

EPL Point	Site Information	Point Type	Parameter	Units of Measure	Frequency	100 percentile concentration limit
			Turbidity	Nephelometric turbidity units	Monthly	-
25	BCK5	Ambient water quality monitoring	Conductivity	Microsiemens per centimetre	Monthly	-
			pH	pH	Monthly	-
			Total suspended solids	milligrams per litre	Monthly	-
			Turbidity	Nephelometric turbidity units	Monthly	-
26	BCK6	Ambient water quality monitoring	Conductivity	Microsiemens per centimetre	Monthly	-
			pH	pH	Monthly	-
			Total suspended solids	milligrams per litre	Monthly	-
			Turbidity	Nephelometric turbidity units	Monthly	-
27	Bayswater Upstream	Ambient water quality monitoring	Conductivity	Microsiemens per centimetre	Monthly	-
			pH	pH	Monthly	-
			Total suspended solids	milligrams per litre	Monthly	-
			Turbidity	Nephelometric turbidity units	Monthly	-
28	Bayswater Midstream	Ambient water quality monitoring	Conductivity	Microsiemens per centimetre	Monthly	-
			pH	pH	Monthly	-
			Total suspended solids	milligrams per litre	Monthly	-
			Turbidity	Nephelometric turbidity units	Monthly	-
29	Bayswater Downstream	Ambient water quality monitoring	Conductivity	Microsiemens per centimetre	Monthly	-
			pH	pH	Monthly	-
			Total suspended solids	milligrams per litre	Monthly	-
			Turbidity	Nephelometric turbidity units	Monthly	-

EPL Point	Site Information	Point Type	Parameter	Units of Measure	Frequency	100 percentile concentration limit
30	Mine water transfer to HV Operations Mine	Discharge to pipeline				-
31	CHPP STP Irrigation Area	Discharge to utilisation area				-

2.5 Groundwater Licences

LCO currently holds groundwater extraction licences as outlined below in ***Table 5.***

Table 5 Groundwater Extraction Licences

Groundwater Licences						
Locality	**Licence No.**	**Holder**	**Lot/DP**	**Purpose**	**Annual Extraction Allocation (ML)**	**Annual Extraction 2020 (ML)**
Haz 6	20BL168066	Liddell Tenements Pty Ltd	81/607296	Monitoring	N/A	N/A
Dur 3	20BL168065	Liddell Tenements Pty Ltd	31/837350	Monitoring	N/A	N/A
LC1	20BL168064	Liddell Tenements Pty Ltd	353/867083	Monitoring	N/A	N/A
Durham 1	WAL41499	Liddell Tenements Pty Ltd	33/862516	Industrial	6000	0
8 South 3 & 4	WAL41498	Liddell Tenements Pty Ltd	32/870789	Industrial	6000*	0
Durham 2 & 4	WAL41497	Liddell Tenements Pty Ltd	3/237654	Industrial (2 bores)	1000	0
Haz 1&2	WAL39760	Enex Liddell Pty Ltd Mitsui Mitsushima Australia Pty Ltd	81/607296	Industrial (2 bores)	5500	0

Groundwater Licences						
ALV1, ALV2, ALV3, ALV4, ALV7, ALV8, ALV9	20BL168053	LCO Pty Ltd	43/654013 201/848078 4/255403 81/607296 6/255403 32/545601	Test bore/Monitoring	N/A	N/A
M49	WAL41493	Liddell Southern Tenements Pty Ltd	32/545601	Dewatering	2500**	233
Mt Owen 1	WAL41493 (previously 20BL168209)	Mt Owen Pty Ltd	353/867083	Stock, domestic, farming and test purposes	2500**	0
Mt Owen 2	20BL169544	Mt Owen Pty Ltd	353/867083	Dewatering	2500	0
Middle Liddell	WAL41498	LCO Pty Ltd	1/237766	Dewatering	6000*	75

*Single allocation of 6000ML/yr shared between 8 South 3&4 and Middle Liddell.
**Single allocation of 2500ML/yr shared between M49 and Mt Owen 1

2.6 Surface Water Licences

LCO currently holds surface water extraction licences as outlined below in ***Table 6***.

Table 6 Surface Water Extraction Licences

Surface Water Extraction Licences						
Locality	**Licence No.**	**Holder**	**Use**	**Water Source/ Management Zone/ Type**	**Annual Allocation (ML)**	**Annual Usage (ML)**
Bowmans Creek	WAL18320	Enex Foydell Pty Ltd	Irrigation	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	50	Nil
Bowmans Creek	WAL18304	Enex Foydell Pty Ltd	Irrigation	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	32	Nil
Bowmans Creek	WAL18318	Novacoal Australia Pty Ltd	Irrigation	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	55	Nil

Surface Water Extraction Licences						
Bayswater Creek	WAL18306	Mitsushima Australia Pty Ltd Enex Liddell Pty Ltd Gabume Pty Ltd	Industrial (coal mining)	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	100	Nil
Bowmans Creek Alluvial	WAL18302	Liddell Southern Tenements Pty Ltd	Irrigation	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	5	Nil
Bowmans Creek Alluvial	20WA210940 (awaiting WAL allocation)	Enex Foydell Limited	Irrigation	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	5	Nil
Hunter River via AGL Macquarie Generation	WAL7815	Liddell Tenements Pty Ltd	Industrial	Hunter Regulated River Water Source/ Zone 1B Regulated River	20	Nil

3. Existing Site Overview

3.1 Landuse

LCO has been highly disturbed in the past by land clearing for agriculture and is now dominated by exotic pasture with isolated areas of native vegetation on some hill crests, mid slopes and drainage lines (SLR, 2013). Approximately 3/4 of LCO has been extensively cleared for approved mining related activities, including mine pits, water storage dams, Coal Handling and Preparation Plant (CHPP), workshops, haul roads and mine infrastructure area.

3.2 Topography

The Soil and Land Resource Assessment (SLR, 2013b) conducted for Mod 5 describes the topography of LCO as comprising gently undulating hills with local relief of up to 90 metres. LCO includes very gently inclined and alluvial fans (1 - 3%), bordered by gently inclined rises (3 - 10 per cent) at elevations ranging from 100 m AHD to 185 m AHD.

3.3 Hydrology

The LCO surface water catchment flows either to Lake Liddell to the northwest, Bowmans Creek to the east or Bayswater Creek to the southwest. Bowmans Creek has a total catchment area of approximately 265 km2 (G&A, 2014) and flows in a southerly direction along the majority of the eastern LCO boundary.

Bayswater Creek has a total catchment area of approximately 96 km2 (G&A, 2014) and flows from Lake Liddell in the south easterly direction along the upper portion of the south western LCO boundary before flowing southerly towards the Hunter River. Chain of Ponds Creek, a tributary of Bayswater Creek also flows in a southerly direction through the southern tip of LCO to its confluence with Bayswater Creek approximately 150 m to the south of LCO. Lake Liddell, an artificial lake constructed to supply water to several power stations in the area, was created by damming Bayswater Creek, collecting runoff from the upper portion of the creek's catchment. Bayswater Creek has been engineered in its upper section to accept discharges from Lake Liddell which is now the primary source of stream flow to the creek. The remaining catchment below Lake Liddell is insufficient to maintain continuous flow in the creek (Umwelt, 2006)

3.4 Geology and Hydrogeology

LCO is located within the Hunter Coalfield of the Permian and Triassic Sydney Basin. The area is underlain by Permian aged Wittingham Coal Measures of the Singleton Super Group (SKM, 2014). The basal unit of the Wittingham Coal Measures is the Saltwater Creek Formation which comprises siltstones and sandstones and minor coal seams. Above the Saltwater Creek Formation, the remaining Wittingham Coal Measures can be divided into two coal bearing subgroups, the Vane Subgroup and the Jerrys Plains Subgroup with a marker bed known as the Archerfield Sandstone separating them. The coal seams are separated by interburden units comprised of sandstone, siltstone, conglomerate, mudstone and shale (SKM, 2014).

LCO is located above the Bayswater Syncline and Camberwell Anticline structural folds. An impervious, north easterly striking dyke, which has previously affected underground mining, is present in the southeast of the site (MER, 2001). Further south, the dyke is known to become faulted and south of LCO the zone is identified as the Davis Creek fault (SKM, 2014).

The Permian strata are overlain by alluvial deposits along the watercourses of Bayswater Creek and Bowmans Creek, tributaries of the Hunter River.

Two aquifer systems are identified within LCO and its vicinity:

a) Localised shallow unconfined water table aquifers associated with the alluvial sediments of Bayswater Creek and Bowmans Creek and the discontinuous aquifers of the shallow (generally weathered) bedrock;

b) Regional hard rock aquifer found within the Permian-aged coal seams (the Wittingham Coal Measures)

The alluvial aquifers of the Hunter River and its tributaries are generally characterised by unconsolidated deposits of silts, sands and gravels of varying permeability. Shallow bedrock aquifers occur beneath the alluvial systems and discontinuously across the landscape. The shallow bedrock aquifers are variously connected and disconnected to the overlying alluvial aquifers. These weathered rocks are of varying but high permeabilities, which generally decreases with depth. The permeability of the underlying coal measures' sequence aquifers within the region are generally orders of magnitude lower than the water table aquifer systems (SKM, 2014).

3.5 Soil Landscapes

The soil landscapes within LCO were described within the Soil and Land Resource Assessment conducted as part of the Environmental Assessment for Mod 5 (SLR, 2013), with reference to Soil Landscapes of the Singleton 1:250 000 Sheet (Kovac and Lawrie, 1991). The Liddell Soil Landscape unit covers the vast majority of the Mod 5 area, with the Hunter Soil Landscape unit covering a small region on the eastern limit of the Entrance Pit Extension area.

3.5.1 Liddell Soil Landscape

The Liddell Soil Landscape unit consists undulating low hills and undulating hills. Slope gradients range from 4-7% with local relief of 60-120 m. The vegetation type is open woodland. Soils are dominated by Yellow Soloths (Dy2.41, Dy3.81) on slopes with some Yellow Solodic Soils (Dy3.32, Dy2.42, Dy3.42) on concave slopes. There are Earthy and Siliceous Sands (Uc5.22, Uc5.11) on mid to lower slopes. Some Red Soloths (Dr2.4 1), Red Solodic Soils and Red Podzolic Soils (Dr5.11) are also present. These soils are associated with a Land Capability of V – VI. Limitations to this unit include minor to severe sheet erosion with some minor rill erosion. Moderate gully erosion (up to 1.5m) can also occur in drainage lines.

3.5.2 Hunter Soil Landscape

The Hunter Soil Landscape unit consists of alluvial floodplains of the Hunter River and its tributaries. Slope gradients range from 0-3% with local relief of <10m. The landscape is cleared of native vegetation due to agricultural uses. Soils are dominated by Brown Clays and Black Earths (Ug5.34, Ug5.17) on prior stream channels and tributary flats. Alluvial soils (Loams, Um5 and Sands, Um5.52, Um6.1, Uc) occur on levees and flats adjacent to the current river channel. Red Podzolic Soils and Lateritic Podzolic Soils (Dr2.11, Db2.41) are located on old terraces, with Non-calcic Brown Soils (Db1.13) and Yellow Sodolic Soils in some drainage lines. These soils are associated with a Land Capability of I – II.

3.5.3 Sodic and Dispersible Soils

The land capability of the Entrance Pit and South Pit extension areas approved under Mod 5 consists predominantly of Class V land (169 ha, 66%), with some Class II (6.6 ha, 3%), Class IV (17.8 ha, 7%), and land disturbed by approved mine related infrastructure. Class V land (land use classified as grazing, occasional cultivation) would require management practices such as soil conservation measures to be implemented to overcome limitations associated with low fertility and dispersibility.

The extension areas consist predominantly of Class 3 agricultural land (187.3 ha, 73%), a classification which indicates the land is suited to grazing and pasture improvement. Overall, production level is moderate due to soil factors such as sodicity, salinity and erodibility. The potential for acid generation from regolith material (topsoil and subsoil) and overburden is considered low.

The primary management and mitigation measures that LCO employ to address issues regarding sodic and dispersive soils include:

a) Improving the soil structure via soil amelioration through the addition of gypsum or lime or organics, or a combination of the above, at quantified rates to the soil;

b) Establishing a vegetation cover to protect against soil detachment;

c) Covering the dispersive soil with a non-dispersive topsoil or mulch; or

d) Application of a chemical binder (used on the haul roads).

If a dispersive soil is eroded then potentially sediment-laden runoff is directed into site containment structures (sediment dams, sumps, mine pit) to prevent it from leaving site untreated. Further information on erosion and sediment controls is provided in Section 8.

4. Water Management Principles and Objectives

4.1 General

Water management at LCO is based on adherence to well-established, best water management practices in the Mine Site Water Management Handbook (Minerals Council of Australia, 1997). These general principles are:

a) Efficient use of water based on the concepts of 'reduce, re-use and recycle'

b) Avoiding or minimising contamination of clean water streams and catchments

c) Protecting downstream water quality for beneficial uses

4.2 Water Management Classes, Design Objectives and Performance Criteria

Under Section 120 of the Protection of the Environment Operations Act 1997 (POEO Act) it is an offence to pollute waters or cause harm unless licenced to do so. Inherent in the concept of not causing harm is the need to manage the risk of spilling from water management dams or related infrastructure, and an understanding of the background qualities in the various creeks.

For management purposes, four classes of water have been identified at LCO, being Mine Water, Dirty Water, Clean Water and Effluent. The class is typically dependent upon the source of the runoff. Dirty Water and Mine Water are effectively managed in the same way at LCO. ***Table 7*** describes the classes of water on site including their source, target design objectives / performance criteria and the way they are managed.

Table 7 Water types design and treatment objectives and criteria

Water Classification	Description and Source(s) of runoff	Target Design Objective / Performance Criteria	Treatment
Mine Water	Water exposed to coal or used in coal processing. Sources of runoff may include: • Open cut mine pits • Water dewatered from former underground workings • Haul roads and hardstand areas • Coal handling and stockpile areas	Minimise interruption to mining through pro-active dewatering of open cut pits and former underground workings. Ensure adequate storage of water to meet operational water demand for operations and prevent uncontrolled discharge offsite. Diversion / storage infrastructure designed,	Water is contained within the IWMS. Water undergoes settlement treatment via a series of storage / sediment dams. Refer to ESCP (***Section 8***) for further details of how the dams are managed. Potential for controlled release to Bayswater Creek under the HRSTS and EPL2094 conditions.

Water Classification	Description and Source(s) of runoff	Target Design Objective / Performance Criteria	Treatment
	• Mine infrastructure areas (industrial area, workshop and vehicle re-fuelling areas) • Active overburden emplacement areas	installed and maintained in line with the Blue Book (Managing Urban Stormwater: Soils and Construction Volumes 1 and 2) and the LCO ESCP as detailed in Section 8.	Water from mine infrastructure areas receives additional treatment such as oil and water separators.
Dirty Water	Runoff from disturbed areas (during both construction and operation). Sources of runoff include: • Rehabilitated overburden emplacement areas; • General disturbed areas (e.g. construction areas, pre-stripped areas etc)	Diversion / storage infrastructure designed, installed and maintained in line with the Blue Book (Managing Urban Stormwater: Soils and Construction Volumes 1 and 2) and the LCO ESCP as detailed in Section 8.	Runoff intercepted from disturbed areas is drained to sediment dams for settlement treatment prior to being reused within the IWMS. Refer to ESCP (Section 8) for further details of how the dams are managed. Potential for controlled release to Bayswater Creek under the HRSTS and EPL2094 conditions.
Clean Water	Runoff from undisturbed or rehabilitated areas	Clean water diversion drains and banks designed in accordance with the Blue Book (*Managing Urban Stormwater: Soils and Construction Volumes 1 and 2*) and the LCO ESCP as detailed in Section 8.	Runoff intercepted from undisturbed or rehabilitated areas is diverted around disturbed areas and released to local creeks.
Effluent	Effluent from the domestic sewage treatment facility	Treated to achieve effluent quality target in accordance with EPL2094.	Effluent from the Mine Infrastructure Area complex is treated at the wastewater treatment plant prior to being reused onsite or discharged via LDP5 under EPL 2094. Effluent from the CHPP area is treated at an aerated sewage treatment plant before being disposed of via onsite irrigation.

4.3 Current Operational Philosophy

The operational objectives of the water management system are:

a) To maintain a low risk of uncontrolled discharge occurring from the process water (CHPP) or mine water systems over the mine life.

b) To minimise the need to export water and salt to the Hunter River by maximising re-use on-site and by transferring excess water to other nearby mining operations.

c) To minimise risks of disruption to mining operations by efficient mine and underground workings dewatering.

d) To ensure that effective control over generation of airborne particulates is not interrupted due to lack of water by maintaining a reliable water supply.

e) To ensure uninterrupted operation of the CHPP by maintaining a reliable water supply.

LCO is guided in its decisions using a life-of-mine water balance model and Greater Ravensworth Area Water System (refer to ***Section 7***) which will enable the prediction of future water supply security and risks of excess open cut pit water.

4.4 Final Voids

Two final voids, the Entrance pit and South pit, will remain at LCO upon cessation of mining as a result of the operation of two separate pits on opposite sides of the Main Northern Railway Line.

There are a number of factors constraining the design and management of the final voids at LCO. The location of the railway line through the mining area presents a considerable constraint and ensuring its long term stability is LCOs primary objective.

LCO has and will continue to work successfully within the existing constraints and the following design objectives and performance criteria when mining both pits:

a) Maximise the coal resource extraction;

b) Provide a safe work environment through appropriate geotechnical stability of highwalls;

c) Protect the integrity of the Main Northern Railway Line by limiting mining to the land outside the zone adjacent to the railway line which is; enclosed by an angle of draw of 35 degrees from the vertical plane of the boundary; and, parallel to a thirty metres horizontal distance from either side of the railways lands. This requirement relating to underground mining methods is stipulated in Clause 31 of ML1597 and has been adopted by LCO in relation to open cut mining methods;

d) Protect the integrity of the Transgrid 132kV powerlines and the Telstra Sydney to Brisbane fibre optic cable adjacent to the Main Northern Railway Line, in accordance with ML1597 Clause 19;

e) Protect the integrity of the Old New England Highway, in accordance with ML1597 Clause 21(a); and

f) Protect the environmentally sensitive Bowmans Creek alluvium.

The final design and size of both final voids has been carefully considered and designed based on a number of factors including provision of sufficient capacity to store water and tailings to meet operational water usage requirements and sizing the voids sufficiently to retain future groundwater and surface water runoff beyond mining to prevent the likelihood of an offsite discharge of water.

A water balance of the final voids was undertaken as part of the Surface Water Assessment for MOD 5 (G&A, 2014) and the results confirm that the voids have been sufficiently sized to reach a state of equilibrium (i.e. approximately 67m AHD within 50 years following the end of mining).

Further detail pertaining to the final voids is contained within the LCO Mining Operations Plan.

5. Existing Water Management System

5.1 General

Water at LCO is managed through the Integrated Water Management System (IWMS) which has evolved to manage groundwater, surface runoff, mine water from the open cut and underground mining areas and decant from the CHPP tailings storages. Water is sourced from groundwater in former underground workings, and surface water that accumulates in above ground mine storages including open cut sumps and tailings decant.

Water intercepted by the mining operations meets the site raw water supply requirement. Surplus water onsite can either be discharged under the Hunter River Salinity Trading Scheme or pumped back into the underground workings. Water can also be transferred offsite to the Mt Owen Complex, Coal & Allied operations and Ravensworth Operations.

The existing water management system is extended and modified as part of continued LCO operations. As the mining area progresses new water management structures are constructed and/or decommissioned, as required, to ensure containment of mine affected water. The IWMS enables pumping of water around the site, typically from the Reservoir North Dam as the central storage for the site.

The Reservoir North Dam supplies the LCO CHPP, and occasionally Ravensworth CHPP, Hunter Valley Operations Howick and Newdell CHPPs, and the Mt Owen Complex. In order to prevent water inflow to the open cut pits (from former underground workings) from disrupting the open cut operations, water is extracted from the former underground workings and transferred primarily to the Reservoir North Dam, via a number of staging dams and pumps. Surface water runoff collected in both open cut pits and other dams can also be pumped to the Reservoir North Dam. A schematic of the current IWMS is shown in ***Figure 2***.Water is preferentially recycled on site for use in the CHPP washing process, for haul road dust suppression, to maintain the statutory volumes of water required for operational purposes and to control spontaneous combustion in the open cut pits. Water is also lost through evaporation or discharged via the LDP's.

Sewage is treated onsite and either reused within the IWMS or disposed of at a designated effluent irrigation area in accordance with the EPL.

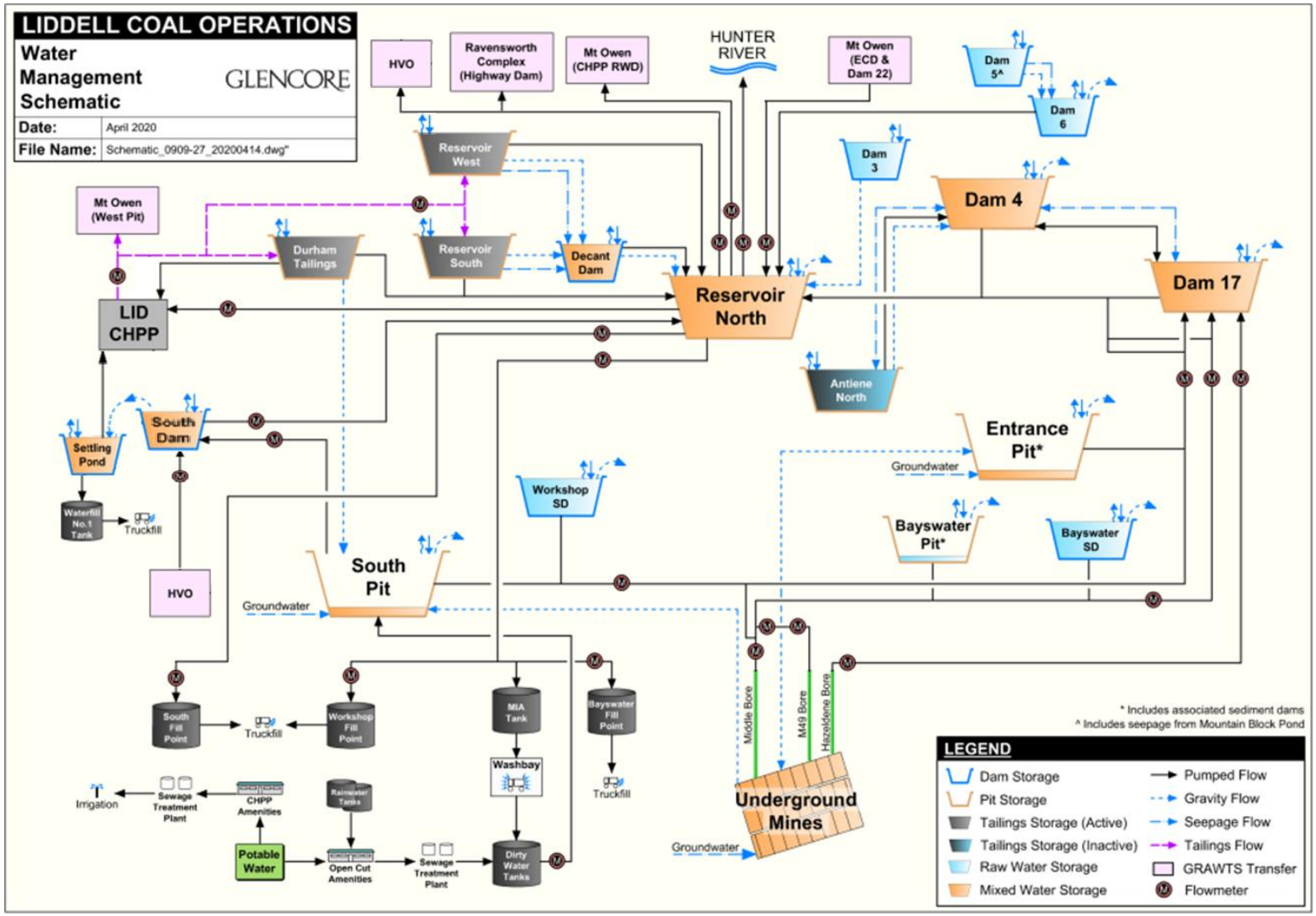


Figure 2 Schematic of Integrated Water Management System

5.2 Clean Water Management

Clean water runoff from undisturbed areas or successfully rehabilitated areas is managed as far as practically possible independently of the IWMS. Diversion drains and banks are constructed where practical to divert clean water to nearby watercourses or existing drainage lines. Clean water management is undertaken in accordance with the Blue Book and the ESCP as outlined in ***Section 8***.

5.3 Integrated (Dirty / Mine) Water Management

The IWMS includes the collection, management and distribution of water pumped from the underground workings and open cut pits, runoff and seepage from overburden emplacement areas, and management of water affected by coal handling and processing activities.

The IWMS comprises various dams, including water storage dams, pollution control and sediment dams and the associated pumps and pipelines. Storages at other Greater Ravensworth Area Operations connected to the system are not listed.

Table 8 indicates the main dams and storage areas currently part of the IWMS together with their approximate design capacity and function.

Table 8 Water Storages

Storage	Capacity (ML)	Description and Use
Reservoir North Dam	2000	The Reservoir North Dam is the main water storage on site. It is located in the north east of LCO. The Reservoir North Dam receives water pumped from both open cut pits, other dams and the former Liddell underground workings via bores. The Reservoir North Dam provides make-up supply to the CHPP, supply to neighbouring Coal & Allied operations, Ravensworth Operations and Mt Owen (via agreement) and water-truck fill points (for dust suppression). Controlled discharges from the Reservoir North Dam can occur to Bayswater Creek under the provisions of the HRSTS and EPL 2094. The Reservoir North Dam will also receive the Liddell proportion of tailings decant return water from the West Pit Tailings Emplacement Area once the pipeline connection is constructed and operating, estimated to occur in 2018 as approved under DA MOD 6.
Dam 4	687	Dam 4 is a disused open cut void adjacent to Bowmans Creek at the north-eastern end of the LCO area. Water in Dam 4 is currently used for control of spontaneous combustion in the Entrance Pit and supplementary source of water for the Reservoir North Dam. Dam 4 also receives decant water from the various tailings dam facilities. It is also hydraulically connected to Dam 17 through mine spoil, and via a pump.
Dam 17	200	Dam 17 is another disused open cut void adjacent to Bowmans Creek and just south of Dam 4. It is understood that Dam 4 and Dam 17 are hydraulically connected. Water from Dam 17 is used for the control of spontaneous combustion in the South Pit, and water supply to the Entrance Pit Water Fill Point. Water can be pumped to the Reservoir North Dam, to/from Dam 4 and from the Hazeldene bores.
Durham Pit – Tailings Storage	3300	The Durham Pit replaced the Reservoir Tailings Emplacement area as the current tailings storage facility at the start of 2015.

Storage	Capacity (ML)	Description and Use
Decant Dam	188	The Decant Dam is a small dam used for storing decanted tailings water. Water is decanted from the surfaces of Durham Pit tailings dam and transferred to the Reservoir North Dam for reuse onsite.
Workshop Sediment Dam	13	The Workshop Sediment Dam is located adjacent to the workshop.
Bayswater Sediment Dam	2	The Bayswater Sediment Dam is located adjacent the Bayswater Pit capturing runoff from surrounding infrastructure areas.
CHPP South Dam	11	The CHPP South Dam is located to the south of the CHPP area adjacent to Bayswater Creek. This dam's primary use is to act as a staging point for transfer of water from South Pit to Reservoir North Dam. Water is pumped to the CHPP area or to a truck fill point as required.
CHPP Settling Pond	20	The CHPP Settling Pond is located to the north of the CHPP area.
Hazeldene Underground	2575	Flooded underground workings. Hazeldene bores are capable of transferring water between the Entrance Pit, the underground workings and Dam 17.
Liddell Underground	6732	Flooded underground workings. The M49 bore and Middle Liddell bore are capable of water transfer between the South Pit, the Middle Liddell underground workings and Reservoir North dam.

5.3.1 Underground Workings Water Management

The underground workings (Liddell Underground and Hazeldene Underground), act as sinks and storage areas for regional groundwater (SKM, 2013). The underground workings are dewatered to ensure the safe and efficient progression of open cut workings. Surplus water can also be pumped back into the underground workings when discharge opportunities under the HRSTS are unavailable.

5.3.1.1 Liddell Underground

The Liddell Underground comprises the former Liddell Colliery underground workings, split into three groups (at different depths), namely, 8 South Underground, Middle Liddell Seam and the M49 Underground. The undergrounds join/spill into each other at different levels. The 8 South and Middle undergrounds also spill to the South Pit as they are progressively mined through. Bores are used to dewater the M49 and Middle Undergrounds with water currently pumped to the Reservoir North Dam.

5.3.1.2 Hazeldene Underground

The former Hazeldene Colliery underground workings are generally located beneath the north-eastern end of the LCO area and beneath Bowmans Creek. The workings are split into (at different depths); Pikes Gully Seam, Upper Liddell Seam and Liddell Seam. As mining in the Entrance Pit progresses in the future, bores will be used to dewater the Hazeldene Underground in order to maintain a water level of 60 m AHD for geotechnical stability. Water is pumped to Dam 4 / Dam 17.

5.3.2 Open Cut Pit Water Management

Water accumulated in the South Pit and Entrance Pit floor is pumped to the Reservoir North Dam. Water volumes in pit are normally kept to a practical minimum so as not to restrict mining operations.

5.3.3 CHPP Water Management

The CHPP consumes water in the washing process. Tailings from the CHPP are currently pumped to the onsite Durham Tailings Void. Runoff in the CHPP area is contained in a local sump and then recycled into the CHPP for use as process water in a closed operating loop. During 2018, a tailings pipeline is planned to be constructed to transfer tailings to the West Pit Tailings Emplacement Area at Mt Owen Complex as approved by DA 305-11-01 Modification 6. This modification improves the tailings management strategy for Liddell by removing the need for tailings cells being constructed in the South Pit overburden dumps once emplacement is completed in the Durham Void and the South Pit void being completed during 2020.

5.3.4 Overburden Emplacement Water Management

Runoff from overburden emplacements upslope of the South Pit and Entrance Pit is directed to the South Pit and Entrance Pit respectively.

5.4 Water Uses / Pollution Control

Water collected within the IWMS is used for:

a) Coal washing at the CHPP

b) Control of spontaneous combustion within the open cut pits

c) Haul road dust suppression

d) Vehicle wash down

Water may also be transferred to other mining operations via water sharing arrangements, including both neighbouring Mt Owen Complex and Ravensworth Operations (Glencore mines) and Hunter Valley Operations (Glencore and Yancoal Joint Venture).

LCO operates light and heavy vehicle wash infrastructure at the MIA and CHPP to mitigate tracking of mud material offsite and prepare equipment for maintenance by removing material hang up hazards. At each vehicle wash bay, oil water separators are employed to mitigate pollution risk from hydrocarbons such as oil and grease that may be present on equipment. Potential contaminated waste materials are managed as per the LCO Waste Management Plan and LCO Waste Management Bioremediation Area Procedure.

5.5 Controlled Discharges

5.5.1 Discharges via Licenced Discharge Points

There are currently two EPL licenced discharge points (LDPs); LDP5 and LDP 6, as described in ***Section 2.4*** *and shown on* ***Figure 11.***

Treated wastewater is discharged from the sewage treatment plant via LDP5 as described in ***Section 5.6***. Discharge quality is limited in accordance with EPL 2094 (as described in ***Section 2.4***).

Water is currently pumped from the Reservoir North Dam at a controlled rate via LDP6 into Bayswater Creek. Discharges are limited in accordance with EPL 2094 (as described in ***Section 2.4***) and the Hunter River Salinity Trading Scheme (HRSTS). The HRSTS allows controlled discharges via LDPs based on volume and electrical conductivity during high or flood flows in the river. The total allowable discharge is determined by Water NSW on a daily basis with reference to the scheme's target salinity (EC) level

of 900µS/cm for the lower sector of the HRSTS. The amount of saline water that may be discharged by a given discharge licence holder is determined by reference to the salinity of the discharge waters, the river flow, the number of credits held and the EPL 2094 limits. LCO currently holds credits and the amount changes every two years dependent on those that expire and those purchased at a salinity credit auction.

5.6 Sewage Treatment

Sewage generated by the Mine Infrastructure Area complex is treated by a waste water treatment system to a concentration of <100 CFU of E.coli per 100mL as per the requirements Condition L.2.4 of EPL 2094 and Schedule 4 Condition 21C. The treated effluent is pumped to the IWMS via LDP5 for re-use.

Sewage generated by the CHPP and associated infrastructure is collected in the CHPP sewage treatment tanks, and pumped to the aerated sewage treatment plant prior to disposal at the designated effluent irrigation area.

5.7 Desalination Plant

LCO has approval via Schedule 4 Condition 22 of DA305-11-01 (as modified) to treat excess mine water via a desalination plant and the discharge of this treated water into Lake Liddell. Since the operation of a desalination plant was approved as part of the 2006 development consent modification (Umwelt, 2006a), the treatment and discharge of excess water has not been required and therefore a desalination plant has not been constructed.

If the treatment and discharge of excess mine water is necessary in the future, the most appropriate method for the treatment and disposal of brine will be further investigated in consultation with relevant government agencies. This water management plan and the water balance model will be updated prior to constructing any mine water treatment plant.

6. Future Water Management

6.1 General

As mining progresses, the overburden emplacement areas also advance, with emplacement occurring behind the advancing open cut pits. Runoff from rehabilitated areas is initially directed to mine water storages and retained within the mine water management system. Once rehabilitated areas revegetate and become stable, runoff will be directed to sediment retention storages prior to being allowed to drain to local drainage lines.

The future changes to the LCO IWMS revolve around continued operations as approved by DA305-11-01 (as modified) and EPBC Approval 2013/6908, which include the following key activities:

a) Progression of mining within the South Pit Extension;

b) Progression of mining within the Entrance Pit Extension;

c) Construction of the new components of the water management system as mining progresses such as water fill points, etc.;

d) Construction of tailings pipeline from the LCO CHPP to the West Pit Tailings Emplacement Area

e) Construction of a tailings emplacement with the South Pit Void at conclusion of mining in this area; and

f) Construction of additional haul roads and infrastructure areas.

As the WMP is reviewed and updated additional future activities are included and described.

Whilst water management occurs generally in accordance with the principles and water management system described in Sections 4 and 5 of this WMP, various components of the existing IWMS may change as a result of continued operations, including:

a) The construction of additional water management infrastructure to manage runoff and seepage from disturbance areas until rehabilitation is established, and other drainage infrastructure such as diversion drains around mining related infrastructure.

b) Construction of tailings pipeline as described above ready for use in approximately 2018;

c) The open cut dewatering system, which pumps from different locations and at lower elevations than is currently the case requiring additional dewatering equipment.

General development of the water management until anticipated completion of mining in 2024 is described below. This is indicative only based on current mine plan schedule, and is subject to mine sequence changes as required. Detailed mine plans can be referenced in the approved Mining Operations Plan (MOP), also referred to as the LCO Rehabilitation Plan, as approved by NSW Department of Planning, Industry and Environment - Resources Regulator (RR)

As the Durham Pit nears full capacity, tailings from the CHPP are proposed to be emplaced in each of the facilities onsite (reservoir south, reservoir west and Durham) to maximise storage capacity. Tailings may also be pumped to the West Pit Tailings Emplacement Area as necessary.

6.2 2020 till Completion of Mining (2024)

Mining continues in the southern extents of the South Pit, with ongoing development of the associated overburden emplacement. Water management comprises drainage from the South Pit overburden emplacement directed to the South Pit and managed as required.

Mining will continue in the Entrance Pit with ongoing development of the planned mining sequence. Final clearing of approved mining footprint will be completed in early 2020. Drainage management for the overburden dumps and mining areas continue to report to the Entrance and Bayswater Pit areas for management as well as including the direction of water to the South Pit via railway culverts where required by topography. Drainage from the southern and eastern sides of the Entrance Pit overburden emplacement would be directed to Dam 17.

The following items are noteworthy amendments to the IMWS during this timeframe till completion of mining. Timeframes are indicative.

- Mining operations balanced between South Pit and Entrance/Bayswater Pit for life of mine;
- Tailings from LCO CHPP will continue to be directed to the West Pit Tailings Emplacement area with occasional deposition in LCO tailings dams to reach final deposition levels as settlement occurs.

6.3 Final Landform Drainage

The final landform will consist of two final voids, one in the South Pit and one in the Entrance Pit. A conceptual drainage plan is presented in the EA for Mod 5 (SLR, 2013) and was designed to ensure clean rainfall runoff is safely conveyed offsite and away from the final voids to minimise their catchment area.

The South Pit and Entrance Pit final landforms are be connected underground via the remnant Middle Underground workings, whilst drainage from the rehabilitated overburden emplacement areas will be directed off site via a system of swales, berm drains and drop structures. The northern portion of the South Pit overburden emplacement area will eventually drain into Lake Liddell while the remaining area will ultimately drain to Bayswater Creek. The west side of the Entrance Pit overburden emplacement area will be directed to a drain adjacent to the Main Northern Railway line and will drain to the south to Bowmans Creek, while the remainder will ultimately drain directly or via small tributaries to Bowmans Creek.

No drainage lines are to be reinstated within the final landform. The two major creeks in the vicinity of LCO, namely Bowmans and Bayswater Creeks, have not and will not be diverted or realigned by LCO. The only drainage line to be removed as a result of future approved mining activities is a small portion of Chain of Ponds Creek near its confluence with Bayswater Creek. The location of the South Pit final void will be in the original location of this creek and it therefore cannot be reinstated in the final landform. The original small catchment of Chain of Ponds Creek not affected by LCO operations however will be directed to Bayswater Creek in the final landform.

7. Site Water Balance

The water management system at LCO is integrated, that is, the water from both the open cut operations and former underground operations is managed together, in an integrated system (refer ***Section 5)***. The future performance of the integrated system is simulated using a water balance model and the Greater Ravensworth Area Water Management System.

Inflows which contribute to the LCO water balance include site rainfall runoff, tailings water reclaim, former underground inflows and water sourced from neighbouring operations. Outflows from the LCO water balance include evaporation, water used in the CHPP (entrained in product as well as output in tailings), for dust suppression, vehicle washdown, to mitigate spontaneous combustion in waste rock emplacements, water exported to neighbouring operations and controlled release of surplus water in accordance with EPL 2094 and the Hunter River Salinity Trading Scheme (HRSTS).

LCO store water on site to maintain supply security during dry conditions, and maximise the water reuse in the CHPP and for dust suppression. The main water storage at LCO onwards is the Reservoir North Dam, with a capacity of approximately 2,000 ML.

A Life-of-Mine water balance model developed for the LCO water management system which has been integrated with models of the two neighbouring Glencore mines (Ravensworth Operations and the Mt Owen complex) water management systems. The model is used to predict surface runoff, evaporation, longer term supply, reliability, storage inventory and discharge requirements.

7.1 Model Overview

The structure of the LCO water balance model has been based on the storages and linkages shown in schematic form in ***Figure 2.*** The model undertakes a mass balance on all simulated water storages on a sub-daily time step. The model simulates the 8-year period (1/1/2015 to 31/12/2022) to the end of the planned mine life using a long period of available climatic data for the region (1892 to 2012). One hundred and twenty one possible eight year climatic "scenarios" are simulated using the available climatic record. The results from all scenarios are used to generate water storage volume estimates and other relevant water balance statistics.

The model uses output from the Hunter River Integrated Quantity Quality Model (IQQM) in order to simulate variations in Hunter River water flows, from which opportunities for water release in accordance with the HRSTS are computed.

The model has been updated to simulate the planned forward mine life based on current and available future mining stage plans. Modelled dam and other storage catchment areas were derived from these plans.

Figure 3 summarises the total catchment area reporting to the mine water management system over the simulated mine life. ***Figure 3*** indicates that the contributing catchment area varies between 12.9 to 14.3 km2. Progressive rehabilitation of waste rock emplacements was assumed, with runoff from areas that are fully rehabilitated assumed directed off site and hence removed from the water management system.

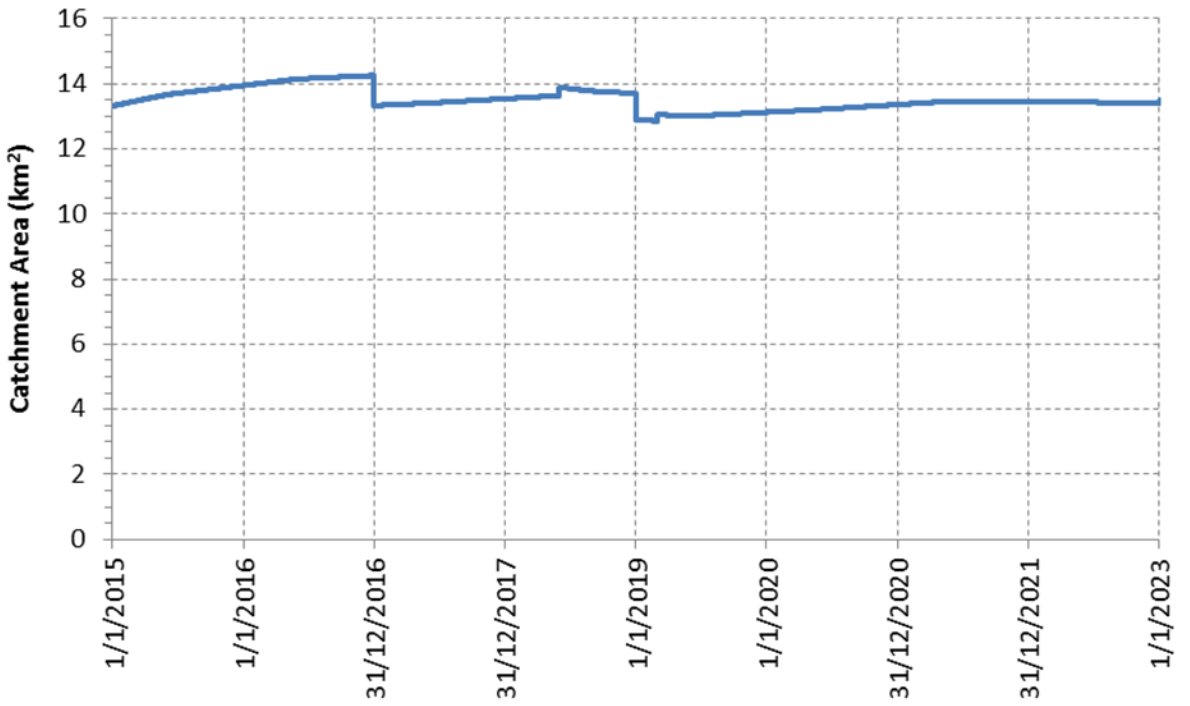


Figure 3 Total Catchment Area Versus Time

The catchment areas were split into different sub-catchment types for rainfall-runoff modelling. Sub-catchments were defined on the basis of vegetation coverage and surface type. Sub-catchment types included in the model were: hardstand (roads, roofed, paved areas), natural surface, open cut, tailings, active waste rock and rehabilitated waste rock emplacements.

The Australian Water Balance Model (AWBM - Boughton, 2004) was used to simulate runoff from rainfall on the various catchments and landforms across the mine area. The AWBM is a catchment-scale water balance model that estimates surface flow from rainfall and evaporation. Different AWBM parameters were used for each sub-catchment type. AWBM parameters for natural surface sub-catchments were taken from regional AWBM calibrations undertaken using streamflow gauging stations. Parameters for other sub-catchments were set based on experience with similar projects.

Simulation of controlled discharge via the HRSTS was undertaken, including simulation of allowable periods of HRSTS discharge according to the number of credits held by LCO (75). A maximum release rate of approximately 350 L/s (30 ML/d) from the Reservoir North dam was simulated. Water was simulated to be released from the Reservoir North dam if the volume stored was greater than an estimated low storage volume of 480 ML, and if the total accessible stored water volume on site (in all storages) exceeded 1,000 ML.

The initial stored water volume, based on monitored surface storage and former underground water levels and adopted storage level-volume relationships, as at the start of 2015 was approximately 5,900 ML.

Key water demands are summarised as follows (averaged over the simulation period):

a) CHPP make-up: 4.1 ML/day

b) Dust suppression: 0.7 ML/day

c) Spontaneous combustion mitigation: 0.6 ML/day

d) Supply to Coal & Allied operations: 0.3 ML/day

e) Mine infrastructure area (vehicle washdown, etc.): 0.11 ML/day

Supply to and water sourced from neighbouring Glencore operations was calculated as part of the simulation of the integrated water management systems.

7.2 Overall Site Water Balance Model Results

Table 9 below summarises the water balance for LCO for the median (50th percentile) rainfall scenario (averaged over the simulation period).

Table 9 Summary Water Balance for Median Rainfall Scenario

Parameter	Average Inflows (ML)
Rainfall Runoff	1,621
Tailings Decant (water liberated as tailings settle)	846
Underground Groundwater Inflow	305
Pit Groundwater Inflow	1,383
Water Sourced from Neighbouring Operations	742
TOTAL	**4,897**
Parameter	Average Outflows (ML)
Evaporation	481
HRSTS Release	243
CHPP Supply	1,428

Haul Road Dust Suppression Supply	262
Net Spontaneous Combustion Supply (Loss)*	17
Mine Infrastructure Area Supply	42
Supply to Neighbouring Operations	1,931
TOTAL	**4,404**

* Assumes 10% of water supplied for Spon Com mitigation is lost

The total volume of water stored at LCO (total inventory) is tracked over the simulation period and is shown in ***Figure 4*** as probability plots, derived from all 121 scenarios.

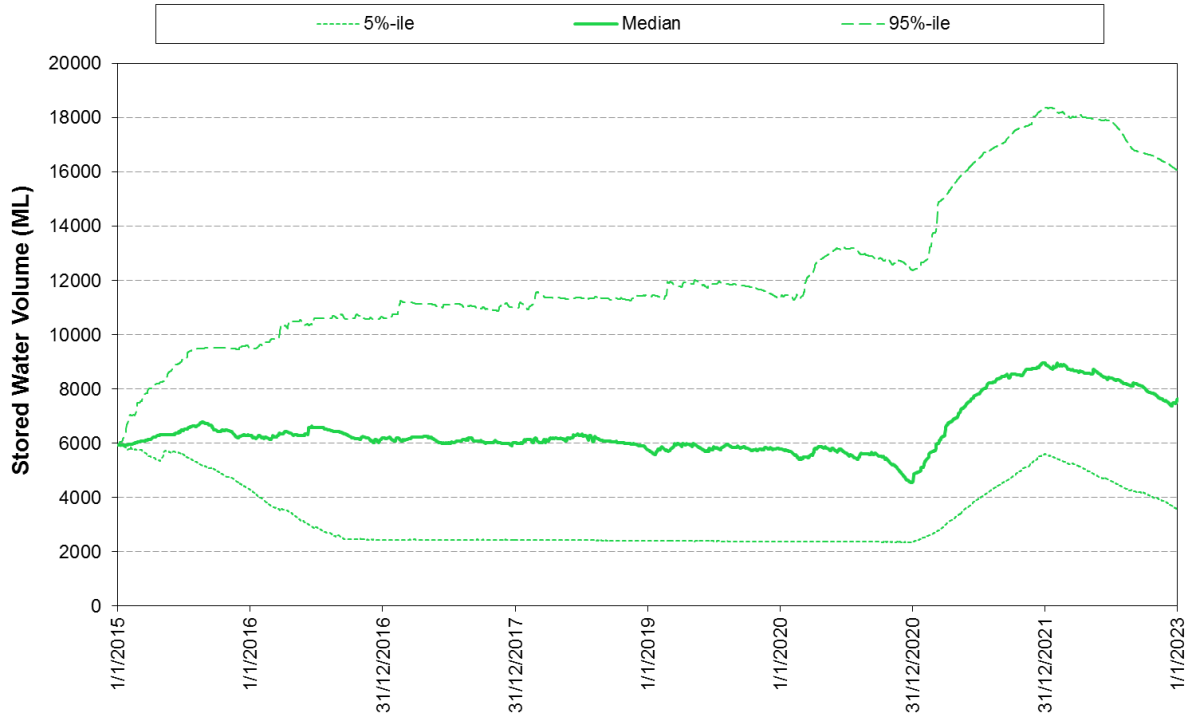


Figure 4 Simulated Total Water Stored on Site

7.2.1 Water Supply Reliability

No water supply shortfalls were identified in any of the climatic scenarios simulated for the remaining mine life. This implies a high level of supply security. LCO will continue to monitor the mine water balance during the operation's life and use the water balance model predictions to forecast the risk and magnitude of any future water supply shortfalls.

As discussed further in Section 13, LCO is part of the Greater Ravensworth Water Sharing System (GRWSS) which operates across the Glencore mining operations within the Ravensworth area, namely LCO, the Mt Owen Complex and Ravensworth Complex. A Greater Ravensworth Area Water Balance Model has been developed incorporating the three mining operations, the results of which enable the probability of various water balance outcomes to be predicted and thereby minimise risks to water supply security at the individual operations through the sharing of water between operations.

7.2.2 Controlled Releases

Figure 5 shows model predicted average annual (calendar year) controlled releases from Reservoir North dam via the HRSTS.

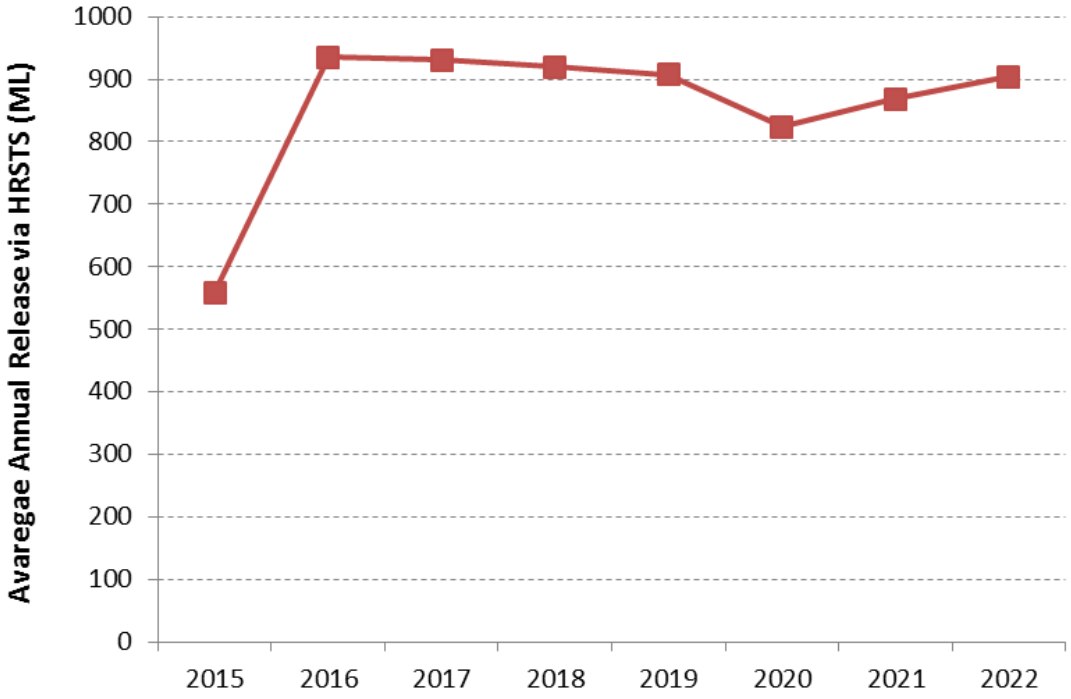


Figure 5 Simulated average annual HRSTS release

7.3 Water Efficiency

The majority of water used at LCO is sourced from rainfall runoff within the mine disturbance area, from groundwater inflow to open cut pits and former underground workings or from water recycled from settling tailings. Site runoff is typically combined with the more saline groundwater and tailings water within the water management system and reticulated around the site for reuse. Collected water is used for dust suppression, in the CHPP (coal washing), for spontaneous combustion mitigation, or is lost to evaporation or transferred to neighbouring operations. LCO does not undertake direct licensed extraction from the Hunter River or any other regulated streams.

Through preferentially sourcing water from the water management system and given the storage buffering capacity provided by the site water storages, there is a reduced need to discharge water off site (via the HRSTS) or to source water from or export to neighbouring operations. To augment LCO water storage buffering capacity, LCO maintains its Environmental Protection Licence and infrastructure to enable discharge water off site via the HRSTS as well as the ability to export water to neighbouring operations.

A number of measures to minimise water use on site at LCO have been implemented as follows:

a) Tailings thickening and flocculation and the priority use of water reclaimed from the tailings storages;

b) Storage and use of runoff from disturbed areas;

c) Use of water reclaimed from former underground operations; and

d) Inspections and maintenance of water management infrastructure.

7.4 Water Balance Monitoring and Model Validation

As part of the water management system, LCO routinely monitor and record site rainfall, and volumes of water:

a) imported to site from neighbouring operations,

b) used on site,

c) exported to neighbouring operations,

d) discharged in accordance with the HRSTS, and

e) stored on site.

The majority of this data is collected and reviewed annually and reported as part of the Annual Review process, and will allow the water balance model to be initially calibrated and then periodically validated every three years.

Calibration will be undertaken using monthly data as listed above on water use, water export, water import (if any), discharge, water levels in all storages (including former undergrounds), and daily rainfall, as well as 'snapshot' plans of the mine for the period of the foregoing data. The model will then be calibrated by adjusting groundwater inflows and rainfall runoff model parameters so that it reproduces the historical observed water level (volume) changes in all site storages.

Each year the modelled and actual water balance is compared and reported in the Annual Review. Initial model calibration occurred in 2016; recalibration then occurred mid-2017 and mid-2020. Model calibrations are required every three years in accordance with the requirement of DA 305-11-01.

7.5 Water Balance Model Review

Water balance review, using the above monitored volumes and data, is undertaken annually and reported as part of the LCO Annual Review.

8. Erosion and Sediment Control

8.1 Objective

The Erosion and Sediment Control Plan (ESCP) fulfils the requirements of the relevant development consent conditions, in particular Condition 23 (c) (ii) of DA 305-11-01 (as modified), and relevant statutory requirements for LCO.

The objective of the ESCP is to ensure that appropriate procedures and programs of work are in place to:

- Meet the requirements of the development consent;
- Meet the requirements of Managing Urban Stormwater: Soils and Construction (the Blue Book), Volume 1 and Volume 2E – Mines and Quarries (Landcom, 2004 and Department of Environment and Climate Change (DECC), 2008);
- Meet the requirements of EPL 2094 with regards to total suspended solids;

- Identify activities that could cause soil erosion and generate sediment;
- Minimise soil erosion and the potential discharge of sediment to downstream waters during mining and recommend erosion and sediment controls in accordance with best management practices;
- Describe the location, function, and capacity of erosion and sediment control structures; and
- Ensure erosion and sediment control structures are appropriately maintained.

8.2 Existing Environment

Details on the existing land use, topography, soil landscapes and units and hydrology pertaining to LCO are outlined in Section 3.

8.3 Erosion and Sediment Causing Activities and Potential Impacts

The aspects of continued open cut mining operations and related activities that have the potential to cause erosion and/or generate sediment and impact on the surrounding catchment areas if not properly managed are:

- Vegetation removal / disturbance;
- Topsoil stripping and stockpiling;
- Overburden dumps and rehabilitated emplacement areas;
- The management and rehabilitation of tailings and reject emplacement areas;
- Coal stockpiles and coal handling equipment areas;
- Vehicle and equipment movements;
- Construction of water management structures (i.e. dams, diversion drains); and
- Construction/maintenance of haul roads, access roads, surface facilities and boreholes.

Potential erosion and sedimentation impacts which may result from LCOs mining operations and related activities include:

- increased runoff volumes and velocities from the removal of vegetation, land disturbance and the introduction of impervious surfaces on the hard stand areas;
- increased potential for sedimentation to occur from increased erosion and runoff associated with open cut mining, stockpiling of material and the construction of surface facilities, access roads/tracks and exploration drilling;
- potential decline in water quality and degradation of local amenities through increased potential for transfer of sediment and dust to nearby watercourses; and
- potential for changes in discharge volumes and quality under the LCO discharge licence.

This ESCP provides control measures appropriate for these activities in order to prevent adverse impacts on surrounding catchment areas and receiving waters.

8.4 Ground Disturbance Permits and Erosion and Sediment Control Activities

Prior to any disturbance activities being undertaken at LCO, a Ground Disturbance Permit (GDP) (CAA-HSEC-PER-0004) is required to be completed. The purpose of the GDP is to identify and address any potential environmental, community, infrastructure or safety hazards associated with the proposed works, and the proposed controls. As part of completing the GDP, an ESCP is required to be developed for the proposed works and the controls must be implemented prior to the main disturbance activity occurring.

All erosion and sediment control activities are to be undertaken in accordance with the following guidelines:

- Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004) and Volumes 2A - Installation of Services, 2C - Unsealed Roads, and 2E - Mines and Quarries (DECC, 2008) (the Blue Book).
- Glencore's internal protocol 11.06 Erosion and Sediment Control (Glencore, 2015).

The authorised Environment & Community (E&C) representative will consider all relevant site approvals and plans such as Life of Mine Plans, MOPs, DAs, EAs, MLs, any other relevant environmental management plans, and relevant legislation (e.g. Water Management Act, etc.) prior to approving the GDP.

As part of the verification process the authorised E&C representative will visit the site to observe where the proposed works will be carried out. The intent of the site visit is for the E&C Representative to understand the actual location of the proposed works. The inspection will include whether the area has been demarcated (e.g. pegged, flagging tape etc.) and to understand the environmental context of the area including such aspects as proximity to drainage lines, receiving waters, community and sensitive receivers, flora and fauna, cultural heritage and the existing landform, etc.

Following approval of the GDP and during the course of the works the E&C representative undertakes planned and unplanned task monitoring and site inspections to verify the identified controls have been installed and are operational.

On completion of the ground disturbance activity the E&C representative undertakes a post-disturbance inspection and assessment. Completed GDPs are stored in line with site procedures and for at least a period of three years including spatial data used in assessing the permit.

8.5 Erosion and Sediment Controls

8.5.1 General

The water management system at LCO captures runoff from the footprint of the mining disturbance and rehabilitation areas. Erosion and sediment control structures / measures are, implemented, for the management of erosion and sediment control across all disturbance activities at LCO to mitigate the impacts of the operation on watercourses and the surrounding environment during the construction, operational and rehabilitation phases of the life of the mine. Standard erosion and sediment control techniques and management principles are used in accordance with the requirements of the Blue Book and the Glencore E&SC protocol.

8.5.2 Construction & Operational Phase

Water quality measures will be implemented during the operational phase to minimise impact on the surrounding environment. These controls will be designed and constructed to a standard consistent with the Blue Book.

The measures to minimise erosion and the generation of sediment include the following:

- clearly identifying and delineating areas required to be disturbed and ensuring that disturbance is limited to those areas, clearing as little vegetation as required and minimising machinery disturbance outside of these areas;
- interception of runoff from disturbed catchment areas in pit floors or sediment dams;
- diversion of clean runoff through drains away from disturbed areas;
- reshaping, topsoiling and vegetating road cut and fill batters as soon as practical;
- progressively stripping and stockpiling topsoil for later use in rehabilitation;
- regular maintenance of all erosion and sediment controls and rehabilitated areas;
- regular inspections of access tracks/roads to ensure that drainage is working effectively and that the tracks/roads are stable, particularly after rain;
- prompt revegetation of areas as soon as earthworks and mining are complete;
- maximising onsite re-use of mine water and runoff (e.g. from CHPP area) for dust suppression, fire control and coal processing;
- installation and maintenance of oil separators in the truck wash and refuelling areas;
- maintenance of silt traps on the truck wash area; and
- placement of 'oil booms' (or other devices performing the same function), where practical at the outlets of dams which have the potential to capture any hydrocarbon related spills.

8.5.3 Rehabilitation Phase

Rehabilitation at LCO will be undertaken in accordance with the LCO Mining Operations Plan and the LCO Biodiversity Management Plan. Rehabilitation of the overburden emplacement areas and backfilled pits will be conducted progressively and as soon as practicable over the life of the mine, as an integral component of mining operations. The erosion and sediment controls to be implemented during the rehabilitation phase include:

- construction of drainage controls to improve the stability of rehabilitated land;
- reshaping, topsoiling and vegetating former areas used for earthworks, roads and batters as soon as practical upon completion of works;
- the application of gypsum or lime at quantified rates to mitigate soil sodicity/dispersibility where exposed subsoils have been identified;
- encourage rapid establishment of vegetative cover on all rehabilitation areas as a priority to minimise exposed subsoils;
- control of weeds through selective herbicide application and the reseeding of areas that fail to establish as soon as practicable;

- construction and installation of erosion and sediment controls works such as silt fences, catch drains and sediment basins down slope of rehabilitation areas;
- regular inspections and maintenance of all erosion and sediment control works to ensure that they are operating in accordance with their design principles; and
- restricting access to rehabilitated areas through the use of fencing and/or signposting.

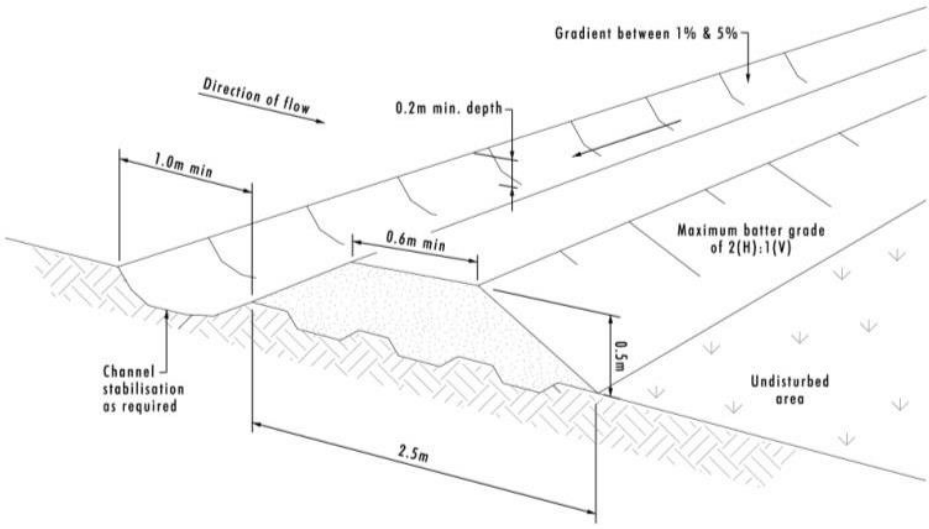
8.6 Erosion and Sediment Control Structures

Appropriate ESC structures and measures will be designed in accordance with the Blue Book and Glencore's internal protocol and utilised throughout LCO. Such ESC structures and measures may include those described in the sub-sections below.

8.6.1 Clean Water Diversion Drains and Banks

Diversion drains are to be designed in accordance with the Blue Book to cater for a minimum 1 in 10 year Average Recurrence Interval (ARI) storm event if only to be in place for less than 12 months, or a 1 in 20 year ARI storm for greater than 12 months. The side batters are to have a maximum grade of 1V: 2H (vertical: horizontal) with typical dimensions as shown in ***Figure 6*** The drains are to be located and designed with base widths so as to minimise peak velocities. Where peak design velocities exceed 1 m/s in clean water catchments and along the roadsides of permanent roads rock bars will be placed along the invert of the drain every 100 metres to reduce the peak velocities.

Clean water runoff from undisturbed areas will be diverted through drains and banks into nearby watercourses. If required, appropriate protection will be established where diverted waters enter creeks through the use of level spreaders (refer to ***Figure 7***) prior to draining into rock armoured creek banks and, if required, additional planting of grass, small shrubs and riparian species to achieve the required bank stability.



Construction Notes:

1) Construct at gradient of between 1 and 5 percent
2) Ensure banks properly compacted to avoid failure
3) Complete stabilisation within 10 days of construction
4) Drains discharging to rivers to be directed to level spreaders in accordance with Sediment and Erosion Control Plan

Use:

1) Diversion of clean runoff away from disturbed areas
2) Segregation of clean and sediment-laden runoff to prevent mixing
3) Return clean
4) Runoff to natural watercourses to reduce volumes to be treated in sediment control system

FIGURE 1

Liddell Colliery - Construction Drawing of Diversion Drain and Bank (for 2ha catchment or less)

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Figure 6 Typical Diversion Drains/Banks

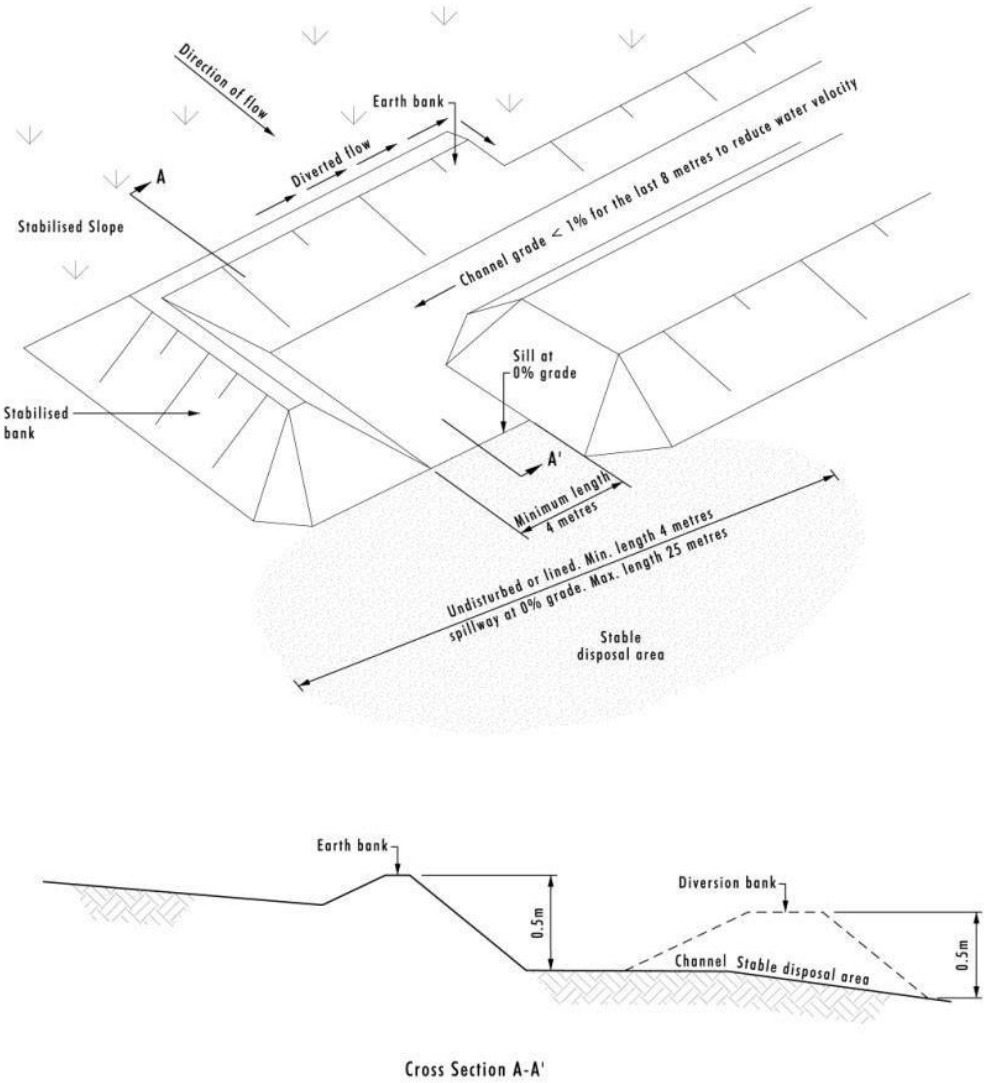


Figure 7 Typical Level Spreader Design

8.6.2 Catch Drains

Catch drains are to be used to collect water for treatment in sedimentation dams. All catch drains are to be designed in accordance with Landcom (2004), specifically Table 6.1 of Volume 2E, criteria to cater for a 1 in 20 year ARI storm event. The typical specifications of the catch drains to be implemented are shown in Figure 6. The side batters are to have a maximum grade of 1V: 2H (vertical: horizontal). The drains will be grassed where practical and will be located and designed with base widths so as to minimise peak velocities.

8.6.3 Silt Fences

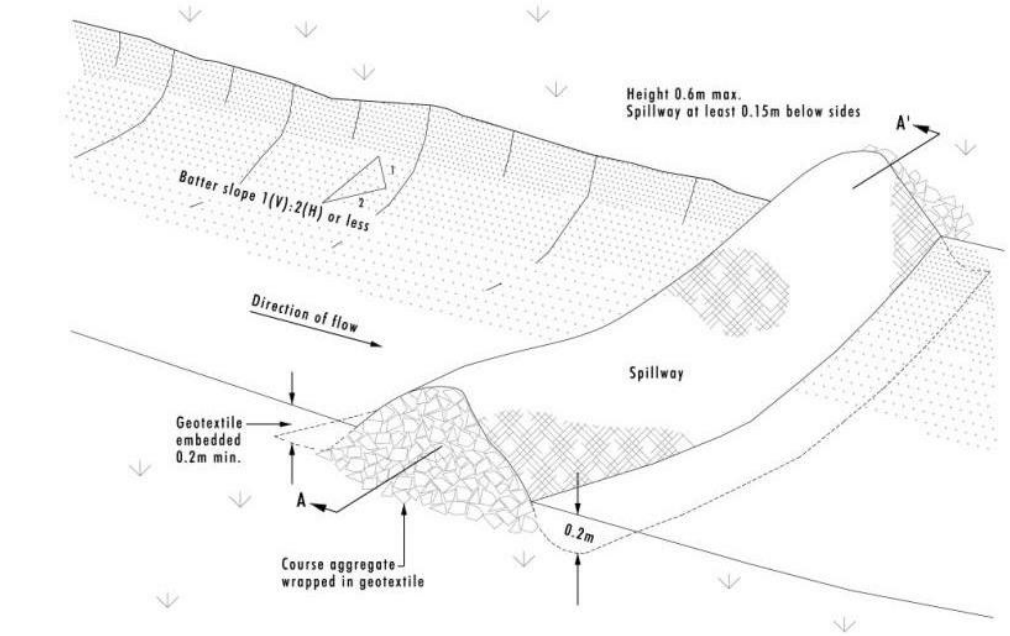
Silt fences are to be designed in accordance with Blue Book with typical dimensions shown in **Error! Reference source not found.**. Where necessary, silt fences are to be constructed immediately downslope of the areas to be disturbed to minimise the potential for sediment transport into receiving catchments and waterways. They are to be constructed along site contours if practicable and the catchment is to have a maximum grade of 1V: 2H (vertical: horizontal). Fences are to be constructed using geotextile filter fabric with structural post to be spaced no more than 1.5 metres apart.

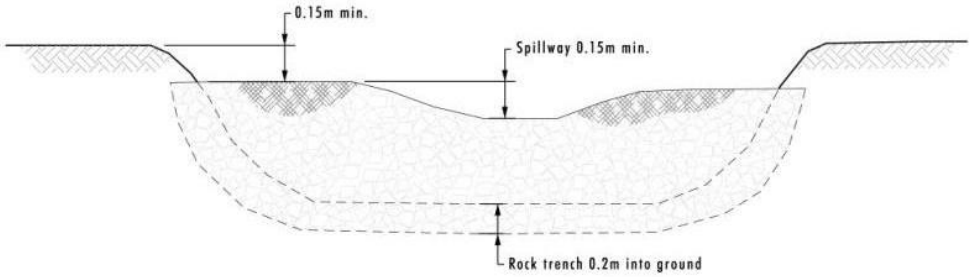
Where practicable, the catchment areas of silt fences are to be limited by constructing the fences with small returns at 20 metre intervals to create smaller contributing subcatchments (refer to **Error! Reference source not found.**) This is necessary as silt fences are prone to failure in larger storm events, and should be designed to ensure a maximum of 50 L/s passes through the silt fence during a storm event.

8.6.4 Sediment Dams

Sediment dams will be designed in accordance with the minimum requirements of Blue Book based on the topsoil and overburden characteristics and contributing area of the disturbance area; such as sodicity, salinity and erodability, groundcover, etc. Sediment dams will capture and treat dirty runoff to for the design criteria specified in Blue Book Volume 2E for each disturbed catchment. The dams will be installed where appropriate prior to any land disturbance activities occurring and maintained following completion. The erosion and sediment controls requirements will be based on the Revised Universal Soil Loss Equation (RUSLE) as described in Landcom (2004). Typically, sizing calculations assume Type F or D soil material and 5 day 95th percentile rainfall depth are utilized. Typical dimensions are shown in ***Figure 10***.

All sediment dams will be maintained in a drawn down state as far as practicable. This will be achieved by ensuring that water in the sediment dams is transferred to the water supply dams and used for dust suppression purposes on a priority basis.





Section A-A'

Construction Notes:

1) If grade exceeds 5%, line train with geofabric
2) Trench the check dam 200mm into the ground across its whole width. Fill trench to a minimum of 100mm above ground surface
3) Maximum height should not exceed 600mm above the gully floor
4) The centre should act as a spillway, being at least 150mm lower than the outer edges
5) Space dams at intervals of 100metres

Use:

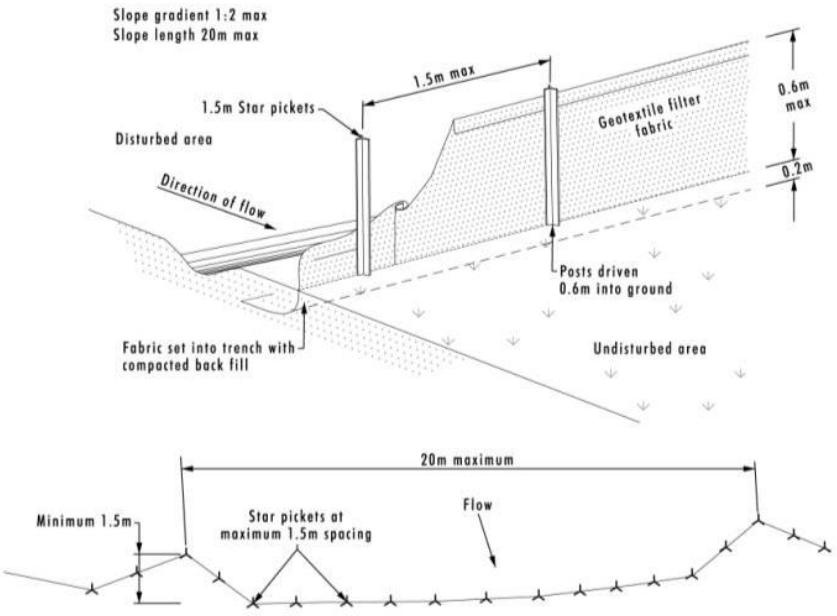
1) Reduce erosive energy levels of water concentrated in drains by reducing velocities
2) Prevent scouring of drains by reducing velocities
3) Reduce sedimentation of downstream areas by providing some sediment removal from runoff

FIGURE 4

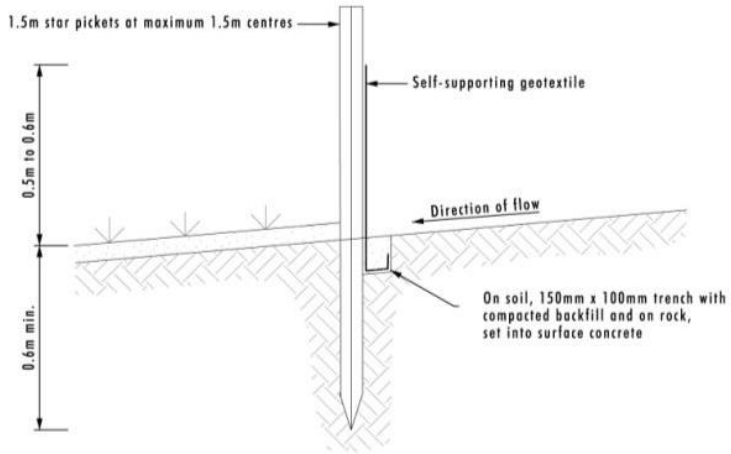
Liddell Colliery - Construction Drawing for Rock Check Dam

File Name (A4): R02_V1/2511_029.dgn

Figure 8 Typical Check Dam Design



Plan Detail



Section Detail

Construction Notes:

1) Construct sediment fence parallel to site contours (if practicable)
2) Cut a 150mm deep trench along the up slope line of the fence for the bottom of the fabric to be entrenched
3) Drive 1.5m long star pickets into ground at 1.5m intervals at the down slope edge of the trench. Fit pickets with safety caps
4) Fix self-supporting geotextile to the up slope side of the posts ensuring it sits along the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer
5) Join sections of fabric at a support post with a 150mm overlap
6) Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile

Use:

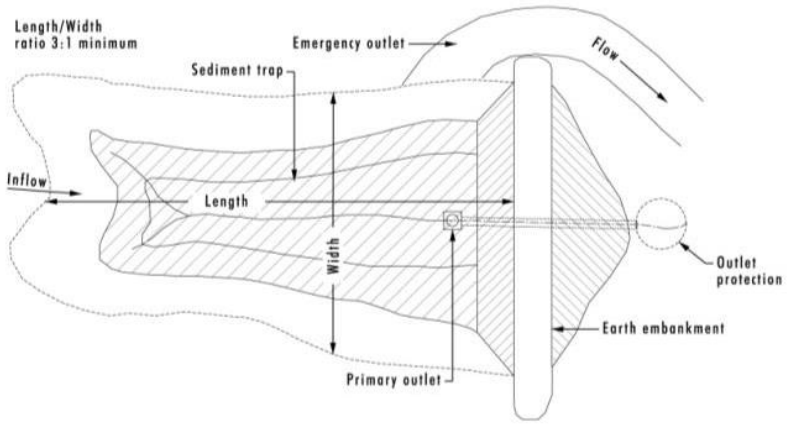
1) Interception of sediment-laden runoff from disturbed areas
2) Prevention of pollution of downstream lands and waterways
3) Capture of large-grained sediments

FIGURE 2

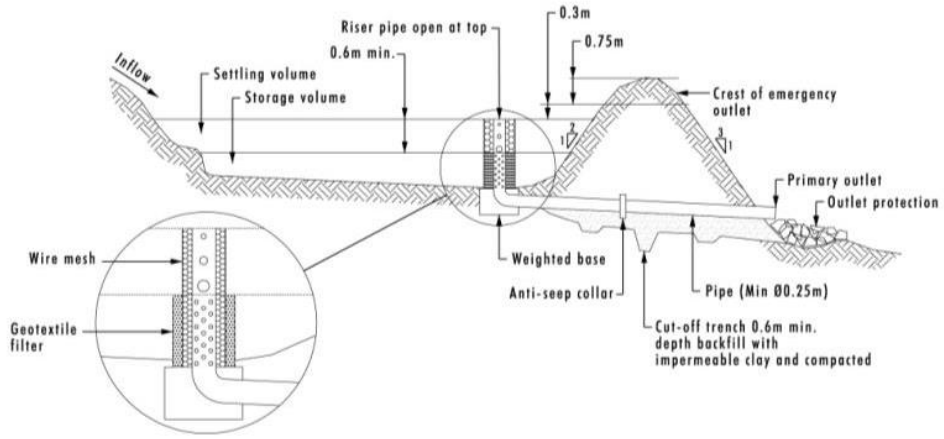
Liddell Colliery - Construction Drawing of Silt Fence

File Name (A4): R02_V1/2511_027.dgn

Figure 9 Typical Sediment Fence Construction



Plan View of Typical Sediment Basin



Cross Section of Typical Sediment Basin

Construction Notes:

1) Remove all topsoil and vegetation from under the dam wall and from within the storage area
2) Form a cut off trench under the centreline of the embankment 600mm deep and 1200mm wide, extending to a point on the watercourse wall above the riser sill level
3) Maintain the trench free of water and recompact the materials to 95 percent standard proctor density
4) Select fill that is free from roots, wood, rock, large stones or foreign material
5) Prepare the site under the embankment by ripping to at least 100mm to help bond the compacted fill to the existing substrate
6) Spread the fill in 100mm to 150mm layers and compact fill
7) Install primary outlet with seepage collar
8) Form batter grades at 2(H):1(V) upstream and 3(H):1(V) downstream of crest

Use:

1) Capture sediment - laden runoff from disturbed areas
2) Retain sediment and other materials
3) Prevent pollution of downstream waterways

FIGURE 3

Liddell Colliery- Construction Drawing for Sediment Dam

File Name (A4): R02_V1/2511_028.dgn

Figure 10 Typical Sediment Dam Construction

8.7 Erosion and Sediment Control Plans

Erosion and Sediment Control (ESC) Plans are to be prepared as part of the GDP process (refer Section 8.4). The ESC Plans are to be prepared in accordance with the Blue Book and Glencore's internal standard.

For small scale disturbances that have been assessed as having a low risk of creating environmental harm, the ESC Plan should include:

- Map features including date developed, scale bar, north arrow and legend;
- Features of the site including contours and drainage paths;
- A map of the construction site including planned areas of disturbance (cut/fill areas), no-go areas and environmental sensitive areas as relevant;
- Access roads and haulage tracks;
- Stockpile areas;
- Location and type of all permanent and temporary ESC structures and/or measures;
- Relevant construction details and specifications of all proposed ESC structures and/or measures; and
- Rehabilitation requirements (e.g. seeding and fertiliser rates).

In addition to the above, for medium to large scale disturbances or those that have been assessed as having a medium to high risk of creating environmental harm, the ESC Plan should also include:

- Information on soil type and compaction requirements;
- design calculations for sediment control features such as sediment basins;
- Staging and proposed time schedules (ESC Installation Sequence) for construction of structures and implementation of measures to control erosion and sedimentation through to rehabilitation (especially important for critical activities such as those located within watercourses).

The location of existing permanent ESC structures currently at LCO are shown in the water management system schematic (refer Figures 2). The existing permanent operating IWMS dams and their approximate design capacities and function are outlined in ***Table 8.***

Due to the nature of the operations, not all details required to be contained in an ESCP under the requirements of the Blue Book can be included on this figure. The required details are included on specific ESC Plans developed under the GDP process.

8.8 Inspections and Maintenance

8.8.1 Inspections

ESC structures and measures will be inspected regularly and monitored monthly as part of the sites environmental inspection program. Monitoring and inspections of the site will include:

- regular inspections of water levels, silt build-up, scouring or erosion and the presence of hydrocarbons within all ESC structures; and
- revegetation progress of disturbed areas.

Additional inspections will be carried out after high rainfall events to ensure the effectiveness of the controls. The inspections determine the scheduling of maintenance required for the structures / measures and the results of the water quality monitoring will assist LCO in assessing the effectiveness of the ESC structures / measures, along with highlighting any areas that may need to have additional controls or improve the function of existing controls.

8.8.2 Maintenance

Erosion and sediment control structures / measures are maintained in a functioning condition until areas have been deemed rehabilitated. Where controls are observed to be not functioning correctly, they are restored to the required standard. Where significant erosion occurs on a regular basis, additional controls are constructed.

8.8.2.1 Drains and Banks

Signs of erosion along the length of the drains and banks will be noted and remedial works undertaken as required. Where significant erosion is observed, additional erosion controls are constructed e.g. establishment of vegetation cover, use of temporary sediment devices until the vegetation is established, scour protection (rock-armouring or erosion blanket) of the channel surface.

8.8.2.2 Silt Fences

Regular visual checks are made of any sediment filter fences to identify if they are functioning adequately and repaired where required.

8.8.2.3 Sediment Dams

Sediment Dams/Basins are to be regularly maintained as follows:

- Dewatering (Settling Zone) within 5 days of a rainfall event via:
    - Transferring water to larger storages; and/or
    - Re-used on site for dust suppression/watering vegetation.
- De-silting (Sediment Storage Zone) once 30% (typically) reduction in storage capacity.

The material that is removed from the dams will be generally removed to overburden dumps or disposed of in a way which will not pollute the environment.

Note: The 'settling zone volume' is the volume of runoff predicted to report to the sediment dam during the design storm event (i.e. 90th percentile 5 day rainfall event).

The 'sediment storage zone volume' is the volume of sediment that is predicted to report to the sediment dam over a period of time (typically 2 to 12 months).

8.9 Reporting and Review

8.9.1 Reporting Requirements

The effectiveness of ESC structures / measures adopted on the site will be assessed and reported to site management as part of the site monthly environmental inspection. Completion of corrective actions identified during the monthly inspection are monitored during subsequent inspections.

For any observed large scale damage or change to surface water parameters, an incident report will be prepared and distributed to mine management. Incident reporting requirements are detailed in ***Section 11***.

A summary of the effectiveness and performance of erosion and sediment control measures will be reported in the Annual Review (This will include the details of any works undertaken including routine maintenance.

8.9.2 Review

This document details the requirements of all ESCP's implemented at LCO. This document shall be reviewed and if necessary revised in accordance with DA 305-11-01 MOD 5, Schedule 5, Condition 10; refer to Section 14.

8.10 Training and Communication

Prior to any commencement of works, the following must be undertaken, as appropriate, so any potential environmental risks identified and suitable management strategies are incorporated into the works/operations process to minimise the impact to the environment.

8.10.1 Ground Disturbance Permit

As per Section 8.3, in the event that ground disturbance works are identified then this will trigger a GDP, including an ESCP, to be completed. The directives of this plan need to be incorporated into the works and the appropriate erosion and sediment control devices and/or equipment needs to be sought.

8.10.2 Change Management

The change management process at LCO can be utilised where there are significant changes to the ESCP controls onsite. This process provides for systematic review of proposed changes, identification of communication requirements and risk assessment review.

8.10.3 Environmental Training / Induction

With respect to specific project/tasks requiring a GDP, prior to works commencing all members of the work team will attend a toolbox talk detailing the objectives and requirements of the work authorisation, GDP and any other relevant plans, standards and guidelines.

The Environment & Community Manager and the Environment & Community Officer are to provide technical support to the Manager(s) for all erosion and sediment control related issues where required.

9. Surface Water and Groundwater Monitoring Program

9.1 Surface Water

9.1.1 Monitoring Program

Ongoing surface water quality monitoring will aim to:

a) Continue to record and document the existing water qualities with creeks adjacent to LCO.

b) Review and monitor the performance of erosion and sediment controls at construction areas.

c) Continue the reporting of monitoring results in the EPL Annual Return and Annual Review which includes an assessment of results in terms of off-site impacts as a result of mining.

The surface water monitoring locations are shown in Figure 11.

9.1.1.1 Water Quality Monitoring

Surface water quality is monitored at three locations on Bayswater Creek (BWKU, BWKM and BWKD) and eight locations on Bowmans Creek (BCK1, BCK1A, BCK2, BCK2A, BCK3, BCK4, BCK5 and BCK6). The monitoring frequency for BCK1A, BCK2, BCK2A, BCK3, BCK4 and BCK5 was previously undertaken on a quarterly basis. The monitoring frequency at these locations was increased to monthly from April 2015 in accordance with condition 12(b)(i) of the EPBC Approval. In addition, HRSTS monitoring is currently conducted at LDP6 in accordance with EPL 2094.

A summary of the creek monitoring program is provided in ***Table 10***.

Table 10 Surface Water Monitoring Program

Water feature	Monitoring Location		Parameters	Monitoring Frequency
Bayswater Creek	Bayswater Creek Upstream	Just upstream of the Chain of Ponds Creek confluence	pH Electrical Conductivity Total Dissolved Solids Total Suspended Solids Turbidity	Monthly
	Bayswater Creek Midstream	South east of the CHPP area		
	Bayswater Creek Downstream	Adjacent to the western tip of LCO		
Bowmans Creek	BCK1 (Bowmans Creek Upstream)	Level with and east of the northern boundary of LCO	pH Electrical Conductivity Total Dissolved Solids Total Suspended Solids Turbidity	Monthly
	BCK1A	South east of Dam 6		
	BCK2	East of Dam 4		
	BCK2A	East of Dam 17		
	BCK3	North west of the Transfer Dam		
	BCK4	South west of the Transfer Dam		

Water feature	Monitoring Location		Parameters	Monitoring Frequency
	BCK5	East of the entrance pit extension		
	BCK6 (Bowmans Downstream)	West of the Mining infrastructure area		

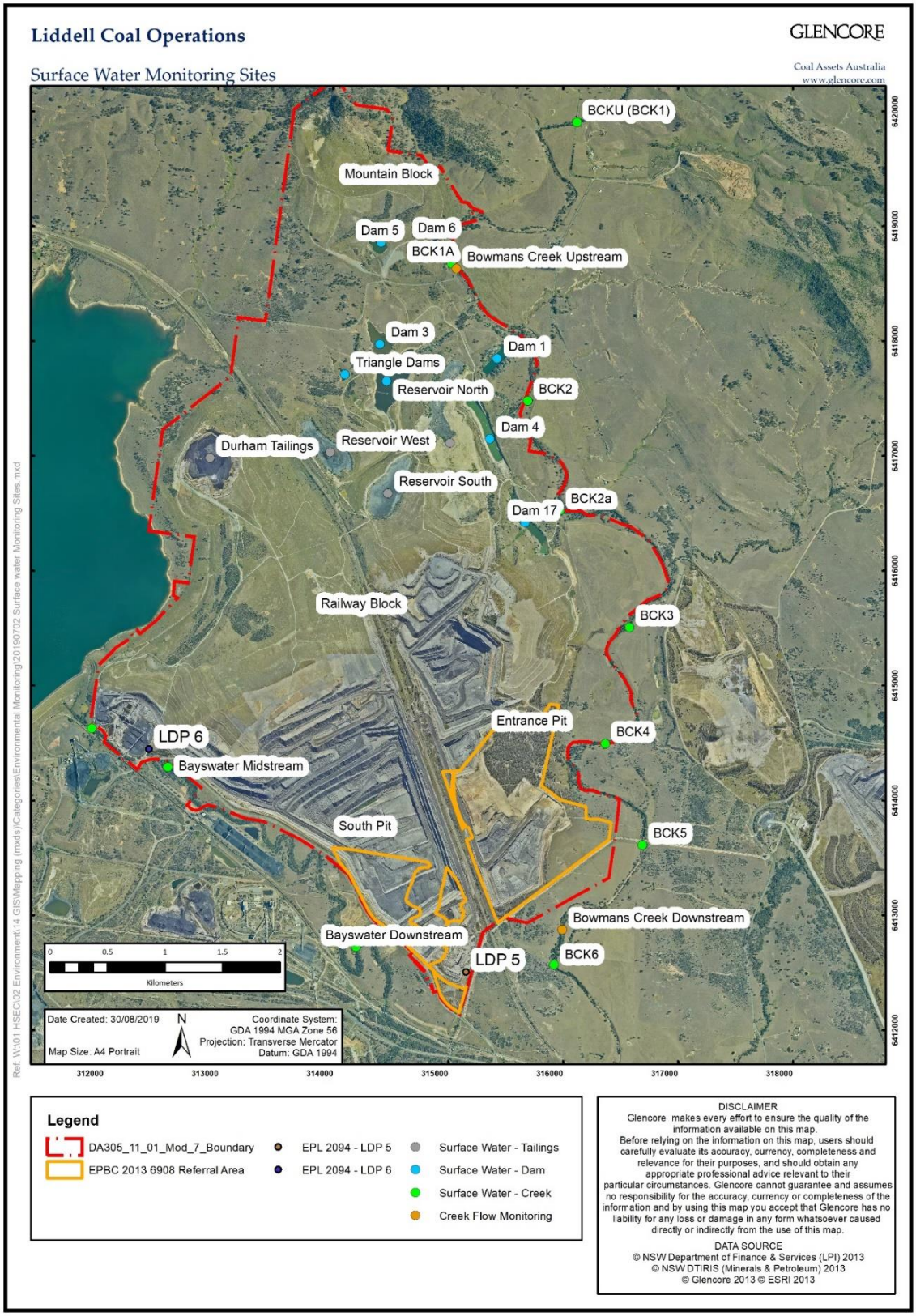


Figure 11 Surface Water Monitoring Locations

Water quality is also currently monitored in a number of onsite mine water storages, including the Reservoir North Dam, Dam 1, Dam 3, Dam 4, Dam 6, Dam 17 and Reservoir Tailings Dam. The mine

water storages monitored varies as mining progresses, with the results used to inform decisions in relation to water management, and in particular regarding discharges off site.

9.1.1.2 Stream and Riparian Vegetation Health and Channel Stability

A program to monitor creek line channel stability and health of riparian vegetation within Bowmans and Bayswater Creeks will continue for the life of the approved action. In summary, this monitoring program is completed annually for Bowmans Creek and Bayswater Creek but at alternative sites each year. Further detail on the procedures and frequency of monitoring is outlined within the approved *LCO Biodiversity Management Plan (LIDOC-90533967-3687)*.

9.1.1.3 Bowmans Creek Flow Monitoring

Two streamflow gauging stations were commissioned in October 2016 along Bowman Creek, in suitable locations upstream and downstream of the active mining areas. The locations of the stations are shown on Figure 9-1. These have been installed to monitor flow variability adjacent to LCO, and in particular to monitor any impacts on streamflow within Bowmans Creek as a result of drawdown in the alluvial aquifer.

9.1.1.4 Effluent Monitoring

Treated effluent generated from the waste water treatment plant and aerated sewage treatment plant is tested every 4 weeks for E.coli.

9.1.2 Baseline Data

9.1.2.1 Creek Water Quality

A statistical summary of surface water quality monitoring data collected from various monitoring locations on Bayswater Creek and Bowmans Creek between 2009 and 2014 is provided in ***Table 11*** and ***Table 12*** respectively. This data has been used to determine the relevant impact assessment criteria, as outlined in Section 9.1.3.

Table 11 Statistical analysis of Bayswater Creek monitoring data

Parameter	Units	Monitoring Location	20th Percentile	80th Percentile	90th Percentile	Maximum
pH	pH	Bayswater Creek Downstream	7.7	8.1	8.2	8.36
		Bayswater Creek Midstream	8	8.3	8.3	8.5
		Bayswater Creek Upstream	7.6	7.9	8	8.4
		Bayswater Creek (Total Data)	7.7	8.2	8.3	8.5
EC	uS/cm	Bayswater Creek Downstream	3098	4450	5806	7300
		Bayswater Creek Midstream	3054	5086	5206	5390
		Bayswater Creek Upstream	2640	3940	4220	5430

Parameter	Units	Monitoring Location	20th Percentile	80th Percentile	90th Percentile	Maximum
		Bayswater Creek (Total Data)	2818	4388	5130	7300
TDS	mg/L	Bayswater Creek Downstream	1986	2938	4052	5180
		Bayswater Creek Midstream	1892	3138	3500	3540
		Bayswater Creek Upstream	1650	2490	2660	3020
		Bayswater Creek (Total Data)	1790	2838	3230	5180
TSS	mg/L	Bayswater Creek Downstream	6	22	65	250
		Bayswater Creek Midstream	4	27	69	302
		Bayswater Creek Upstream	6	18	30	54
		Bayswater Creek (Total Data)	6	19	34	302

Table 12 Statistical analysis of Bowmans Creek monitoring data

Parameter	Units	Monitoring Location	20th Percentile	80th Percentile	90th Percentile	Maximum
pH	pH	BCK1 (Bowmans Creek Upstream)	7.7	8.1	8.3	8.8
		BCK1A	7.7	8.1	8.2	8.3
		BCK2	7.6	8.1	8.3	8.44
		BCK2A	7.7	8.2	8.3	8.3
		BCK3	8.0	8.2	8.3	8.3
		BCK4	7.9	8.2	8.3	8.3
		BCK5	8	8.2	8.3	8.3
		BCK6 (Bowmans Creek Downstream)	7.6	8.0	8.2	8.3
		Bowmans Creek (Total Data)	7.7	8.1	8.3	8.8
EC	uS/cm	BCK1 (Bowmans Creek Upstream)	696	981	1055	4570
		BCK1A	861	3182	4336	4400
		BCK2	797	1458	1713	3870
		BCK2A	758	1256	1364	1460
		BCK3	837	1342	1450	1510
		BCK4	891	2050	2292	2340

Parameter	Units	Monitoring Location	20th Percentile	80th Percentile	90th Percentile	Maximum
		BCK5	897	2054	2317	2480
		BCK6 (Bowmans Creek Downstream)	911	1637	1918	2190
		Bowmans Creek (Total Data)	792	1550	2020	4570
TDS	mg/L	BCK1 (Bowmans Creek Upstream)	404	533	635	3460
		BCK1A	489	2030	2942	3052
		BCK2	456	851	1028	2190
		BCK2A	374	703	749	801
		BCK3	486	764	814	868
		BCK4	517	1216	1338	1390
		BCK5	556	1198	1353	1390
		BCK6 (Bowmans Creek Downstream)	530	990	1108	3050
		Bowmans Creek (Total Data)	440	904	1210	3460
TSS	mg/L	BCK1 (Bowmans Creek Upstream)	2	12	26	55
		BCK1A	3	11	13	13
		BCK2	2	10	72	97
		BCK2A	3	39	48	48
		BCK3	10	45	50	75
		BCK4	2	31	38	62
		BCK5	6	28	32	50
		BCK6 (Bowmans Creek Downstream)	4	16	32	73
		Bowmans Creek (Total Data)	4	19	38	97

9.1.2.2 Streamflow and Creek Condition

Streamflow data for both Bayswater Creek and Bowmans Creek is provided within the Surface Water Impact Assessment (SWIA) (Gilbert & Associates, 2014). Streamflow data for Bowmans Creek is also provided within the Groundwater Impact Assessment (GIA) (SKM, 2014). In summary, flow duration curves developed during the project assessment for Bayswater Creek and Bowmans Creek are reflective of their relative contribution to drainage in the region and the following observations were made:

i. The low median annual flow rate for Bayswater Creek of approximately 1ML/day reflects the impact of Lake Liddell and the significantly altered flow system of the creek.

ii. Two stream flow sites along Bowmans Creek show markedly different flow duration curves, with the gauge located near LCO (now defunct for some years) recording measurable stream flow only 65% of the time, while the gauge further downstream near the confluence of the Hunter River, indicates near perennial flow.

Baseline conditions for Bowmans Creek and Bayswater Creek are described in detail in Section 7.5.3 of the Environmental Assessment for Mod 5 (SLR, 2013), and in the Aquatic Ecology and Groundwater Dependant Ecosystem Assessment (ELA, 2013).

Based on the outcomes of the field survey for the assessment, Bayswater Creek was deemed to be in poor condition, with heavy loads of fine sediment on the bottom and evidence of bank erosion. The main factor influencing the ecological condition appears to be the control of water flow from Lake Liddell. The riparian zone of Bayswater Creek was deemed to be in moderate condition, dominated by dense growth of Casuarina cunninghamiana as overstorey and exotic understorey.

Bowmans Creek, on the other hand was found to be in relatively good condition, with all physio-chemical variables falling within ANZECC guidelines for lowland rivers in NSW, at the time of assessment. Moderate to good ecological condition scores were recorded along the study area, with a diverse macro-invertebrate population identified, including those sensitive to pollution. The main impacts on the stream appeared to be from cattle access to banks and creek, with evidence of erosion throughout the study area.

9.1.3 Impact Assessment Criteria

9.1.3.1 Methodology

Surface water quality monitoring has been undertaken at LCO since 2001. Bowmans Creek and Bayswater Creek are monitored on a monthly basis). This data has enabled observation of long term and seasonal trends of surface water quality within the creeks.

The availability of monthly historical surface water quality monitoring data has thus allowed the application of Australian and New Zealand Environment and Conservation Council (ANZECC) (2000) guidelines to develop site specific trigger values. ANZECC (2000) states that in order to apply these trigger values appropriately, a minimum of monthly data over a two year period must be used. In cases where data are highly variable due to either a perceived seasonal, or other temporal change, to a point where applying a single annual trigger value is problematic, trigger values can be assigned to account for these seasonal variations. Alternatively, for water quality data in particular, trigger values can be defaulted to the documented ANZECC (2000) water quality trigger values.

9.1.3.2 Downstream Water Quality

Bayswater Creek is considered to be a highly disturbed system with respect to ANZECC 2000 with low ecological value and a flow regime which is controlled by discharges from Lake Liddell with the remaining catchment not sufficient to maintain flow within the creek adjacent to LCO.

Bowmans Creek is considered to be a moderately disturbed system with respect to ANZECC 2000 with moderate ecological value. A review of flow data within the Groundwater Impact Assessment (SKM, 2014) indicates that flow within Bowmans Creek is intermittent adjacent to LCO although consistent flow is recorded further downstream nearer to the Hunter River.

The ephemeral nature of flow within the creeks adjacent to LCO means that stagnant pools of water are sometimes monitored which may have higher/atypical concentrations of the key parameters (pH, Total Suspended Solids (TSS) and Electrical Conductivity (EC) and Total Dissolved Solids (TDS)) than during periods of flow.

Impact assessment criteria for both Bayswater and Bowmans Creek has been determined based on a statistical analysis of data collected over a 5 year period. In accordance with ANZECC (2000) guidelines a 90th percentile concentration is appropriate for maintaining water quality. Due to the disturbed nature of both catchments this is deemed to be an appropriate statistical criterion to adopt whilst mining operations are ongoing. The creek trigger levels are presented in ***Table 13***.

Table 13 Creek Trigger Levels

Creek	pH lower limit[4]	pH upper limit		EC 90th %tile[1]	EC Max[2]	TDS 90th %tile[1]	TDS Max[2]	TSS 90th %tile[1]	TSS Max[2]
		90th %tile1	Max2						
Bayswater	6.5	8.3	8.5	5130	7300	3230	5180	50[3]	302
Bowmans Creek	6.5	8.3	8.8	2020	4570	1210	3460	50[3]	97

[1] whole creek 90th percentile
[2] maximum recorded value for whole creek
[3] ANZECC criteria for TSS
[4] ANZECC criteria for pH lower limit

Trigger Level when creek is flowing
Trigger Level when no flow in creek

9.1.3.3 Stream and Riparian Vegetation Health and Channel Stability

As described in the LCO Biodiversity Management Plan (***LIDOC-90533967-3687***), instream and riparian condition is monitored at LCO using the Riparian Channel and Environmental (RCE) inventory (Peterson 1992) which has been modified to suit Australian Conditions (Chessman et al. 1997). RCE is undertaken at three locations along Bowmans Creek (Bowmans Creek Upstream, BCK3 and BCK 5), and at the Bayswater Creek Upstream and Downstream monitoring points. The monitoring program is completed annually for Bowmans Creek and Bayswater Creek but at alternative sites each year.

RCE will be monitored biennially using a set of 13 descriptors, each with scores between 1 and 4. This will provide a total score for each site out of 52 that will be used to indicate the degree of modification as a result of human activity.

The RCE scores obtained during each biennial monitoring event will be reviewed against the baseline condition of Bowmans and Bayswater Creeks, as documented in the EA for Mod 5 (SLR, 2013). A substantial decrease in the total score (by 10 points) will trigger further investigation.

9.1.3.4 Treated Effluent

The impact assessment criteria for treated effluent monitoring are provided in ***Table 14*** below.

Table 14 Treated effluent trigger value and EPL Limit

Parameter	Trigger value	EPL Limit
E.coli	Detection of E.coli at less than 100 colony forming units per 100 ml	100 colony forming units per 100 ml

9.2 Groundwater

Two distinct groundwater systems are monitored and reported across the region:

a) the shallow, unconfined, water table aquifer is measured via open standpipes in the alluvial and shallow bed rock aquifers. Monitoring records actual water tables and formation-specific parameters;

b) the deep, confined aquifers are monitored via a series of open bores that penetrate the shallow bedrock aquifers and the voids of the underground workings and one monitoring site that targets the overburden and Pikes Gully coal seam. The former provide monitoring records that give an indication of regional groundwater pressures and aid in the calibration of the regional groundwater model.

Given there are two groundwater systems, the groundwater monitoring program is required to recognise and consider each system separately.

9.2.1 Monitoring Program

In accordance with condition 23 (c)(iv) of DA 305-11-01, ongoing groundwater monitoring activities conducted at LCO monitors:

a) groundwater inflows to the mining operations;

b) seepage/leachate from water storages, emplacements and final voids;

c) background changes in groundwater yield/quality against mine-induced changes;

impacts of the development on:
regional and local (including alluvial) aquifers;
groundwater dependant ecosystems and riparian vegetation;
the seepage/leachate from water storages, emplacements, backfilled voids and final voids;
any impacts on the Bowmans Creek alluvial aquifer.
Monitoring is undertaken at least every two months for groundwater quality, and at least every month for groundwater pressures / levels, in accordance with the requirements of EPBC 2013/6908 (Condition 12 (b) (ii)). The groundwater monitoring network is shown on ***Figure 12***.

The purpose of these monitoring activities is to inform management actions, mitigation measures and practices designed to limit impacts to groundwater and connected surface water resources. Each monitoring activity includes its own measurement criteria and data trigger values to assist with these action plans and help determine if an affect is due to mining operations.

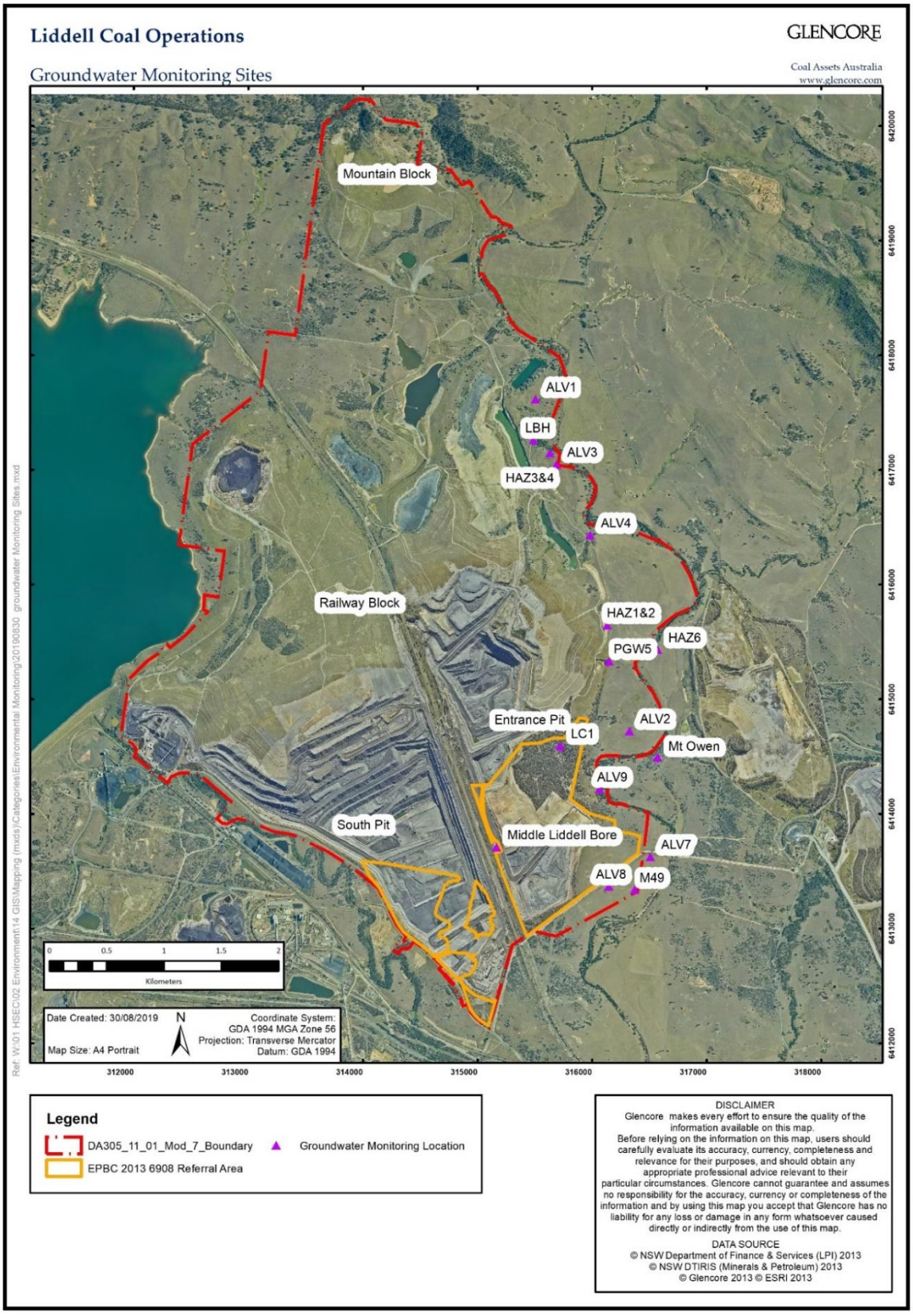


Figure 12 Groundwater monitoring locations

LCO has an established groundwater monitoring program comprising a network of 18 locations (refer to Table 15 and Figure 12) that target both the surrounding alluvial aquifer associated with Bowmans Creek and the regional hard rock aquifer associated with the coal measures. With the exception of bore 8 South 2, which was mined through in 2011, all of the piezometers in the monitoring network are located outside the current open cut pits at LCO, and as such are considered appropriate locations for providing data on groundwater levels and pressures and groundwater quality for surrounding aquifers, including both alluvial aquifer systems and the regional hard rock aquifers associated with the coal measures. Piezometers targeting the alluvium are nested and monitor both the alluvial aquifer and the adjacent underlying shallow bedrock strata (where the bore name suffix L = alluvium and S = shallow bedrock or overburden). The piezometers are monitored at least monthly for groundwater levels and at least every two months for water quality parameters pH and electrical conductivity. Eleven of the piezometers are also sampled biannually and analysed for a range of parameters, including inorganic analytes. ***Table 15*** details the piezometers within the groundwater network, the unit in which they are installed and parameter measurement frequency. Details of monitoring of dewatering bores are also presented in ***Table 15***.

The groundwater monitoring network at LCO was reviewed by Jacobs (formerly SKM) as part of the preparation of the Water Management Plan to ensure the network will adequately monitor areas where additional draw down is predicted. The existing network includes all piezometers specified in Figure 2-13 of the Groundwater Impact Assessment (SKM, 2014) prepared for Mod 5. The addition of one piezometer to the existing network was recommended by this review; being the existing Ravensworth Operations 'Coffey Dam borehole' to provide additional coverage to the south of LCO.

During 2017, LCO installed piezometer ALV 9 into the Bowman's Creek Alluvium to monitor the predicted drawdown impacts as detailed in Section 9.2.3.

Bores targeting the underground voids (which are used for groundwater storage) monitor water levels only and are not sampled, as they represent mixed water from a variety of sources. This water is subsequently sampled and analysed when pumped to surface storage sites.

Table 15 Groundwater monitoring network bores and monitoring strategies

Piezometer ID	Unit	Measurement parameter	Frequency
Water table aquifer: Bowmans Creek Alluvium and underlying shallow bed rock			
ALV 1	Alluvial aquifer (L) Shallow bedrock (S)	Water level, pH and conductivity	Monthly
		Chemistry[1]	Biannually
ALV 2	Alluvial aquifer (L) Shallow bedrock (S)	Water level, pH and conductivity	Monthly
		Chemistry[1]	Biannually
ALV 3	Alluvial aquifer (L) Shallow bedrock (S)	Water level, pH and conductivity	Monthly
		Chemistry[1]	Biannually
ALV 4	Alluvial aquifer (L) Shallow bedrock (S)	Water level, pH and conductivity	Monthly
		Chemistry[1]	Biannually
ALV 7	Alluvial aquifer (L) Shallow bedrock (S)	Water level, pH and conductivity	Monthly
		Chemistry[1]	Biannually
ALV 8	Alluvial aquifer (L) Shallow bedrock (S)	Water level, pH and conductivity	Monthly
		Chemistry[1]	Biannually
ALV 9	Alluvial aquifer (L)	Water level	Monthly
LBH	Alluvial aquifer	Water level, pH and conductivity	Monthly

		Chemistry[1]	Biannually
Hard rock (Coal measures) aquifer			
PGW5	Overburden (L) Pikes Gully Seam (S)	Water level, pH and conductivity	Monthly
		Chemistry[1]	Biannually
8 South 2	Middle Liddell workings	Mined through in 2011	-
Haz 1/2	Hazeldene (Liddell) workings	Water level (or equivalent water pressure)	Monthly
Haz 3/4	Hazeldene (Liddell) workings	Water level (or equivalent water pressure)	Monthly
Haz 6	Hazeldene (Liddell) workings	Water level (or equivalent water pressure), pH and conductivity	Monthly
		Chemistry[1]	Biannually
LC1	Middle Liddell workings	Water level (or equivalent water pressure), pH and conductivity	Monthly
M49	Middle Liddell workings	Water level (or equivalent water pressure)	Monthly
		Yield	Monthly
Middle Liddell (MLB)	Middle Liddell workings	Water level (or equivalent water pressure)	Monthly
		Yield	Monthly
Mt. Owen 2	Middle Liddell workings	Water level (or equivalent water pressure)	Monthly
		Yield	Monthly
Coffey Dam Borehole	Ravensworth Surface Operations (Liddell seams)	Water level (or equivalent water pressure)	Monthly
		pH and conductivity	Quarterly
		Chemistry[1]	Biannually

[1]Chemistry analysis to be undertaken for S, Al, Ca, Fe-Sol, K, Mg, Na, Si, B, Cu, Ni, Zn, Mn, Cr, Sr, As, Ba, Hg, Pb, Cd, Co, Se, Li, Be, Rb, Cs, Cl, OH, CO_3, HCO_3, TDS on evaporation, pH

Groundwater monitoring at LCO is undertaken in accordance with relevant Australian Standards, legislation and NSW DECC (now EPA) approved methods for sampling, which include (but are not limited to):

- NSW DECC, 2004, Approved Methods for the Sampling and Analysis of Water Pollutants in New South Wales.
- AS/NZS 5667.1:1998 Water Quality – Sampling – Guidance on the Design of Sampling Programs, Sampling Techniques, and the Preservation and Handling of Samples.
- AS/NZS 5667.11:1998 Water Quality - Sampling - Guidance on Sampling of Groundwaters.

Modelling of the groundwater systems is complex and has undergone continuous refinement over the past two decades. Groundwater impacts from LCO are currently modelled using a cumulative impacts, regional groundwater model - using the MODFLOW-SURFACT program. Calibration of this model relies on high quality spatially and temporally extensive data, which is obtained through the groundwater monitoring network. Procedures for groundwater model validation and update is provided in Section 9.3.

9.2.1.1 Groundwater Inflows to Mining Operations

The contribution of groundwater to the open cut is monitored by LCO by measurement of all water pumped from the mine pits. Pumping data will be compared to predicted inflow rates from the numerical groundwater model and assessed against current licensed approvals to extract from the hard rock aquifer. Groundwater inflow volumes, so far, have been consistent with that presented in the LCO groundwater model.

9.2.1.2 Groundwater Storage

Groundwater levels in the old underground workings are monitored via a series of bores penetrating the major storage zones. Thus, the Hazeldene Underground workings are isolated from the Liddell Underground workings by a coal barrier, with four Hazeldene bores used to monitor the Hazeldene voids and four bores monitoring the Liddell voids. Infrastructure is in place to facilitate transfer to these voids and from the voids to Dam 17 (Hazeldene bores) and Reservoir North Dam (Liddell bores).

Any abstraction volumes are recorded from the operational dewatering bores via flow meters that were installed in 2013 by LCO. The purpose of these observations is to measure volumes of abstracted water and combine with pit inflow volumes to compare against LCO's water allocation. As an example, ***Table 16*** presents the recorded abstraction volumes for operational dewatering bores in the Liddell Underground void as reported annually in the 2018 and 2019 Annual Reviews.

Table 16 Extraction volumes from LCO operational dewatering bores

Extraction bore	Entitlement (ML)	Extraction volume (ML/yr)			
		2018		2019	
		Passive Take	Active Take	Passive Take	Active Take
M49 bore (Liddell workings)	2500	365	35	365	545
Middle Liddell Bore	6000	242	128	196.22	613
Hazeldene 1 & 2	5500	0	172	0	524
Total	**14000**	**942**		**2243.22**	

9.2.1.3 Groundwater Dependent Ecosystems

Potential groundwater dependant environmental receptors that may be affected by mining operations at LCO include aquatic and riparian ecosystems associated with Bowmans and Bayswater Creeks, and in particular the Bowmans Creek alluvial aquifer.

Instream and riparian ecological condition is conducted at LCO in accordance with the Biodiversity Management Plan (LIDOC-90533967-3687). Stygofauna monitoring is also undertaken at LCO in accordance with the procedures outlined in the Biodiversity Management Plan.

9.2.2 Baseline Data

9.2.2.1 Water Table Aquifers Groundwater Levels

Table 17 presents the minimum and maximum groundwater level observations for the historical dataset (July 2005 to May 2017) for the water table aquifers.

Water levels in piezometers accessing the alluvium ranged between 2.39 and 8.36 metres below ground level (mbgl) (108.80 to 83.66 mAHD). Groundwater levels within the piezometers accessing the shallow bedrock ranged between 1.70 and 11.38 mbgl (109.49 and 80.94 mAHD).

Table 17 Monthly groundwater level observations in water table aquifers (July 2005 to May 2017)

Piezometer ID[1]	Unit	Minimum water depth (mbgl[2])	Maximum water height (mAHD)	Maximum water depth (mbgl)	Minimum water height (mAHD)
ALV 1 L	Alluvial aquifer	2.39	108.80	6.31	104.88
ALV 1 S	Shallow bed rock	1.70	109.49	6.84	104.35
LBH	Alluvial aquifer	3.33	107.46	6.24	104.55
ALV 3 L	Alluvial aquifer	4.25	105.26	7.08	102.43
ALV 3 S	Shallow bed rock	4.42	105.09	7.26	102.25
ALV 4 L	Alluvial aquifer	4.27	103.43	6.73	100.97
ALV 4 S	Shallow bed rock	4.80	102.90	7.42	100.28
ALV 2 L	Alluvial aquifer	3.20	94.68	6.76	91.12
ALV 2 S	Shallow bed rock	2.62	95.26	8.53	89.35
ALV 7 L	Alluvial aquifer	5.38	88.39	7.34	88.39
ALV 7 S	Shallow bed rock	6.35	87.42	11.38	82.39
ALV 8 L	Alluvial aquifer	5.49	86.53	8.36	83.66
ALV 8 S	Shallow bed rock	6.27	85.75	11.08	80.94

[1]Groundwater monitoring piezometers reported from north to south along Bowmans Creek
[2]mbgl = metres below ground level

9.2.2.2 Water Table Aquifers Groundwater Yield

Groundwater is not drawn from the water table aquifers for LCO operations.

9.2.2.3 Water Table Aquifers Groundwater Quality

Table 18 presents the maximum and minimum pH water quality observations for piezometers accessing the water table aquifers between July 2005 and May 2017.

Table 18 Monthly pH water quality observations in water table aquifers (July 2005 to May 2017)

	Alluvial aquifer		Shallow bedrock	
	Minimum	*Maximum*	*Minimum*	*Maximum*
pH	6.31	8.69	6.67	9.56

Table 19 presents the maximum and minimum water quality electrical conductivity observations for piezometers accessing the water table aquifers between July 2005 and May 2017. Water sampled from piezometers screening the alluvial aquifer range between 0.57 and 4.16 mS/cm. Water sampled from piezometers screening the shallow bedrock range between 1.01 and 6.43 mS/cm.

Table 19 Monthly water electrical conductivity observations in water table aquifers (July 2005 to May 2017)

Piezometer ID[1]	Unit	Minimum (mS/cm)	Maximum (mS/cm)
ALV 1 L	Alluvial aquifer	0.91	2.02
ALV 1 S	Shallow bed rock	1.01	1.77
LBH	Alluvial aquifer	0.76	3.09
ALV 3 L	Alluvial aquifer	0.67	3.08
ALV 3 S	Shallow bed rock	1.34	4.51
ALV 4 L	Alluvial aquifer	1.25	3.08
ALV 4 S	Shallow bed rock	3.78	6.43
ALV 2 L	Alluvial aquifer	1.32	4.16
ALV 2 S	Shallow bed rock	1.63	3.37
ALV 7 L	Alluvial aquifer	0.84	2.31
ALV 7 S	Shallow bed rock	1.69	2.54
ALV 8 L	Alluvial aquifer	0.57	1.88
ALV 8 S	Shallow bed rock	1.32	2.40

[1]Groundwater monitoring piezometers reported from north to south along Bowmans Creek

9.2.2.4 Regional Hard Rock Aquifer Groundwater Quality

The groundwater quality of the hard rock aquifers is primarily sampled within the surface water storages that the hard rock bores are dewatered to, and this water then managed appropriately within the IWMS. Given that surface water storages receive input from multiple locations, water quality data from these storages is not presented as it would not be representative of groundwater quality in the hard rock aquifer.

There are two monitoring piezometers, however, installed into the hard rock aquifer at site PGW5. PGW5L is installed into the overburden and PGW5S is installed into the Pikes Gully coal seam. Data from these piezometers is presented below.

Table 20 presents the maximum and minimum pH observations for piezometers accessing the hard rock aquifer (site PGW5) between July 2005 and May 2017.

Table 20 Monthly water pH observations in hard rock aquifer (July 2005 to May 2017)

Piezometer ID	Unit	Minimum (pH units)	Maximum (pH units)
PGW5 L	Overburden	6.92	9.14
PGW5 S	Pikes Gully Seam	6.81	8.69

Table 21 presents the maximum and minimum electrical conductivity observations from piezometers accessing the hard rock aquifer (site PGW5) between July 2005 and May 2017.

Table 21 Monthly water electrical conductivity observations in hard rock aquifer (July 2005 to May 2017)

Piezometer ID	Unit	Minimum (mS/cm)	Maximum (mS/cm)
PGW5 L	Pikes Gully Seam	3.41	6.06
PGW5 S	Overburden	3.93	6.82

9.2.3 Impact Assessment Criteria

9.2.3.1 Methodology

Groundwater monitoring at LCO since 2002 has provided observation of long term and seasonal trends of groundwater levels and water quality, with particularly focus on the water table aquifer systems. Data are observed to have remained relatively consistent since monitoring began, with minor seasonal variability, allowing robust assessment criteria to be established for the monitoring network to effectively monitor local groundwater conditions.

Approval conditions in EPBC 2013/6908 stipulate that trigger values specified in the Preliminary Documentation shall apply unless revised trigger values are agreed by the Department. NSW Approvals conditions refer to trigger values in excess of those predicted in the Environmental Assessment for the project.

The specific application of trigger levels is described below, in Section 10. Selection of trigger levels for groundwater is covered in this section.

It is important to note that groundwater triggers in our Water Management Plan are used for purposes of assessing mining related impacts. The groundwater assessments, prepared for the Liddell Operation for the environmental approvals, clearly identified that both the alluvial and hard rock systems have been impacted by previous mining and there will be additional impact from the current and approved future mining. These impacts have been fully described within the studies supporting the project approval and LCO has groundwater allocations for the incidental take of groundwater for current and future mining. The groundwater triggers are an important element in our ongoing environmental management of our operations. The triggers ensure that we maintain compliance and manage our impacts within the predictions of the groundwater water studies and our license allocations.

LCO has implemented a methodology using the 80th percentile (EC) and 10th percentile (water level) for the baseline dataset (in this case, July 2005 to May 2017) to calculate site specific trigger values. The 20th percentile (EC) value has also been adopted for monitoring sites ALV2S and ALV8S as sites representative where the potential leakage between the alluvial and hard rock aquifers could exceed the predictions of the groundwater model if the previously observed fracturing was reinitiated. The

maximum observations for EC and groundwater level are presented in the WMP to provide reference against the 80th percentile trigger value, and context of the environmental system that is being monitored.

9.2.3.2 Groundwater Level Trigger Definition

Groundwater level monitoring is carried out at least monthly on the shallow, unconfined, water table aquifers of Bowmans Creek alluvium and the underlying shallow bedrock. Water pressure monitoring is carried out at least monthly on the deeper, confined, hard rock aquifers.

There are three components to the groundwater level trigger definition.

1. The first component is an impact trigger and is drawdown of 2m in the alluvium compared to the local reference site. This additional drawdown was identified, assessed and approved with respect to DA 305-11-01 (as modified) (refer Figure 3-16 in SKM (2014)). It is noted that this drawdown is expected to occur in 2022.

There are two areas of additional impact to the alluvium identified in SKM (2014).

For the northernmost impact zone (refer Figure 3-16 of SKM (2014)), monitoring site ALV 9 was installed in 2017 into the alluvium. The local reference for the northern impact zone will be the existing up-gradient site, ALV2.

For the southern impact zone (refer Figure 3-16 of SKM (2014)), monitoring site ALV 8 is already established. The local reference for the southern impact zone will be the existing up-gradient site, ALV7.

Table 22 presents the 2m drawdown trigger definition. It is noted that the definition presented in ***Table 22*** satisfies the requirements of EPBC Approval Condition 12(b)(iii) that the reference value for drawdown is documented and that justification is provided for that reference value.

Table 22 Groundwater Level Trigger Definition #1 - 2m drawdown in Bowmans Creek Alluvium

Impact Zone	Trigger Definition – 2m Drawdown
Northern Impact Zone	
ALV9L	Groundwater elevation of monitoring piezometer ALV2L minus 5.0m (AHD). The predicted difference in groundwater elevation between site ALV2L and the new site (ALV9L) is 3.0m. The 2m drawdown is added to the predicted difference in groundwater elevation between the sites.
Southern Impact Zone	
ALV8L	Groundwater elevation of monitoring piezometer ALV7L minus 4.5m (AHD). The predicted difference in groundwater elevation between these ALV7L and ALV8L is 2.5m. The 2m drawdown is added to the difference in groundwater elevation between the sites.

2. The second component is an investigation trigger and is measurement below the monthly, baseline (10th percentile) water level on three consecutive occasions. The purpose of this trigger is to identify unexpected changes to groundwater level.

Table 23 presents site specific trigger values (10th percentile values) for monitoring piezometers accessing the water table aquifers.

Groundwater bores that are used to access the deeper hard rock aquifers will be directly impacted by mining as an approved activity. Monitoring data for these deep aquifers (including abstraction volumes for reference against hard rock aquifer allocations) will be recorded in the Annual Review, but no further reporting to the relevant government departments or agencies is required.

Table 23 Groundwater Level Trigger Definition #2 - Lower 10th percentile

Piezometer ID[1]	Unit	Lower limit (10th percentile)		Reference Maximum	
Water Table Aquifers		*Depth to water (m)*	*Groundwater elevation (mAHD)*	*Depth to water (m)*	*Groundwater elevation (mAHD)*
ALV 1	Alluvial aquifer (L)	4.97	106.22	6.31	104.88
	Shallow bedrock (S)	4.75	106.44	6.84	104.35
LBH	Alluvial aquifer	5.05	105.74	6.24	104.55
ALV 3	Alluvial aquifer (L)	5.70	103.81	7.08	102.43
	Shallow bedrock (S)	5.99	103.52	7.26	102.25
ALV 4	Alluvial aquifer (L)	5.56	102.14	6.73	100.97
	Shallow bedrock (S)	6.28	101.42	7.42	100.28
ALV 2	Alluvial aquifer (L)	4.80	93.08	6.76	91.12
	Shallow bedrock (S)	4.67	93.21	8.53	89.35
ALV 7	Alluvial aquifer (L)	6.75	87.02	7.34	86.43
	Shallow bedrock (S)	10.21	83.56	11.38	82.39
ALV 8	Alluvial aquifer (L)	6.96[2]	85.06[2]	8.36	63.66
	Shallow bedrock (S)	9.03	82.99	11.08	80.94

[1]Groundwater monitoring piezometers reported from north to south along Bowmans Creek

[2]Data at ALV8L between April 2006 and May 2007, inclusive, were omitted from the calculation of lower 10th percentile due to the piezometer being dry during that period.

3. The third component is a subsequent investigation trigger and addresses the potential for harm to listed threatened species, communities and migratory species of concern to EPBC Approval 2013/6908 due to continuing exceedance of the lower 10th percentile trigger.

Table 24 Groundwater Level Trigger Definition #3 - Longer term impact to fauna and flora

Piezometer ID	Trigger Definition – Longer Term Impact
All ALV series and LBH	Following an investigation of an exceedance of Groundwater Level Trigger Definition #2 that concludes the exceedance is not mining-related, should groundwater levels continue to be measured below the lower 10th percentile for a further nine months, such that the exceedance has continued continuously for 12 months, then a subsequent investigation shall be undertaken to confirm that the exceedance remains unrelated to mining activity.

9.2.3.3 Groundwater Quality Trigger Definition

Groundwater quality is monitored as electrical conductivity (EC – as a proxy for salinity) and pH (to determine the acid-alkali state). Measurements on piezometers monitoring the water table aquifers are recorded at least monthly and reported annually (in the Annual Review). In addition, every six months groundwater samples are analysed for total dissolved solids (TDS), total suspended solids (TSS), heavy metals, cations and anions.

Table 25 presents the 80th and 20th percentile trigger definition for EC for water table aquifers. The 80th and 20th percentile trigger definitions were derived from the baseline dataset (in this case, July 2005 to May 2017).

It is noted that the 20th percentile EC trigger definition is only used to assess the potential for increased leakage of groundwater from the alluvial aquifer to the hard rock aquifer due to mining. For this impact to occur it needs to be associated with a declining water level in the alluvial that is not climate related. The assessment will also include a comparison of the volume of flow over the relevant period between the upstream/downstream streamflow gauging stations along Bowmans Creek to determine if there has been a measurable loss of streamflow that is not associated with recharging the alluvium or filling of instream storages. This trigger will only be reported when this trend is observed.

Table 25 Groundwater Quality Trigger Definition #1 - Electrical conductivity (mS/cm)

Piezometer ID[1]	Unit	Upper limit: 80th percentile (mS/cm)	Lower limit: 20th percentile (mS/cm)	Reference Maximum (mS/cm)
ALV 1	Alluvial aquifer (L)	1.37	-	2.02
	Shallow bedrock (S)	1.56	-	1.77
LBH	Alluvial aquifer	1.55	-	3.09
ALV 3	Alluvial aquifer (L)	1.39	-	3.08
	Shallow bedrock (S)	2.80	-	4.51
ALV 4	Alluvial aquifer (L)	1.92	-	3.08
	Shallow bedrock (S)	5.31	-	6.43
ALV 2	Alluvial aquifer (L)	2.83	-	4.16
	Shallow bedrock (S)	2.82	2.56	3.37

ALV 7	Alluvial aquifer (L)	1.78	-	2.31
	Shallow bedrock (S)	2.23	-	2.54
ALV 8	Alluvial aquifer (L)	1.31[2]	-	1.88
	Shallow bedrock (S)	1.99	1.54	2.40

[1]Groundwater monitoring piezometers reported from north to south along Bowmans Creek

[2]Data at ALV8L between April 2006 and May 2007, inclusive, were omitted from the calculation of 80th percentile due to the piezometer being dry during that period.

Table 26 presents the trigger definition for pH for water table aquifers. The trigger definition is based on the default trigger value from ANZECC (2000) for lowland rivers located in NSW.

Table 26 Groundwater Quality Trigger Definition #2 - pH

Monitoring Piezometers	ANZECC (2000) guidelines	Upper level	Lower level
All ALV series and LBH	South East Australia (NSW Lowland Rivers)	8.5	6.5

9.3 Groundwater Model Verification

The validity of the numerical groundwater model shall be assessed by a suitably qualified, experienced and independent reviewer to assess the efficacy of the existing model and compare its prediction results with the monitored data. The reviewer will make suggestions for improvements to the model. Review will be undertaken at least every three years and actions will follow the following guidelines:

If monitoring results are found to be within the uncertainty bounds of the existing model predictions for:

- groundwater table levels observed in alluvium monitoring bores;
- groundwater pressures as presented in potentiometric surfaces in the EA;
- water quality criteria, and
- pit inflows

If the model is found to be conservative in its predictions (i.e. the observed impacts are less than the predicted case), then the model shall continue to be deemed fit-for-purpose.

If there is substantial (and detrimental) deviation from the predicted groundwater table and pressure surfaces, or a decline in water quality as measured at designated monitoring sites, a further review of the model shall consider whether the model should be refined and re-calibrated utilising the additional monitoring data, or whether this refinement can be reasonably foregone pending the subsequent review.

If the model requires refinement, the rationale shall be given by the reviewer and the Department consulted on the process and extent of this refinement.

10. Surface Water and Groundwater Response Plan

10.1 Surface Water

10.1.1 Exceedance of Trigger Values

LCO will monitor surface water quality in accordance to this monitoring plan. Where the surface water monitoring results exceed the trigger values listed within this WMP, LCO Environment and Community Manager shall act in accordance with Section 3.3.2.3 of ANZECC (2000) where the aim of further site-specific investigations is to assess if a 'potential risk' or an actual problem exists.

If an exceedance is observed in the surface water data, a Trigger Action Response Plan (TARP) must be followed. ***Table 27*** presents the definitions used within this WMP to identify exceedances and typical responses if they were to occur.

As discussed in ***Section 9.3.2.4*** exceedances of the triggers for mine storages should be reviewed internally but excluded from the Annual Review reporting with the exception of any offsite discharges via LDPs.

Table 27 Definition of surface water and groundwater exceedance criteria

Adopted terminology	Comment
Investigation trigger	Occurs when a nominated trigger value is exceeded three times or more times consecutively. Action is taken in the form of checking flow conditions within the creek, resampling, and review of all data as required to complete investigation into the cause of the exceedance.
Management / mitigation trigger	Occurs when a nominated trigger value is: • exceeded three or more consecutive times, and determined to be mining related; • due to an incident where environmental harm has occurred and there is potential for environmental harm. Action is taken to investigate the cause of the exceedance/incident, implement of measures to prevent/reduce environmental harm, and development of mitigation/action plan to prevent re-occurrence.

10.1.2 Response Plan

Figure 13 presents how the response plan may be implemented based on the exceedance of nominated trigger values. It is important to note that before an exceedance is to be considered to have been reached, monitoring will continue for up to two observations beyond the initial exceedance measurement (i.e. a total of three consecutive exceedances of a trigger value). This is to check that the exceedance is repeated, ongoing, and not erroneous. Notwithstanding, a decision should be made whether the initial exceedance requires immediate investigation.

Table 28 Surface Water Trigger Action Response Plan

Key Element	Trigger	Action/Response
Exceedance of creek water quality criteria	See *Section 9.1.3.2*	Initiate surface water quality criteria exceedance protocol within the required timeframes as detailed in ***Figure 10-1***.
Impacts on stream and riparian vegetation health or channel stability	See *Section 9.1.3.3*	Investigate results and trends of monitoring, considering any mitigating factors, and where applicable and notify DPIE – Planning and Assessment. Determine if an incident has occurred. Initiate incident reporting protocol as required. Initiate detailed investigation if trends indicate potential for environmental harm. If potential for environmental harm notify DAWE and fulfil reporting requirements (refer to ***Section 11***). Carry out risk assessment and develop and implement mitigation plan if appropriate.
Effluent quality exceedance	See *Section 9.1.3.4*	If the effluent trigger value is exceeded, action is taken in the form of resampling. If the effluent trigger value is exceeded on more than one consecutive occasion then action is taken in the form of an investigation into the cause of the exceedance including an inspection of treatment infrastructure by appropriate maintenance personnel. Maintenance to be carried out as required. Determine if an incident has occurred. Initiate incident reporting protocol as required. If potential for environmental harm notify DAWE and fulfil reporting requirements (refer to ***Section 11***).Carry out risk assessment and develop and implement mitigation plan if appropriate.
Exceedance of HRSTS criteria	See Section 5.5.1	Investigate results, considering any mitigating factors, and where applicable notify the EPA. Determine if an incident has occurred. Initiate incident reporting protocol as required (***Section 11.3***). Initiate detailed investigation if trends indicate potential for environmental harm. If potential for environmental harm notify DAWE and fulfil reporting requirements (refer to ***Section 11***).

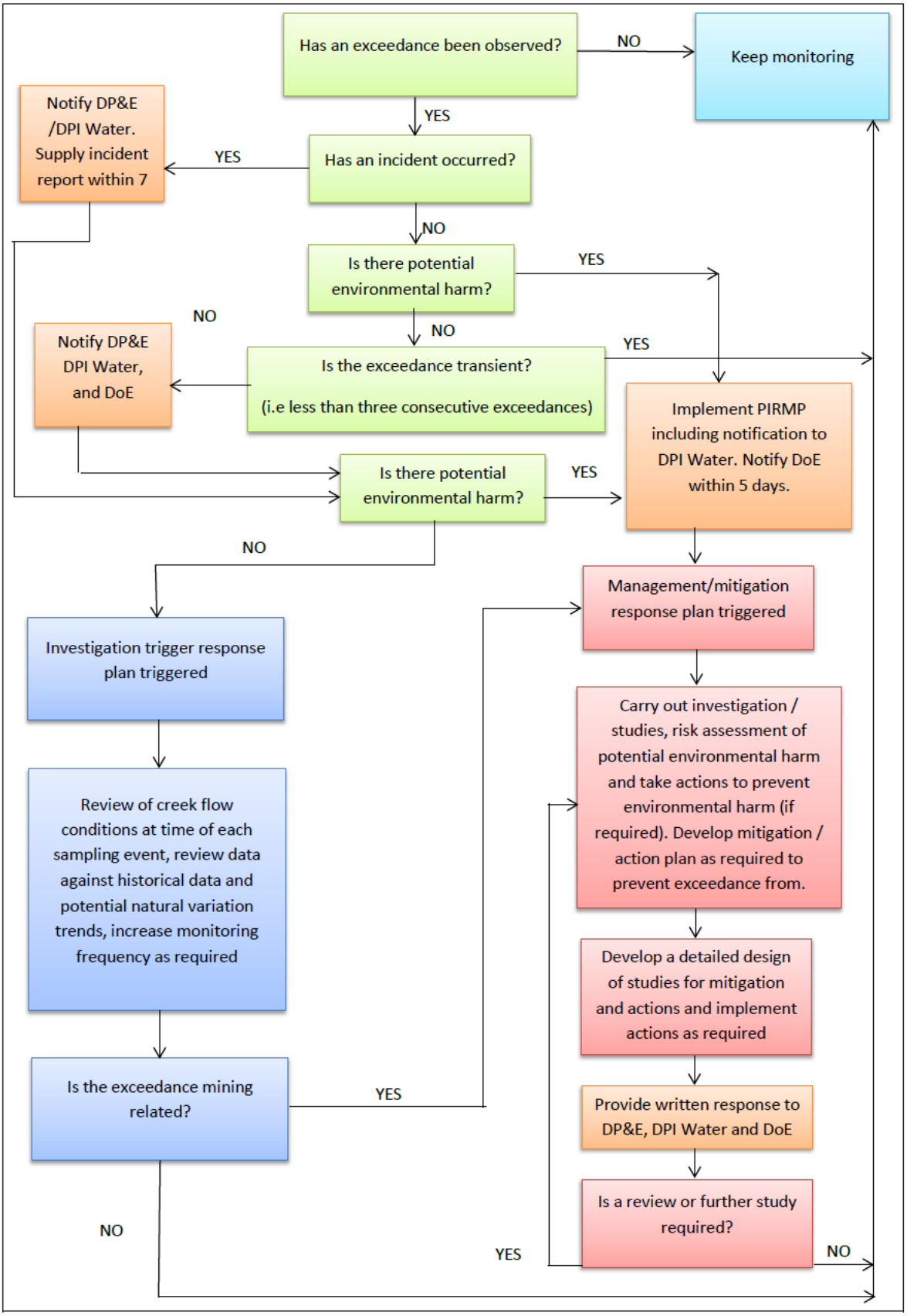


Figure 13 Exceedance of surface water quality trigger values protocol

10.1.3 Downstream Receptors

Groundwater modelling indicates that, when leakage from the alluvial aquifer as a result of mine progression is at its peak, there will be a very small loss of approximately 1.3% of mean annual streamflow from Bowmans Creek. The peak leakage rate leading to this small loss in stream flow is predicted to occur for a limited time during the last year of mining in the Entrance Pit, and falls well below the range of estimated baseflow contributions observed throughout the historical record (SKM, 2014).

All land along Bowmans Creek downstream of LCO to Ashton is owned by Glencore and as such there are landowners potentially affected by this loss in streamflow. Hence no mitigation or compensation measures are necessary for the negligible loss in streamflow predicted for Bowmans Creek.

As noted in Section 7.5, the water balance will be reviewed annually, and the outcomes of this review reported as part of the LCO Annual Review. Potential impacts on downstream receptors will be re-assessed as part of each model review.

10.2 Groundwater

10.2.1 Exceedance of Trigger Values

LCO will monitor groundwater levels, groundwater quality and abstraction volumes in accordance to this monitoring plan. If an exceedance is observed in the groundwater data, a Trigger Action Response Plan (TARP) must be followed. ***Table 29*** presents the definitions used within this WMP to identify exceedances and typical responses if they were to occur.

Table 29 Definition of exceedance criteria

Adopted terminology	Comment
Investigation trigger	Occurs when: A nominated trigger value provided in either **Table 9-14**, **Table 9-16** or **Table 9-17** is exceeded three or more times consecutively; or a trigger value in **Table 9-15** is activated. Action is taken in the form of resampling, a review of all data or checks against model predictions and completion of an investigation report to determine whether mining related impact. Further detail is provided in **Section 10.2.2**.
Management / mitigation trigger	Occurs when a nominated trigger value is exceeded three or more times, and a potential impact to a receptor and or the potential for environmental harm is identified. Action is taken in the form of further detailed hydrogeological studies to investigate the cause of the exceedance, determination of appropriate mitigation strategy for detailed design and implementation. The severity of the exceedance may instigate immediate remediation in the form of on-ground works at the discretion of the Environmental Manager. Further detail is provided in **Section 10.2.2**.
Drawdown limit	Occurs when the groundwater elevation at ALV9L (new site) and / or ALV8L (existing site) falls below the pre-defined limit specified in **Table 9-13**. Action can occur as an investigation trigger or management / mitigation trigger upon the Environmental Manager's decision. The exceedance of the drawdown limit requires reporting to the DAWE within 5 days, and the DPIE - Planning and Assessment within 7 days in accordance with Schedule 5 of DA305-11-01.

When an exceedance has been investigated the findings of the investigation will be reported in the Annual Review.

10.2.2 Response Plan

Figure 14 presents how the response plan may be implemented based on the exceedance of nominated trigger values. If the results are outside the trigger limits notification will be made to NSW DPI - Water, DPIE – Planning and Assessment and DAWE, and an Investigation Trigger is activated to determine if the impacts are potentially mining related. It is highlighted that the notification is for information purposes only.

The investigation trigger will include:

- Assessment of the extent of drawdown from mining operations and whether the piezometers triggered are within the drawdown area;
- Any potential seepage sources. If necessary further water quality sampling to characterise the anions and cations to assess if the groundwater has been impacted by mine affected water;
- Review of the cumulative rainfall deficit to determine if water levels are responding to climatic variations or if the piezometers that have exceeded the trigger limits are anomalous to general trends; and
- If any exceedances are outside the maximum ranges recorded or would impact down gradient beneficial uses.

If it is clear that impacts are not mining related and there is no potential for environmental harm then the investigation report is forwarded to NSW DPIE - Water, DPIE – Planning and Assessment and the DAWE, with no further action taken. The monitoring results and the assessment are also included in our Annual Review. At this point DPIE - Water or DAWE can review the assessment outcomes and direct further investigation to be completed by a hydrogeologist as recommended. As stated previously, the 20th percentile EC trigger is only used to assess the potential for increased leakage of groundwater from the alluvial aquifer to the hard rock aquifer due to mining. For this impact to occur it needs to be associated with a declining water level in the alluvial that is not climate related. This trigger will only be reported when this trend is observed.

If the results of the initial assessment is inconclusive, or indicates that there is a potential that the exceedances have been mining related then an investigation is undertaken by an experienced hydrogeologist. The hydrogeologist assesses the data to determine:

- Is there the potential for environmental harm;
- If the impacts are mining related and or due to cumulative impacts from neighbouring operations;
- If the impacts are within the predictions of the groundwater model and in accordance with the license allocations the operations hold;
- If the groundwater model needs to be recalibrated;
- Review the actions required under the trigger action response plan and ensure that the actions are appropriate; and
- Assess if additional monitoring is required.

The results of the assessment are reported to DPIE - Water, DPIE – Planning and Assessment and DAWE and a management/mitigation trigger initiated as appropriate.

The typical responses that would be assessed to mitigate impacts include:

- Use of the operations raw water allocations to supplement baseflows in the creek via releases of raw water to the creek;

- Sealing sections of the alluvium to reduce seepage losses;
- Altering the pit dewatering system to reduce drawdown; or
- Grout injection into the hard rock aquifer to reduce vertical hydraulic conductivity.

As discussed in Section 9.2.3.2 where an investigation of an exceedance of Groundwater Level Trigger Definition #2 has concluded that the exceedance is not mining-related, should groundwater levels continue to be measured below the lower 10th percentile for a further nine months, such that the exceedance has continued continuously for 12 months notification will be made to the DAWE. The subsequent investigation shall be undertaken to confirm that the exceedance remains unrelated to mining activity. If this is not the case, then a management/mitigation trigger will be applied.

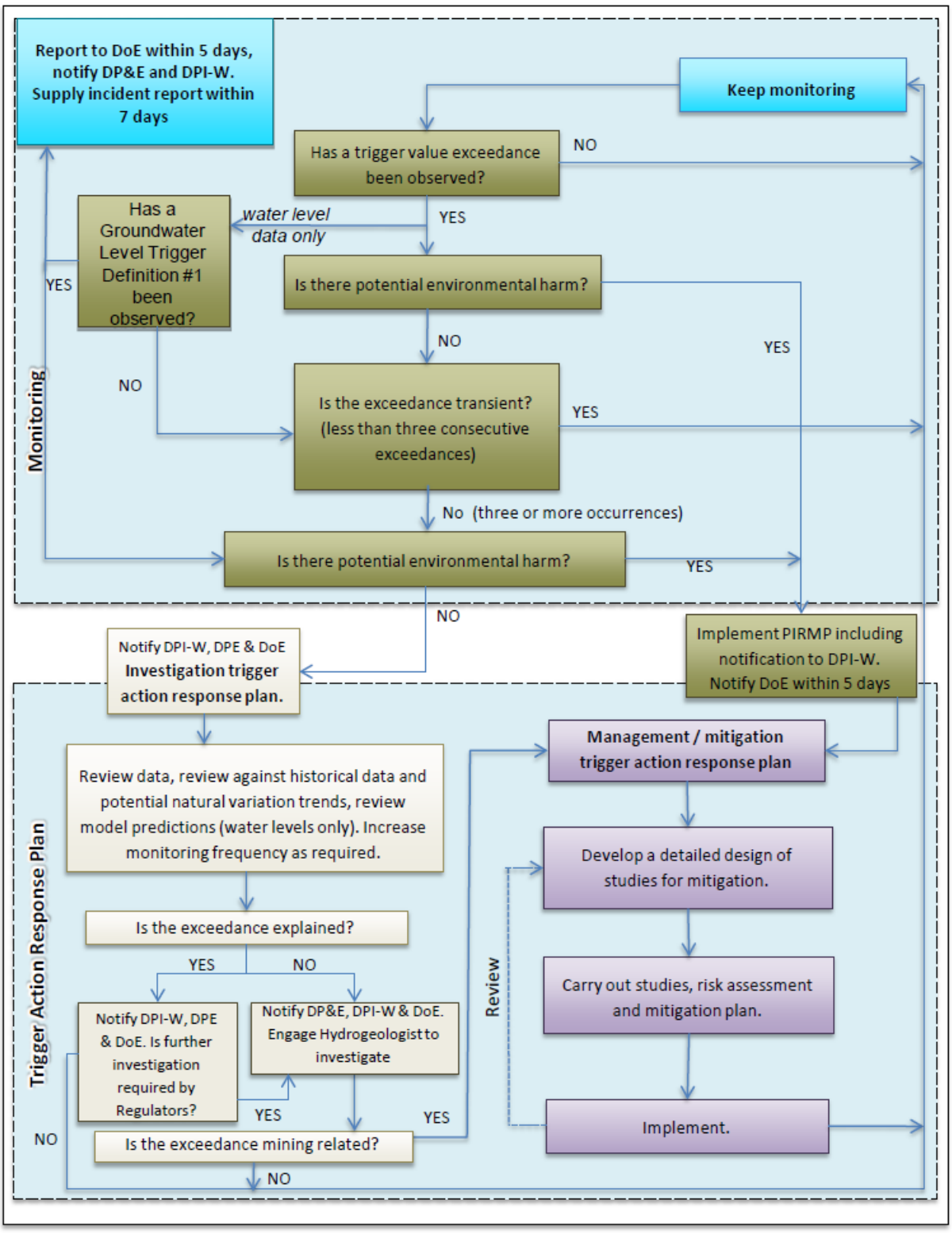


Figure 14 Exceedance of groundwater trigger values action response plan (TARP)

10.2.3 Bowmans Creek Alluvium

In accordance with condition 23 (c)(iv) of DA 305-11-01, measures to mitigate any direct hydraulic connection between the backfilled open cuts and the Bowmans Creek alluvium will be investigated if the potential for adverse effects is detected as part of the monitoring undertaken on site. However, it is noted that as documented in the groundwater assessment conducted for Mod 5 (SKM, 2014), the peak predicted losses from the alluvium (corresponding to a drawdown of up to 2 metres) are not predicted to occur until the progression of the Entrance Pit to the south-eastern side of the dyke and Davis Creek Fault and into the M49 underground workings, in approximately 2021 and 2022. Until this time the Entrance Pit is predicted to result in minor additional impacts on leakage rates. Accordingly, investigations into mitigation measures with regards to hydraulic connection are not anticipated to be required until that time.

If groundwater leakage in excess of that predicted in the EA for Mod 5 is predicted by the groundwater model, as it is reviewed and updated in accordance with the validation and calibration procedures outlined in Section 9.3, measures to prevent, minimise, or offset this loss will be investigated at that time.

10.3 Unforeseen Impacts

In the event of unforeseen impacts associated with surface water and groundwater, the following will be implemented:

- Conduct a preliminary review of the nature of the impact including monitoring data and current mine activities and land use practices.
- Commission an investigation by an appropriate specialist into the unforeseen impact to confirm the cause and effect and consider relevant options for amelioration of impact(s) as appropriate.
- Prepare an action plan in consultation with the appropriate regulatory agency.
- Mitigate casual factors where possible.
- Implement additional monitoring as necessary to measure the effectiveness of the controls implemented.
- Update the Water Management Plan as necessary.

The implementation of the mitigation measures will be undertaken in consultation with DPIE - Planning and Assessment, DPIE - Water, Environment Protection Authority (EPA) and DAWE and will be reported in the Annual Review.

11. Reporting

11.1 Overview

All monitoring records are kept by LCO within the Glencore Environmental Monitoring Database. Monitoring and water balance results will be reported according to the requirements in the relevant monitoring sections of this management plan. Typically these results are presented in the monthly EPL compliance report and reported annually in the Annual Review. Both reports are available on the LCO external website. In addition, water take across Ravensworth/Mt Owen and LCO will be included as part of the annual analysis and reporting of data.

Additionally each discharge event is recorded. An annual report of activity under the HRSTS is forwarded to the EPA.

In accordance with Condition 25 of EPBC 2013-6908, this management plan will be published on the LCO website within one month of being approved, and will remain on the website for the lifetime of the approval.

Within three months of each 12 month anniversary of the commencement of the action (activities approved by Mod 5 and within the referral areas as shown on Figure 6.1) LCO will publish a report on the website addressing compliance with this management plan, in accordance with Condition 19 of EPBC 2013/6908. This report will also be provided to the DAWE.

11.2 Trigger Exceedance

All reporting of trigger exceedances will be carried out as per the Trigger Action Response Plan processes discussed in Section 10.

To address the requirements EPBC Approval 2013/6908 Condition 15, if monitoring results indicate that a management/mitigation trigger is activated for surface water triggers the following protocol will be followed:

a) A written record of any exceedance must be kept.

b) DPIE - Planning and Assessment and DPIE - Water will be notified if an incident has occurred, and an incident report will be submitted within 7 days.

c) The exceedance will be reported to DAWE within 5 business days of the monitored exceedance if the exceedance has the potential to result in environmental harm. . The Pollution Incident Response Management Plan (PIRMP) will also be implemented and DPIE - Water notified in accordance with the PIRMP reporting requirements.

d) Unless agreed otherwise by DAWE in writing, an investigation into the potential for environmental harm for any exceedance must be undertaken and a written report provided to the DAWE, DPIE – Planning and Assessment & DPIE - Water within 30 calendar days of receiving the result including:

- A description of the investigations carried out;
- A statement of the cause and extent of the exceedance;
- An assessment of the potential for environmental harm. This assessment will include;
    - A review of the nature of the impact based on monitoring data results;
    - A review of baseline data of the receiving environment, such as Bowmans and Bayswater Creeks, to ascertain the potential for harm;
    - Investigate the steps required to rectify the situation causing the exceedance and ascertain if this will enable environmental harm to be avoided.
- Actions taken to prevent environmental harm (if required); and
- Actions taken to prevent exceedance from re-occurring in the future.

To address the requirements EPBC Approval 2013/6908 Condition 16, if the groundwater monitoring identifies groundwater drawdown in the alluvium of Bowmans Creek of more than 2 metres, LCO must:

a) The exceedance will be reported to DAWE within 5 business days of the monitored exceedance. DPIE - Planning and Assessment and DPIE - Water will also be notified and an incident report submitted within 7 days.

b) The Pollution Incident Response Management Plan (PIRMP) will be implemented and DPIE - Water notified in accordance with the PIRMP reporting requirements.

c) Unless agreed otherwise by the Department in writing, complete an investigation into the potential for environmental harm and provide a written report to the Department within 30 calendar days of receiving the result, including:

- A description of the investigations carried out;
- A statement of the cause and extent of the exceedance;
- actions taken to prevent environmental harm; and
- actions taken to prevent exceedance from re-occurring in the future.

11.3 Incident Reporting

In the event of a pollution incident that causes or threatens material harm to the environment, the LCO Pollutant Incident Response Management Plan (PIRMP) ***(LIDOC-90533967-2175)*** will be implemented and relevant PIRMP reporting requirements adhered to.

In accordance with Schedule 4 Condition 11 of DA305-11-01, LCO shall notify the DPIE - Planning and Assessment and any other relevant agencies such as DPIE - Water and EPA of any incident which occurs. Within 7 days of the date of the incident, LCO will provide the DPIE - Planning and Assessment and other relevant agencies with a detailed incident report. Any further reports requested by the DPIE - Planning and Assessment will be provided in a timely manner as agreed with the Department.

In accordance with Condition R4 of EPL 2094, LCO must notify the EPA by telephoning the Environmental Line service of 131 555 immediately if LCO becomes aware of any pollution of waters incident in accordance with Condition L1. This notification is irrespective of whether LCO believe that environmental harm has occurred as defined by Part 5.7 of the POEO Act.

11.4 Notifications to Affected Landowners

In accordance with Schedule 4 of DA 305-11-01, if the results of monitoring undertaken at LCO as documented in this water management plan identify impacts generated by the development are greater than the impact assessment criteria, except where this is predicted in the Environmental Assessment and/or a negotiated agreement has been entered into in relation to that impact, then LCO shall notify the DPIE - Planning and Assessment and the affected landowners and/or existing or future tenants (including tenants of mine owned properties) accordingly and provide quarterly monitoring results to each of these parties until the results shown the development is complying with the impact assessment criteria.

12. Validation Program

12.1 Water Balance Model

The site water balance will be validated and calibrated in accordance with the program described in ***Section 7.5***. Any revisions undertaken will be documented in a modelling report and discussed in the Annual Review. LCO will liaise with DPIE - Water at times of model calibration, as required, to ensure that sufficient entitlement is held from each water source for current and ongoing operations.

12.2 Groundwater Model

LCO will review and validate the Project's groundwater model to identify whether scenarios and predictions are applicable for scheduled mine operations. This review will be undertaken every three years following the process outlined in Section 9.3. Any revisions undertaken will be documented in a modelling report and discussed in the Annual Review. Liddell Coal Operations liaise with DPIE - Water, as required, at times of model calibration to ensure that sufficient entitlement is held from each water source for current and ongoing operations.

13. Water and Data Sharing

A water sharing system operates across the Glencore mining operations within the Ravensworth area as follows:

a) Liddell Coal Operations;

b) Ravensworth Complex (incorporating the open cut and underground operations); and

c) Mt Owen Complex (includes Ravensworth East, Mt Owen and Glendell).

The various mining operations within the water sharing system are linked through a range of water transfer and storage infrastructure. Inherent in the system is the sharing of water between operations so as to both avoid the import of water from external sources and to minimise offsite discharges.

A Greater Ravensworth Area Water Balance Model (GRAWBM) has been developed which links together three separate sub-models for the three operations. This model has been progressively developed by since 2009 by combining the three individual models and adding water transfers between the operations. The results from the model enable the probability of various water balance outcomes to be predicted and thereby minimise cumulative impacts in relation to water resources from the three operations.

In addition to this, the groundwater model discussed in this WMP is a regional model, that is, it incorporates all mining operations in the area including LCO, Mt Owen Complex, Ravensworth Operations, Integra Underground, as well as other non-Glencore sites including Ashton and Coal and Allied. The model therefore inherently enables prediction of cumulative impacts from the neighbouring mining operations.

The review and update of the surface water and groundwater models covering LCO, Mt Owen, and Ravensworth is therefore a collaborative effort given the linkages between the three sites with regards to water management.

All Glencore sites, including LCO, Ravensworth and Mt Owen Complex, store monitoring data in the Environmental Monitoring Database (EMD). The data from key monitoring sites, such as those where a cumulative impact could be detected is also shared between relevant operations.

Glencore Coal Assets Australia (GCAA) also provides an over-arching water management protocol for operations, addressing among other aspects, measures to minimise water quantity and quality impacts and water sharing opportunities. To this end and to integrate the GRAWBM, a Greater Ravensworth Area Water Management System has been established to allow for the management of water across the GRA and to mitigate the business risks posed by shortfalls or excess of water, while leveraging associated cost savings and minimising fresh water use across the GRA. An internal management plan provides reference to the procedures to be implemented so that the GRWMS can be operated and maintained in accordance with each operation's water demands and infrastructure capacities, and in accordance with regulatory requirements.

Finally, where an incident investigation in relation to a complaint or exceedance of the trigger levels documented in ***Sections 9.1.3*** and ***9.2.4*** identifies potential cumulative impacts, joint investigation will then be initiated to determine the appropriate mitigation/remediation strategy.

14. Review

This document shall be reviewed in accordance with condition 10 Schedule 5 of DA 305-11-01, and if necessary revised, within three months of the following:

a) The submission of an Annual Review;

b) The submission of an incident report under the Surface and Groundwater Response Plan (refer to ***Section 10***)

c) The submission of an independent environmental audit; and

d) Following any modification to the LCO approvals.

15. Audits and Inspections

15.1 Internal Audits

Internal audits of this document will be undertaken every three years or when triggered by a modification to the development consent. Improvements from the audit are to be incorporated in the site action database so the actions are assigned to the relevant people and completed.

15.2 External Audits

External audits of this management plan will be undertaken by specialists periodically as determined by the LCO Environmental and Community Manager or in response to significant environmental incidents for which a systems failure has been determined as a contributor to the incident.

An Independent Environmental Audit will be undertaken every three years (or as otherwise required by the DPIE - Planning and Assessment) by an audit team whose appointment has been endorsed by the Secretary of the DPIE - Planning and Assessment, as required by Schedule 5 Condition 4 of DA 305-11-01.

Any actions arising from external audits will be loaded into the site action database and assigned to the relevant people for completion.

In addition, an independent audit will be conducted by LCO upon the direction of the Minister, in accordance with condition 21 of EPBC 2013/6908, by and independent auditor approved by the Minister.

16. Complaints Procedures

If complaints relating to surface water or groundwater are received by LCO, the complaint details are to be circulated and actioned by the responsible party. The procedures and protocols are detailed in the LCO Community Complaint and Enquiry Management Procedure.

17. Training and Awareness

All personnel working on site are required to complete a site familiarisation induction prior to commencing any work onsite. This induction includes an environmental component relating to water management requirements including:

- Spill control response and requirement not to pollute waters;
- Pollution incident response management;
- Incident reporting requirements; and
- When a GDP is required.

The site familiarisation “refresher” is required to be completed annually and the full induction is required to be completed every 3 years.

All personnel working at LCO are required to complete three yearly Environmental Awareness Training. In addition to further detailed information regarding the items listed above, the awareness training package details clean and mine affected water strategies and the location of nearby sensitive water receptors including Bayswater Creek and Bowmans Creek. Further training competency is provided for those employees involved with water transfer internally or externally, providing additional focus on flow pipe leak detection and alarm response protocols.

18. Document Information

Relevant legislation, standards and other reference information must be regularly reviewed and monitored for updates and should be included in the site management system. Related documents and reference information in this section provides the linkage and source to develop and maintain site compliance information.

18.1 Related Documents

Related documents, listed in ***Table 18-1*** below, are *documents* directly related to or referenced from within this document.

Number	Title
LIDOC-90533967-797	Environmental Management Strategy
LIDOC-90533967-2175	Pollution Incident Response Management Plan
LIDOC-90533967-3687	Biodiversity Management Plan
LIDOC-90533967-798	Community Complaint and Enquiry Management Procedure
LIDOC-90533967-4423	Water Management TARP
LIDOC-90533967-1062	HRSTS Discharge Procedure
LIDOC-90533967-1811	Monthly Environmental Inspection Procedure
LIDOC-90533967-4375	Erosion & Sediment Control Inspection Form
GCAA-625378177-10320	11.03 Water Management Protocol
GCAA-625378177-10323	11.06 Erosion and Sediment Control Protocol

Table 18-1 – Related documents

18.2 Reference Information

Reference information, listed in ***Table 18-2*** below, is *information* that is directly referred to for the development of this document.

Reference	Title
Landcom (2004)	Managing Urban Stormwater: Soils and Construction (the Blue Book), Volume 1
DECCW (2008)	Managing Urban Stormwater: Soils and Construction Volume 2E Mines and Quarries.
Minerals Council of Australia (1997)	Mine Site Water Management Handbook
EcoLogical Australia (ELA) (2013)	Liddell Coal Operations Modification 5 - Aquatic Ecology and Groundwater Dependant Ecosystem Assessment
Umwelt (Australia) Pty Limited (2006)	Environmental Assessment for Liddell Colliery Modification to Development Consent. Prepared for Liddell Coal Operations Pty Ltd
SLR Consulting Australia (2013a)	Liddell Coal Operations Proposed Modification 5, Environmental Assessment

Reference	Title
SLR Consulting Australia (2013b)	Liddell Coal Operations Proposed Modification 5, Soil and Land Resource Assessment
Kovac and Lawrie, 1991	Soil Landscapes of the Singleton 1:250,000 Sheet, 1991
Boughton, W.C., 2004	The Australian Water Balance Model. Environmental Modelling and Software, 19:943-956.
SKM, 2014	Liddell Coal Operations Modification 5 to Development Consent DA 305-11-01, Groundwater Impact Assessment, V8, January 2014
Gilbert & Associates, 2014	Liddell Coal Mine, Modification 5, Surface Water Assessment, June 2014

Table 18-2 – Reference information

18.3 Change Information

Full details of the document history are recorded in the document control register, by version. A summary of the current change is provided in ***Table 18-3*** below.

Version	Date	Review Team	Change Summary
1.0	13 March 2015	LCO, SLR Consulting, Jacobs, Gilbert & Associates	New document
2.0	05 May 2015	LCO, SLR Consulting,	Update to address comments from DoE and NOW in multiple sections of the document.
3.0	25 May 2015	B de Somer, L Barben	Update Fig 10-2 to address final NOW comments.
4.0	7 July 2015	L Barben, J Young	Evidence of DP&E Secretary approval of WMP consultants attached as Appendix D. Update to address comments from DP&E in multiple sections of the document.
	13 August 2015	L Barben, B de Somer	Append DP&E Approval
5.0	15 October 2015	B de Somer, L Barben	Include additional reference to GCCA Water Management Protocol in Section 1. Updated references section 19.1.
6.0	18 December 2015	B de Somer, Jacbos	Update to ground water triggers in Section 9.2.
7.0	21 January 2016	L Barben, H Simms	Update to Appendix D to include DP&E approval dated 20.1.2016
8.0	October 2016		Document migration to new SharePoint.

Version	Date	Review Team	Change Summary
9.0	18 August 2017	B de Somer, S Downes (GCAA), Justin Bell (Jacobs)	Update to groundwater triggers and TARP in Sections 9.2 and 10.2. Inclusion of recommendation from DPI-Water in Section 9.2.3.3 and adjust Fig 10-1 as per DPI-Water correspondence dated 2 September 2016 and included in Appendix A. Further update to varying sections as per DoE revision comments received December 2016. Further update to varying sections as per DoE revision comments dated received 20 March 2017.
10.0	16/04/2018	M Wendtmann	Critical Control logo added to document as per the GCAA Catastrophic Hazard Project.
11.0	7 July 2018	B de Somer, J Young	Update contextual information throughout document to make it current with 2018 operations. Update to Table 2.1 and section 8.10 as per feedback from DPE dated 4/10/2018. Inclusion of DPE approval letter of version 9.0 to Appendix D dated 4/10/2018.
12.0	2 July 2019	B de Somer, J Young	Update contextual information throughout document to reflect DA305-11-01 Modification 7. Minor amendments to reflect 2019 Independent Audit Recommendations and Annual Review updates for currency Updated Figures 9-1 and 9-2 to reflect modified DA305-11-01 boundary. Updated Table 2.4.to reflect Water Management Act licencing changes.
13.0	20 July 2021	B de Somer, L Depczynski	Updated to new template. Updated to include revised Environmental Protection Licence 2094 Points and requirements and general document updates.
14.0			

Table 18-3 – Change information

Appendix A - NSW DPIE-Water Correspondence

Department of Primary Industries
Office of Water

Contact Hannah Grogan
Phone (02) 4904 2516
Fax (02) 4904 2501
Email Hannah.grogan@dpi.nsw.gov.au

Our ref ER21632
Your ref DA 305-305-11-01 MOD 5

Ben de Somer
Environment & Community Superintendent
Liddell Coal Operations Pty Ltd

By email: ben.desomer@glencore.com.au

Dear Mr de Somer

Liddell Glencore Plan for Water Management (LCO SD PLN 0041) – Additional Information

The NSW Office of Water has reviewed the revised Liddell Coal Operations Water Management Plan referred on 5 May 2015. In accordance with this review the following comments are provided.

It is noted that recommendations made regarding updating Table 2.5 to include the detail of water sources and water management zones, have been incorporated into the Water Management Plan. Additionally it can be seen that tables 2.4 and 2.5 have been amended to refer to terminology consistent with *Water Management Act 2000*. Also changes are noted as having occurred to more accurately represent licences held under the Water Act 1912 by Liddell Coal Operations. However it is noted that the revised WMP submitted to NSW Office of Water for review includes WAL 18302 in table 2.5 which is a groundwater alluvial access licence.

Information provided by Liddell Coal Operations regarding final landform drainage satisfies the NSW Office of Water that removal of a portion of chain of ponds creek was considered in the approval of DA 305-11-01 MOD 5 (mine extension). As such the information requested by the NSW Office of Water via letter dated 4 May 2015 is no longer required.

However the NSW Office of Water provides the following comments regarding further information provided regarding *Figure 10-1 Exceedance of surface water quality trigger values protocol*:

- The NSW Office of Water should be notified in conjunction with DP&E.
- The written report to be provided to the Department of Environment (DoE) within 30 Calendar days should also be provided to the NSW Office of Water for review.

Additionally the acronym (section 1.6) for DoE should note the definition of 'Department' as per EPBC approval, 2013/6908, this being 'the Australian Government Department administering the EPBC Act.'

The NSW Office of Water finds the response timeframes in Figure 10-1 to be consistent with approvals from both the NSW and Commonwealth Governments.

Similarly the NSW Office of Water provides the following comments regarding *Figure 10-2 Exceedance of groundwater trigger values action response plan (TARP)*:

- The NSW Office of Water should be notified within 7 days if an exceedance is non-transient, or if the exceedance is considered to pose potential environmental harm.
- The written report required as per condition 16 of 2013/6908 should also be provided to the NSW Office of Water for review.

Level 11, 10 Valentine Avenue, Parramatta | PO Box 3720 Parramatta NSW 2124
t (02) 8281 7777 | f (02) 88387554 | www.water.nsw.gov.au

- After 'Has a trigger value exceedance been observed?' If the answer is yes the next step in the flow chart should be 'Is there potential environmental harm?' This should be reviewed after each monitoring round.

It can be seen that potential impacts on downstream receptors will be re-assessed as part model recalibration.

Any written notification required to be provided to the Office of Water should be provided by email to water.referrals@dpi.nsw.gov.au or the primary corporate email address specified on the Office of Water's website at the time of notification.

Please contact Hannah Grogan, Water Regulation Officer (Newcastle) on (02) 4904 2516 or hannah.grogan@dpi.nsw.gov.au if you have further enquiries regarding this matter.

Yours sincerely

Mitchell Isaacs
Manager, Strategic Stakeholder Liaison
12 May 2015

From: Desomer, Ben (Liddell - AU)
To: Desomer, Ben (Liddell - AU)
Subject: FW: LCO Water Management Plan - Ground water TARP
Date: Monday, 25 May 2015 8:40:25 AM

From: Hannah Grogan [mailto:hannah.grogan@dpi.nsw.gov.au]
Sent: Friday, 22 May 2015 2:50 PM
To: Desomer, Ben (Liddell - AU)
Cc: Water Referrals
Subject: Re: LCO Water Management Plan - Ground water TARP

Good Afternoon Ben,

The NSW Office of Water (NOW) is satisfied that the updated trigger action response plan satisfies the recommendations previously made by NOW via letter dated 12 May 2015.

The updated groundwater TARP also reflects the description of the TARP in section 10.2.2 of the water management plan.

Please do not hesitate to contact me on 4904 2516 should you wish to further discuss.

Kind regards,

Hannah Grogan | Water Regulation Officer

Department of Primary Industries | Office of Water

Level 3 | 26 Honeysuckle Drive | Newcastle NSW 2300

T: 02 4904 2516 | F: 02 4904 2503 | E: hannah.grogan@dpi.nsw.gov.au

W: www.water.nsw.gov.au

On 22 May 2015 at 14:19, <Ben.Desomer@glencore.com.au> wrote:
Good afternoon Hannah,
As per our discussion, I have amended *Fig 10-2 Exceedance of groundwater trigger values action response plan (TARP)* form our Water Management Plan to align with your recommendations in your letter dated 12 May 2015 in relation to when assessment and notification of environmental harm should occur. A copy is attached for your reference and will be inserted in the WMP. Please note that with regards to the step "Implement PIRMP including notification to NOW", this requires us to notify authorities nominated under our Pollution Incident Response Management Plan (PIRMP) immediately as per the definitions under the POEO Act.
I trust this meets your requirements. Please advise if you require any further amendment before I finalise the WMP.
Regards,

Ben de Somer
Environment & Community Manager
Liddell Coal Operations Pty Ltd - A Glencore Managed Company
Telephone: +61 2 6570 9947
Fax: +61 2 6570 9999
Mobile: +61 (0) 427 936 734

Email: ben.desomer@glencore.com.au

Department of Primary Industries Water

Contact Hannah Grogan
Phone (02) 4904 2516
Fax (02) 4904 2501
Email Hannah.grogan@dpi.nsw.gov.au

Ben de Somer
Environment & Community Superintendent
Liddell Coal Operations Pty Ltd

Our ref V15/3875#51 (INW16/39962)

By email: ben.desomer@glencore.com.au

Dear Mr de Somer

Liddell Water Management Plan – Revised Groundwater Monitoring Triggers and Associated Trigger Action Response Plan

DPI Water has reviewed the revised groundwater monitoring triggers and associated Trigger Action Response Plan (TARP) and provides the following advice.

Liddell Coal Operations (LCO) commissioned an Investigation Trigger Response Plan (ITARP) after transient exceedances of Electrical Conductivity (EC) trigger values were observed at the LBH Bowmans Creek alluvial aquifer groundwater monitoring well between June and September 2015. This ITARP also included investigation into exceedances observed in ALV 1 L and AVL 7 L Bowmans Creek alluvial aquifer groundwater wells which occurred over the same period.

DPI Water acknowledges that since this initial ITARP LCO have undertaken additional review and assessment of the groundwater monitoring triggers and associated trigger action response plan. It is the understanding of DPI Water that LCO is currently operating under two Water Management Plans (WMP), one of which has been approved by NSW State Government (Department of Planning and Environment) and the other of which has been approved by the Federal Government (Department of Environment). It is understood that LCO will be seeking to have this amended WMP approved with concurrence by both the State and Federal Governments.

DPI Water notes that the revised TARP includes the feedback provided by DPI Water at the meeting held on 4 July 2016. DPI Water provided the following feedback during this meeting:

- Inclusion for 20th percentile EC triggers for representative bores where lower salinity values may represent loss of water from the alluvial aquifer to the shallow hard rock aquifer as a result of mining drawdown.
- Extra step in TARP for DPI Water to review outcomes of initial assessment completed by LCO in the event of consecutive groundwater triggers and require further investigation by hydrogeologist.

DPI Water is satisfied with the revised groundwater monitoring triggers and associated TARP. However it is recommended that the trigger to assess mining induced increased leakage from the alluvial aquifer to the consolidated aquifer be based on a combination of the 20th percentile EC trigger and/or (i) a declining water level in the alluvial that is not climate related (ii) a measurable loss in Bowmans Creek stream flow between the upstream and downstream gauges adjacent to LCO and closest to monitoring sites ALV2S and ALV8S.

It is also recommended that the Figure 10-1 be updated to reflect DPI Water's name change from NSW Office of Water.

Please contact Hannah Grogan, Water Regulation Officer (Newcastle) on (02) 4904 2516 or hannah.grogan@dpi.nsw.gov.au if you have further enquiries regarding this matter.

Yours sincerely

Richard Nevill
A/Regional Manager – Metro
Water Regulation Operations
2 September 2016

From: Hannah Grogan
To: Desomer, Ben (Liddell - AU)
Subject: Re: Liddell Coal - amended groundwater triggers
Date: Friday, 9 September 2016 3:15:08 PM

Thank you Ben.

Should any further discussion be required please do not hesitate to contact me.

Kind regards,

Hannah Grogan | Water Regulation Officer
NSW Department of Primary Industries | Water
Level 3 | 26 Honeysuckle Drive | Newcastle NSW 2300 | PO Box 2213, Dangar NSW 2309
T: 02 4904 2516 | F: 02 4904 2503 | E: hannah.grogan@dpi.nsw.gov.au
W: www.water.nsw.gov.au | www.dpi.nsw.gov.au

On 9 September 2016 at 15:06, <Ben.Desomer@glencore.com.au> wrote:

> Good afternoon Hannah,
>
> Thank you for sending through the review comments on the revised groundwater triggers and associated TARP. We have reviewed the correspondence and wish to advise that we accept the recommendations and have incorporated these within the revised management plan. I expect to submit the Water Management Plan, including your correspondence, to DPE and DoE early next week for their review and approval.
>
> Thanks again for your assistance.
>
> Regards,
>
> Ben de Somer
> *Environment & Community Manager*
>
> *Liddell Coal Operations Pty Ltd - A Glencore Managed Company*
>
> *Telephone*: +61 2 6570 9947
> *Fax*: +61 2 6570 9999
> *Mobile*: +61 (0) 427 936 734
>
> *Email*: ben.desomer@glencore.com.au

NSW GOVERNMENT Department of Industry

Contact: Jane Curran
Email: jane.curran@nrar.nsw.gov.au

Our ref: DOC21/32729, V15/3875#51

Mikayla Henderson
Environment & Community Officer
Liddell Coal Operations, Glencore
Old New England Highway
Ravensworth NSW 2333

Emailed: Mikayla.Henderson@glencore.com.au

Dear Mikayla,

22 February 2021

Re: Liddell Coal Operations (LCO) Modification 7 - Water Management Plan (WMP)

Thank you for giving the Department of Planning, Industry and Environment – Water (DPIE-Water) the opportunity to review the Water Management Plan for the Liddell Coal Operations (LCO) Modification 7, please see DPIE-Water's response below.

DPIE-Water recommends the proponent:

1 Update Table 5 of WMP with correct shares link to water access licences
2 Check and update Table 2 of WMP with correct Sections (references) where conditions are addressed/stated in the WMP document.

Should you have any further queries in relation to this submission please do not hesitate to contact the Natural Resources Access Regulator's Service Support Team at nrar.servicedesk@dpie.nsw.gov.au.

Yours sincerely

Alison Collaros
Licensing and Approvals Manager (East)
Natural Resources Access Regulator
Department of Planning, Industry and Environment

Level 11 Macquarie Tower, 10 Valentine Ave, Parramatta NSW 2150 | Locked Bag 5123 Parramatta NSW 2124
e: nrar.servicedesk@dpie.nsw.gov.au | https://www.industry.nsw.gov.au

Appendix B - NSW Environment Protection Authority Correspondence

NSW EPA

Our reference: DOC15/111226-01, EF13/3223
Contact: Kurt Sorensen (02) 4908 6827
Electronic correspondence to: hunter.region@epa.nsw.gov.au

LIDDELL COAL OPERATIONS PTY LIMITED
PO BOX 7
SINGLETON NSW 2330
Attention: Mr Ben De Somer

Ben.Desomer@glencore.com.au

Dear Ben

MANAGEMENT PLANS FOR LIDDELL COAL OPERATIONS PTY LIMITED
ENVIRONMENT PROTECTION LICENCE (EPL) 2094

I refer to your email to the Environment Protection Authority (the EPA), dated 2 April 2015, providing copies of the Liddell Coal Water Management Plan (the Plan), and seeking comments from the EPA on the Plan.

The EPA encourages the development of such plans to ensure that proponents have met their statutory obligations and designated environmental objectives. However, the EPA does not review these documents as our role is to set environmental objectives for environmental/conservation management, not to be directly involved in the development of strategies to achieve those objectives.

If you require any further information regarding this matter please contact Kurt Sorensen on 4908 6827.

Yours sincerely

18-5-15

KAREN MARLER
Head Regional Operations Unit – Hunter
Environment Protection Authority

PO Box 488G Newcastle NSW 2300
Email: hunter.region@epa.nsw.gov.au
117 Bull Street, Newcastle West NSW 2302
Tel: (02) 4908 6800 Fax: (02) 4908 6810
ABN 43 692 285 758
www.epa.nsw.gov.au

Appendix C - DAWE Correspondence

Australian Government
Department of the Environment

Our reference: 2013/6908

Contact Officer: Manel Samarakoon
Telephone: (02) 6274 1080 Facsimile: (02) 6274 1878
Email: post.approvals@environment.gov.au

Mr Ben de Somer
Environment & Community Superintendent
Liddell Coal Operations Pty Ltd
PO Box 7
SINGLETON NSW 2330

Dear Mr Somer

Extension of Liddell open cut coal mining operations – EPBC 2013/6908
Approval of Plan for Biodiversity Management and Plan for Water Management

I refer to your recent correspondence to the Department which attached copies of the following documents:

- Plan for Water Management, version 2.0, 13 May 2015 (condition 12)
- Plan for Biodiversity Management, version 2.0, 12 May 2015 (conditions 2, 3 & 4)

Officers of the Post Approvals Section have reviewed the above plans and found them to satisfactorily meet the requirements of the relevant approval conditions. On this basis, and as delegate of the Minister for the Environment, I have decided to approve the above plans. You must now undertake the action in accordance with the approved plans.

Please ensure that you maintain accurate records of all activities associated with, or relevant to the conditions of approval, so that they can be made available to the Department on request. Such documents may be subject to audit and used to verify compliance. Summaries of results of audits may be published by the Department. Information about the monitoring and audit program can be found on the Department's website at http://www.environment.gov.au/resource/compliance-and-enforcement-policy-environment-protection-and-biodiversity-conservation-act

You should note that any transfer of this approval to another person must have the consent of the Minister for the Environment under section 145B of the EPBC Act.

If you have any enquiries please contact Manel Samarakoon on 02 6274 1080.

Yours sincerely

S.Gaddes

Shane Gaddes
Assistant Secretary
Compliance & Enforcement Branch

14/5/2015

GPO Box 787 Canberra ACT 2601 • Telephone 02 6274 1111 • Facsimile 02 6274 1666
www.environment.gov.au

Australian Government
Department of the Environment and Energy

Our reference: 2013/6908

Mr Ben de Somer
Environment and Community Manager
Liddell Coal Operations
PO Box 7
SINGLETON NSW 2330

Dear Mr de Somer

Extension of Liddel Open Cut Coal Mining Operations (EPBC 2013/6908)

Thank you for your letter dated 12 September 2016 to the Department, seeking approval of the *Plan for Water Management*, in accordance with condition 12 of the approval decision dated 24 December 2014.

Officers of this Department have considered the *Plan for Water Management version 7.1* and are satisfied that it meets the requirements of condition 12 of the approval for this project. On this basis, and as a delegate of the Minister for the Environment, I have decided to approve the *Plan for Water Management version 7.1*. This plan must now be implemented.

In accordance with EPBC 2013/6908 condition 22, if the approval holder wants to act other than in accordance with this approved plan, the approval holder must submit a revised plan for approval. Until the Minister (or his delegate) has approved the revised plan, the approved version of the plan must continue to be implemented.

Should you require any further information please contact Hagen Ganahl, Assistant Director, Post Approvals Section, on 02 6274 1699 or by email: post.approvals@environment.gov.au.

Yours sincerely

James Barker
Assistant Secretary
Assessment and Governance Branch
Environment Standards Division

26/7 2017

Appendix D - Department of Planning, Industry and Environment Correspondence

From: Scott Brooks [mailto:Scott.Brooks@planning.nsw.gov.au]
Sent: Thursday, 22 January 2015 1:57 PM
To: Desomer, Ben (Liddell - Coal)
Cc: Mike Young (DPE-DASP)
Subject: Re: Approval of Water Management Plan consultant

Ben,
Following a review of your submission to use SLR Consulting for the Liddell Water Management Plan, I can advise the use of this consulting company and the following consultants has been approved by the Secretary, Dept Planning & Environment.

Nicole Armit
Andrew Behrens
Will Legg.

Scott Brooks
As Nominee of the Secretary, Planning & Environment
22-1-2015

Scott Brooks
Investigations (lead), Compliance
Planning Services, Resources Assessments
Planning & Environment
Suite 14, Level 1, 1 Civic Av
PO Box 3145
Singleton NSW 2330
http://www.planning.nsw.gov.au
E: scott.brooks@planning.nsw.gov.au
P: 02 6575 3401 | | M: 0419 970924
F: 02 65753415

NSW GOVERNMENT | Planning & Environment

Please consider the environment before deciding to print this e-mail.

>>> <Ben.Desomer@glencore.com.au> 1/22/2015 11:45 am >>>
Good morning Scott,

Please find attached request as discussed yesterday.

Regards,

Ben de Somer
Environment & Community Superintendent
Liddell Coal Operations Pty Ltd - A Glencore Managed Company
Telephone: +61 2 6570 9947
Fax: +61 2 6570 9999
Mobile: +61 (0) 427 936 734

Planning & Environment

Ben de Somer
Environment and Community Manager
Liddell Coal Operations Pty Ltd
PO Box 7
SINGLETON NSW 2330

Contact: Chris Knight
Phone: (02) 6575 3404
Fax:(02) 6575 3415
Email:christopher.knight@planning.nsw.gov.au
Our ref: DA 305-11-01

Dear Ben,

Liddell Coal Operations – Approval of the Water Management Plan, Noise Management Plan and the Air Quality Management and Monitoring Plan.

Thank you for forwarding the Liddell Coal Operations Water Management Plan, Noise Management Plan and the Air Quality Management and Monitoring Plan to the Department of Planning & Environment (the Department or DP&E), as required by Condition 29, Schedule 3 of DA 305-11-01.

The Department has conducted a review and wishes to advise that the Secretary has approved the Water Management Plan, the Noise Management Plan the Air Quality Management and Monitoring Plan (dated 7th, 13th & 15th July 2015 respectively).

This approval of the Water Management Plan, Noise Management Plan and Air Quality Management and Monitoring Plan replaces previous approvals dated 24/4/14, 8/4/14 and 24/4/14 respectively.

Please note that the requirements of the Water Management and Noise Management Plans come into force on the 31st August 2015 while the requirements of the Air Quality Management and Monitoring Plan come into force on 30th November. All three plans remain in force until replaced by any future updated approved Plans.

Could you please place a copy of the three plans on your website and forward a finalised copy of the plans (preferably in PDF format with a copy of this approval letter appended) for the Department's records by the end of August 2015.

Should you have any queries on this matter, please do not hesitate to contact Chris Knight, Senior Compliance Officer, on (02) 6570 3404 or email christopher.knight@planning.nsw.gov.au.

Yours sincerely,

Scott Brooks
Investigations (lead) Compliance Northern Region
as the Secretary's Nominee
13-8-2015

NSW GOVERNMENT Planning & Environment

Ben de Somer
Environment and Community Manager
Liddell Coal Operations Pty Ltd
PO Box 7
SINGLETON NSW 2330

Contact: Chris Knight
Phone: (02) 6575 3404
Fax:(02) 6575 3415
Email:christopher.knight@planning.nsw.gov.au
Our ref: DA 305-11-01

Dear Ben,

Liddell Coal Operations – Approval of the Water Management Plan, and Biodiversity Offset Management Plan.

Thank you for forwarding the Liddell Coal Operations Water Management Plan and Biodiversity Offset Management Plan to the Department of Planning & Environment (the Department or DP&E), as required by Condition 29, Schedule 3 of DA 305-11-01.

The Department has conducted a review and wishes to advise that the Secretary has approved the Water Management Plan, and Biodiversity Offset Management Plan (dated 18/12/2015 and 7/1/2016 respectively).

This approval of the Water Management Plan and Biodiversity Offset Management Plan replaces all previous approvals of these plans.

Please note that the requirements of the Water Management and Biodiversity Offset Management Plans come into force on the 1st February 2016. All plans remain in force until replaced by any future updated approved Plans.

Could you please place a copy of the two approved plans on your website and forward a finalised copy of the plans (preferably in PDF format with a copy of this approval letter appended) for the Department's records by the 1st February 2016.

Should you have any queries on this matter, please do not hesitate to contact Chris Knight, Senior Compliance Officer, on (02) 6570 3404 or email christopher.knight@planning.nsw.gov.au.

Yours sincerely,

W Jones 20/1/16

Wayne Jones
Investigations (lead) Compliance Northern Region
as the Secretary's Nominee

NSW GOVERNMENT Planning & Environment

Resource Assessments
Contact: Megan Dawson
Phone: 9274 6391
Email: megan.dawson@planning.nsw.gov.au

Mr Ben de Somer
Environment and Community Manager
Liddell Coal Operations Pty Ltd
PO Box 7
SINGLETON NSW 2330

Dear Mr de Somer

Liddell Colliery (DA 305-11-01)
Water Management Plan

I refer to your email dated 15 August 2017 submitting a revised Water Management Plan (WMP, version 7.1) for Liddell Colliery (DA 305-11-01). I understand that this plan was prepared to address both the Department's requirements under condition 23 of Schedule 3 of DA 305-11-01 and the Commonwealth's relevant requirements under EPBC Approval 2013/6908.

I note that the Department recently approved a WMP for the site on 20 January 2016. Since this time, Liddell Coal has revised the plan following feedback from Commonwealth Department of the Environment. Liddell Coal is now seeking the Secretary's approval of the revised plan.

The Department has reviewed this plan and is satisfied that it still meets the relevant requirements of condition 23 of Schedule 3 of the above consent, and the nature of the changes do not warrant re-consultation in accordance with condition 12 of Schedule 2 of the above consent. As such, I wish to advise that the Secretary approves this plan. Please provide a final (untracked) version of this plan to the Department at your earliest convenience and a copy of this plan is placed on your website.

Should you have any enquiries in relation to this matter, please contact Megan Dawson at the details above.

Yours sincerely,

17/08/17

Matthew Sprott
A/Director Resource Assessments
as the Secretary's nominee

Department of Planning and Environment
320 Pitt Street Sydney NSW 2000 | GPO Box 39 Sydney NSW 2001 | **www.planning.nsw.gov.au**

NSW GOVERNMENT | Planning & Environment

Planning Services
Resource Assessments
Name: Ingrid Berzins
Phone: 9373 2885
Email: Ingrid.Berzins@planning.nsw.gov.au

Ben de Somer
Environment & Community Manager
Liddell Coal Operations
PO Box 7
Singleton NSW 2330

Dear Mr de Somer,

Liddell Colliery (DA 305-11-01)
Approval of Management Plans

I refer to your emails dated 30, 31 July and 31 August 2018 submitting revised management plans for Liddell Colliery. The Department has reviewed the following revised management plans and is satisfied that they address the relevant conditions of consent:

- Noise Monitoring Program v7.1 (condition 3 of Schedule 3);
- Blast Management Plan v5.1, Blast Management Strategy – Chain of Ponds Inn v4.1, Blast Management Strategy – Newdell Zone Substation v3.1 (condition 15A of Schedule 3);
- Air Quality Management and Monitoring Program v4.1 (condition 19 of Schedule 3);
- Water Management Plan v7.1 (condition 23 of Schedule 3); and
- Environmental Management Strategy v9.0 (condition 1 of Schedule 5).

The Secretary therefore approves these revised plans, on the condition that:

- the statement regarding cosmetic damage on page 13 of Blast Management Strategy – Chain of Ponds Inn is amended so that minor cosmetic repairs can only be waived if agreed by the relevant stakeholders; and
- references in Table 2-1 of the Water Management Plan are updated, and the first sentence in Section 8.10 is rephrased to avoid using "maybe".

Please provide final (untracked) versions of these plans to the Department at your earliest convenience and place a copy of them on your company website.

If you have any enquiries about this matter, please contact Ingrid Berzins on the details above.

Yours sincerely

4/10/18

Megan Dawson
Acting Director
Resource Assessments
as the Secretary's nominee

Department of Planning and Environment
320 Pitt Street Sydney NSW 2000 | GPO Box 39 Sydney NSW 2001 | T 1300 305 695 | **www.planning.nsw.gov.au**

Planning, Industry & Environment

Planning and Assessments
Energy and Resource Assessments
Contact: Anthony Barnes
Phone: 8289 6709
Email: anthony.barnes@planning.nsw.gov.au

Ms Hayley Frazer
Environment and Community Coordinator
Liddell Coal Operations – Glencore
PO Box 7
Singleton NSW 2330

Dear Ms Frazer

Liddell Colliery Continued Operations (DA 305-11-01)
Approval of Water Management Plan

I refer to your email dated 9 May 2019, submitting a revised Water Management Plan for approval in accordance with condition 23 of Schedule 3 of Liddell Colliery Continued Operations' development consent DA 305-11-01.

The Department has reviewed the revised plan and considers that it adequately addresses the relevant consent condition. Therefore, the Secretary has approved the plan.

Please ensure the plan is published on Liddell Colliery's website at your earliest convenience.

If you have any enquiries, please contact Anthony Barnes at the above details.

Yours sincerely

06/01/2020

Matthew Sprott
Director
Resource Assessments
as nominee of the Secretary

320 Pitt Street Sydney 2000 | GPO Box 39 Sydney 2001 | dpie.nsw.gov.au | 1

Planning, Industry & Environment

Ben Desomer
Environment and Community Manager
Old New England Highway
Ravensworth, NSW, 2333

20/05/2021

Dear Mr Desomer

Liddell Coal (DA305-11-01)
Water Management Plan

I refer to the Water Management Plan which was submitted in accordance with Condition 23 of Schedule 3 of the approval for Liddell Coal (DA305-11-01).

The Department has carefully reviewed the document and is satisfied that it addresses the conditions of approval.

Accordingly, the Planning Secretary has approved the Water Management Plan (Version 13, February 2021). Please ensure that the approved plan is placed on the project website at the earliest convenience.

The Department notes feedback was not received from DPIE Water. Should DPIE Water provide feedback, please review and if required revise the Water Management Plan to reflect this feedback. Should revision be required, submit the revised Water Management Plan via the Major Projects portal.

If you wish to discuss the matter further, please contact Daniel Martin at daniel.martin@dpie.nsw.gov.au

Yours sincerely

Matthew Sprott
Director
Resource Assessments (Coal & Quarries)

As nominee of the Planning Secretary