

HUNTER VALLEY OPERATIONS



Water Management Plan

Hunter Valley Operations

DOCUMENT CONTROL

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1. PREFACES

1.1 Introduction

Hunter Valley Operations (HVO) is an open cut mining complex located approximately 24 kilometres north-west of Singleton, New South Wales (NSW) and geographically divided by the Hunter River into HVO North and HVO South. While HVO is managed as one operation, HVO North and HVO South each have separate planning approvals.

This Water Management Plan (WMP) applies to the whole HVO complex (the Project).

The Project is generally bounded by Lemington Road and Jerrys Plains Road alongside its western boundary. The New England Highway is located to the north and east of the Project area with the Golden Highway and Wallaby Scrub Road to the south.

The HVO North Approval (DA 450-10-2003) was granted on 12 June 2004. Subsequent modifications were approved in August 2005, June 2006 and in March 2013, January 2014, December 2016, January 2017 and July 2017.

HVO South operates in accordance with the Project Approval (PA 06_0261) granted on 24 March 2009 (the HVO South Approval). Subsequent modifications were approved in December 2009, February 2012, October 2012 and February 2018.

The HVO North Approval and the HVO South Approval are jointly referred to herein as 'the Approvals'.

The March 2013 modification to the HVO North Approval involved an extension to the south-west of the existing Carrington Pit and it is that modification which brought about the requirement for a WMP for HVO North. The existing requirement under the HVO South Approval is the basis under which this plan is required to cover HVO South.

The Project is described in detail in:

- the EIS titled '*Hunter Valley Operations – West Pit Extension and Minor Modifications*', dated October 2003, and prepared by Environmental Resources Management Australia;
- the section 96(1A) modification application for the '*Hunter Valley Loading Point*', dated 30 June 2005, and prepared by Matrix Consulting;
- the '*Carrington Pit Extended Statement of Environmental Effects*', dated October 2005, and prepared by Environmental Resources Management Australia;
- the '*Carrington West Wing Environmental Assessment*', dated 1 October 2010, and prepared by EMGA Mitchell McLennan (CWW EA);
- the Environmental assessment titled '*Hunter Valley Operations South Coal Project Environmental Assessment Report*', Volumes 1, 2 and 3, dated January 2008, including the response to submissions;
- the Environmental Assessment titled '*Raising of Lake James Dam*', dated October 2009, and the response to submissions (including its Statement of Commitments) dated November 2009;
- the Environmental Assessment titled '*Proposed Modification to HVO South Project*', dated May 2010, and the response to submissions dated August 2010;
- the Environmental Assessment titled '*Hunter Valley Operations South Project Approval – Modification 4 – Administrative Omissions and Clarifications*' [sic], dated 26 September 2012; and
- the Environmental Assessment titled '*Hunter Valley Operations South Project Approval – Modification 5 – Dedication of Lands for Offsets*' [sic], dated 26 September 2012.
- The Environmental Assessment titled '*North – Fine Reject Emplacement Modification*', dated June 2013.

- The Environmental Assessment titled '*Barry's Pit Modification Groundwater Assessment*', dated September 2013.
- The Environmental Assessment titled '*HVLP Sediment Basin and HVO North Communication Towers*', dated November 2016.
- The Environmental Assessment titled '*Carrington In-Pit Fine Reject Emplacement*', dated November 2016.
- The Environmental assessment titled 'Hunter Valley Operations South – Modification 5' dated 1 February 2017.

Surface and Groundwater studies were prepared as part of the Environmental Assessments, the most recent being for the Carrington In-Pit Fine Reject Emplacement and Hunter Valley Operations South – Modification 5.

The Project will occur in an area where mining is already a feature of the landscape. HVO is located in the Hunter Valley coalfields with surrounding mines and infrastructure including Mount Thorley Warkworth (MTW), Wambo and Ravensworth.

This WMP is the primary tool that will be utilised to reduce potential water impacts related to the Project.

1.2 Scope of the Water Management Plan

This WMP was prepared in accordance with Schedule 4, Condition 27 of the HVO North Approval and Schedule 3, Condition 27 of the HVO South Approval. The Department of Planning and Environment approved Andrew Hodge as being suitably qualified and experienced to undertake the preparation of this plan on the 28 November 2017.

This WMP applies to the area within HVO North and HVO South boundaries, including:

- Operating Pits;
- Rehabilitated land;
- Biodiversity areas within the mine footprint;
- Coal Preparation Plants (CPPs);
- Loading Points; and
- Water abstraction and discharge points.

This WMP is to be applied from the time of approval of this plan, during construction and operation of the Project and incorporates mitigation measures and strategies that HVO will employ to comply with the relevant water management conditions of the Approvals and Environment Protection Licence (EPL). Table 1.1 below highlights the conditions required to be covered by this WMP and the sections within this document in which they are addressed.

Table 1.2 highlights where items in the Statement of Commitments (SOC) related to water impacts are addressed in this WMP.

Table 1.1: Consent Conditions Addressed

Consent Condition	Environmental Performance Conditions	Section of WMP which addresses this requirement
HVO NORTH CONSENT (DA 450-10-2003)		
Sch. 4, Cond. 27	The Applicant shall prepare and implement a Water Management Plan for the HVO North mine to the satisfaction of the Secretary. This plan must be prepared in consultation with DPI Water and the EPA by suitably qualified and experienced persons whose appointment has been approved by the Secretary, and submitted to the Director-General by the end of September 2013 unless otherwise agreed.	Section 3 and Appendices A and B
Sch. 4, Cond. 27(a)	<p>The Applicant shall prepare and implement a Water Management Plan for the HVO North mine to the satisfaction of the Secretary...This plan must include:</p> <p>(a) a Site Water Balance that::</p> <ul style="list-style-type: none"> • includes details of: <ul style="list-style-type: none"> ➢ sources and security of water supply, including contingency planning for future reporting periods; ➢ water use on site; ➢ water management on site, including details of water sharing between neighbouring mining operations; ➢ any off-site water transfers and discharges; ➢ reporting procedures, including comparisons of the site water balance for each calendar year 	Section 6
Sch. 4, Cond. 27(a)	<p>The Applicant shall prepare and implement a Water Management Plan for the HVO North mine to the satisfaction of the Secretary...This plan must include:</p> <p>a Site Water Balance that:</p> <ul style="list-style-type: none"> • describes the measures that would be implemented to minimise clean water use on site 	Section 6
Sch. 4, Cond. 27(b)	<p>a Surface Water Management Plan, that includes:</p> <ul style="list-style-type: none"> • detailed baseline data on surface water flows and quality in the waterbodies that could be affected by the development; 	Section 7
Sch. 4, Cond. 27(b)	<p>a Surface Water Management Plan, that includes:</p> <ul style="list-style-type: none"> • a detailed description of the water management system on site, including the: <ul style="list-style-type: none"> ➢ clean water diversion systems and their final positioning; ➢ erosion and sediment controls; and ➢ water storages; 	Section 5 and Section 7
Sch. 4, Cond. 27(b)	<p>a Surface Water Management Plan, that includes:</p> <ul style="list-style-type: none"> • detailed plans, including design objectives and performance criteria, for: <ul style="list-style-type: none"> ➢ design and management of the final voids; ➢ design and management of the evaporative sink; ➢ design and management of any tailings dams; ➢ ensuring the stability of high walls adjacent to low permeability barriers; ➢ establishment of drainage lines on the rehabilitated areas of the site; and ➢ control of any potential water pollution from the rehabilitated areas of the site; 	Section 5 and Section 7
Sch. 4, Cond. 27(b)	<p>a Surface Water Management Plan, that includes:</p> <ul style="list-style-type: none"> • performance criteria for the following, including trigger levels for investigating any potentially adverse impacts associated with the development: <ul style="list-style-type: none"> ➢ the water management system; ➢ the stability of high walls adjacent to low permeability barriers; 	Section 5, Section 7 and Table 8

Table 1.1: Consent Conditions Addressed

Consent Condition	Environmental Performance Conditions	Section of WMP which addresses this requirement
	<ul style="list-style-type: none"> ➤ surface water quality of the Hunter River; and ➤ stream and riparian vegetation health of the Hunter River; 	
Sch. 4, Cond. 27(b)	<p>a Surface Water Management Plan, that includes:</p> <ul style="list-style-type: none"> • a program to monitor: <ul style="list-style-type: none"> ➤ the effectiveness of the water management system; and ➤ surface water flows and quality, stream and riparian vegetation health in the Hunter River (in so far as it could potentially be affected by the development) 	Appendix C.
Sch. 4, Cond. 27(b)	<p>a Surface Water Management Plan, that includes:</p> <ul style="list-style-type: none"> • a plan to respond to any exceedances of the performance criteria, and mitigate and/or offset any adverse surface water impacts of the development. 	Section 9.
Sch. 4, Cond. 27(c)	<p>a Groundwater Management Plan, which includes:</p> <ul style="list-style-type: none"> • detailed baseline data on groundwater levels, yield and quality in the region, and privately owned groundwater bores, that could be affected by the development; 	Section 8
Sch. 4, Cond. 27(c)	<p>a Groundwater Management Plan, which includes:</p> <ul style="list-style-type: none"> • groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts; 	Section 9
Sch. 4, Cond. 27(c)	<p>a Groundwater Management Plan, which includes:</p> <ul style="list-style-type: none"> • a program to monitor: <ul style="list-style-type: none"> ➤ groundwater inflows to the open cut mining operations; ➤ the impacts of the development on: <ul style="list-style-type: none"> ○ the alluvial aquifers, including additional groundwater monitoring bores as required by DPI Water; ○ the effectiveness of the low permeability barrier; ○ base flows to the Hunter River; ○ any groundwater bores on privately-owned land that could be affected by the development; and ○ groundwater dependent ecosystems, including the River Red Gum Floodplain Woodland EEC located in the Hunter River alluvium; ➤ the seepage/leachate from water storages, backfilled voids and the final void; 	Appendix D
Sch. 4, Cond. 27(c)	<p>a Groundwater Management Plan, which includes:</p> <ul style="list-style-type: none"> • a program to validate and recalibrate (if necessary) the groundwater model for the development, including an independent review of the model every 3 years, and comparison of monitoring results with modelled predictions; 	Section 8
Sch. 4, Cond. 27(c)	<p>a Groundwater Management Plan, which includes:</p> <ul style="list-style-type: none"> • a plan to respond to any exceedances of the groundwater assessment criteria. 	Section 9
Sch. 6, Cond. 2(a)	<p>The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: detailed baseline data</p>	Section 8
Sch. 6, Cond. 2(c)	<p>The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:</p>	Sections 2 and Section 9

Table 1.1: Consent Conditions Addressed

Consent Condition	Environmental Performance Conditions	Section of WMP which addresses this requirement
	a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria	
Sch. 6, Cond. 2(d)	<p>The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:</p> <p>a program to monitor and report on the:</p> <ul style="list-style-type: none"> • impacts and environmental performance of the development; • effectiveness of any management measures (see c above) 	Section 9
Sch. 6, Cond. 2(e)	<p>The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:</p> <p>a contingency plan to manage any unpredicted impacts and their consequences</p>	Section 9
Sch. 6, Cond. 2(f)	<p>The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:</p> <p>a program to investigate and implement ways to improve the environmental performance of the development over time</p>	Section 9
Sch. 6, Cond. 2(g)	<p>The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:</p> <p>a protocol for managing and reporting any:</p> <ul style="list-style-type: none"> • incidents; • complaints; • non-compliances with statutory requirements; and • exceedances of the impact assessment criteria and/or performance criteria 	Sections 9 and 9.5
Sch. 6, Cond. 2(h)	<p>The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:</p> <p>a protocol for periodic review of the plan</p>	Section 11
Sch. 6, Cond.4	<p>Within 3 months of:</p> <p>(a) the submission of an annual review under Condition 5 above;</p> <p>(b) the submission of an incident report under Condition 5B below;</p> <p>(c) the submission of an audit under Condition 6 below; and</p> <p>(d) any modification to the conditions of this consent (unless the conditions require otherwise),</p> <p>the Applicant shall review, and if necessary revise, the strategies, plans, and programs required under this consent to the satisfaction of the Secretary.</p> <p><i>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.</i></p>	Section 11
Sch. 6, Cond.7	<p>The Applicant shall notify, at the earliest opportunity, the Secretary and any other relevant agencies of any incident that has caused, or threatens to cause, material harm to the environment. For any other incident associated with the development, the Applicant shall notify the Secretary and any other relevant agencies as soon as practicable after the Applicant becomes aware of the incident. Within 7 days of the date of the incident, the Applicant shall provide the Secretary and any relevant agencies with a detailed report on the incident, and such further reports as may be requested.</p>	Section 9
Sch. 6, Cond. 8	<p>The Applicant shall provide regular reporting on the environmental performance of the development on its website in accordance with the reporting arrangements in any plans or programs approved under the conditions of this consent.</p>	Section 9
HVO SOUTH CONSENT (PA 06_0261)		
Sch. 3, Cond. 27(a)	<p>The Proponent must prepare and implement a Water Management Plan to the satisfaction of the Secretary. This Plan must:</p> <p>(a) be prepared in consultation with CLWD by a suitably qualified expert whose appointment has been approved by the Secretary;</p>	Section 3 and Appendices A and B

Table 1.1: Consent Conditions Addressed

Consent Condition	Environmental Performance Conditions	Section of WMP which addresses this requirement
Sch. 3, Cond. 27(b)	<p>The Proponent shall prepare and implement a Water Management Plan to the satisfaction of the Secretary. This Plan must:</p> <p>(b) be submitted to the Secretary for approval within 6 months of this approval or otherwise agreed by the Secretary; and</p>	<p>We rely upon the “Water Management Plan: Hunter Valley Operations, September 2009” which is superseded by this WMP</p>
Sch. 3, Cond. 27(c)	<p>The Proponent shall prepare and implement a Water Management Plan to the satisfaction of the Secretary. This Plan must:</p> <p>(c) include:</p> <ul style="list-style-type: none"> • a site water balance, which includes details of sources and security of water supply, on site water use and management and off site water transfers and investigates and describes measures to minimise water use by the project; 	Section 6
Sch. 3, Cond. 27(c)	<p>The Proponent shall prepare and implement a Water Management Plan to the satisfaction of the Secretary. This Plan must:</p> <p>(c) include:</p> <ul style="list-style-type: none"> • an erosion and sediment control plan for surface works on the site that is consistent with the requirements of the Managing Urban Stormwater: Soils and Construction Manual (Landcom 2004, or its latest version); 	Section 7
Sch. 3, Cond. 27(c)	<p>The Proponent shall prepare and implement a Water Management Plan to the satisfaction of the Secretary. This Plan must:</p> <p>(c) include:</p> <ul style="list-style-type: none"> • a program for review of groundwater modelling that includes assessment of the effect of short and long-term changes to groundwater quality and mobilisation of salts; 	Section 8
Sch. 3, Cond. 27(c)	<p>The Proponent shall prepare and implement a Water Management Plan to the satisfaction of the Secretary. This Plan must:</p> <p>(c) include:</p> <ul style="list-style-type: none"> • a surface water monitoring program that includes: <ul style="list-style-type: none"> ➤ detailed baseline data of surface water flows and quality in the watercourses that could be affected by the project, including the Hunter River and Wollombi Brook; ➤ a detailed description of the surface water management system; ➤ details of water licensing requirements for all water storages; ➤ details of licensed discharged points and limits; ➤ detailed design objectives and performance measures for erosion and sediment control works, water storages, water diversions, sediment dams, emplacement areas, backfilled voids, and the final void; ➤ surface water impact assessment criteria, including trigger levels for investigating potentially adverse impacts of the project; ➤ a program to monitor potentially adverse impacts of the project on the surface water flows and quality , flooding, stream and riparian health, including monitoring controlled and uncontrolled discharges and seepage/leachate from the site;; and ➤ A plan to respond to any exceedance of the performance criteria or surface water impact assessment criteria, and repair, mitigate and/or offset any adverse surface water impacts of the project; ➤ 	Appendix C
Sch. 3, Cond. 27(c)	<p>The Proponent shall prepare and implement a Water Management Plan to the satisfaction of the Secretary. This Plan must:</p> <p>(c) include:</p>	Appendix D

Table 1.1: Consent Conditions Addressed

Consent Condition	Environmental Performance Conditions	Section of WMP which addresses this requirement
	<ul style="list-style-type: none"> • a groundwater monitoring program that includes: <ul style="list-style-type: none"> ➤ additional baseline data of groundwater levels, yield and quality in the region, and privately-owned groundwater bores, which could be affected by the project; ➤ groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts of the project; and ➤ a program to monitor: <ul style="list-style-type: none"> ○ groundwater inflows to the open cut mining operations; and ○ impacts of the project on the region’s aquifers, any groundwater bores, and surrounding watercourses, and in particular, the Hunter River and Wollombi Brook and adjacent alluvium; and ○ impacts of the project on groundwater dependent ecosystems, riparian vegetation and River Red Gum populations; and ➤ a plan to respond to any exceedances of the performance criteria or surface water impact assessment criteria, and repair, mitigate and/or offset any adverse groundwater impacts of the project 	
Sch. 3, Cond. 27(c)	<p>The Proponent shall prepare and implement a Water Management Plan to the satisfaction of the Secretary. This Plan must:</p> <p>(c) include:</p> <ul style="list-style-type: none"> • a program to periodically update and validate the water balance and groundwater model for the project and compare monitoring results with modelled predictions, unless otherwise agreed by the Secretary. 	Section 8

Table 1.2: Statement of Commitments Addressed

SOC reference	Commitments	Where Commitment is addressed
HVO NORTH - Carrington West Wing Statement of Commitments, dated 4 March 2013		
Groundwater	<p>Prior to mining within 100m of the western arm of the Hunter River Paleochannel a groundwater barrier wall will be constructed across the western arm of the paleochannel. The wall will be sufficiently deep to prevent flows of groundwater within the alluvium in either direction.</p>	To be included in future version when date of mining within 100m of the western arm of the Hunter River Paleochannel is known.
Groundwater	<p>Continued monitoring will include:</p> <ul style="list-style-type: none"> • two-monthly monitoring of water levels in any new standpipe piezometer in proximity to the proposed extension area and quarterly monitoring elsewhere, unless water level changes dictate otherwise; • daily or more frequent monitoring of pore pressures by installed auto recorders at some existing piezometers in order to discriminate between oscillatory groundwater movements attributed to rainfall recharge, and longer term pressure losses related to open cut and underground mining; and • construction of additional piezometers where deemed necessary, as information is generated from within the existing network, during the course of mining. Permeability testing will be completed on new piezometers in order to facilitate estimation of leakage and subsurface flows. 	Table 8
Groundwater	Continued groundwater quality monitoring will include:	Table 8

SOC reference	Commitments	Where Commitment is addressed
	<ul style="list-style-type: none"> two-monthly or quarterly (depending upon location) monitoring of basic water quality parameters, pH and EC, in existing and any new piezometers; and six monthly measurement of TDS and speciation of water samples in piezometers. 	
Groundwater	<p>Future impact analyses will include the following.</p> <ul style="list-style-type: none"> Where monitoring data shows significant departures from predictions in three consecutive readings, an investigation into the cause will be triggered. This could include a need to conduct more intensive monitoring, e.g. increased frequency, parameters or additional piezometers, or to review the management and mitigation measures. Formal review of depressurisation of coal measures and comparison of responses with aquifer model predictions, conducted biennially by a suitably qualified hydrogeologist. Annual reporting (including all water level and water quality data) in the AEMR. 	Section 9
Surface water	Water quality monitoring will be continued.	Section 9 and Appendices D and E
Surface water	The HVO water balance model will be updated regularly to ensure currency with the operational configuration of the mine water management system.	Section 6
Surface water	Runoff from undisturbed catchments will be diverted away from disturbed areas using surface drains.	Section 7
Surface water	Surface runoff from disturbed areas will be treated through sedimentation basins prior to discharge from the site. All new sediment dams and water management systems will be designed in accordance with relevant standards.	Section 7
Surface water	Sedimentation basins will be used to treat surface runoff from rehabilitated areas until the quality of runoff is suitable for release. These will be maintained or constructed as required and will be designed in accordance with relevant design standards.	Section 7
Surface water	Saline water from mining related activities will be collected within the mine water management system. Discharges will be managed in compliance with the HRSTS.	Section 6
Surface water	<p>A Management Plan for the positioning of the diversion of the Unnamed Tributary will be developed in consultation with NOW and I&I NSW, and will include details of:</p> <ul style="list-style-type: none"> existing and proposed channel alignment, longitudinal section and cross-sections; proposed locations of cut and fill; sediment and erosion control measures to be implemented during construction; proposed revegetation of the channel bed, banks and riparian zone; a proposed monitoring regime to ensure ongoing stability and ecological health of the stream, which would include periodic inspection for erosion or deposition and a photographic record of key cross-section locations, supplemented by ground survey if instability is detected; and contingency measures to be implemented to address any observed issues with establishment of the modified channel. 	To be included in future version when date of mining in Carrington West Wing Extension area is known.

SOC reference	Commitments	Where Commitment is addressed
Groundwater	<p>In addition to the mitigation measures undertaken at HVO for groundwater management, the following controls specific to the proposal will be implemented:</p> <ul style="list-style-type: none"> • Groundwater Flow To and From Rivers: <ul style="list-style-type: none"> ➤ development of protocols for monitoring and reporting of DPI Water stream gauge results to clearly record any reductions in flows that are attributed to mining. This will include monitoring Hunter River flows immediately up gradient and down gradient of the site. In addition, consideration will be given to tying in specific CNA water level recordings with current DPI Water gauging locations; ➤ monitoring of groundwater elevations within alluvium between the Hunter River and the Cheshunt Pit; and ➤ measured groundwater elevations and river flow will be assessed against predictions to determine whether application of additional management measures is required; and ➤ offset seepage to pits in accordance with regulatory requirements. 	Section 88
Groundwater	<ul style="list-style-type: none"> • Regional Groundwater Drawdown: <ul style="list-style-type: none"> ➤ the HVO River Red Gum Rehabilitation and Restoration Strategy and CNA EMS procedure for Flora and Fauna will be updated to reflect changes resulting from the proposal. This will include monitoring the health of the River Red Gums located on the Hunter River and Wollombi Brook alluvium as identified in Chapter 11 (Figure 11.2) of the ERM (2008) EA. The monitoring programme will include details on frequency of monitoring, reporting and corrective actions; and ➤ up to three monitoring wells will be installed in the proximity of the cluster of registered NOW bores located to the east of the LCPP (Figure 25 Annex J of the ERM (2008) EA). Data will be used to compare actual versus predicted impacts. Deviations away from predicted impacts will be assessed, and if predictions are exceeded, management measures will be implemented. 	These commitments have been met and are therefore not covered in this WMP
Groundwater	<ul style="list-style-type: none"> • Alluvial Buffer Zone: <ul style="list-style-type: none"> ➤ a buffer zone of 100 m will be retained from the Cheshunt Pit highwall to the edge of alluvium of the Hunter River; ➤ a buffer zone of 150 m will be retained from the South Lemington Pit 2 highwall to the edge of alluvium of the Wollombi Brook; ➤ bores will be installed to further delineate the saturated zone between the Hunter River and the Cheshunt Pit before mining commences within this area; and ➤ the groundwater component of the HVO Water Management Manual will include procedures for monitoring potential impacts, including accurately measuring seepage to pits throughout mining and assessment of proximity to alluvials as mining approaches. 	These commitments have been met and are therefore not covered in this WMP
Groundwater	<ul style="list-style-type: none"> • Final Void: <ul style="list-style-type: none"> ➤ the final void will be designed to intercept leachate from overburden emplacements and minimise discharge of saline groundwater. Final void design will be reviewed at least three years prior to anticipated mine closure; 	To be included in future version when date of final void is known.

SOC reference	Commitments	Where Commitment is addressed
	<ul style="list-style-type: none"> ➤ a post closure monitoring programme will be developed as part of the Final Void Management Plan for water quality monitoring of the final void; and ➤ the mine plan will be further reviewed with a view to minimise the area of the final void as much as practicable. 	
Surface Water	<p>In addition to the mitigation measures undertaken at HVO for surface water management, the following controls specific to the proposal will be implemented.</p> <ul style="list-style-type: none"> • Water Supply: <ul style="list-style-type: none"> ➤ modify Water Access Licences, review conditions and report on water use in the AEMR; ➤ monitor and record abstraction quantities; and ➤ increase pump capacity from Dam 20S (or alternative storage) to the LCPP and undertake minor improvements to the existing HVO South water system in conjunction with the design of the LCPP to minimise need to pump from Hunter River Water Discharge 	To be implemented prior to the LCPP being developed
Surface Water	<ul style="list-style-type: none"> • review current discharge conditions in respect of the proposal and incorporate where applicable into the Water Management Manual. 	This WMP
Surface Water	<ul style="list-style-type: none"> • Flood Mitigation: <ul style="list-style-type: none"> ➤ construct South Lemington Pit 2 Levee SLL2 as a permanent levee and ensure the outer face of the levee will withstand 100-year ARI flood flow velocities; and ➤ assess Hobden Gully levee (CL1) prior to mine closure to determine if protection of the Deep Cheshunt Pit final void is required. 	Section 7 Hobden Gully commitment not applicable. Final Void is proposed for Riverview
Surface Water	<ul style="list-style-type: none"> • Erosion and Sediment Control: <ul style="list-style-type: none"> ➤ erosion and sediment control structures will remain in place to divert water away from the Deep Cheshunt Pit final void unless required for use as flood flow storage. 	Not applicable. Final Void is proposed for Riverview
Surface Water	<ul style="list-style-type: none"> • Monitoring and Inspections: <ul style="list-style-type: none"> ➤ prior to LCPP and infrastructure construction works review the Surface Water Monitoring Programme, establish additional representative monitoring sites where required and undertake monitoring; and ➤ annual monitoring of water level and water quality in the final void after mining operations have ceased as part of the post closure monitoring programme. Monitoring will continue in accordance with regulatory requirements. 	To be implemented prior to the LCPP being developed
HVO NORTH – Fine Reject Emplacement Statement of Commitments, dated 7 June 2013		
Groundwater	The monitoring bores and vibrating wire piezometers that were installed as part of the groundwater assessment (GW_103 to GW_115 series) will be retained and integrated into the groundwater monitoring plan for the life of the Carrington Pit.	Appendix D

1.3 Objectives

The purpose of this WMP is to provide reasonable and feasible measures to address potential water impacts of the Project as identified in the Approvals and satisfy the relevant conditions of the Approvals.

This WMP describes procedures required to ensure compliance with conditions of the Approvals relating to potential water impacts. This WMP also provides a mechanism for assessing water quality and quantity monitoring results.

The key elements of the WMP are:

- Site water balance;
- Surface water management; and
- Groundwater management.

HVO manages water according to three main objectives:

- Fresh water usage is minimised;
- Impacts on the environment and HVO neighbours are minimised; and
- Interference to mining production is minimal.

This is achieved by:

- Minimising freshwater use from the Hunter River;
- Preferentially using mine water for coal preparation and dust suppression;
- An emphasis on control of water quality and quantity at the source;
- Segregating waters of different quality where practical;
- Recycling on-site water;
- Ongoing maintenance and review of the system; and
- Disposing of water to the environment in accordance with statutes and regulations.

2. REGULATORY REQUIREMENTS

2.1 Background

This WMP has been prepared to fulfil the requirements of relevant legislation, the Approvals, EA commitments, EPL conditions and relevant standards and guidelines.

2.2 Project Approval

The Approvals and subsequent amendments were assessed under the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act.). The current HVO North Approval was granted on 12 June 2004 and subsequently modified by the Planning Assessment Commission as delegate of the Minister for Planning and Infrastructure in March 2013, January 2014, December 2016, January 2017 and July 2017.

The current HVO South Approval was granted on 24 March 2009, and was subsequently modified in October 2012 and February 2018

The requirement for this WMP arises from Condition 27 of Schedule 4 of the HVO North Approval and Condition 27 of Schedule 3 of the HVO South Approval. A list of the relevant conditions of the Approvals and where they are addressed in this WMP is found in Section 1.2 (see in particular Tables 1.1 and 1.2).

2.3 Environmental Protection Licence

The *Protection of the Environment Operations Act 1997* (NSW) (PoEO Act) is the principal piece of legislation regulating pollution (including water pollution) emissions in NSW. EPL 640 for HVO was issued on 29 September 2000 by the Environmental Protection Authority (EPA) under the PoEO Act.

EPL 640 prescribes the licensed discharges to water including locations of discharge points and concentration limits as well as volume limits and the monitoring and recording limits associated with those.

2.4 Relevant Standards and Guidelines

Guidelines and standards applying to water management at HVO include:

- HVO Water Balance Model – Baseline Scenario 2015
- Hunter River Salinity Trading Scheme (HRSTS) Discharge Checklist and Reporting Environmental Work Instruction, and; Discharge Operation Work Instruction
- Carrington Billabong River Red Gum Rehabilitation and Restoration Strategy

3. CONSULTATION

Schedule 4, Condition 27 of the HVO North Approval requires the WMP to be prepared in consultation with DPI Water and the EPA.

Schedule 3, Condition 27 of the HVO South Approval requires the WMP to be prepared in consultation with DPI Water.

3.1 Government Agencies

On 29 May 2017 DPI Water were provided with a copy of this WMP and were asked to provide any comments

for HVO to consider, and where appropriate, incorporate into the WMP. The EPA has previously advised they do not review management plans (correspondence attached in Appendix B) and as such a copy has not been provided to them for review.

In a letter dated 6th December 2017, Department of Industry- Crown lands and Water Division (formerly DPI-Water), provided a list of comments to enhance understanding of the WMP. The WMP has been updated to reflect the comments received.

4. EXISTING CHARACTER

4.1 Existing Character

The HVO North complex comprises the:

- Carrington Pit;
- West Pit;
- Hunter Valley Coal Preparation Plant (HVCPP);
- West Pit (Howick) Coal Preparation Plant (HCPP);
- Hunter Valley Load Point (HVLP); and
- Newdell Loading Point (NLP).

HVO South comprises the:

- Cheshunt Pit;
- Riverview Pit; and
- Lemington Pit.

Figure 1 shows the layout of HVO.

4.2 Existing Approved Activities

HVO's mining activities north of the Hunter River are comprised of:

- four coal mining areas, including the West and Mitchell Pits and Carrington Pit;
- use of the HCPP, NCPP and HVCPP;
- use of the NLP and the HVLP train loading facilities;
- use of two administration areas including bathhouses, one adjacent to the HVCPP and one adjacent to the HCPP;
- two workshops, one adjacent to the HVCPP and one adjacent to the HCPP; and
- use of numerous internal haul roads and conveyors.

HVOs mining activities south of the Hunter River are comprised of:

- open-cut and highwall mining of coal reserves in Cheshunt Pit, Riverview Pit;
- mining by a combination of draglines, shovels, excavators and associated haul trucks;
- use of numerous internal haul roads;
- use of one administration area, including a bathhouse; and
- use of infrastructure to facilitate transfer of product coal (a rail spur and loop, overland conveyor or trucks, or any combination).

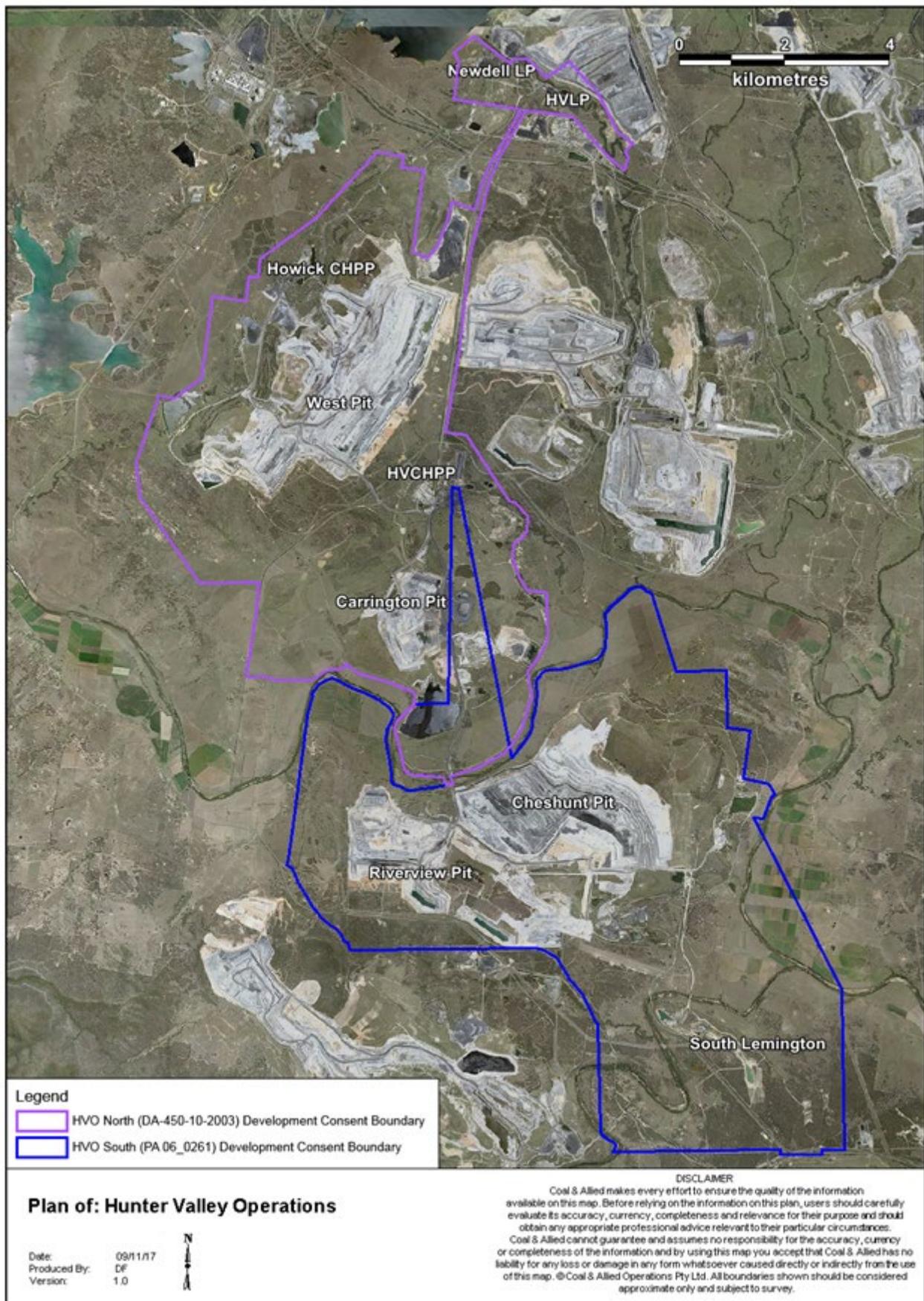


Figure 1- Layout of HVO

5. HVO WATER MANAGEMENT SYSTEM

5.1 Objectives

HVO manages surface and ground water according to three main objectives:

- Fresh water usage is minimised;
- Impacts on the environment and HVO neighbours are minimised; and
- Interference to mining production is minimal.

This is achieved by:

- Minimising freshwater use from the Hunter River;
- Preferentially using mine water for coal preparation and dust suppression;
- An emphasis on control of water quality and quantity at the source;
- Segregating waters of different quality where practical;
- Recycling on-site water;
- Ongoing maintenance and review of the system; and
- Disposing of water to the environment in accordance with statutes and regulations.

5.2 Water Management Classification

Water is managed according to type. Water type is determined by catchment source, quality and use. The main types of water managed at HVO include:

- Mine Water
- Sediment Water
- Clean Water

5.2.1 Mine Water

Mine Water is coal contact water or used in the production of coal, consisting of:

- Runoff from pits, haul roads, active waste dumps and CHPP or Workshop areas;
- Groundwater seepage and seepage from spoils/tailings dams; and
- Water output from coal processing, including water recovered from tailings.

These three streams of saline water become so thoroughly intermixed as to be indistinguishable, and they are generically referred to as 'mine water'.

Water used in coal production at HVO is predominantly saline due to interaction with saline groundwater within coal seams and contact with saline mine spoils. Saline water cannot be released from site except for opportunistic discharges as regulated by the HRSTS.

5.2.2 Sediment Water

Sediment water consists of runoff from:

- Rehabilitated mine spoil (waste dumps) without established ground cover;
- Disturbed areas, such as roads, car parks, ancillary infrastructure areas; and
- Pre-stripped areas ahead of mining.

Sediment water is typically lower salinity, but may contain elevated Total Suspended Solids (TSS).

5.2.3 Clean Water

Clean water consists of runoff from:

- Non-mined (undisturbed) areas; and
- Rehabilitated areas with established ground cover.

Clean water is typically low salinity and low TSS.

5.3 Water Management Infrastructure

The HVO water management system consists of a network of infrastructure (i.e. dams, pipelines, contour banks) to control the movement of water around the site. The elements of the water management system are depicted geographically in **Figures 2, 3 and 4** and schematically in **Figures 5, 6 and 7**.

Pit water is pumped to out of pit storage dams or to available in-pit storages using mobile diesel or electric pumps and relocatable high density polyethylene (HDPE) pipelines. Priority is given to water that accumulates in active mining areas, followed by areas to be mined in the short term, and last of all, inactive mining areas. The majority of dewatering is directed to:

- Parnells Dam (Dam 9W) at West Pit
- Dam 9N at Carrington/North Pit
- Riverview Void (Dam 33S) at South Pit

Water is pumped between HVO South and HVO North via pipelines across the Hunter River haul road bridge. Water is pumped between HVO North and HVO West via pipelines between Dam 9W and Dam 9N. Water from the open cuts can be moved in both directions using these pipelines, although the majority of flows are from HVO South to HVO North.

Surplus mine water from Carrington and South Pits is directed primarily to Dams 9N and 33S respectively, which ultimately feed water to the HVO North CHPP. In-pit dust suppression consumes large quantities of mine water via fast fill water cart stations located at West, North and South Pits.

Once CHPP and dust suppression usage is met, excess mine water is retained in the storages set out in Table 5.1. Large mine-water dams have sufficient free-board capacity maintained to prevent overtopping during heavy rainfall events.

5.4 Tailings Water

There are two active tailings dams: North Pit Tailings Dam (Dam 29N) and Dam 6W; and three inactive

facilities known as Dam 27N, Dam 28N and Dam 20W (Bob's Dump Tailings Dam). Cumnock Void is also utilised for tailings storage, via agreement with Glencore (Glencore owned and operated facility, which HVO has access rights for a defined volumetric capacity for tailings storage). Active and inactive tailings facilities are managed in accordance with environmental procedures for coarse rejects and tailings disposal, and Operational and Maintenance manuals in accordance with requirements for management of prescribed dams.

5.5 Clean Catchment

Clean catchment consists of non-mined and ancillary catchment. Catchment and diversion structures for clean water are installed with consideration to "Harvestable Rights" quantities (*Water Management Act 2000* (NSW) [**WMA Act**]) and storm induced flood flows into operating pits.

Clean water diversion structures are employed to divert clean water away from the active pits. Diversion structures are currently employed for West Pit, North Pit and South Pit. Clean catchment which has been disturbed by ancillary mining activities (e.g. road construction or car-parks) has the potential to produce degraded water. Prior to release from site this water is managed to minimise sediment load. Sediment control structures are implemented generally in accordance with "Managing Urban Stormwater Volume: 2E mines and Quarries".

5.6 River Water

Hunter Valley Operations holds both High and General Security Water Access Licences to withdraw water from the Hunter River. Should HVO require more water, entitlements can be traded to this licence in accordance with the WMA to increase output through the scheme.

Water access licences (WALs) are detailed in Table 5.2. The combined entitlement is 4,665 Units (ML/annum or a share of the available resources). The currently licensed water extraction volume of 4,665 ML/a is adequate for both HVO North and HVO South requirements provided internal water use continues to

be actively managed, and provided high security water licence allocations are maintained at the current levels. River water is accessed from various pump stations located in Zone 1b and Zone 2a of the Hunter Regulated River source.

5.7 Groundwater Interception

Under the Water Act 1912, the Water Management Act 2000 and the Aquifer Interference Policy 2015, Groundwater intercepted either directly or indirectly is required to be licensed under the relevant water sharing plan. A summary of the WAL's for each water

sharing plan held by HVO to account for groundwater interception is also shown in Table 5.2. An estimate of the volume of groundwater intercepted by HVO mine operation is undertaken annually and reported in the Annual Environment Report. This includes direct take from Permian sources and indirect take from streams and alluvium. Further Details on groundwater management can be found in Section 8.

Table 5.1: Large Storages at HVO

Storages in Excess of 200 ML	Operating Capacity (ML)
9W - Parnells	750
21N – South East Sump	450
15S – Lake James	680
16S – Old East Cut	265
27S - South Lemington Void	900
Riverview Pit Void	4,000

Table 5.2: HVO WALs

WAL	Water Sharing Plan	Water Source – Management Zone	Share Component (Units)	Detail
962	Hunter Regulated River	Hunter River Zone 1b	3,165	HVCPD River Pump
970		Hunter River Zone 2a	500	LCPP River Allocation
1006			500	
1070			500	
23889	Hunter Unregulated and Alluvial Water Sources	Lower Wollombi Brook	144	Greenleek
36190		Jerrys Management Zone	120	HVO North, old farm bore
18327			150	HV Loading Point Pump Bayswater Creek (diversion works)
18307			500	HVO West – Parnells Creek Dam (Diversion Works Bywash)
18158			65	Ollenberry
18127		Hunter Regulated River Alluvial Water Source – Upstream Glennies Creek management zone	383	Carrington BB1
39798		North Coast Fractured and Porous Rock	Permian Coal Seams	1800
41527	700			HVO North Carrington Pit
41533	20			HVO North Pit Excavations
40466	460			HVO Pit Excavation – Alluvial Lands Bores
40463	180			
40462	2400			



Figure 2: HVO North Pit Water Management Infrastructure



Figure 3: HVO South Pit Water Management Infrastructure



Figure 4: HVO West Pit Water Management Infrastructure

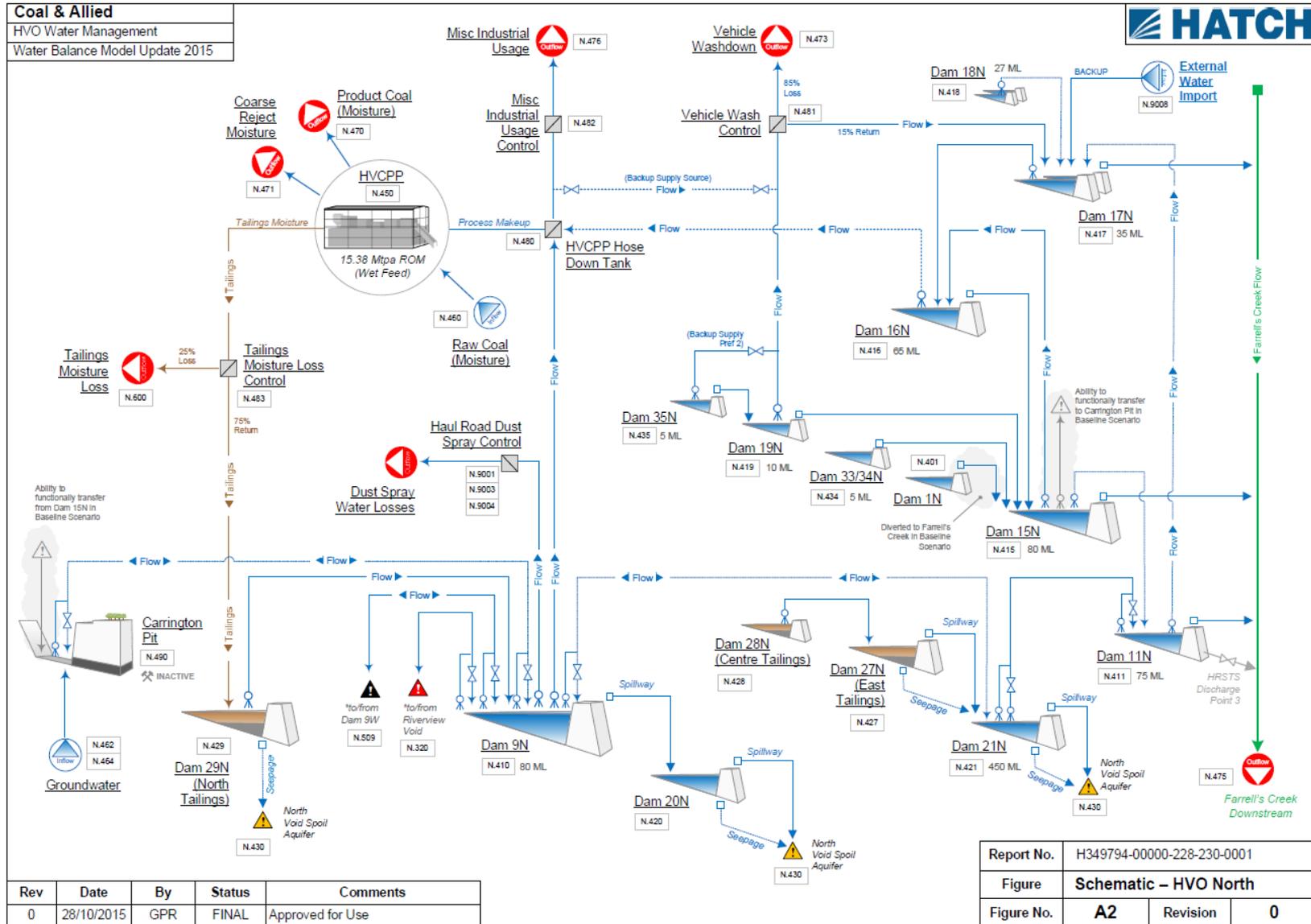


Figure 5: HVO North Pit Water Management Schematic

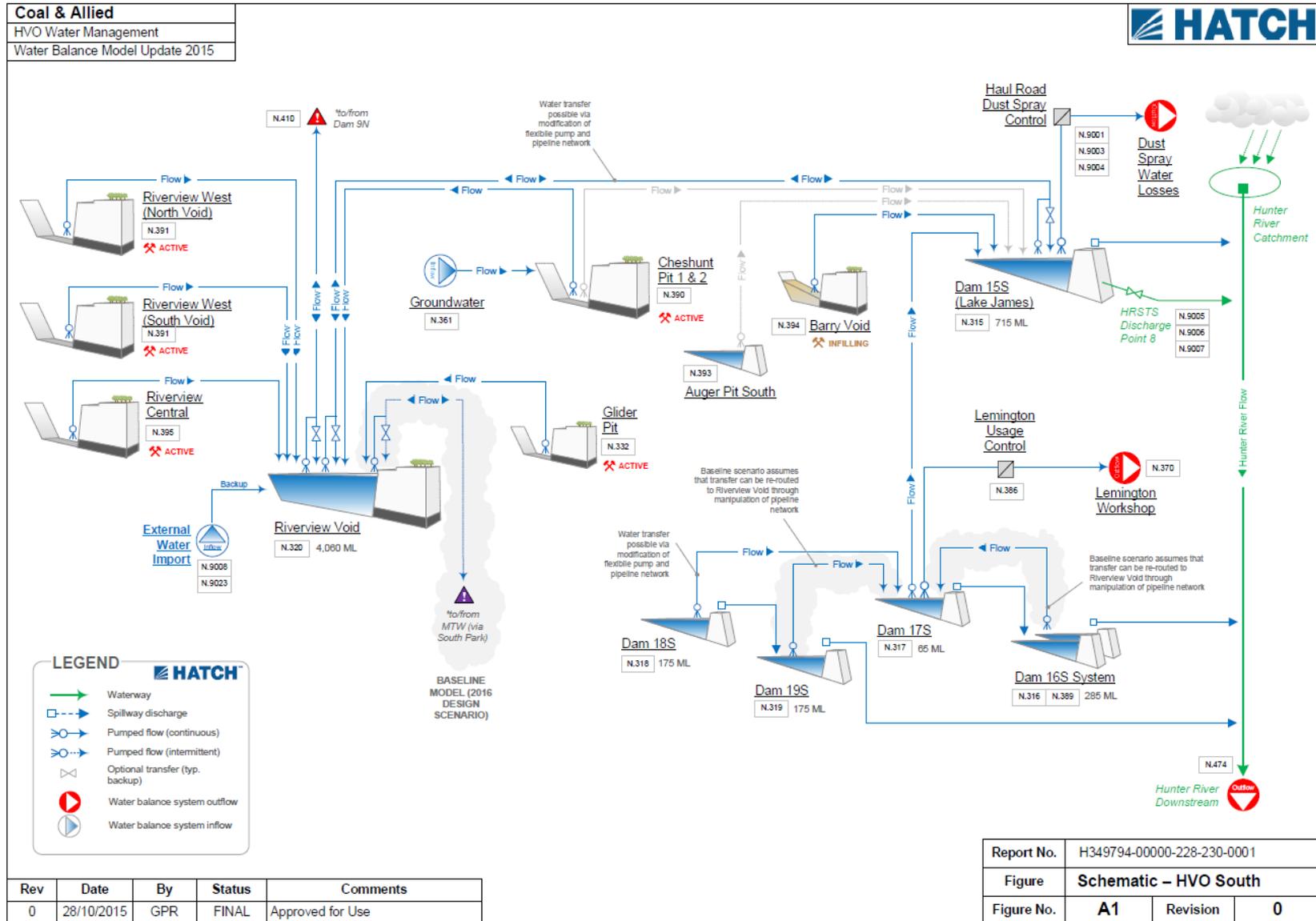


Figure 6: HVO South Pit Water Management Schematic

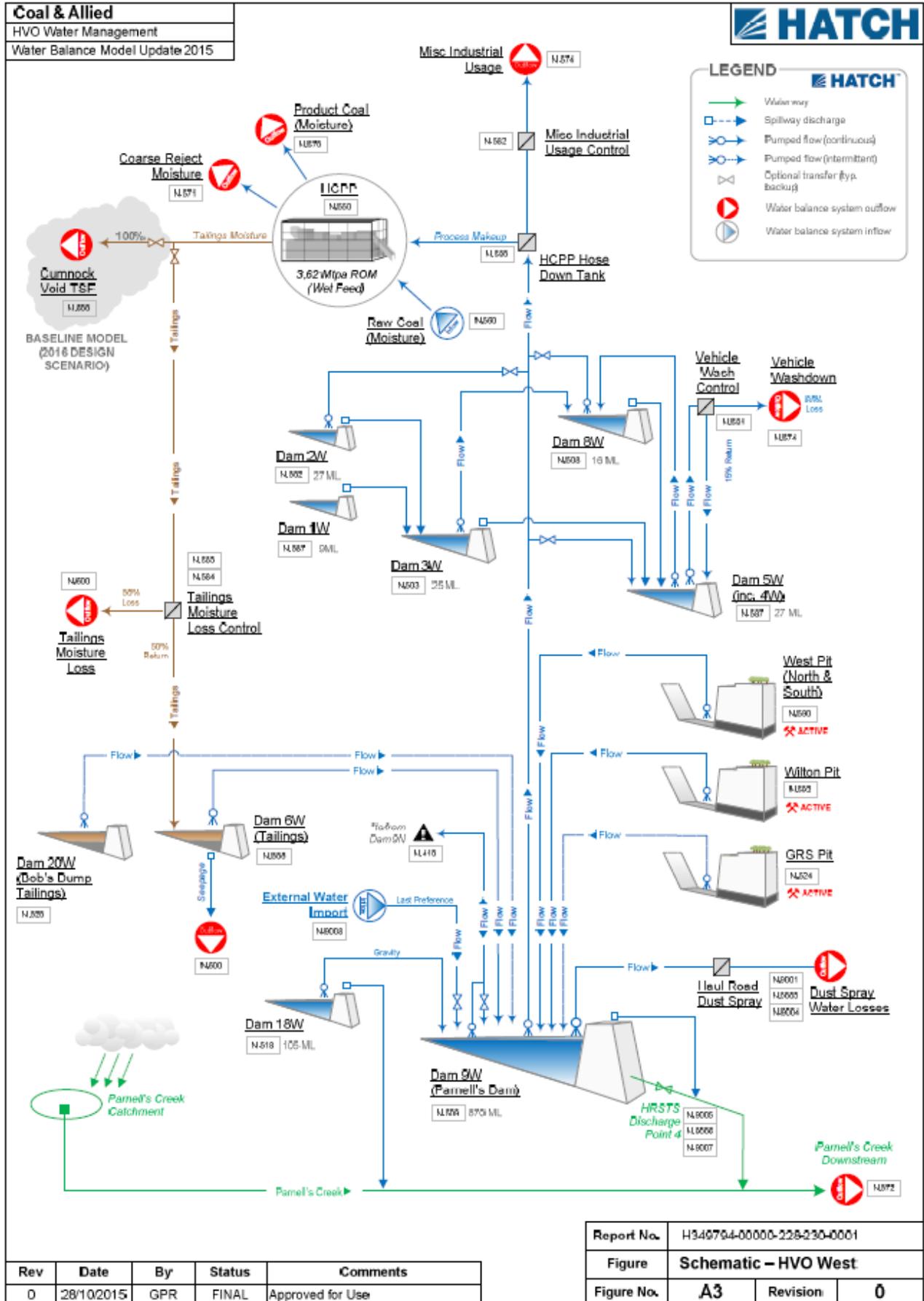


Figure 7: HVO West Pit Water Management Schematic

5.8 Licenced Discharges

Excess mine water can be released via licensed discharge points into the Hunter River. Licensed discharge points are located on: Parnells Dam (9W), Dam 11N and Lake James (Dam 15S). Discharges are only allowed during high and flood flow periods in the Hunter River as determined by Water NSW and DPI Water. Discharges are regulated by conditions in the site EPL 640 and by the Hunter River Salinity Trading Scheme Regulation 2000 (HRSTS). A summary of the current discharge limits under the HRSTS for EPL 640 are outline in table 5.3 below

HVO is also licensed in its EPL 640 to discharge water from its Alluvial Lands. This discharge point has specific discharge parameters and is not regulated under the Hunter River Salinity Trading Scheme. Discharge parameters are in accordance with EPL 640 and only allow for discharge of fresh quality water.

5.9 Water Storages

Providing sufficient water storage capacity provides a buffer against drought and flood interruptions to the

Table 5.3 HRSTS discharge limits under EPL 640

EPA Identification no.	Dam Name	Volume Limit (ML/d)	TSS (mg/L)	pH range
3	Dam 11N	100	120	6.5-9.5
4	Parnells Dam	130	120	6.5-9.5
8	Lake James	120	120	6.5-9.5

6. SITE WATER BALANCE

6.1 Overview

HVO has developed a representative water balance model utilising the OPSIM Operational Simulation Program. The OPSIM operational simulation model was initially set up in 2007, and has since been regularly updated and calibrated when new data has been made available (most recently in 2015).

HVO uses the water balance to record and assess water flux, but also to forecast and plan water management needs. These annual site water balances are then compared to previous results. The model has been configured to simulate the operations of all major

business and prevents unlicensed discharge of polluted water offsite. HVO utilises disused mining voids and large out of pit dams to provide storage. The capacity and status of large storages located at HVO are listed in Table 5.1.

In addition to the main water stores a series of smaller dams provide buffer storage for production and ancillary demands.

A water licence was secured to access water from the decommissioned Lemington underground mine workings. The production bore can supply water to both HVO and the neighbouring Mount Thorley Warkworth (MTW) mining operation.

5.10 Drainage lines on rehabilitation sites

Drainage lines are designed as part of the Mine Operations Plan (or Rehabilitation and Environmental Management Plan).

components of the water management system including:

- Climatic variability – rainfall and evaporation;
- Catchment runoff and collection;
- Pit dewatering;
- Pump and gravity transfers;
- Water storage filling, spilling and leaking;
- Industrial water extraction, usage and return; and
- Discharge to the Hunter River under the HRSTS.

Table 6 shows a summary water balance for 2017 at HVO.

Table 6: 2017 HVO Water Balance

Water Stream	Volume (ML)
<i>Inputs</i>	
Fresh Water (potable)	40 (0.5%)
Fresh Water (Hunter River Extraction)	12 (0.2%)
Groundwater	1,3725 (17.8%)
Rainfall Runoff	4,345 (58.2%)
Recycled to CHPP from Tails & Storage (not included in total)	2,653
Imported (Liddell)	285 (3.8%)
Water from ROM Coal	1,453 (19.5%)
Total Inputs	7,460
<i>Outputs</i>	
Dust Suppression	3,156(35.4%)
Evaporation - Mine Water & Tailings Dams	1,347 (15.1%)
Entrained in Process Waste	1,399 (15.7%)
Discharged (HRSTS)	0
Vehicle Wash Down	310 (3.5%)
Miscellaneous Industrial Use	350 (3.4%)
Water in Coarse Reject	628 (7.1%)
Water in Product Coal	1,416 (15.9%)
Total Outputs	8,905
Change in Pit Storage (decreased)	1,446

6.2 Sources & Security of Water Supply

Water is supplied to HVO through a number of sources, including:

- Rainfall runoff
- Pit groundwater inflows
- Moisture entrained in ROM coal

Additional sources of poor quality water are also available from the Lemington Underground Bore and inter-site transfer. Abstraction of water from the Hunter River water is also available should alternative sources be unavailable (see Section 5.4).

HVO is typically a net generator of water; that is, the water captured via rainfall runoff and pit groundwater inflows is generally greater than the water demand. Coupled with significant mine void and out of pit storage capacity external sources of water are not typically required unless prolonged drought conditions occur. Significant High Security Water holdings for the Hunter River are available as contingency should poor quality water sources be exhausted. Regular updates to the HVO water balance model will ensure currency with the current operational configuration of the mine water management system.

6.3 Water Sharing with Neighbouring Mines

HVO seeks to use non-potable sources of water preferentially prior to accessing water from the Hunter River. Typically excess water is stored on site, however piping infrastructure is in place to transfer water to MTW via Dam 27S (Lemington void). A water transfer agreement is in place with the Glencore Liddell mine. During average conditions, water is transferred from the Liddell mine to HVO's train load points for use, due to the proximal location of the operations.

In drier than average conditions HVO (where possible) would seek to transfer surplus mine water from neighbouring mines to supplement its water demands. Infrastructure is currently in place that allows the transfer of water to and from the Peabody Wambo mine, the Mount Thorley Warkworth mine and a

connection to the Ravensworth mine water supply is also available when required.

6.4 Off-Site Water Transfers and Discharges

Saline water cannot be released from site except for opportunistic discharges as regulated by the Hunter River Salinity Trading Scheme (HRSTS).

Controlled discharges are undertaken in accordance with the HRSTS as specified in the EPL.

Any discharges of water that are required are managed under the guidelines of the HRSTS.

7. SURFACE WATER MANAGEMENT PLAN

7.1 Overview

HVO has built up a large knowledge base from more than 30 years of surface water monitoring providing detailed baseline data of surface water flows and quality in watercourses that could be affected by the project.

The HVO surface water management plan is detailed in the following sections. The plan includes:

- Baseline water quality and flow assessment;
- Detailed plans of mine water infrastructure;
- Erosion and sediment controls;
- Performance criteria for the water management system, surface water quality and stream and riparian vegetation health; and
- Water quality and flow trigger response plans.

7.2 Water Quality and Water Flow

Water quality data is collected for water courses, ephemeral streams and water bodies that could be affected by the project. These sites are detailed in the Hunter Valley Operations Surface Water Monitoring Programme in Appendix C. The main water courses potentially affected by mining at HVO are the Hunter River and Wollombi Brook.

The Hunter River is sampled from seven monitoring locations adjacent to HVO to monitor the impact of

mining on the Hunter River. The Hunter River monitoring sites extend from Moses Crossing upstream (Site W109) to just downstream of the Wollombi Brook confluence (H3). The Wollombi Brook is sampled from three monitoring locations upstream and downstream of operations.

Water quality is also monitored in several ephemeral watercourses: Parnells Creek, Farrells Creek, Davis Creek, Emu Creek, Comleroi Creek, Pikes Creek and Carrington Billabong.

Baseline data for HVO and receiving waters are detailed in the Carrington West Wing EA for HVO North (2007-2008). Recent electrical conductivity (EC), pH and total suspended solids (TSS) data for 2013 to 2016 are given in Tables 7.1, 7.2 and 7.3 below.

7.3 Water Management System

7.3.1 Clean Water Diversions

Clean water diversion structures are employed to divert clean water away from the active pits. Prior to release from site this water is managed to minimise sediment load. Sediment control structures are implemented generally in accordance with *'Managing Urban Stormwater Volume: 2E mines and Quarries'*.

7.3.2 Erosion and Sediment Control

Overview

A Ground Disturbance Permit is required for all disturbance activities. Prior to disturbance, appropriate erosion and sediment controls consistent will be established. This includes establishing erosion and sediment controls due to advance of mining and establishment or disturbance of rehabilitation. Where ground conditions allow, erosion and sediment controls are designed generally in accordance with the 'Blue Book': *Managing Urban Stormwater: soils and construction (Volume 1 and 2E – Mines and Quarries)*.

Sediment mobilisation and erosion will be minimised by;

- Where practical, diverting runoff from undisturbed catchments around disturbed areas via diversion drains and banks to discharge into natural watercourses;
- Retaining runoff from disturbed areas in sediment dams to settle out suspended sediment with possible treatment prior to discharge back to the natural system;
- Return water back to the mine water system if water quality is not suitable for release;
- Installing appropriate erosion and sediment controls prior to disturbance of any land;
- Limiting the extent of disturbance to the practical minimum and maintaining groundcover;

- Reducing the flow rate of water across the ground on disturbed surfaces;
- Progressively stripping and stockpiling topsoil for later use in rehabilitation and stabilisation;
- Stabilising topsoil stockpiles to minimise erosion;
- Progressively rehabilitating disturbed land to increase ground cover, increase infiltration and reduce erosion potential;
- Constructing drainage controls such as scour protection to improve stability in concentrated flow areas; and
- Restricting access to rehabilitation and non-disturbed areas.

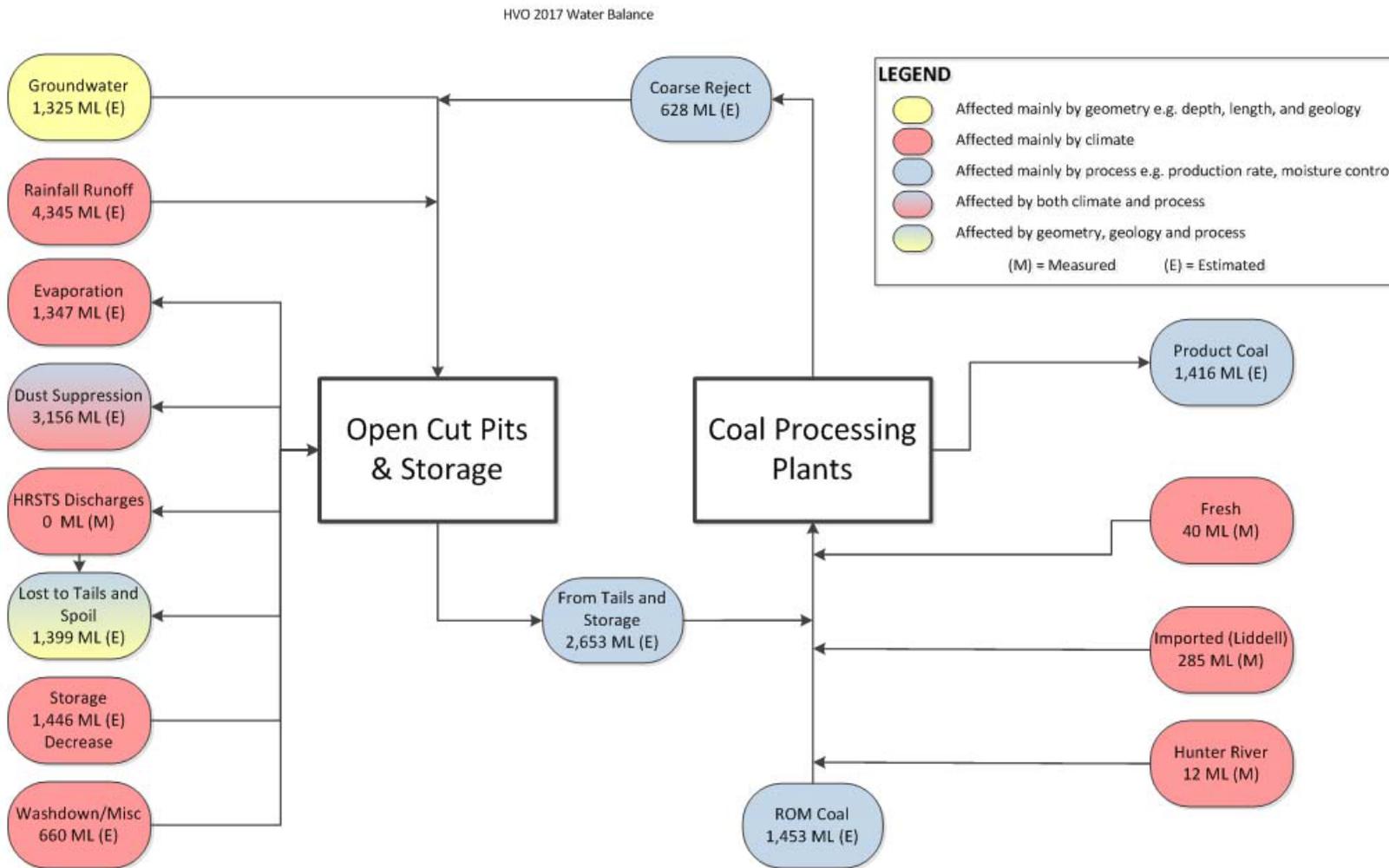
Potential Impacts from Mining

Activities that have the potential to cause erosion at HVO include:

- Vegetation clearing and topsoil stripping;
- Stockpiling of topsoil;
- Rehabilitation
- Vehicle movements
- Construction of roads and infrastructure; and
- Construction of overburden dumps.

Potential impacts from these activities include:

- Increased surface erosion from disturbed and rehabilitated areas through the removal of vegetation and stripping of topsoil;
- Increased sediment and pollutant load entering the natural water system; and



• Figure 8: HVO Water balance schematic diagram (2017 results)

- Siltation or erosion of watercourses and waterbodies.

In addition to potential impacts from mining other sources of sediment may include:

- Clearing associated with powerline easements;
- Erosion from disturbed areas created by natural processes; and
- Erosion from areas disturbed by previous agricultural land uses.

Performance indicators for Erosion and Sediment Controls

The performance of erosion and sediment controls across the HVO is assessed as part of the HVO Surface Water Monitoring Program. A set of monitoring sites located in (or representative of) downstream receival drainage lines are sampled under the “rain event” sampling routine to assess the effectiveness of erosion and sediment controls. Samples which record elevated levels of the key analytes (or lower in the case of pH analysis) are investigated and reported accordingly. Further detail on the surface water monitoring program can be found in Appendix C.

Erosion and Sediment Control Structures

Contour banks are positioned at HVO to direct runoff from rehabilitated areas and disturbed areas to sedimentation dams.. Erosion and sediment control structures will remain in place to divert water away from the final void unless required for use as flood flow storage.

7.3.3 Flood Mitigation

Existing flood mitigation controls in place at HVO include:

- HVO North:
 - Levee No. 3 (20FW213278)
 - Carrington Levee No. 5 (20FW213280)
 - North Pit Levee – Alluvial Lands (20FW213274)
 - North Pit Levee – West (20FW213278)

- HVO South:

- Barry’s Levee and Barry’s Levee South (20FW213281)
- Hobden Gully Levee (20FW213277)

HVO will construct South Lemington Pit 2 Levee SLL2 as a permanent levee and ensure the outer face of the levee will withstand 100-year ARI flood flow velocities; this will not be triggered until mining recommences at South Lemington; and

7.4 Detailed Plans

7.4.1 Final Voids

The rehabilitation objective of the mine site, including the final void is to be safe, stable and non-polluting. Design and management of the voids will be in accordance with the Mine Operations Plan (or Rehabilitation and Environmental Management Plan). The EA’s depict three final voids; two in West Pit and one in Riverview Pit.

7.4.2 Evaporative Sink

The final void evaporative sinks located in Carrington Pit and Riverview Pit have been designed to facilitate evaporative losses at a rate which is greater than the accumulation of groundwater within the pit shell, rainfall runoff and infiltration through the rehabilitated final landform. Further details on the proposed evaporative sinks can be found in the respective Environmental Assessments for each of the Project Approvals

7.4.3 Emplacement Areas and Backfilled Voids

All overburden, interburden and coarse reject material is disposed of in out-of-pit emplacement areas or within backfilled voids within the HVO complex. Operations will be managed to ensure that the method of placing material in these areas will be safe, stable and non-polluting Design and management of these areas is dependent on material competency. These areas may be reshaped as required to ensure that the final landform is capable of maintaining a stable watershed and drainage conduits.

7.4.4 Tailings Dams

Table 7.4 details the current tailings impoundments at HVO and the status of each facility. The locations of each facility are shown in **Figures 2, 3 and 4**. Tailings dams are engineered in accordance with the Dams Safety Act 1978 (NSW).

Table 7.4: current tailings impoundments at HVO and their status

Storage	Location	Status	Proposed rehabilitation
North Pit Void (29N)	North	Active	2031
Dam 6W	West	Active	2034
Centre (28N)	North	Inactive	2020
South East (27N)	North	Capping commenced	2019
Bobs Dump (20W)	West	Decommissioned	2022

7.4.5 Highwalls adjacent to low permeability barriers

Detailed plans, including design objectives and performance criteria for ensuring the stability of high wall adjacent to low permeability barriers as part of the Carrington West Wing Extension will be developed in consultation with the Department of Planning and Environment (DP&E) prior to construction.

8. GROUNDWATER MANAGEMENT PLAN

8.1 Overview

Detailed assessments of the potential groundwater impacts of mining at HVO were undertaken using a numerical groundwater model during the EA for HVO North (2003), HVO South (2017) and Carrington West Wing Extension (2010). The model calculated groundwater seepage and drawdown responses for the development, as detailed in this plan.

An integrated management approach is employed at HVO to mitigate the potential impacts of mining on the groundwater environment and other groundwater users, including dependent ecosystems.

The key groundwater management measures are:

1. Physical water management;
2. Groundwater monitoring, data management and reporting;
3. Groundwater model revisions and verification of predictions;
4. Salinity trading and water sharing; and
5. Direct compensation measures.

Objectives:

- Identify potential impacts of coal mining activities upon the uses of groundwater;
- Groundwater impact assessment criteria; and
- Exceedance response measures.

The groundwater management measures are intended to compliment the groundwater monitoring program given in Appendix D. HVO will continue to meet all commitments under the relevant water sharing and Hunter River Salinity Trading Scheme. Continued groundwater monitoring combined with a 3-yearly review of the site numerical groundwater model will inform future decision making with respect to quantifying impacts on the groundwater environment.

Overall the studies to date have highlighted that the Carrington West Wing Extension and HVO South

operations will pose limited risk to the groundwater regime. By the implementation of these groundwater management measures, any residual risks can be effectively mitigated or managed.

8.2 Water Sharing Plans

NSW water sharing plans (WSPs) establish rules for sharing water between environmental needs of the river or aquifer and water users, and difference types of water use such as town supply, rural domestic supply, stock watering, industry and irrigation.

Three WSP's apply to the area of the aquifers and surface waters which are within the HVO complex development consent boundary, namely:

- Hunter Regulated River Water Source 2016 (Hunter Regulated)
- Hunter Unregulated and Alluvial Water Sources 2009 (Hunter Unregulated)
- North Coast Fractured and Porous Rock Groundwater Sources 2016 (North Coast Fractured and Porous Rock)

The Hunter Unregulated and Alluvial Water Source WSP includes unregulated rivers and creeks within the hunter river catchment, the highly connected alluvial groundwater (above the tidal limit), and the tidal pool areas. In total there are 39 water sources covered by the Hunter Unregulated and Alluvial Water Source WSP and nine of these are further sub-divided into management zones. The following water sources / management zones are located within or immediately adjacent to the HVO complex development consent boundary.

- Hunter Regulated River Water Source-Upstream Glennies Creek Management Zone (Zone 1B)
- Hunter Regulated River Water Source-Downstream steam Glennies Creek Management Zone (Zone 2A)
- Hunter Unregulated and Alluvial Water Sources
- Wollombi Brook Management zone within the Hunter Extraction Management Unit
- Jerrys Management Zone

8.3 NSW Aquifer Interference Policy

The NSW Aquifer Interference Policy (AIP) clarifies the water licensing and approval requirements for aquifer interference activities in NSW, including the interception of water from an aquifer as a course of mining activities. The water licenses held by the HVO complex are displayed in Table 5.2 above.

The AIP requires that potential impact on groundwater sources, including Ground Water Dependant Ecosystems and fellow groundwater users, be assessed against minimal impact considerations for water pressure, water table and water quality.

Based on the AIP, the groundwater system impacted by HVO Mining activities can be separated into two systems, as follows:

- porous and/or fractured consolidated sedimentary rock of the Permian coal measures (less productive aquifer); and
- groundwater within alluvium associated with the Hunter River and Wollombi Brook (both highly productive and less productive zones).

The minimal impact considerations described in the AIP have been referenced for developing groundwater assessment criteria where applicable.

8.4 Water Quality, Levels and Yield

Baseline data for HVO, including water levels, quality and yield estimates are detailed in the EA for HVO North (2003), HVO South (2017) and Carrington West Wing Extension (2010) and the HVO North Fine Reject Emplacement (2014)

An extensive network of groundwater monitoring bores and piezometers, screening the alluvium, coal seams and interburden is routinely monitored. Environmental monitoring data is presented on the company website. The current groundwater monitoring network is shown in **Appendix D**.

8.5 Impacts on Groundwater and Monitoring

HVO has developed a knowledge base from 30 years of groundwater monitoring to provide detailed baseline data of groundwater yield and quality in the immediate region.

Groundwater monitoring will be undertaken in accordance with the Groundwater Monitoring Programme in Appendix D. This programme is in accordance with *AS 5667.1:-1998, Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples* and *AS 5667.11-1998, Guidance on Sampling of Groundwaters*.

In accordance with Schedule 4, condition 27(c) of the HVO North Consent and Schedule 3, condition 27(c) of the HVO South Consent, the Groundwater Monitoring Program should address the predicted impacts. The potential impacts from mining are described in the below sections. For each of these risks some groundwater monitoring works will be considered in addition to the Groundwater Monitoring Programme in Appendix D. Commitments related to installing monitoring bores and subsequent monitoring requirements the development of Carrington West Wing are detailed in Table 8.

8.5.1 Groundwater Inflows to the Open Cut Mining Operations

Leakage of groundwater from the target coal seams and alluvial aquifers are calculated on an annual basis. The latest figures are given in the Groundwater Impacts Reports for HVO North and South, found in the Annual Review.

The calculated groundwater inflows show good agreement with previously modelled leakage estimates in the EA's.

A summary of groundwater take for each WSP over the period 1 July 2016 to 30 June 2017 is shown below in table 8.1.

Table 8.1: Predicted Groundwater Take for 2017 (Annual Review, 2017)

	HVO Operations	LUG Bore Abstraction
Hunter Regulated	159 ML	
Hunter Unregulated	358 ML	
North Coast Fractured and Porous Rock	928 ML	901 ML

8.5.2 Effectiveness of the Low Permeability Barrier

A monitoring program to measure the effectiveness of the low permeability barriers as part of the Carrington West Wing Extension will be developed in consultation with the P&E and DPI Water prior to construction.

Performance of the Alluvial Lands Barrier is assessed regularly through a series of piezometers along the length of the barrier. A summary of monitoring results for the monitoring bores associated with verifying the effectiveness of the Low Permeability Barrier is shown below in Table 8.2, including a basic analysis of the data set at each location.

Table 8.2 Low Permeability Barrier Monitoring Results Summary (dataset from 2001 to present)

Monitoring Pt	Monitoring Frequency	Max Water Level (m AHD)	Min Water Level (m AHD)	Average Water Level (m AHD)
PZ5CH1800	Quarterly	56.54	51.34	55.58
PZ4CH1380		56.51	54.44	55.46
PZ3CH800		56.71	54.10	55.11
PZ2CH400		62.58	53.54	58.00
PZ1CH200		60.90	53.65	55.88

8.5.3 Base Flow

Loss of baseflow is currently assessed on an annual basis in the Groundwater Impacts Reports for HVO North and South, found in the Annual Review. The

annual estimate is derived from the groundwater model as indirect water take from streams and alluvium. Due to negligible flow it is not practicable to measure groundwater flow into the pit. Furthermore, measuring the captured groundwater by metering the pump-out of water collected in pit is confounded by mixing with rainfall runoff.

8.5.4 Impact on Private Groundwater Bores

It is not anticipated that HVO mining operations will result in any unreasonable loss of groundwater yield at existing privately owned water bores in the local area.

There are no privately owned boreholes (excluding those associated with mining operations) that are likely to be yield affected within the predicted envelope of groundwater depressurisation that will surround the mine pit. Nearest boreholes are located about 2.5 km to the south and are situated in Hunter River alluvium. The existing network of groundwater monitoring bores, covering both the coal seams and the alluvium, should be sufficient to ascertain whether a change in private water bore production could be attributed to the HVO operation.

8.5.5 Impact on Groundwater Dependant Ecosystems

Groundwater dependent ecosystems (GDEs) nearby HVO operations are limited to river red gum stands along the Hunter River and Wollombi Brook. The impact on these GDEs is assessed in the EAs. It is not anticipated that groundwater drawdown (as a result of this project) will result in stress to the associated vegetation communities. Whilst the species utilises groundwater, it relies on flooding regimes for recruitment. Current flooding regimes are not predicted to be significantly affected as a result of the project.

The HVO River Red Gum Rehabilitation and Restoration Strategy outlines the management and monitoring regime to ensure these communities are maintained

The HVO River Red Gum Rehabilitation and Restoration Strategy stipulates that groundwater monitoring data will be made available to the persons undertaking the ecological monitoring in order to assess the impact that fluctuating groundwater levels may have on the health of the Carrington Billabong and the Priority Sites listed in the strategy document.

8.5.6 Seepage/Leachate from Water Storages

Overburden removed and dumped as a function of mining is prone to preferential weathering and will tend to leach dissolved salts, which can enter the groundwater and surface water environment. Modelling undertaken concluded that the final void water levels will equilibrate below the regional water table and will therefore act as a sink to groundwater flow in the area. Seepage from voids is therefore not expected to occur.

The existing Groundwater Monitoring Programme is currently sufficient to verify voids will operate as designed. To verify that the groundwater is retained in the mine voids at closure HVO should install and maintain permanent floating buoys that measure the water level and electrical conductivity of the void water, combined with water level / electrical conductivity loggers fitted into a representative selection of monitoring bores.

8.5.7 Alluvial Lands Dewatering Management

The alluvial lands area of North Pit was mined and subsequently backfilled between the late-1990's and mid-2000's, following initial approval in 1995. The original groundwater modelling predicted the backfilled void would recharge via rainfall runoff and equilibrate to a water quality which would ultimately allow mixing with the Hunter River.

To ensure management commitments relating to the water quality objectives for Hunter River mixing could be achieved at some time in the future investigations determined dewatering of the void should be undertaken to reduce the salt load.

One deep dewatering bore (DM6) and three shallow dewatering bores (DM7, 8 and 9) were constructed as the void was backfilled in the mid-2000's. The bores were intermittently operated following construction however pumping ceased in June 2007, as site water inventories were full due to heavy rainfall.

Shallow bores DM8 and DM9 were re-commissioned in 2013 and provide a low dewatering rate. In 2015, the drilling of test holes to confirm the target site for a deep dewatering bore was undertaken. Four holes were drilled, none of which yielded sufficient water to support the construction of a dewatering bore. A consultant will be engaged to develop a hydraulic testing programme and review the conceptual hydrogeological model for the alluvial lands area.

The existing Groundwater Monitoring Programme and Groundwater Impacts Report are used to monitor and manage alluvial lands dewatering.

8.6 Validation of Groundwater Model

Every three years HVO will instigate an independent review (validation and recalibration, if necessary) of the groundwater model. The years for these reviews are based on the dates of the latest Environmental Assessments where the groundwater models were reviewed. HVO North was 2016 and HVO South was 2018.

Table 8: Monitoring Commitments associated with developing the Carrington West Wing groundwater barrier wall.

WORKS/ACTIONS	ESTIMATED TIMING
Two-monthly monitoring of water levels in any new standpipe piezometer in proximity to the Carrington West Wing extension area and quarterly monitoring elsewhere, unless water level changes dictate otherwise.	When mining begins in the Carrington West Wing extension area,
Daily or more frequent monitoring of pore pressures by installed auto recorders at some existing piezometers in order to discriminate between oscillatory groundwater movements attributed to rainfall recharge, and longer term pressure losses related to open cut and underground mining.	When mining begins in the Carrington West Wing extension area
Construction of additional piezometers. Permeability testing will be completed on new piezometers in order to facilitate estimation of leakage and subsurface flows.	Where deemed necessary, as information is generated from within the existing network, during the course of mining.
Two-monthly or quarterly (depending upon location) monitoring of basic water quality parameters, pH and EC, in existing and any new piezometers	When mining begins in the Carrington West Wing extension area
Six monthly measurement of TDS and speciation of water samples in piezometers	When mining begins in the Carrington West Wing extension area

9. ASSESSMENT, REPORTING AND REVIEW

9.1 Performance Criteria & Trigger Levels

Trigger values provide the measurable basis for identifying adverse water related impacts and the basis on which to consider implementing contingency measures, provided there is a large enough data set for statistically robust values. Key analytes include;

- pH (acidity / alkalinity)
- Conductivity (EC)
- Total Suspended Solids (TSS).
- Standing Water Level (SWL) (specific groundwater sites only)

HVO's EPL 640 stipulates HRSTS discharge criteria, as detailed in Table 9.1.

Table 9.1: Surface Water Impact Assessment Criteria

Parameter	Unit of Measure	Concentration Limit
pH	pH	6.5 - 9.5 ^a
Total Suspended Solids (TSS)	Milligrams per litre (mg/L)	120 ^b

NOTES: A. PERMISSIBLE RANGE
B. MAXIMUM

In the absence of licence or applicable ANZECC criteria, the 95th percentile of the available validated data record for a monitoring station will be adopted as the basis for a water quality management guideline trigger value. The calculated trigger values will be incorporated into quarterly reviews of monitoring data.

Specific groundwater impact assessment criteria have been derived from predicted changes in the HVO North and HVO South EA's and also give consideration to minimal impact considerations in the AIP (Table 9.2). Performance against these assessment criteria will be reported to the Department of Planning and

Infrastructure in the AR. Sufficient baseline groundwater data is available to guide the development and use of the various impact assessment criteria.

To provide further context to the Groundwater Impact Assessment criteria in table 9.2, the beneficial use categories for groundwater (as defined by Food and Agricultural Organisation of the United Nations, FAO 2013) are shown in table 9.3 as a function of Total Dissolved Solids. The beneficial use categories in table 9.3 have been adopted for the purpose of assessing potential water quality impacts at the HVO site.

Impact assessment criteria related to the performance of the Carrington West Wing Low Permeability Barrier will be developed in consultation with DP&E and DPI Water prior to construction commencing.

Table 9.2: Groundwater Impact Assessment Criteria

Criteria	Description
1	The groundwater level does not decline more than 2m at any privately owned bores and wells identified in the HVO complex EA's (with the exception of a single bore on land owned by the Ravensworth mine (10011459) which is predicted to decline by a maximum of 2.7m.)
2	Water quality does not lower the beneficial use category of the groundwater source beyond 40m from the mining pit. This will be identified using groundwater triggers (EC) for individual monitoring bores specified in the Groundwater Monitoring Programme.
3	The alluvial groundwater source within 40m of the recognised GDE communities does not experience more than a 10% reduction in piezometric levels predicted in the EA's for HVO North and HVO South (allowing for typical climatic variation).

Table 9.3 Beneficial Use Categories for groundwater sources (FAO, 2013)

Beneficial Use Category	TDS (mg/L)
Fresh Water	<500
Brackish (Slightly Saline)	500 to 1,500
Moderately Saline	1,500 to 7,000
Saline	7,000 to 15,000
Highly Saline	15,000 to 35,000
Brine	>35,000

9.2 Monitoring Controlled Discharges

Controlled discharges at the HVO complex are authorised under the HRSTS. All controlled discharges will be monitored in accordance with the criteria prescribed in EPL 640. A summary of the monitoring requirements for controlled discharges are shown below in table 9.4 and table 9.5

Table 9.4 Controlled Discharges Sampling Method Requirements

EPA ID No.	Analyte monitored	Sampling Method
Point 3, 4 and 8	Conductivity	Probe designed to measure the range of 0 10 10,000 uS/cm
	pH	Grab Sample
	Total Suspended Solids	Grab Sample

Table 9.5 Controlled Discharges Sampling Frequency Requirements

EPA ID No.	Analyte monitored	Sampling Frequency
Point 3,4 and 8	Conductivity	Continuous during discharge
	pH	Daily During Discharge
	Total Suspended Solids	Daily During Discharge

9.3 Monitoring Uncontrolled Discharge

Uncontrolled discharges from saline mine water storages at the HVO complex will be regarded as an environmental incident and will enact the incident response protocol. Uncontrolled discharges of mine water will be investigated and reported as required

Uncontrolled overflow from sediment control structures as a result of rain events which exceed the design capacity of the sediment control structure will be monitored as part of the rain event sampling program. Where an uncontrolled overflow from a

sediment control structure has been experienced during a rainfall event which has not exceeded the design rainfall event (or in the absence of a rainfall event), the uncontrolled discharge will enact the incident response protocol and be investigated and reported as required.

The HVO rain event sampling procedure was developed to assess water quality at sites located in watercourses (or representative of) downslope of the operations. Where an exceedance of the trigger limit is obtained during the rain event sampling program, further sampling of sediment control structures located upslope will be undertaken, with further investigation and reporting undertaken as required. The trigger to initiate a rain event sampling run is 30mm in 24 hours. Further details on the rain even sampling can be found in Appendix C.

9.4 Monitoring Stream and Riparian Vegetation Health

A programme to monitor surface water flows on Stream and Riparian Vegetation health in the Hunter River potentially affected by the HVO South Project will commence by 28th February 2019 (within 12 months of the Project Approval being granted) Performance Criteria will be established on the basis of the monitoring program.

9.5 Response to Exceedance & Performance Indicators

The following management responses will be routinely implemented as per below.

- Formal review of measured depressurisation of coal measures and alluvial aquifers will be undertaken annually by a suitably qualified hydrogeologist.
- The predicted loss of water from the alluvial aquifer and from baseflow in the Hunter River will be offset by ensuring sufficient entitlements are held from the Hunter Regulated River Water Sharing Plan.

HVO would purchase and retire existing water licences from the Wollombi Brook Water Source Zone for the predicted loss of water from the alluvial aquifer and from baseflow in Wollombi Brook if required. In the event that a water quality measurement exceeds a predetermined trigger value, exceedances will be recorded and HVO will initiate a site specific investigation if:

- professional judgement determines that the single deviation or a developing trend could result in environmental harm.
- three consecutive measurements of EC, pH or Standing water level (for specific groundwater sites only) exceed trigger values.
- One measurement of TSS exceeds the trigger value.

The investigation will:

- Determine the source and risk of impact on downstream water quality.
- Determine the need for and extent of contingency measures and/or the impact of the results on the long term viability of recognised GDE's. Communicate outcomes to senior management
- Be reported in the AR.

9.6 Management of Unpredicted Impacts

Contingency measures will be implemented commensurate with the degree of impacts determined by the investigation. Depending on the outcomes of an investigation, one or a number of remedial actions may be taken.

Remedial actions for surface water may include:

1. intercepting and pumping the water back into the mine water management system;
2. establishment of containment or diversion systems upstream to prevent the water discharging offsite;
3. establishing controls to improve the water quality; and/or
4. cease or modify any activity that may be degrading the water quality; and/or
5. additional water licences or water allocations will be sourced if required to ensure that HVO's water allocation is not exceeded.

Remedial actions for groundwater may include:

1. more intensive monitoring and/or seeking professional advice in regards to model predictions; and/or
2. geotechnical investigations; and/or
3. structural assessments; and/or
4. contingency measures to ensure the long term viability of recognised GDE's, as guided by suitable professionals, (to the satisfaction of the Minister, as required in the AIP) and/or.

consideration of changes to the mine plan if required. Monitoring and reporting would be continued to demonstrate the effectiveness of the actions in remediating the water excursion.

9.7 Reporting

The process for compliance reporting is described in Table 9.4.

Table 9.4: Water quality management reporting

Reporting aspect	Relevant Legislation	What is reported	When	Who to report to
Results of water monitoring undertaken in accordance with the requirements of this approval	Condition 9 of Schedule 6 of the HVO North Consent (DA 450-10-2003) & Condition 9 of Schedule 6 of HVO South Consent (06_0261)	Monitoring results	Monthly	Public via the company website HVO website & The HVO Community Consultative Committee (CCC)
Results of monitoring collected in accordance with EPL	PoEO Act, Schedule 2, Section 66	Monitoring results	Within 14 days of receipt - reported on the HVO Australia website (monthly summary)	Public via the company website
Annual Review	Condition 5 of Schedule 6 of the HVO North Consent (DA 450-10-2003) & Condition 9 of Schedule 6 of HVO South Consent (06_0261)	All water monitoring results for the corresponding year. The Annual Review will also detail any complaints relating to water quality received at HVO	By the end of March each year	Relevant stakeholders including but not limited to EPA, DP&E, Singleton Council and Community Consultative Committee (CCC)
Potential or confirmed exceedance / noncompliance of water triggers (internal reporting)	HVO Environmental Management Strategy	Details of potential or confirmed exceedance / noncompliance of water triggers incidents	By exception	The Environmental Coordinator reports to the Environment and Community Manager
Trigger exceedance investigation determines contingency measures required	HVO Environmental Management Strategy	Details of the trigger exceedance investigation and contingency measures to be enacted	Following exceedance investigation	Relevant stakeholders including but not limited to DP&E, DPI Water
Incident causing or threatening to cause Environmental harm	PoEO Act, Section 148	Details of incident	Notification Immediately following receipt of information	Relevant stakeholders including but not limited to EPA, DP&E, DPI Water

Reporting aspect	Relevant Legislation	What is reported	When	Who to report to
			<p>indicating actual or potential harm</p> <p>Incident report to be provided within 7 days of the incident</p>	
Water use	Water Access Licence under the WMA	<p>Water supply and use</p> <p>NB: Where conditions of Water Licences issued by NoW dictate, a compliance report, which reports on the results of the Groundwater Monitoring and Contingency Plan required by a Water Licence, will be lodged DPI Water</p>	Annually	Reported on in the AR and in accordance with Water Licence requirements.
Annual Environmental Audit Report	Water Act 1912 20BL173392 20BL173587 20BL173588 20BL173589	<p>report on:</p> <ul style="list-style-type: none"> • compliance with the terms and conditions of the relevant Water Licence, including any Groundwater Monitoring and Contingency Plan; • Actual impacts of the extractions on any aquifers, groundwater dependant eco-systems and any streams in the area; • The difference between actual and predicted impacts (modelled results); and • Recommendations as to works 	Annually	Reported on in the AR

Reporting aspect	Relevant Legislation	What is reported	When	Who to report to
		that ought to be performed or additional obligations that ought to be imposed in order to rectify any impacts on groundwater.		

9.8 Complaints Management

Community Complaints are lodged via the Community Complaints line (**1800 888 733**). The hotline number will be prominently displayed on the HVO Insite webpage, and regularly advertised in the local newspaper.

The Complaints Hotline will be in operation 24 hours per day, seven days a week. Complaints will be recorded and investigated by HVO staff. All other complaints lodged via letter, in person or by fax, will also be recorded and investigated by the Environmental Coordinator.

All complaints will be investigated, and, where the investigation identifies potential non-compliance with a consent or licence condition, mitigating action will be taken.

The details of all water related complaints, and any mitigating actions taken, will be circulated to senior management. Where requested, follow-up correspondence with the complainant will be provided. In accordance with the conditions of EPL640 relating to handling of pollution complaints, HVO will maintain a register of complaints, recording the following information (at minimum):

- Date and time of the complaint
- Method by which the complaint was made
- Any personal details of the complainant which were provided

- The nature of the complaint
- Any action taken in relation to the complaint
- If no action, the reason why no action was taken

A record of each complaint will be kept for a minimum of four years, and will be produced on request to any authorised officer of the EPA.

9.9 Continuous Improvement

HVO will continuously seek to further water management by way of improving existing controls or implementing new controls where required, and thoroughly investigating any exceedance and noncompliance events.

10. ROLES AND RESPONSIBILITIES

Table 10: Roles and Responsibilities

Manager – Mining

- Manage water in compliance with the WMP and HVO Water Management procedures.
 - Delegate a representative for the Water Management Operations Team.
 - Water infrastructure in the mining area is regularly inspected and maintained. Specifically:
 - Maintain dewatering capability.
 - Systems to protect against sudden inrushes of water are operational.
 - Mitigate spills, leaks and unlicensed discharges.
 - Water supply from the mine meets supply demands of the CHPP's.
 - Water management infrastructure is designed and constructed in accordance with this WMP and HVO Water Management procedures.
-

Manager – Environment and Community

- A site Water Management Plan is prepared, implemented & maintained.
 - Surface and groundwater monitoring programmes are implemented and current.
 - Review and reporting of water data is consistent with regulatory requirements.
 - Administer and manage compliance with water licenses.
 - Design and budget for the construction of small to medium cleanwater diversions and, sediment/erosion control structures and discharge facilities.
 - Arrange monthly water management infrastructure inspections and storage facility inspections as required.
 - Manage releases of water for the mine site so that releases comply with statutory requirements.
 - Advise Managers for Short, Medium and Long Term Mine Planning on water management control & planning requirements.
 - Prepare site water balances that define water use, storage and discharge requirements.
 - Regularly monitor the availability, use, quality and discharge of water with licence requirements and relevant site management plans.
 - Delegate a chairperson for regular water management operations team meetings.
-

Manager – CPP

- Manage water in compliance with the WMP and HVO Water Management procedures.
 - Delegate a representative for the Water Management Operations Team.
 - Water infrastructure in the CHPP area of accountability is regularly inspected and maintained. Specifically:
 - Preferential use of poor quality water over river water.
 - Mitigate spills, leaks and unlicensed discharges.
 - Water is ordered and administered in accordance with the WMA.
 - Water management infrastructure is designed and constructed in accordance with this WMP and HVO Water Management procedures.
 - Communicate the WMP to relevant members of team.
 - Maintain operational procedures and work instructions for the management of water in the CHPP area.
-

Manager – Maintenance

- Water is managed in compliance with the WMP and the HVO Water Management procedures.
 - Delegate a representative for the Water Management Operations Team.
 - Water infrastructure in the Maintenance area of accountability is regularly inspected and maintained.
-

- Specifically:
 - Preferential use of poor quality water over river water.
 - Mitigate spills, leaks and unlicensed discharges.
- Planned maintenance schedules are implemented to maintain the availability of fixed and mobile pumps in the mining area.
- Water management infrastructure is designed and constructed in accordance with this WMP and HVO Water Management procedures.
- Communicate the WMP to relevant members of team.
- Maintain operational procedures and work instructions for the management of water in the Maintenance area.

Manager – Technical Services

- Incorporate surface and ground water management into mine planning and landform design.

Manager Operations Support and Projects

- Water is managed in compliance with the WMP and HVO Water Management procedures.
 - Delegate a representative for the Water Management Operations Team.
 - Water infrastructure in the OS&P area of accountability is regularly inspected and maintained. Specifically:
 - Install sediment and erosion control for ground disturbance activities.
 - Mitigate spills, leaks and unlicensed discharges.
 - Budget for and provide EPCM for medium to large scale water management projects. Provide supervision and construct small water management projects. .
 - Budget for the maintenance of all permanent clean, sediment, erosion control and mine water drains and dams.
 - Maintain operational procedures and work instructions for the management of water in the Projects work area.
 - Communicate the WMP to relevant members of team.
-

11. REVIEW

The WMP will be reviewed within three months of the submission of the AR and updated to the satisfaction of the DP&E where necessary.

The WMP will also be reviewed within three months of the completion of an independent environmental audit, any exceedance of the Approvals' criteria or any modification to the conditions of the Approvals. The WMP updated to the satisfaction of DP&E where necessary.

Any major amendments to the WMP that affect its application will be undertaken in consultation with the appropriate regulatory authorities and stakeholders. Minor changes such as formatting edits may be made with version control on the Project website.

REFERENCES

- Project Approval - DA 450-10-2003.
- Project Approval - DA 06_0261.
- The Environmental Impact Assessment titled '*Hunter Valley Operations – West Pit Extension and Minor Modifications*', dated October 2003, and prepared by Environmental Resources Management Australia.
- The '*Carrington West Wing Environmental Assessment*', dated 1 October 2010, and prepared by EMGA Mitchell McLennan (CWW EA).
- The Environmental assessment titled '*Hunter Valley Operations South Coal Project Environmental Assessment Report*', Volumes 1, 2 and 3, dated January 2008, including the response to submissions.
- The Environmental assessment titled '*Hunter Valley Operations South Coal Project- Modification 5 Environmental Assessment Report*', dated February 2017, including the response to submissions.
- FAO 2013, Food and Agricultural Organisation of the United Nations
 - <http://www.fao.org/docrep/t0667e/t0667e05.htm>.

Appendix A – Director General’s Endorsement of Suitably Qualified and Experienced Author



Mr Mark Nolan
Manager Project Approvals
Yancoal Australia Ltd
1011 Lemington Road
Ravensworth NSW 2330

Dear Mr Nolan

**Hunter Valley Operations – Water Management Plan
Approval of Suitably Qualified and Experienced Persons**

I refer to your letter dated 28 November 2017, seeking approval of a suitably qualified and experienced person to prepare the Water Management Plan for Hunter Valley Operations (HVO).

The Secretary has approved Mr Andrew Hodge as a suitably qualified and experienced person for the preparation of the Project's *Hunter Valley Operations Water Management Plan*, as required under condition 27, Schedule 4 of the HVO North consent (DA 450-10-2003) and condition 27, Schedule 3 of HVO South approval (PA 06-0261).

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

Yours sincerely

Howard Reed 28.11.17
Director
Resource Assessments
as nominee of the Secretary

Appendix B – Correspondence with DPI Water and the EPA



OUT17/48695

Chris New
Environmental Specialist - Operations
Rio Tinto
PO Box 315
Singleton NSW 2330

via email: chris.new@riotinto.com

Dear Mr New

Hunter Valley Operations – Review of Water Management Plan

Thank you for providing Crown Lands and Water Division (CL&W) the opportunity to provide comment on the Hunter Valley Operations Water Management Plan (WMP) and associated appendices. CL&W has reviewed the WMP and recommends that to enhance understanding of the WMP the following need to be undertaken

Groundwater

- The WMP should be updated to reflect the document management changes. If links to external documents are to be used these must be correct and functioning.
- The different water sources and water sharing plans (WSP) that are in effect over the HVO site must be presented in the WMP.
- Groundwater take for each groundwater (water) source and each aquifer needs to be presented within the WMP.
- All relevant data and reports which are linked external documents are to be summarised and included within the WMP under the relevant sections so that the WMP can function as a stand-alone document.
- Trigger and assessment water level criteria within the WMP should be in terms of reference to the AIP.
- The WMP should outline how the water quality criteria ("4") within riverine alluvium of "in excess of three (3) standard deviations from the long term mean" was derived, or more importantly how this relates to the AIP criteria.
- The WMP should include a tabulated summary of groundwater inflow calculations and modelled comparisons to make it more effective.
- The WMP should list which piezometers monitor the low permeability barrier (Alluvial Lands Barrier), the frequency of monitoring, plus the maximum, minimum, and average water levels recorded with the trigger level.
- The WMP should include a tabulated summary of groundwater baseflow to Hunter River for all recorded data showing maximum, minimum, and average by distance from the river.

- The WMP should outline how the monitoring program ensures the AIP criteria for Groundwater Dependant Ecosystems (GDE's) are met.
- The WMP must be updated to reflect response and action planning and reporting with defined timelines, given it is a requirement of conditions and necessary component of all water management.
- Please note that the most recent consolidated DA 450-10-2003 is dated July 2017 - the schedule numbers have changed, this must be updated within the WMP.

Surface Water

- The WMP has satisfactorily addressed Crown Lands and Water's requirements for surface water and no further recommendations are required to be addressed by the proponent.

Please contact Ryan Shepherd, Water Regulation Officer (Newcastle) on (02) 4904 2650 or ryan.shepherd@dpi.nsw.gov.au if you have further enquiries regarding this matter.

Yours sincerely



Irene Zinger
Manager Regulatory Operations - Metro
Crown Lands and Water

06-12-2017



DOC18/180487-02, EF16/2461

Hunter Valley Operations
PO Box 267
SINGLETON NSW 2330

18 June 2018

Attention: Dominic Brown

Dear Mr Brown

HUNTER VALLEY (HVO) MANAGEMENT PLAN CONSULTATION

Reference is made to your email dated 26 March 2018 to the Environment Protection Authority ("EPA") in relation to *Hunter Valley Operations Management Plan Consultation*.

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, nor provide input to 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.

The EPA does not require HVO to consult with it regarding the development of plans required under planning consents. The EPA provides its recommended conditions of approval to the Department of Planning and Environment during the development assessment and approvals process.

If you wish to discuss the matter further please contact Natasha Ryan on 02 4908 6833.

Yours sincerely



MARK HARTWELL
Head Regional Operations Unit - Hunter
Environment Protection Authority

Appendix C – Surface Water Monitoring Programme

Hunter Valley Operations Surface Water Monitoring Programme

Purpose

This document provides a summary of the surface water monitoring programme for Hunter Valley Operations.

The monitoring locations are subject to change and will be updated periodically to align with management needs and to accommodate progression of mining.

Programme

Table 1: Surface Water Monitoring Overview

Monitoring Location	Frequency & Parameter			
	EC	pH	Comprehensive Analysis ¹	TSS
Barellan	RE	RE	A	RE
Bayswater Creek Downstream	RE	RE	A	RE
Bayswater Creek Mid	RE	RE	A	RE
Bayswater Creek Upstream HVLP	RE	RE	A	RE
Bayswater Creek Upstream NLP	RE	RE	A	RE
Carrington Billabong	RE	RE	A	RE
Carrington Downstream	RE	RE	A	RE
Carrington Upstream	RE	RE	A	RE
Coal Loader Dam (HVLP, Bayswater)	Q	Q	-	Q
Comleroi Creek	RE	RE	A	RE
Dam 11N	Q	Q	A	Q
Dam 16W	Q	Q	-	Q
Dam 18W Parnell's Ck	Q	Q	A	Q
DM6 North Void Tailings	Q	Q	A	Q
Emu Ck Sed Dam	Q	Q	A	Q
EOC (Dam 16S)	Q	Q	-	Q
H1 Hunter River (upstream K Dam)	Q	Q	A	Q
H2 Hunter River	Q	Q	A	Q
H3 Hunter River downstream Wollombi	Q	Q	A	Q
K Dam/ Lake James	Q	Q	6M	Q
NSW1 (Parnells Ck)	RE	RE	A	RE
NSW2 Emu Ck	RE	RE	A	RE
NSW3 Davis Ck	RE	RE	A	RE
Pikes Creek Downstream	RE	RE	A	RE
Pikes Creek Upstream	RE	RE	A	RE
Redbank Creek Catchment	RE	RE	A	RE
W1 Hunter River (Carrington)	Q	Q	A	Q

W109 Hunter R. Moses Crossing	Q	Q	-	Q
W11 Farrells Ck Lemington Rd	RE	RE	A	RE
W2 Wollombi Bk	Q	Q	A	Q
W3 Hunter River	Q	Q	-	Q
W3 Parnells Ck Dam	Q	Q	A	Q
W4 Hunter River (Oaklands)	Q	Q	A	Q
W5 Farrells Ck downstream	RE, S2	RE	A	RE
W5 Farrells Ck upstream	RE, S2	RE	A	RE
W9 (Dam 14W)	Q	Q	A	Q
Warkworth Bridge Wollombi Bk	Q	Q	A	Q
WL1 Wollombi Bk	Q	Q	A	Q
WLP3	6M	6M	6M	-

¹Comprehensive analysis includes major ions TDS, Al, As, B, Ca, Cd, Cl, (CO₃), Cu, Hg, K, Mg, Na, Ni, Pb, Se, SO₄ (or S), Zn, Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity, Hydroxide Alkalinity.

RE – Rain Event sampling (≥30mm rainfall in 24hrs, max 2 sampling events per quarter), Q – Quarterly, 6M – Six Monthly, A – Annual, A* - Annual comprehensive analysis to be undertaken on the first rain event sampling occasion for the year, S2 – Special sampling during discharge)

Methods

CNA engages qualified suitably experienced contractors to carry out sampling and analysis. Sampling is undertaken in accordance with relevant Australian Standards and other regulatory guidelines. Samples are analysed by laboratories that are National Association of Testing Authorities (NATA) accredited or equivalent for the parameters being analysed.

Impact Assessment Criteria

In the absence of licence or applicable ANZECC criteria, the 5th / 95th percentile of the available validated data record for a monitoring station will be adopted as the basis for a water quality management guideline trigger.

Electrical Conductivity, pH and TSS will be monitored in accordance with the frequency and methodology outlined in Section 2. Trigger levels for investigating potentially adverse surface water impacts are specified in the table below. Trigger limits are calculated as the 95th percentile maximum value (pH and EC), and the 5th percentile minimum value (pH) from historical data 2011 – current collected from the monitoring station. The 50mg/L ANZECC criteria has been adopted for TSS. Trigger limits have only been calculated for Watercourses. Trigger limits for surface water monitoring locations are summarised in Table 2.

The response to trigger levels is detailed in Hunter Valley Operations Water Management Plan 2017.

Table 2: Surface Water Trigger Limit

Site	Electrical Conductivity μS/cm	pH		Total Suspended Solids mg/L
	95th	5th	95th	
Bayswater Creek Downstream	3273	7.0	8.0	50
Bayswater Creek Upstream HVLP	4916	7.7	8.4	50
Bayswater Creek Midstream	5068	7.8	8.3	50
Carrington Billabong				50
Comleroi Creek	372	6.3	7.9	50
H1	1137	7.9	8.4	50
H2	1089	8.0	8.6	50
H3	890	7.7	8.5	50
NSW 1 Parnells Creek	8413	8.0	8.7	50
NSW 2 Emu Creek	9835	7.0	8.9	50
NSW3 Davis Creek				50
Pikes Creek Downstream	5962	7.3	8.0	50
Pikes Creek Upstream	10377	7.3	8.2	50
W1 (Hunter River)	1251	8.0	8.5	50
W109	1216	8.0	8.5	50
W11	2997	7.3	8.6	50
W2	1010	7.1	8.3	50
W3 Hunter River	1200	8.0	8.5	50
W4 Hunter River	1205	8.0	8.6	50
WL1	843	7.3	8.2	50
Warkworth Bridge	1056	7.1	8.2	50

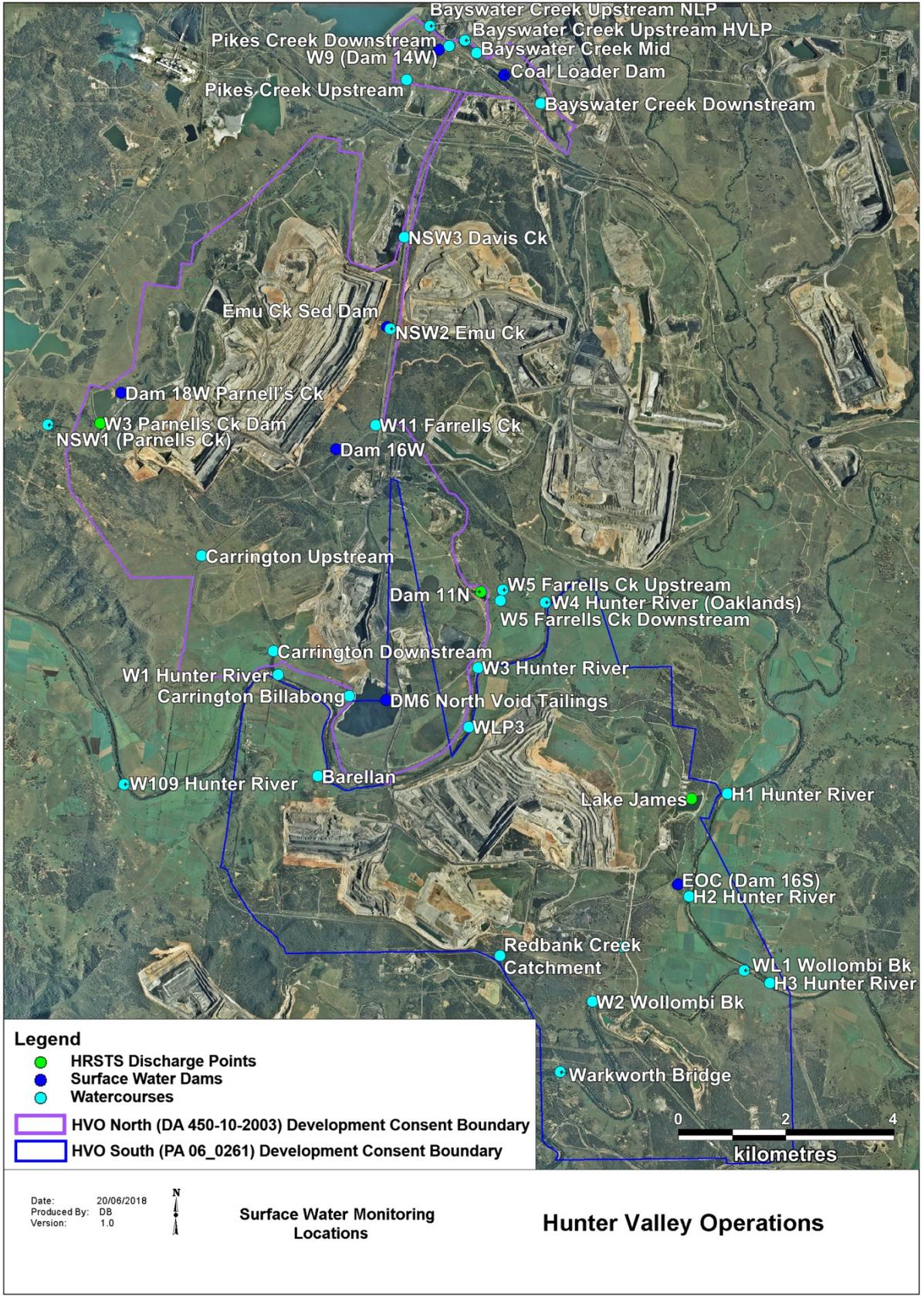


Figure 1: HVO Surface Water Monitoring Plan

Appendix D – Groundwater Monitoring Programme

Hunter Valley Operations Groundwater Monitoring Programme

Purpose

This document provides a summary of the ground water monitoring programme for Hunter Valley Operations.

The monitoring locations are subject to change and will be updated periodically to align with management needs and to accommodate progression of mining.

Programme

Table 1: Groundwater Monitoring Programme Overview

Location					
Sample Point	Water Level	EC	pH	Comprehensive Analysis	Alk/Acidity
4032P	Q	Q	Q	6M	
4034P	Q	Q	Q	6M	
4036C	Q	Q	Q		
4037P	Q	Q	Q	6M	
4040P	Q	Q	Q		
4051C	Q	Q	Q		
4116P	Q	Q	Q	6M	
4119P	Q	Q	Q	6M	
Appleyard Farm	M	Q	Q	A	
B334(BFS)	Q	6M	6M		
B425(WDH)	Q	6M	6M	A	
B631(BFS)	Q	6M	6M		
B631(WDH)	6M	6M	6M		
B925(BFS)	Q	6M	6M	A	
BC1a	Q	Q	Q		
BUNC45A	Q	Q	Q	6M	
BUNC45D	Q	Q	Q	6M	
BZ1-1	Q	Q	Q	6M	
BZ1-3	Q	Q	Q	6M	
BZ2A(1)	Q	Q	Q		
BZ3-1	Q	Q	Q		
BZ3-3	Q	Q	Q		
BZ4A(2)	Q	Q	Q		
BZ8-2	Q	Q	Q	6M	
C122(WDH)	6M	6M	6M		
C122(BFS)	Q	Q	Q		
C130(AFS1)	6M	6M	6M	A	
C130(ALL)	Q	Q	Q	A	
C130(BFS)	6M	6M	6M		
C130(WDH)	6M	6M	6M		
C317(BFS)	Q	6M	6M		
C317(WDH)	Q	6M	6M		
C613(BFS)	Q	6M	6M		
C621(BFS)	Q	6M	6M		
C630(BFS)	6M	6M	6M		
C809 (GM/WDH)	6M	6M	6M		
C919(ALL)	M	Q	Q	A	
CFW55R	Q	Q	Q	6M	

CFW57	Q	Q	Q	6M	
CGW32	Q	Q	Q		
CGW39	Q	Q	Q	6M	
CGW45	Q	Q	Q		
CGW46	Q	Q	Q	6M	
CGW47a	Q	Q	Q	6M	
CGW49	Q	Q	Q		
CGW51a	Q	Q	Q		
CGW52	Q	Q	Q		
CGW52a	Q	Q	Q		
CGW53	Q	Q	Q		
CGW53a	Q	Q	Q		
CGW55a	Q	Q	Q		
CHPZ10A	Q	Q	Q	6M	
CHPZ12A	Q	Q	Q	6M	
CHPZ12D	Q	Q	Q	6M	
CHPZ1A	Q	Q	Q	6M*	
CHPZ2A	Q	Q	Q	6M	
CHPZ3A	Q	Q	Q	6M	
CHPZ3D	Q	Q	Q	6M	
CHPZ4A	Q	Q	Q	6M	
CHPZ8A	Q	Q	Q	6M	
CHPZ8D	Q	Q	Q	6M	
D010(BFS)	6M	6M	6M		
D010(GM)	6M	6M	6M	A	
D010(WDH)	6M	6M	6M		
D214(BFS)	Q	6*M	6*M		
D317(BFS)	Q	6M	6M		
D406(AFS)	6M	6M	6M		
D406(BFS)	6M	6M	6M		
D510(AFS)	6M	6M	6M		
D510(BFS)	6M	6M	6M		
D612(AFS)	6M	6M	6M		
D612(BFS)	6M	6M	6M		
D807(BFS)	6M	6M	6M		
DM1	Q	Q	Q	A	Q
DM3	Q	Q	Q	A	Q
DM4	Q	Q	Q	A	Q
DM7	Q	Q	Q	A	Q
G1	Q	Q	Q	A	
G2	Q	Q	Q	A	
G3	Q	Q	Q	A	
GA3	Q	Q	Q		
GW_100	Q	Q	Q	A	
GW_100a (VWP)	Q*				
GW_101	Q	Q	Q	A	
GW_101a (VWP)	Q*				
GW_102 (VWP)	Q*				
GW_103 (VWP)	Q*				
GW_104 (VWP)	Q*				
GW_105 (VWP)	Q*				
GW_106	Q	Q	Q	A	
GW_107	Q	Q	Q	A	
GW_108	Q	Q	Q	A	
GW_109 (VWP)	Q*				
GW_110 (VWP)	Q*				
GW_114	Q	Q	Q	A	

GW_115	Q	Q	Q	A	
HG2	Q	Q	Q		
HG2a	Q	Q	Q		
Hobdens Well	Q	Q	Q	A	
HV3(2)	Q	Q	Q		
LUG Bore	M	Q	Q	A	
NPz2	Q	Q	Q	A	
NPz3	Q	Q	Q	A	
NPz5	Q	Q	Q	A	
PBO1(ALL)	M	Q	Q	A	
PZ1CH200	Q	Q	Q		
PZ2CH400	Q	Q	Q	6M*	
PZ3CH800	Q	Q	Q	6M*	
PZ4CH1380	Q	Q	Q		
PZ5CH1800	Q	Q	Q		
SR001	6M	6M	6M		
SR002	6M	6M	6M		
SR003	6M	6M	6M		
SR004	6M	6M	6M		
SR005	6M	6M	6M		
SR006	6M	6M	6M		
SR007 (RC_11)	6M	6M	6M	A	
SR008 (RC_7)	6M	6M	6M	A	
SR009 (RC_8)	6M	6M	6M	A	
SR010 (RC_6)	6M	6M	6M	A	
SR011 (RC_14)	6M	6M	6M	A	
SR012 (HQ_11)	6M	6M	6M	A	
MB14HVO01	Q	Q	Q	A	
MB14HVO02	Q	Q	Q	A	
MB14HVO03	Q	Q	Q	A	
MB14HVO04	Q	Q	Q	A	
MB14HVO05	Q	Q	Q	A	

¹ Comprehensive analysis includes major ions TDS, Al, As, B, Ca, Cd, Cl, (CO₃), Cu, Hg, K, Mg, Na, Ni, Pb, Se, SO₄ (or S), Zn, Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity, Hydroxide Alkalinity. *TDS, Al, As, B, Be, Ca, Cd, Cl, CO₃, Co, Cu, F, Fe, Hg, K, Mg, Mn, Na, Ni, NH₃, NO₂, NO₃, P, Pb, Rb, Sb, Se, SO₄ (or S), SiO₂, Sr, Zn, Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity, Hydroxide Alkalinity.

Notes:

(VWP) indicates that the hole is fitted with a grouted vibrating wire piezo. Q* - Data downloaded quarterly

RE – Rain Event sampling (≥30mm rainfall in 24hrs, max 2 sampling events per quarter), M – Monthly, Q – Quarterly, 6M – Six Monthly, A – Annual

Methods

CNA engages qualified suitably experienced contractors to carry out sampling and analysis. Sampling is undertaken in accordance with relevant Australian Standards and other regulatory guidelines. Samples are analysed by laboratories that are National Association of Testing Authorities (NATA) accredited or equivalent for the parameters being analysed.

Sampling is undertaken via Bailer method for all samples requiring only pH and Electrical Conductivity. Groundwater bores are purged (3x casing volumes where possible) prior to sample extraction for all samples requiring comprehensive analysis.

Impact Assessment Criteria

In the absence of licence or applicable ANZECC criteria, the 5th / 95th percentile of the available validated data record for a monitoring station will be adopted as the basis for a water quality management guideline trigger.

Electrical conductivity and pH will be monitored in accordance with the frequency and methodology outlined in Section 2. Trigger levels for investigating potentially adverse groundwater impacts are specified in the table below. Trigger limits are calculated as the 95th percentile¹ maximum value and the 5th percentile minimum value from data collected from 2011 onwards. Trigger levels have been set on the basis of geographical proximity and target stratigraphy.

Bores not listed in the following table have not been assigned trigger limits due to insufficient data for statistical analysis. Trigger limits for these bores will be developed in line with future revisions of the programme as additional data becomes available.

To ensure the AIP criteria for GDE's has been met, bores located in the alluvium near to the recognized GDE communities at HVO (CFW55R, CFW57, CGW52a, CGW53a, CGW55a) will adopt the 5th/95th percentile of the available validated data record for the standing water level for each site as the basis of groundwater management trigger guideline.

The response to trigger levels is detailed in Hunter Valley Operations Water Management Plan 2018.

Table 2: Groundwater Trigger Limits

Site	Location	Target Seam / Stratigraphy	Electrical Conductivity	pH		Standing Water Level (m)	
			95 th	95 th	5 th	95 th	5 th
B334(BFS)	Lemington South	Bowfield	12440	7.9	6.7	N/A	
B631(BFS)							
B925(BFS)							
C122(BFS)							
C130(BFS)							
C317(BFS)							
C613(BFS)							
C621(BFS)							
C630(BFS)							
D010(BFS)							
D214(BFS)							
D317(BFS)							
D406(BFS)							
D510(BFS)							
D612(BFS)							
D807(BFS)							
B425(WDH)	Lemington South	Woodlands Hill	20240	7.6	6.6	N/A	
B631(WDH)							
C122(WDH)							
C130(WDH)							
C317(WDH)							
C809 (GM/WDH)							
D010(WDH)	Lemington South	Arrowfield	15324	7.5	6.8	N/A	
C130(AFS1)							
D406(AFS)							
D510(AFS)							
D612(AFS)							
BC1a	Cheshunt	Mt Arthur	3350	7.6	6.5	N/A	
BZ1-3							
BZ2A(1)							
BZ3-3							
BZ4A(2)							
CHPZ12D							
CHPZ8D							
CHPZ3D							
HG2a	Cheshunt	Interburden	6213	7.7	6.9	N/A	
BZ3-1							
BZ8-2							
HG2	West Pit	Sandstone / Siltstone	13428	8.0	6.9	N/A	
NPz2							
NPz3							
NPz5	Cheshunt / North Pit	Alluvium	4462	7.5	6.6	N/A	
BUNC45A							
BZ1-1							
CHPZ10A							
CHPZ12A							
CHPZ1A							
CHPZ2A							
CHPZ3A							
CHPZ4A							
CHPZ8A							
GA3							
Hobdens Well							
HV3(2)							
PZ1CH200							

PZ2CH400							
PZ3CH800							
PZ4CH1380							
PZ5CH1800							
G1	West Pit	Alluvium	10751	8.6	7.1	N/A	
G2							
G3							
GW_100							
GW_101							
4032P	Carrington West Wing	Alluvium	2775	7.5	7.0	N/A	
4034P							
4037P							
4040P							
CGW49							
CGW46	Carrington West Wing	Bayswater				N/A	
CGW45	Carrington West Wing	LBL	3531	7.6	7.3	N/A	
D010 GM	Lemington South	Glen Munro	1894	7.2	6.5	N/A	
C130(ALL)	Lemington South	Interburden	11408	7.1	6.7	N/A	
Appleyard Farm	Lemington South	Alluvium	22700	7.0	6.8	N/A	
C919(ALL)			3938	7.7	6.6		
PBO1(ALL)							
CFW55R	Carrington	Alluvium	6154	8.0	7.0	59.41	57.06
CFW57						59.24	58.24
CGW52a						60.52	58.23
CGW53a						59.19	58.33
CGW55a						58.43	57.49
4051C	Carrington	Interburden	10824	7.4	6.7	N/A	
4036C							
CGW51a							
CGW52	Carrington	Broonie	8628	7.1	6.8	N/A	
CGW53							
DM1	North Pit	Spoil	12460	7.8	6.5	N/A	
DM3							
DM4							
DM7							
4116P							
4119P							
GW_114							
GW_115							
MB14HVO01							
MB14HVO02							
MB14HVO03							
MB14HVO04							
MB14HVO05							
BUNC45D	Cheshunt	Piercefield	2596	6.8	6.4	N/A	
CGW32	Carrington West Wing	Flood Plain	9280	7.8	6.8	N/A	
CGW39							
CGW47a							
GW_106							

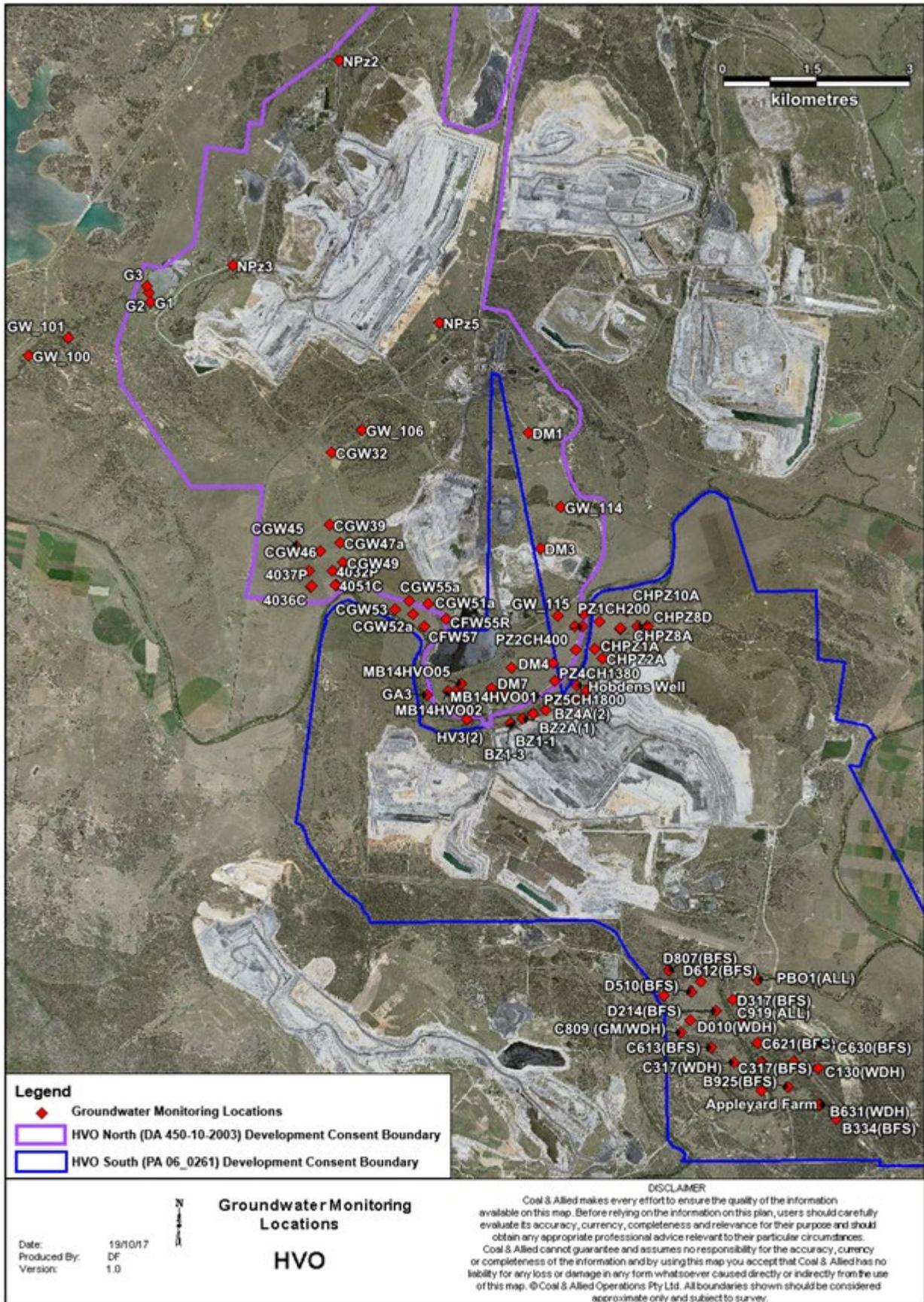


Figure 2: HVO Groundwater Monitoring Plan