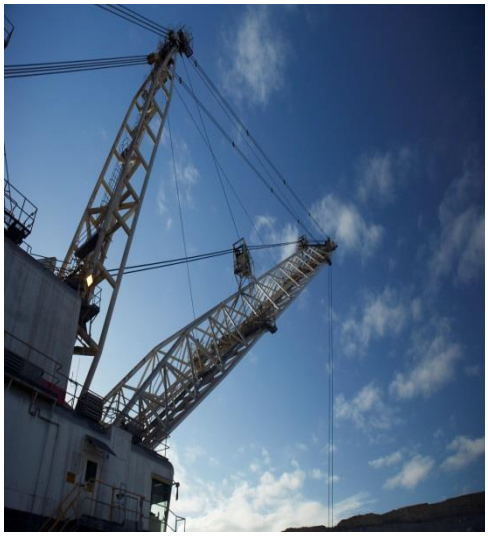

Water Management Plan

Mount Thorley Warkworth

DOCUMENT CONTROL

Version	Date	Revision Description	Author	Approver	Secretary Approval Date
1.0	31/01/2013	Original	Kelly Mullane	Andrew Speechly	
2.0	19/06/2014	Revision and re-format following Warkworth Modification 6 Approval (and disapproval of Warkworth Extension)	Chris New	Andrew Speechly	
2.1	25/08/2014	Revision incorporating feedback from DP&E and NOW	Chris New	Andrew Speechly	
2.2	10/09/2014	Approved by DP&E	Chris New	Andrew Speechly	
2.3	26/06/2015	Updated monitoring programmes, approved by DP&E	Chris New	Andrew Speechly	
3.0	02/12/2015	Revision following WML and MTO Continuation Approvals	Chris New	Andrew Speechly	
3.1	29/01/2016	Approved by DP&E	Chris New	Andrew Speechly	
3.2	21/03/2016	Updated monitoring programmes (revised triggers) and incorporation of dam risk assessment process	Chris New	Andrew Speechly	
3.3	16/05/2017	Updated to include stream and riparian health monitoring in Wollombi Brook and Loders Creek, Updated monitoring programmes	Chris New	Andrew Speechly	
3.4	22/06/2017	Updated Chapter 11 (Revision) following feedback from DP&E	Chris New	Andrew Speechly	
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4.1	12/2/2018	Revision incorporating feedback from DP&E	Andrew Hodge	Andrew Speechly	12/2/2018
4.2	27/7/2018	Review following Annual Review	Andrew Hodge	Gary Mulhearn	
4.3	18/09/2018	Revision incorporating feedback from DP&E	Doug Fenton	Gary Mulhearn	20/09/2018

TABLE OF CONTENTS

1. PREFACES 4

1.1 Introduction....4
1.2 Scope of the Water Management Plan....4
1.3 Objectives....15

2. BACKGROUND 17

2.1 Project Approval....17
2.2 Environment Protection Licence....17
2.3 Relevant Standards and Guidelines....17
2.4 Commitments Made in Environmental Assessments....17

3. CONSULTATION 17

3.1 Government Agencies....17

4. EXISTING CHARACTER 18

4.1 Existing Character....18
4.2 Infrastructure....18

5. MTW WATER MANAGEMENT SYSTEM 20

5.1 Objectives....20
5.2 Water Management Classification....20
5.3 Water Management Infrastructure....21
5.4 Tailings Water....24
5.5 Clean Catchment....24
5.6 River Water....24
5.7 Licenced Discharges....25
5.8 Impacts on Nationally Listed Threatened Species and Ecological Communities....25

5.8.1 Giant Burrowing Frog 25
5.8.2 Wollemi National Park 26

6. SITE WATER BALANCE 27

6.1 Overview....27
6.2 Sources & Security of Water Supply....27
6.3 Water Sharing with Neighbouring Mines....28
6.4 Off-Site Water Transfers and Discharges....28
6.5 Water Balance Reporting....28

7. SURFACE WATER MANAGEMENT PLAN 29

7.1 Overview....29
7.2 Water Quality....29
7.3 Water Flow....29
7.4 Channel Stability, Stream and Riparian Vegetation Health....30
7.5 Water Management System....30

7.5.1 Clean Water Diversions 30
7.5.2 Flood Mitigation Measures 31
7.5.3 Erosion and Sediment Controls 31

7.6 Detailed Plans....32

7.6.1 Final Voids 32
7.6.2 Emplacement Facilities 32

7.6.3 Final Rehabilitation Drainage 32

8. GROUNDWATER MANAGEMENT PLAN 33

8.1 Overview 33
8.2 Water Levels, Yield and Quality 33
8.3 Impacts on Groundwater and Monitoring 34

8.3.1 Groundwater Inflows to the Open Cut Pits 34
8.3.2 Seepage/Leachate from Water Storages, Emplacements, Backfilled Voids and Final Voids 34
8.3.3 Regional and Local Aquifers 34
8.3.4 Groundwater Supply of Potentially Affected Landowners 35
8.3.5 Groundwater Dependent Ecosystems and Riparian Vegetation 35
8.3.6 Base Flows to the Wollombi Brook and Loders Creek 36

8.4 Validation of Groundwater Model 36

9. ASSESSMENT, REPORTING AND REVIEW 37

9.1 Performance Criteria & Trigger Levels 37

9.1.1 Channel Stability, Stream and Riparian Vegetation Health 37

9.2 Response to Exceedance & Performance Indicators 37
9.3 Management of Unpredicted Impacts 38
9.4 Reporting 38
9.5 Complaints Management 40
9.6 Continuous Improvement 41

10. Roles and Responsibilities 42
11. Review 44

Appendix A – Correspondence with DPI Water, EPA and the OEH 46

Appendix B – Surface Water Monitoring Programme 47

Appendix C – Groundwater Monitoring Programme 51

Planning Services
Resource Assessments
Contact: Jack Murphy
Phone: (02) 8217 2016
Email: jack.murphy@planning.nsw.gov.au

Mr Gary Mulhearn
Environment and Community Manager
Yancoal Australia Ltd
PO Box 267
Singleton NSW 2330

Email: Gary.Mulhearn@yancoal.com.au

Dear Mr Mulhearn,

Mt Thorley Warkworth Complex (SSD-6465 and SSD-6464)
Environmental Management Plans

I refer to your email dated 20 September 2018, submitting the revised environmental management plans for the Mt Thorley Warkworth Complex (SSD-6465 and SSD-6464). The Department has reviewed the following documents:

- Air Quality Management Plan dated September 2018 (condition 18, Schedule 3 of SSD 6465 and condition 20, Schedule 3 of SSD 6464);
- Biodiversity Management Plan dated September 2018 (condition 36, Schedule 3 of SSD 6464);
- Blast Management Plan dated September 2018 (condition 14, Schedule 3 of SSD 6465 and condition 16, Schedule 3 of SSD 6464);
- Noise Management Plan dated September 2018 (condition 5, Schedule 3 of SSD 6465 and condition 7, Schedule 3 of SSD 6464); and
- Water Management Plan dated September 2018 (condition 25, Schedule 3 of SSD 6465 and condition 27, Schedule 3 of SSD 6464).

The Secretary has approved the above documents. Please ensure finalised copies of these documents are made available on the company's website.

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

Yours sincerely,

MgBDa 20/9/18

Megan Dawson
A/Director
Resource Assessments
As nominee of the Secretary

1. PREFACES

1.1 Introduction

Mount Thorley Warkworth (MTW) is an integrated operation of two open cut mines, Warkworth Mining Limited (WML) and Mount Thorley Operations (MTO) which are located adjacent to each other and 15 km south west of Singleton in the Hunter Valley region of New South Wales. The operation supplies international and domestic markets with semi-soft coking coal and thermal coal.

MTW is an open cut mine, using dragline and truck and shovel method. Employees work in shifts to keep the mine operational 24 hours a day, seven days a week.

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

Development Consent for the Warkworth and Mount Thorley Continuation Projects (SSD-6464 and SSD-6465 respectively) were granted on 26 November 2015.

The Projects are described in detail in the Environmental Impact Statements and supporting documents (prepared by EMM, June 2014).

This WMP is the primary tool that will be utilised to reduce potential water impacts related to the Project. The Warkworth Project Approval and Mount Thorley Project Approval are herein jointly referred to as the Project Approval.

1.2 Scope of the Water Management Plan

This WMP has been prepared in accordance with Schedule 3, Condition 27 of the Warkworth Approval and Schedule 3, Condition 25 of the Mount Thorley Approval.

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 MTW will employ to comply with the relevant water management conditions of the Approvals and Environment Protection Licences (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 lists the Statement of Commitments and relevant sections of this WMP.

Table 1.1 Consent Conditions Addressed

Consent Condition	Environmental Performance Conditions	Section of WMP which addresses this requirement
MOUNT THORLEY CONSENT (SSD-6465)		
Sch. 3, Cond. 20	The Applicant shall ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of mining operations to match its available water supply. Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain the necessary water licences for the development.	6.2
Sch. 3, Cond. 21	The Applicant shall provide a compensatory water supply to the owner of any privately-owned land whose basic landholder water rights as defined in the Water Management Act 2000 are adversely and directly impacted as a result of the development. This supply must be provided in consultation with NOW, and to the satisfaction of the Secretary. The compensatory water supply measures must provide an alternative long-term supply of water that is equivalent to the loss attributable to the development. Equivalent water supply should be provided (at least on an interim basis) as soon as practicable from the loss being identified, unless otherwise agreed with the landowner. If the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.	9.3

Table 1.1 Consent Conditions Addressed

<table>
<tr><th>Consent Condition</th><th>Environmental Performance Conditions</th><th>Section of WMP which addresses this requirement</th></tr>
<tr><td></td><td>If the Applicant is unable to provide an alternative long-term supply of water, then the Applicant shall provide alternative compensation to the satisfaction of the Secretary.
Note: The Water Management Plan (see condition 25) is required to include trigger levels for investigating potentially adverse impacts on water supplies.</td><td></td></tr>
<tr><td>Sch. 3, Cond. 22</td><td>Unless an EPL or the EPA authorises otherwise, the Applicant shall ensure that all surface water discharges from the site comply with the:
(a) discharge limits (both volume and quality) set for the development in any EPL; and
(b) relevant provisions of the POEO Act or Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002.
Note: For the avoidance of doubt, it is noted that the EPA will determine the cumulative allowable salinity discharges to the Hunter River catchment, according to rules of the Hunter River Salinity Trading Scheme and the respective quantities of tradable salinity credits held by participants in the scheme (including the Bulga mine and other nearby mining operations).</td><td>9.1</td></tr>
<tr><td>Sch. 3, Cond. 23</td><td>The Applicant may receive water from, and transfer water to, the Warkworth mine, Bulga mine, Hunter Valley Operations mine and Redbank Power Station.</td><td>6.3</td></tr>
<tr><td>Sch. 3, Cond. 24</td><td>The Applicant shall comply with the performance measures in Table 8 to the satisfaction of the Secretary.
<table>
<tr><th>Feature</th><th>Performance Measure</th></tr>
<tr><td>Water management – General</td><td>Minimise the use of clean water (i.e. water not in contact with disturbed areas) on site
Minimise the need for make-up water from external supplies (apart from permissible mine water transfers)
Maximise the use of mine water</td></tr>
<tr><td>Construction and operation of infrastructure</td><td>Design, install and maintain erosion and sediment controls generally in accordance with the series Managing Urban Stormwater: Soils and Construction including Volume 1, Volume 2A – Installation of Services and Volume 2C – Unsealed Roads
Design, install and maintain the infrastructure within 40 m of watercourses generally in accordance with the Guidelines for Controlled Activities on Waterfront Land (DPI 2007), or its latest version
Design, install and maintain any creek crossings generally in accordance with the Policy and Guidelines for Fish Habitat Conservation and Management (DPI, 2013) and Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings (NSW Fisheries 2003), or their latest versions</td></tr>
<tr><td>Clean water diversion & storage infrastructure</td><td>Design, install and maintain the clean water system to capture and convey the 100 year ARI flood
Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on site</td></tr>
<tr><td>Sediment dams</td><td>Design, install and maintain the dams generally in accordance with the series Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries</td></tr>
<tr><td>Mine water storages</td><td>Design, install and maintain mine water storage infrastructure to ensure no unlicensed or uncontrolled discharge of mine water off-site (except in accordance with condition 20)
On-site storages (including mine infrastructure dams and treatment dams) are suitably designed, installed and maintained to minimise permeability
Maintain adequate freeboard within the pit void at all times to minimise the risk of discharge to surface waters</td></tr>
<tr><td>Flood mitigation measures</td><td>Design, install and maintain flood mitigation measures along the western side of the development, to ensure there is adequate freeboard (at least 500mm) between</td></tr>
</table></td><td>5.2, 7.4.2 and 9.1.1</td></tr>
</table>

Table 1.1 Consent Conditions Addressed

Consent Condition	Environmental Performance Conditions		Section of WMP which addresses this requirement
		the Probable Maximum Flood level in Wollombi Brook and the crest levee or peak of the flood mitigation infrastructure Residual impacts downstream must be managed in an appropriate manner	
	Overburden emplacements	Design, install and maintain emplacements to encapsulate and prevent migration of tailings, acid forming and potentially acid forming materials, and saline and sodic material Design, install and maintain emplacements to prevent offsite migration of saline groundwater seepage	
	Chemical and hydrocarbon storage	Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards	
	Loders Creek	Maintain or improve baseline channel stability Improve riparian health	
Sch. 3, Cond. 25(a)	The Applicant shall prepare a Water Management Plan for the development to the satisfaction of the Secretary, and carry out the development in accordance with this plan. The plan must: (a) be prepared in consultation with the EPA, NOW and OEH and submitted to the Secretary for approval prior to carrying out any development under this consent; and		3.1
Sch. 3, Cond. 25(b)	In addition to the standard requirements for management plans (see condition 3 of schedule 5), include a: Site Water Balance that:: • includes details of: ➢ sources and security of water supply, including contingency planning for future reporting periods; ➢ water use and management of site, including details of water sharing between neighbouring mining operations; ➢ any off-site water transfers and discharges; ➢ reporting procedures, including the preparation of a site water balance for each calendar year		6
Sch. 3, Cond. 25(b)	In addition to the standard requirements for management plan (see condition 3 of schedule 5), this plan must include: Site Water Balance that: • investigates and implements all reasonable and feasible measures to minimise water use on site		6
Sch. 3, Cond. 25(b)	Surface Water Management Plan, that includes: • detailed baseline data on surface water flows and quality in the waterbodies that could potentially be affected by the development;		7.2 and 7.3
Sch. 3, Cond. 25(b)	Surface Water Management Plan, that includes: • a detailed description of the water management system on site, including the: ➢ clean water diversion systems; ➢ erosion and sediment controls (mine water system); and ➢ mine water management systems including irrigation areas;		7.4
Sch. 3, Cond. 25(b)	Surface Water Management Plan, that includes: • detailed plans, including design objectives and performance criteria, for:		7.5

Table 1.1 Consent Conditions Addressed

Consent Condition	Environmental Performance Conditions	Section of WMP which addresses this requirement
	➢ design and management of the final voids; ➢ design and management for the emplacement of coal reject materials; ➢ reinstatement of drainage lines on the rehabilitated areas of the site; and ➢ control of any potential water pollution from the rehabilitated areas of the site;	
Sch. 3, Cond. 25(b)	Surface Water Management Plan, that includes: • performance criteria for the following, including trigger levels for investigating any potentially adverse impacts associated with the development: ➢ mine water management system; ➢ surface water quality of Loders Creek; and ➢ channel stability, stream and riparian vegetation health of Loders Creek;	9.1.1
Sch. 3, Cond. 25(b)	Surface Water Management Plan, that includes: • a program to monitor and report on: ➢ the effectiveness of the mine water management system; and ➢ surface water flows and quality, stream and riparian vegetation health in Loders Creek potentially affected by the development;	7.4 and 9.1.1
Sch. 3, Cond. 25(b)	Surface Water Management Plan, that includes: • a plan to respond to any exceedances of the performance criteria, and mitigate and/or offset any adverse surface water impacts of the development.;	9.2
Sch. 3, Cond. 25(b)	Groundwater Management Plan, which includes: • detailed baseline data on groundwater levels, yield and quality in the region, and privately owned groundwater bores, that could be affected by the development;	8.2
Sch. 3, Cond. 25(b)	Groundwater Management Plan, which includes: • groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts;	9.1
Sch. 3, Cond. 25(b)	Groundwater Management Plan, which includes: • a program to monitor and report on: ➢ groundwater inflows to the open cut pits; ➢ the seepage/leachate from water storages, emplacements, backfilled voids, and final voids; ➢ the impacts of the development on: ○ regional and local (including alluvial) aquifers; ○ groundwater supply of potentially affected landowners; ○ groundwater dependent ecosystems and riparian vegetation; ○ base flows to Loders Creek;	8.3

Table 1.1 Consent Conditions Addressed

Consent Condition	Environmental Performance Conditions	Section of WMP which addresses this requirement
Sch. 3, Cond. 25(b)	Groundwater Management Plan, which includes: • a plan to respond to any exceedances of the groundwater assessment criteria; and	9.1
Sch. 3, Cond. 25(b)	Groundwater Management Plan, which includes: • a program to validate the groundwater model for the development, including an independent review of the model with every independent environmental audit, and compare the monitoring results with modelled predictions.	8.4
Sch. 5, Cond. 3(a)	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	7.2 and 8.1
Sch. 5, Cond. 3(b)	A description of: • the relevant statutory requirements (including any relevant approval, licence or lease conditions); • any relevant limits or performance measures/criteria; • the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;	2, 9.1 and 9.4
Sch. 5, Cond. 3(c)	The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria	2, 9.1 and 9.4
Sch. 5, Cond. 3(d)	The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: a program to monitor and report on the: • impacts and environmental performance of the development; • effectiveness of any management measures (see c above)	9.4, App. B and App. C
Sch. 5, Cond. 3(e)	The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: a contingency plan to manage any unpredicted impacts and their consequences	9.3
Sch. 5, Cond. 3(f)	The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: a program to investigate and implement ways to improve the environmental performance of the development over time	9,6
Sch. 5, Cond. 3(g)	The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: a protocol for managing and reporting any: • incidents; • complaints;	9.4 and 9.5

Table 1.1 Consent Conditions Addressed

Consent Condition	Environmental Performance Conditions	Section of WMP which addresses this requirement
	• non-compliances with statutory requirements; and • exceedances of the impact assessment criteria and/or performance criteria	
Sch. 5, Cond. 3(h)	The Applicant shall ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include: a protocol for periodic review of the plan	11
Sch. 5, Cond. 5	Within 3 months of: (a) the submission of an: • annual review under Condition 4 above; • incident report under Condition 7 below; • audit report under Condition 9 below; or (b) any modification to the conditions of this consent (unless the conditions require otherwise), or (c) the introduction of any NSW government policy regarding voids, the Applicant shall review, and if necessary revise, the strategies, plans, and programs required under this consent to the satisfaction of the Secretary. Where this review leads to revisions in any such document, then within 4 weeks of the review, unless the Secretary agrees otherwise, the revised document must be submitted to the Secretary for approval. *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.*	11
Sch. 5, Cond. 7	The Applicant shall immediately notify the Secretary and any other relevant agencies of any 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.	11
Sch. 5, Cond. 8	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.	9.4
WARKWORTH CONSENT (SSD-6464)		
Sch. 3, Cond. 22	The Applicant shall ensure that it has sufficient water for all stages of the development, and if necessary, adjust the scale of mining operations to match its available water supply. Note: Under the Water Act 1912 and/or the Water Management Act 2000, the Applicant is required to obtain the necessary water licences for the development.	6.2
Sch. 3, Cond. 23	The Applicant shall provide a compensatory water supply to the owner of any privately-owned land whose basic landholder water rights (as defined in the Water Management Act 2000) are adversely and directly impacted as a result of the development. This supply must be provided in consultation with NOW, and to the satisfaction of the Secretary. The compensatory water supply measures must provide an alternative long-term supply of water that is equivalent to the loss attributable to the development. Equivalent water supply should be provided (at least on an interim basis) as soon as practicable from the loss being identified, unless otherwise agreed with the landowner. If the Applicant and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.	9.3

Table 1.1 Consent Conditions Addressed

<table>
<tr><th>Consent Condition</th><th>Environmental Performance Conditions</th><th>Section of WMP which addresses this requirement</th></tr>
<tr><td></td><td>If the Applicant is unable to provide an alternative long-term supply of water, then the Applicant shall provide alternative compensation to the satisfaction of the Secretary.
Note: The Water Management Plan (see condition 27) is required to include trigger levels for investigating potentially adverse impacts on water supplies.</td><td></td></tr>
<tr><td>Sch. 3, Cond. 24</td><td>Unless an EPL or the EPA authorises otherwise, the Applicant shall ensure that all surface water discharges from the site comply with the:
(a) discharge limits (both volume and quality) set for the development in any EPL; and
(b) relevant provisions of the POEO Act or Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002.
Note: For the avoidance of doubt, it is noted that the EPA will determine the cumulative allowable salinity discharges to the Hunter River catchment, according to rules of the Hunter River Salinity Trading Scheme and the respective quantities of tradable salinity credits held by participants in the scheme (including the Bulga mine and other nearby mining operations).</td><td>9.1</td></tr>
<tr><td>Sch. 3, Cond. 25</td><td>The Applicant may receive water from, and transfer water to, the Mt Thorley mine, Hunter Valley Operations mine, Bulga mine and Redbank Power Station.</td><td>6.3</td></tr>
<tr><td>Sch. 3, Cond. 26</td><td>The Applicant shall comply with the performance measures in Table 8 to the satisfaction of the Secretary.
<table>
<tr><th>Feature</th><th>Performance Measure</th></tr>
<tr><td>Water management – General</td><td>Minimise the use of clean water (i.e. water not in contact with disturbed areas) on site
Minimise the need for make-up water from external supplies (apart from permissible mine water transfers)</td></tr>
<tr><td>Wollombi Brook Alluvial Aquifer</td><td>Negligible environmental consequences to the alluvial aquifer beyond those predicted in the EIS</td></tr>
<tr><td>Construction and operation of infrastructure</td><td>Design, install and maintain erosion and sediment controls generally in accordance with the series Managing Urban Stormwater: Soils and Construction including Volume 1, Volume 2A – Installation of Services and Volume 2C – Unsealed Roads
Design, install and maintain the infrastructure within 40 m of watercourses generally in accordance with the Guidelines for Controlled Activities on Waterfront Land (DPI 2007), or its latest version
Design, install and maintain any creek crossings generally in accordance with the Policy and Guidelines for Fish Habitat Conservation and Management (DPI, 2013) and Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings (NSW Fisheries 2003), or their latest versions</td></tr>
<tr><td>Clean water diversion & storage infrastructure</td><td>Design, install and maintain the clean water system to capture and convey the 100 year ARI flood
Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on site</td></tr>
<tr><td>Sediment dams</td><td>Design, install and maintain the dams generally in accordance with the series Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries</td></tr>
<tr><td>Mine water storages</td><td>Design, install and maintain mine water storage infrastructure to ensure no discharge of mine water off-site (except in accordance with condition 23)
On-site storages (including mine infrastructure dams and treatment dams) are suitably designed, installed and/or maintained to minimise permeability
Maintain adequate freeboard within the pit void at all times to minimise the risk of discharge to surface waters</td></tr>
<tr><td>Flood mitigation measures</td><td>Design, install and maintain flood mitigation measures along the western side of the development, to ensure there is adequate freeboard (at least 500mm) between</td></tr>
</table></td><td>5.2, 7.4.2 and 8.3</td></tr>
</table>

Table 1.1 Consent Conditions Addressed

Consent Condition	Environmental Performance Conditions		Section of WMP which addresses this requirement
		the Probable Maximum Flood level in Wollombi Brook and the crest levee or peak of the flood mitigation infrastructure Residual impacts downstream must be managed in an appropriate manner	
	Overburden emplacements	Design, install and maintain emplacements to encapsulate and prevent migration of tailings, acid forming and potentially acid forming materials, and saline and sodic material Design, install and maintain emplacements to prevent offsite migration of saline groundwater seepage	
	Chemical and hydrocarbon storage	Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards	
Sch. 3, Cond. 27(a)	The Applicant shall prepare and implement a Water Management Plan for the development to the satisfaction of the Secretary, and carry out the development in accordance with this plan. This plan must: (a) be prepared in consultation with the EPA, NOW and OEH and submitted to the Secretary for approval prior to carrying out any development under this consent;		3.1
Sch. 3, Cond. 27(b)	In addition to the standard requirements for management plan (see condition 3 of schedule 5), this plan must include a: (i) Site Water Balance that:: • includes details of: ➢ sources and security of water supply, including contingency planning for future reporting periods; ➢ water use and management on site, including details of water sharing between neighbouring mining operations; ➢ any off-site water transfers and discharges; ➢ reporting procedures, including the preparation of a site water balance for each calendar year		6
Sch. 3, Cond. 27(b)	In addition to the standard requirements for management plan (see condition 3 of schedule 5), this plan must include: Site Water Balance that: • investigates and implements all reasonable and feasible measures to minimise water use on site;		6
Sch. 3, Cond. 27(b)	(ii) Surface Water Management Plan, that includes: • detailed baseline data on surface water flows and quality in the watercourses that could potentially be affected by the development;		7.2 and 7.3
Sch. 3, Cond. 27(b)	(ii) Surface Water Management Plan, that includes: • a detailed description of the water management system on site, including the: ➢ clean water diversion systems; ➢ erosion and sediment controls (mine water system); and ➢ mine water management systems including irrigation areas;		7.4
Sch. 3, Cond. 27(b)	(ii) Surface Water Management Plan, that includes: • detailed plans, including design objectives and performance criteria, for: ➢ design and management of final voids;		7.5

Table 1.1 Consent Conditions Addressed

Consent Condition	Environmental Performance Conditions	Section of WMP which addresses this requirement
	➢ design and management for the emplacement of coal reject materials; ➢ reinstatement of drainage lines on the rehabilitated areas of the site; and ➢ control of any potential water pollution from the rehabilitated areas of the site;	
Sch. 3, Cond. 27(b)	(ii) Surface Water Management Plan, that includes: • performance criteria for the following, including trigger levels for investigating any associated potentially adverse impacts associated with the development: ➢ mine water management system; ➢ surface water quality of Wollombi Brook; and ➢ channel stability, stream and riparian vegetation health of Wollombi Brook;	9.1.1
Sch. 3, Cond. 27(b)	(ii) Surface Water Management Plan, that includes: • a program to monitor and report on: ➢ the effectiveness of the mine water management system; and ➢ surface water flows and quality, stream and riparian vegetation health in Wollombi Brook potentially affected by the development;	7.4 and 9.1.1
Sch. 3, Cond. 27(b)	(ii) Surface Water Management Plan, that includes: • a plan to respond to any exceedances of the performance criteria, and mitigate and/or offset any adverse surface water impacts of the development;	9.2
Sch. 3, Cond. 27(b)	(iii) Groundwater Management Plan, that includes: • detailed baseline data on groundwater levels, yield and quality in the region, and privately-owner groundwater bores, that could be affected by the development;	8.2
Sch. 3, Cond. 27(b)	(iii) Groundwater Management Plan, that includes: • groundwater assessment criteria, including trigger levels for investigating any potentially adverse groundwater impacts;	9.1
Sch. 3, Cond. 27(b)	(iii) Groundwater Management Plan, that includes: • a program to monitor and report on: ➢ groundwater inflows to the open cut pits; ➢ the seepage/leachate from water storages, emplacements, backfilled voids, and final voids; ➢ the impacts of the development on: ○ regional and local (including alluvial) aquifers; ○ groundwater supply of potentially affected landowners; ○ groundwater dependent ecosystems and riparian vegetation; ○ base flows to Wollombi Brook;	8.3
Sch. 3, Cond. 27(b)	(iii) Groundwater Management Plan, that includes:	9.1

Table 1.1 Consent Conditions Addressed

Consent Condition	Environmental Performance Conditions	Section of WMP which addresses this requirement
	• a plan to respond to any exceedances of the groundwater assessment criteria; and	
Sch. 3, Cond. 27(b)	(iii) Groundwater Management Plan, that includes: • a program to validate the groundwater model for the development, including an independent review of the model with every independent environmental audit, and compare the monitoring results with modelled predictions	8.4
Sch. 5, Cond. 3(a)	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	7.2 and 8.1
Sch. 5, Cond. 3(b)	A description of: • the relevant statutory requirements (including any relevant approval, licence or lease conditions); • any relevant limits or performance measures/criteria; • the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	2, 9.1 and 9.4
Sch. 5, Cond. 3(c)	a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria	2, 9.1 and 9.4
Sch. 5, Cond. 3(d)	a program to monitor and report on the: • impacts and environmental performance of the development; • effectiveness of any management measures (see c above)	9.4, App. B and App. C
Sch. 5, Cond. 3(e)	a contingency plan to manage any unpredicted impacts and their consequences	9.3
Sch. 5, Cond. 3(f)	a program to investigate and implement ways to improve the environmental performance of the development over time	9.6
Sch. 5, Cond. 3(g)	a protocol for managing and reporting any: • incidents; • complaints; • non-compliances with statutory requirements; and • exceedances of the impact assessment criteria and/or performance criteria	9.4 and 9.5
Sch. 5, Cond. 3(h)	a protocol for periodic review of the plan	11
Sch. 5, Cond. 5	Within 3 months of: (a) the submission of an: • annual review under Condition 4 above; • incident report under Condition 7 below; • audit report under Condition 9 below; or (b) any modification to the conditions of this consent (unless the conditions require otherwise), or (c) the introduction of any NSW government policy regarding voids, the Applicant shall review, and if necessary revise, the strategies, plans, and programs required under this consent to the satisfaction of the Secretary.	11

Table 1.1 Consent Conditions Addressed

Consent Condition	Environmental Performance Conditions	Section of WMP which addresses this requirement
	Where this review leads to revisions in any such document, then within 4 weeks of the review, unless the Secretary agrees otherwise, the revised document must be submitted to the Secretary for approval. *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.*	
Sch. 5, Cond. 7	The Applicant shall notify the Secretary and any other relevant agencies immediately of any 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.	11
Sch. 5, Cond. 8	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.	9.4

Table 1.2 Statement of Commitments Addressed

SOC reference	Commitments	Where Commitment is addressed
Warkworth Continuation 2014 EIS; Table 22.1 Groundwater	Management and monitoring of groundwater would continue to be undertaken in accordance with the MTW WMP. The MTW WMP would be reviewed and updated to include the additional management measures prescribed below.	
	Updates to current groundwater monitoring programme: • installation of nested monitoring bores along the Wollombi Brook (PZ10, PZ11, PZ12); and • installation of monitors bores with the Warkworth Sands system as part of an update to the existing Warkworth Sands Ephemeral Perched Aquifer Management Plan within the MTW WMP.	8.3.3 and 8.3.5
	Mine seepage monitoring programme: • recording of the time, location and estimated volume of any unexpected increased groundwater outflow from the highwall and endwall; • measurement of water pumped from the mine, preferably using flow meters or other suitable gauging apparatus; • correlation of rainfall records with mine seepage records so groundwater and surface water can be separated; and • monitoring of coal moisture content.	6 and 8.3.1
	Data management and reporting: • establishment of trigger levels; • quarterly review of groundwater levels and field water quality against trigger levels, with site-specific investigations initiated; • formal review of depressurisation of coal measures and alluvium would be undertaken annually by a suitably qualified hydrogeologist; • annual reporting (including all water level and water quality data); and • all groundwater data being stored in a database customised for MTW with suitable QA/QC controls.	9
	Future model iterations: • assess the validity of the model predictions every three years; and • incorporate into the model and revise predictions, if required.	8.4
	Licensing: • retain and obtain appropriate water licences, as required, to account for modelled take.	6.2
Warkworth Continuation 2014 EIS; Table 22.1 Surface Water	Management and monitoring of surface water would continue to be undertaken in accordance with the MTW WMP. The MTW WMP will be	

Table 1.2 Statement of Commitments Addressed

SOC reference	Commitments	Where Commitment is addressed
	reviewed and updated to include the following additional management measures:	
	Licensing: • retain and obtain appropriate water licences, as required, to meet operational requirements.	6.2
	Surface water monitoring programme: • update to include locations of new dams as they are constructed (i.e. NOOP and Sediment Dam B) with EC, pH and TSS monitored monthly and a comprehensive analysis six monthly.	5.3, 7.2
Mount Thorley Operations 2014 EIS; Table 21.1 Groundwater	Management and monitoring of groundwater will continue to be undertaken in accordance with the MTW WMP. The WMP will be reviewed and updated to include the additional management measures prescribed below.	
	A site specific investigation into trigger level exceedance would be undertaken if: • professional judgement determines that the single deviation or a developing trend could result in environmental harm; or • three consecutive measurements exceed trigger values.	9.2
	Data management and reporting: • establishment of trigger levels; • quarterly review of groundwater levels and field water quality against trigger levels, with site specific investigations initiated; and • all groundwater data being stored in a database customised for MTW with suitable QA/QC controls.	9
	Licensing: • retain and obtain appropriate water licences, as required, to account for modelled take.	6.2
Mount Thorley Operations 2014 EIS; Table 21.1 Surface Water	Management and monitoring of surface water will continue to be undertaken in accordance with the MTW WMP. The WMP will be reviewed and updated to include the following additional management measures:	
	Licensing: • retain and obtain appropriate water licences, as required, to meet operational requirements.	6.2
	Surface water monitoring programme: • Update to include locations of new dams as they are constructed (e.g. Sediment Dam A) with EC, pH and TSS monitored monthly and a comprehensive analysis six monthly.	7.2

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.

MTW manages water according to three main objectives:

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

This is achieved by:

- Preferentially using mine water for coal preparation and dust suppression where feasible;
- 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. BACKGROUND

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

2.1 Project Approval

The Approvals and subsequent amendments were assessed under the Environmental Planning and Assessment Act 1979 (NSW) (EP&A Act.). Development Consent for the Warkworth Continuation Project (SSD-6464) and Mount Thorley Continuation Project (SSD-6465) was granted on 26 November 2015. 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 Table 1.1).

2.2 Environment 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. Two EPL's cover the mining complex: EPL 1376 for Warkworth Coal Mine (issued on 21 August 2000) and EPL 1976 for Mount Thorley Operations (issued on 28 September 2000).
EPLs 1376 and 1976 prescribe 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.

2.3 Relevant Standards and Guidelines

Guidelines and standards applying to water management at MTW include:

- MTW Water Balance Model – 2015 Review
- Hunter River Salinity Trading Scheme (HRSTS) Discharge Checklist and Reporting Environmental Work Instruction, and; Discharge Operation Work Instruction

2.4 Commitments Made in Environmental Assessments

Table 1.2 details the management, mitigation and monitoring commitments made in the relevant environmental assessments.

3. CONSULTATION

Schedule 3, Condition 27 of the Warkworth Approval requires the WMP to be prepared in consultation with the Department of Primary Industries Water (DPI Water), the EPA and The Office of Environment and Heritage (OEH).

Schedule 3, Condition 25 of the Mount Thorley Approval requires the WMP to be prepared in consultation with the DPI Water, the EPA and the OEH.

3.1 Government Agencies

On 2 December 2015 DPI Water and the OEH were provided with a copy of this WMP and were asked to provide any comments for MTW to consider, and where appropriate, incorporate into the WMP.

In a letter to the EPA dated 18 July 2018, Yancoal Australia sought to clarify the EPA's position with regard to the review and input of Environmental Management Plans. In a letter dated 19 July 2018, the EPA advised "The EPA encourages the development of such plans to ensure that proponents have met their statutory obligations and designated environmental objectives. However, the EPA does not review these documents as our role is to set environmental objectives for environmental/conservation management, not to be directly involved in the development of strategies to achieve those objectives". (See **Appendix A**.)

In a letter dated 14 December 2015, the OEH provided feedback and recommendations regarding the management plan. Based on these recommendations minor changes were incorporated into the document.

In a letter dated 19 January 2016, DPI Water provided feedback and recommendations regarding the

management plan. Based on these recommendations minor changes were incorporated into the January 2016 approved document (Version 3.1). Minor changes have been made to the document to reflect additional monitoring data collected, however the nature of the changes do not warrant further review from government agencies.

4. EXISTING CHARACTER

4.1 Existing Character

Mount Thorley Warkworth (MTW) is an integrated operation of two open cut mines, Warkworth Mining Limited (WML) and Mount Thorley Operations (MTO) which are located adjacent to each other and 15 km south west of Singleton in the Hunter Valley region of New South Wales. The operation supplies international and domestic markets with semi-soft coking coal and thermal coal.

MTW is generally bounded by public roads – the Golden Highway alongside the Northern and Eastern WML boundary, Wallaby Scrub and Charlton Roads to the West. The operation is bisected by Putty Road, WML to the North of the road, and MTO to the South. MTO shares its southern boundary with the adjoining Bulga Open Cut (BOC).

Surrounding land uses include Mining (nearby operations include Bulga Coal, Wambo Coal and Hunter Valley Operations), agriculture (to the east in the areas of Mount Thorley and Hambledon Hill), Industrial pursuits in the Mount Thorley Industrial Estate, and nearby residential communities of Bulga, Milbrodale, Warkworth and Long Point. The township of Singleton is located approximately 7km to the east of WML.

4.2 Infrastructure

MTW comprises the following major areas and infrastructure:

- WML open cut mine;• MTO open cut mine;
- WML Run Of Mine pad (ROM) and Coal Handling Prep Plant (CHPP);
- MTO ROM and CHPP;
- MTCL rail load-out facility;
- Workshop and administration facilities; and
- Tailings Storage Facilities.

Figure 1 shows the layout of MTW.

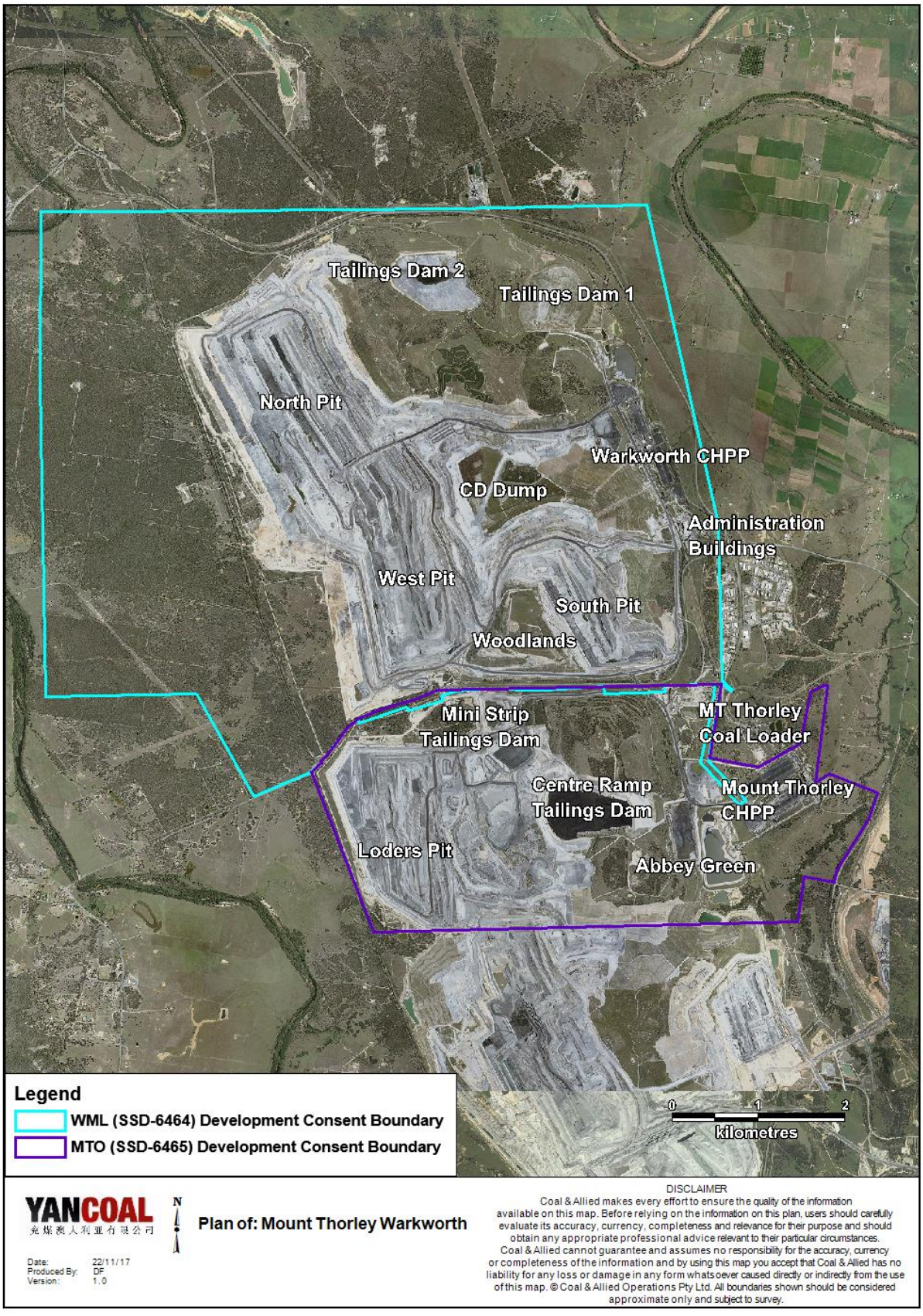

Figure 1 - Layout of MTW

5. MTW WATER MANAGEMENT SYSTEM

5.1 Objectives

An adaptive management approach is implemented at MTW to achieve the following objectives for water management:

- Preferential re-use of poor quality mine water over clean water;
- Minimise the use of fresh water; and
- Protect clean water systems.

This is achieved by:

- 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 water management system; and
- Disposing of water to the environment in accordance with statutory requirements.

5.2 Water Management Classification

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

- Mine Water
- Sediment Water
- Clean Water

A detailed description of water types and their performance measures are given in **Table 5.1**.

Table 5.1 Water Management Classifications

Water Type	Description	Water Quality Determination	Performance Measure
Mine Water	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; • Water output from coal processing, including water recovered from tailings.	• Typically saline, due to contact with coal seams or saline mine spoils. • May contain hydrocarbons, where there is runoff from Workshops area.	• Dams designed, installed and maintained to mitigate unlicenced or uncontrolled discharge off site , except for opportunistic discharges as regulated by the HRSTS. • New on-site storage facilities designed, installed and maintained to minimise permeability. • Freeboard maintained in pit voids at all times to minimise the risk of discharge to mine waters. • Overburden emplacements designed, installed and maintained to encapsulate and prevent migration of tailings, acid forming and potentially acid forming materials, and saline and sodic material. • Overburden emplacements designed, installed and maintained to prevent offsite migration of saline groundwater seepage. • Chemical and hydrocarbon products to be stored in bunded areas in accordance with the relevant Australian Standards.
Sediment Water	Runoff from: • rehabilitated mine spoil (waste dumps) without established ground cover; • disturbed areas, such as roads, car parks, ancillary infrastructure areas; • pre-stripped areas ahead of mining.	Typically lower salinity, but elevated Total Suspended Solids (TSS).	• Design, install and maintain erosion and sediment controls generally in accordance with the series Managing Urban Stormwater: Soils and Construction including Volume 1, Volume 2A – Installation of Services and Volume 2C – Unsealed Roads. • Design, install and maintain the infrastructure within 40 m of watercourses generally in accordance with the Guidelines for Controlled Activities on Waterfront Land (DPI 2007), or its latest version. • Design, install and maintain any creek crossings generally in accordance with the Policy and Guidelines for Fish Habitat Conservation and Management (DPI, 2013) and Why Do Fish Need To Cross The Road? Fish Passage Requirements for Waterway Crossings (NSW Fisheries 2003), or their latest versions. • Design, install and/or maintain the dams generally in accordance with the series Managing Urban Stormwater: Soils and Construction – Volume 1 and Volume 2E Mines and Quarries.
Clean Water	Runoff from: • Non-mined (undisturbed) areas; • Rehabilitated areas with established ground cover.	Typically low salinity and low TSS.	• Design, install and maintain any new clean water diversion system to capture and convey the 100 year ARI flood. • Maximise as far as reasonable and feasible the diversion of clean water around disturbed areas on site. • Designed with consideration to "Harvestable Rights" quantities - *Water Management Act 2000 (NSW).* • Drainage on rehabilitated lands in line with Mine Operations Plan (MOP).

5.3 Water Management Infrastructure

The MTW 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 key elements of the water management system are depicted geographically in **Figure 2** "Water Management Infrastructure" and schematically in **Figure 3** "Water Management System Schematic". There are several historic minor rural water storage dams throughout the undeveloped areas that are owned by MTW which were built by previous landholders. Where these minor dams are deemed fit for purpose they may also be used for containment of waters as required.

Pit water is pumped to out of pit storage dams or to available in-pit storages using mobile diesel 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,

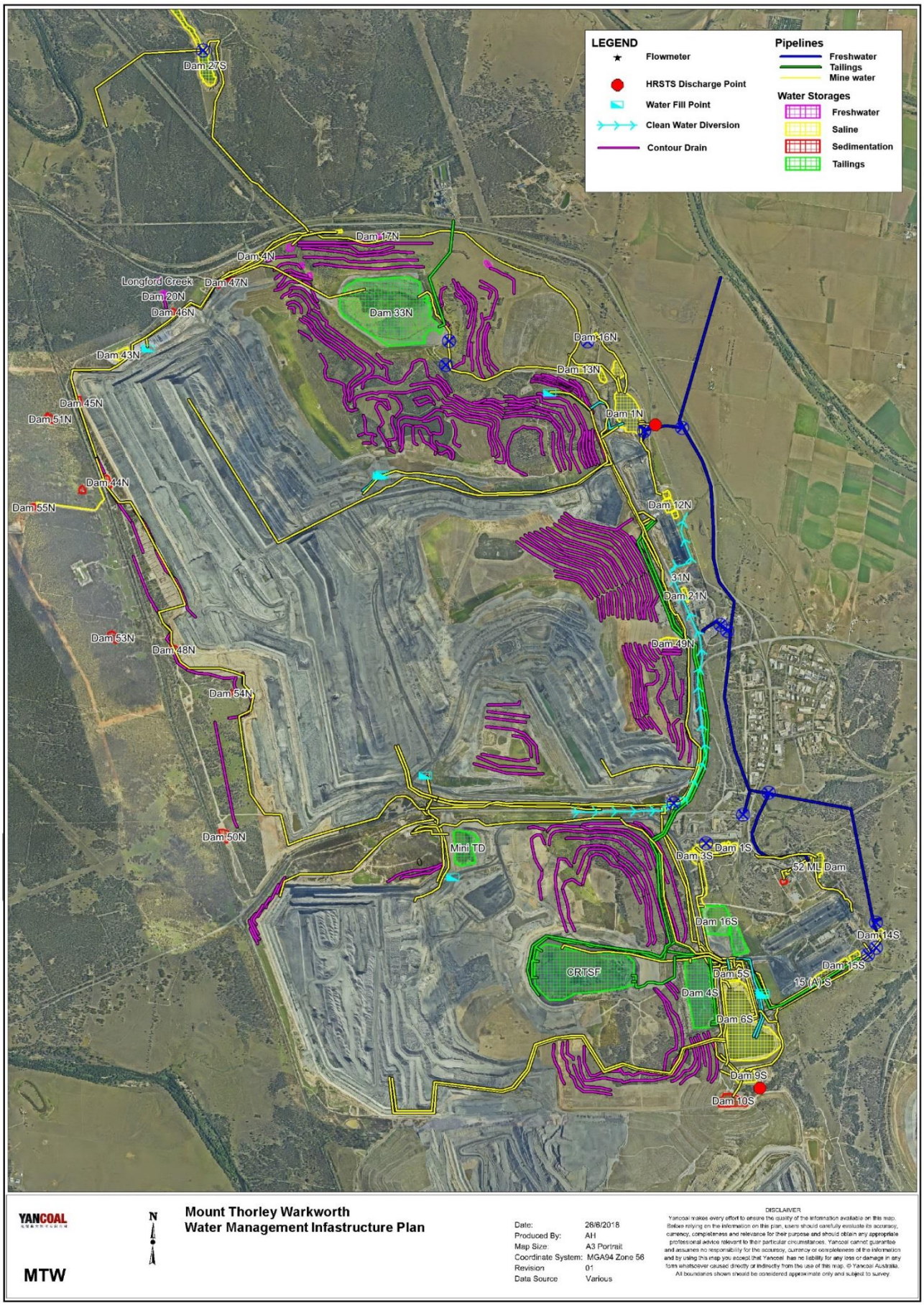

Figure 2 – MTW Water Management Infrastructure Plan

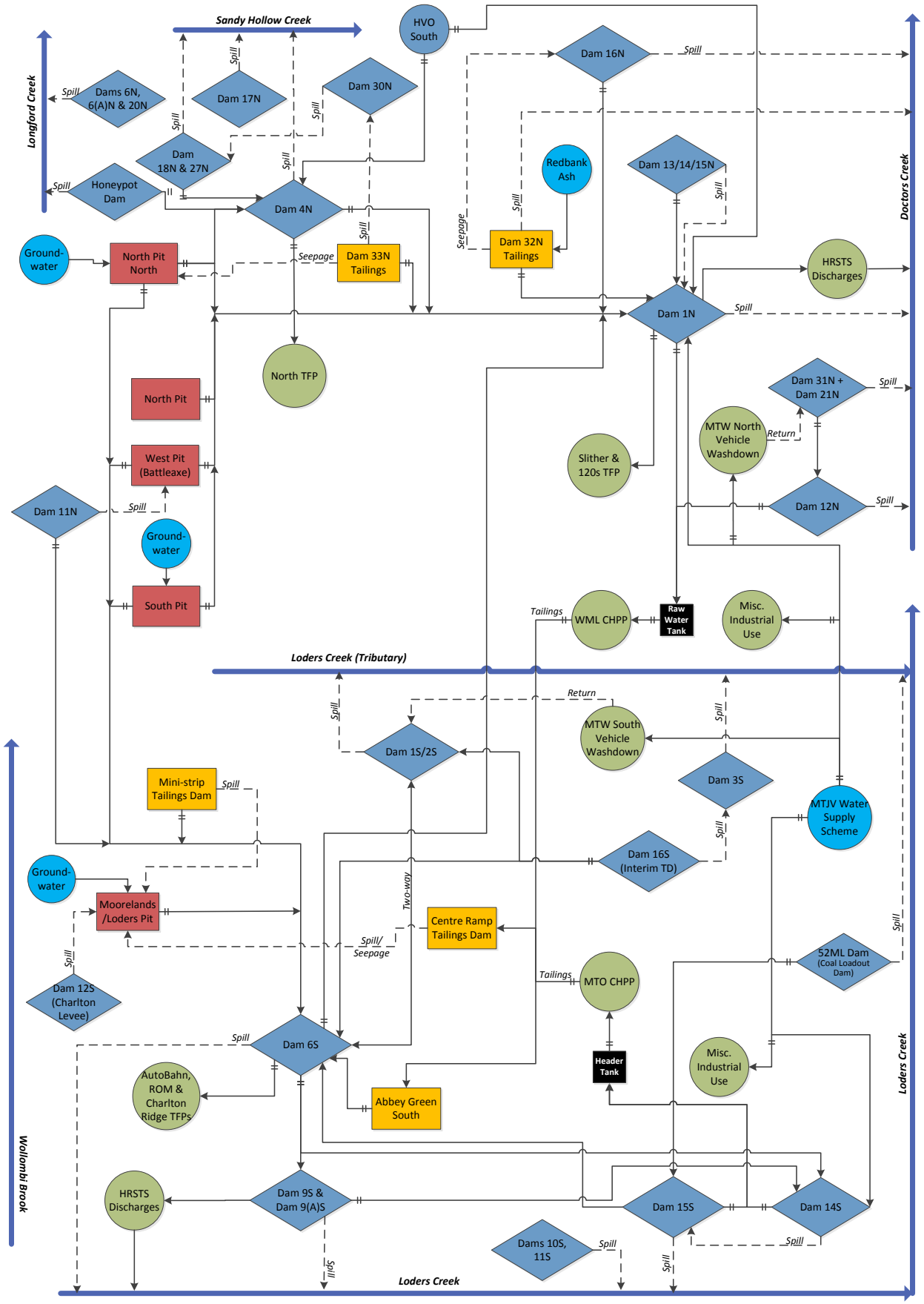

Figure 3 – MTW Water Management System Schematic

and last of all, inactive mining areas. The majority of dewatering is directed to:

- Dam 1N (Main Dam at WML)
- Dam 6S (SOOP, or South out of Pit Dam at MTO)
- Dam 9S (MTO)

WML is approved to construct a new Northern Out of Pit Dam (NOOP) by the Approvals, adjacent to Dam 1N. The NOOP dam will increase available storage for dewatering and stormwater flows. The manner of its use in water management activities at MTW will be described in a future version of the WMP. Prior to a new dam being designed and constructed, a risk assessment will be completed to ensure the level of engineering used is commensurate with the dam risk.

Water is pumped between MTO and WML via pipelines linking both CHPPs, which are the largest users of water on site. Dewatering from the open cuts is also moved between both sites. In-pit dust suppression also consumes large quantities of mine water via fast fill water cart stations located at Warkworth and Mount Thorley pits.

5.4 Tailings Water

There are two active tailings dams: Centre Ramp Tailings Storage Facility and Abbey Green Tailings Storage Facility. Tailings Dam 1 (Dam 32N), Tailings Dam 2 (previously used for Redbank Power Station ash only) and the Mini-strip Tailings Dam are currently inactive; capping of Tailings Dam 2 commenced in 2016. Active and inactive tailings facilities are managed in accordance with environmental procedures for coarse rejects and tailings disposal, and any which area also prescribed dams adhere to requirements of the relevant prescribed dam Operational and Maintenance manual.

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. To some degree, Warkworth and Mount Thorley pits are both susceptible to storm induced flood flows. Clean water diversion structures are employed to divert clean water away from the active pits. The catchment areas are progressively reducing as the high-walls advance. Only minor diversion structures are currently employed for Loders Pit, West Pit and North Pit.

Dams solely for the capture, containment and recirculation of mine affected water consistent with best management practice to prevent the contamination of a water source are "excluded works" and are exempt from the requirement for water supply works approvals and WALs under the *Water Management Act 2000*. On this basis, water captured in the site water management structures, with the exception of rainfall runoff from undisturbed natural catchments, is not subject to licensing.

The MTW contiguous land holdings for the harvestable rights calculation are 4,007 ha in the Hunter River catchment and 2,667 ha in the Wollombi Brook catchment. At a harvestable right of 0.07ML/year, this equates to a volume of 280ML and 187ML in the Singleton and Lower Wollombi Brook Water Sources respectively.

5.6 River Water

Singleton Shire Council holds a high security water licence (WAL 10543) on behalf of the Mount Thorley Joint Venture Water (MTJV) Supply Scheme. The Council maintains and operates the Scheme to supply raw water, sourced from the Hunter River, to MTW and other joint venture parties.

MTW's share of the Scheme allocation is a maximum of 1,012 ML per financial year and is used if site water stocks are low or not available. In addition, MTW has General Security unit entitlements under a number of WALs to withdraw water from the Hunter River; these licences are not currently authorised for mine water

supply purposes however may be altered to allow this type of use. Should MTW require more than 1,012 ML, water entitlement can be traded to this licence in accordance with the Water Management Act to increase output through the scheme. Water licences are detailed in **Table 5.2**.

Table 5.2: MTW Water Licences

Licence No.	DWE Reference	Share Component (Units)	Location/Purpose
10543	20AL201239	1,012	Zone 2B: Hunter River from Wollombi Brook junction to Oakhampton Rail Bridge
963	20AL201242	243	Warkworth farm - Hunter River pump (Zone 2B)
971	20AL201258	270	Warkworth farm - Hunter River pump (Zone 2B)
1008	20AL201341	243	Warkworth farm - Hunter River pump (Zone 2B)
995	20AL201302	243	Anndale farm – Hunter River pump (Zone 2B)
1009	20AL201343	435	Anndale farm – Hunter River pump (Zone 2B)
969	20AL201254	39	Zone 1B: Hunter River from Goulburn River junction to Glennies Creek junction; Glennies Creek pump
19022	20AL209903	60	Sandy Hollow Creek (Unregulated river – Singleton Water Source)
18558	20AL208627	50	Lower Wollombi Brook Water Source
18469	20AL20858	245	Lower Wollombi Brook Water Source
40464	20AL218784	180	Mt Thorley Excavation; North Coast Fractured and Porous Rock Groundwater Sources
40465	20AL218785	750	Warkworth Excavation; North Coast Fractured and Porous Rock Groundwater Sources

5.7 Licenced Discharges

Saline water releases from site are regulated by the Hunter River Salinity Trading Scheme (HRSTS).

Excess mine water can be released via licensed discharge points into the Hunter River. Licensed discharge points are located on: Dam 9S (MTO) and Dam 1N (WML). Discharges are only allowed during high and flood flow periods in the Hunter River as determined by State Water and DPI Water. Discharges are regulated by conditions in the site EPLs 1376 and 1976 and by the Hunter River Salinity Trading Scheme Regulation 2000

5.8 Impacts on Nationally Listed Threatened Species and Ecological Communities

In accordance with condition 7(b) of the federal approval for the Warkworth Extension 2010 (EPBC 2009/5081), granted pursuant to the Environmental Protection and Biodiversity Conservation Act 1999 (Cth) consideration has been given to potential impacts on nationally listed threatened species and ecological species in preparing this WMP as set out below.

An updated copy of this WMP, which includes the site water balance modelling and numerical groundwater model, will be provided to the Department of Sustainability, Environment, Water, Population and Communities to satisfy conditions condition 6 and 7(a) of EPBC 2009/5081. It is considered that there is no potential for water related matters of national environmental significance to be impacted by MTW.

5.8.1 Giant Burrowing Frog

It is not anticipated that groundwater impacts from the MTW mining operations will result in any impact on the Giant Burrowing Frog or its habitat.

The ridgeline that extends along the northern boundary of the Warkworth Continuation area splits the ephemeral perched aquifer flow routes to the north and southwest. The lack of hydraulic connection with the underlying fractured rock as well as the non-impeded through flow of the perched aquifer indicates that the cumulative impacts on the Giant Burrowing Frog habitat will be negligible.

The Warkworth Continuation area is at the northern extent of the known range of the Giant Burrowing Frog. The Warkworth 2010 EA states that, despite suitable habitat being recorded in the area, the lack of recorded findings of this species and previous intensive agricultural land use indicate that this species is unlikely to be found within the area of impact.

Sound scientific research was relied upon to make the statements in the EIS that the potential impact to the habitat of the Giant Burrowing Frog will be minimal and the consequence to this species will be negligible.

5.8.2 Wollemi National Park

MTW is not within the Wollemi National Park. The Wollemi National Park is located 5km west of the approved mine area.

It is unlikely that the cumulative impacts of the existing and approved operations would impact on the World heritage values of the Wollemi National Park for several reasons, including:

- The existing MTW and Bulga Mining Complexes have not reported any significant ground water seepage volumes into the pit due to the low permeability of the Permian strata.

- The groundwater model set out in the EIS does not predict a significant change in baseflow to the Wollombi Brook, please refer to Section 8.3.

- The Wollemi National Park does not utilise the alluvium associated with the Wollombi Brook and therefore the associated aquatic or riparian ecosystems will not be impacted by the approved mining area.

6. SITE WATER BALANCE

6.1 Overview

MTW 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).

MTW uses the water balance to record and assess expected site water management performance based on statistics generated from the historical 122 year climatic record for the region. These annual site water balances are then compared to previous results.

The model has been configured to simulate the operations of all major 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.

Catchment runoff is calculated for both disturbed (mine affected water from the disturbed footprint, exempt from harvestable rights calculations) and from undisturbed natural catchments (subject to harvestable rights).

Table 6.1 shows a summary water balance for 2017 at MTW. The simulation method used and water balance model calibration is fully described in the 2014 EIS.

6.2 Sources & Security of Water Supply

Likely mine site water requirements were determined from the water balance modelling as described above. A significant proportion of mine site water requirements would be sourced from water collected onsite, including rainfall runoff and groundwater inflows to the open cut pits

The results of the water balance modelling show that external water may be required to meet all site demands. Total external water requirements are characterised as:

- A 90% chance that at least 450ML of external water would be required in any year of project life;
- a 50% chance that between 1,500 to 2,000ML/year of external water would be required; and
- a 10% chance that between 3,000 to 3,700ML/year of external water would be required.

The current MTJV allocation is 1,012ML/year (at 100 per cent Available Water Determination (AWD)). Additional sources of poor quality water are also available from the Lemington Underground Bore, inter-site transfers and water sharing with neighbouring mines (see Section 6.3). Abstraction of water from the Hunter River water is also available should alternative sources be unavailable (see Section 5.6).

If required, additional water licences would be sought and purchased by Yancoal over the life of the proposal to meet external raw water demands. As all offsite water supplies for the proposal would be obtained from licensed sources, there would be no adverse impact on other licensed users who would still have access to their entitlement (subject to climatic conditions and the operation of the water supply scheme).

6.3 Water Sharing with Neighbouring Mines

MTW seeks to augment its site water inventory using external sources of non-potable water. As previously mentioned water is transferred between HVO and MTW via infrastructure, allowing access to surplus water stored in voids or from the Lemington Underground Void (LUG) bore.

MTW also has agreements with neighbouring Bulga and Wambo mines to supply water to MTW when mutually beneficial to do so. This will assist in supplementing MTW's water demands going forward.

6.4 Off-Site Water Transfers and Discharges

Saline water releases from site are regulated by the Hunter River Salinity Trading Scheme (HRSTS). Controlled discharges are undertaken in accordance with the HRSTS as specified in the EPL.

Intra-site transfers of excess water may occur to the neighbouring HVO mine where required, under agreement with HVO.

6.5 Water Balance Reporting

The site water balance will be reviewed annually, with the results to be presented in the Annual Review Report.

Table 6.1: Water Balance Results for 2017

Water Stream	Volume (ML) (% Total)
Inputs	
Rainfall Runoff	3,368 (39%)
Hunter River (MTJV supply scheme)	1,790 (21%)
Potable (Singleton Shire Council / trucked)	18 (<1%)
Groundwater	517 (6%)
Recycled to CHPP from tailings (not included in total)	4,097
Imported (LUG bore)	1,533 (18%)
Water from ROM Coal	1,044 (12%)
Total Inputs	**8,570**
Outputs	
Dust Suppression	3,131 (40%)
Evaporation – mine water dams	987 (13%)
Entrained in process waste	1,876 (24%)
Discharged (HRSTS)	0 (0%)
Water in coarse reject	704 (9%)
Water in product coal	1,028 (13%)
Miscellaneous use (wash-down etc.)	110 (1%)
Total Outputs	**7,836**
Change in storage (increased)	**733**

7. SURFACE WATER MANAGEMENT PLAN

7.1 Overview

MTW 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 MTW 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

Water quality data is collected for water courses, ephemeral streams and water bodies that could potentially be affected by the project. These sites are detailed in the Mount Thorley Warkworth Surface Water Monitoring Programme in **Appendix B**. The main water courses potentially affected by mining at MTW are the Wollombi Brook and Loders Creek.

The Hunter River as the primary water course in the greater catchment is also monitored for completeness, however is not expected to be potentially affected by mining at MTW. The two water quality sampling locations on the Hunter River, W1 and W3, are located upstream and downstream of the Loders Creek confluence respectively. A comparison of results between W1 and W3 indicate that even though water discharged from Loders Creek and Doctors Creek typically has relatively high EC levels, there is no noticeable impact on water quality in the Hunter River.

Baseline data for MTW and receiving waters are detailed in the Warkworth Continuation EIS and Mount Thorley Operations EIS (2014). Recent electrical conductivity (EC), pH and total suspended solids (TSS) data are given in **Table 7.1**; data presented is that available in the current site electronic data management system.

The Surface Water Monitoring Programme will be modified to include new dams as they are constructed.

7.3 Water Flow

Wollombi Brook drains in a north easterly direction and joins the Hunter River approximately 3.5km north of the site. Other drainage lines adjacent to MTW (Salt Pan Creek, Longford Creek and Dights Creek are ephemeral and mostly drain westward or north westward to Wollombi Brook. Clean water diversions are employed to divert water away from the active mining area; Doctors Creek diversion runs along the southern margin of Warkworth and exits site east of the Warkworth CHPP. Loders Creek and Doctors Creek (both also ephemeral) capture runoff from undisturbed areas east of MTW, and are the receiving water bodies for licenced HRSTS discharges.

Streamflow data for the Wollombi Brook is collected by two DPI Water stream gauging stations in the vicinity of the site:

- Station No. 210004 – Wollombi Brook at Warkworth (approximately 7km upstream of the Hunter River confluence); and
- Station No. 210028 – Wollombi Brook at Bulga (approximately 20km upstream of the Hunter River confluence.

The data from these gauging stations show the Wollombi Brook is ephemeral, with a flow rate of 2ML/d at Warkworth and 0.2ML/d at Bulga for 80% of the time. The median flow rate is about 40ML/d at Warkworth and 30ML/d at Bulga. During significant flood events water levels at Warkworth may be affected by backwater from the Hunter River.

During active mining operations the MTW water management system captures runoff from areas that would have previously flowed to the Wollombi Brook or Hunter River. The maximum total catchment area captured during the Continuation is 10.5km^2, or 0.56% of the Wollombi Brook catchment to the confluence with the Hunter River. To limit the loss of catchment progressive rehabilitation is undertaken. The Hunter River catchment area (excluding Wollombi Brook catchment) will be restored to 99.96% of its pre-mining area, whilst the Wollombi Brook catchment will be restored to 99.56% of its pre-mining area.

Given the flow regime for the Wollombi Brook and limited loss of catchment as described above, any change in surface water flows is predicted to be small and likely below the limit of detection.

Table 7.1: Historical Surface Water Quality Results

Monitoring Location	Dataset	EC (µS/cm)			pH			TSS (mg/L)		
		Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.
W5 Loders Creek	2002 - current	440	8080	16,250	7.1	8.2	9.3	1	47	1,170
W15 Loders Creek	1993 - current	160	5,580	16,350	6.2	8.0	9.7	1	33	300
Wollombi Brook	2002 - current	182	728	1,580	6.4	7.4	9.5	1	11	430
Wollombi Brooks Upstream	2012 - current	256	718	1443	6.7	7.5	8.5	1	5.4	11

7.4 Channel Stability, Stream and Riparian Vegetation Health

A programme to monitor and report on the stream and riparian vegetation health in Loders Creek and Wollombi Brook potentially affected by the development commenced in 2016, with monitoring being undertaken routinely on an annual basis.

Monitoring includes the following:

- Documenting locations and dimensions of significant erosive or depositional features;
- Photographs upstream, downstream, at both the left and right banks;
- Rating the site with the Ephemeral Stream Assessment protocol developed by the CSIRO to assess the erosional state of the creek at the monitoring location (a measure of channel stability);
- Rating the site with the Rapid Appraisal of Riparian Condition protocol developed by Land & Water Australia. This assesses the ecological condition of riparian habitats using indicators that reflect functional aspects of the physical, community and landscape features of the riparian zone (a measure of stream health); and
- Taking measurements of the channel cross-sections (transects) for comparison purposes for any future monitoring.

Results will be compared to previous data to monitor their condition over time. Performance criteria are outlined in Section 9.1.1.

7.5 Water Management System

7.5.1 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. Where required sediment control structures are implemented generally in accordance with 'Managing Urban Stormwater Volume: 2E mines and Quarries'.

Figure 3 shows the OPSIM mine water management schematic for MTW.

7.5.2 Flood Mitigation Measures

Flooding investigations were undertaken as part of the Project Approval, covering the Hunter River to the east and Wollombi Brook to the west. The results showed the proposal will not increase the Hunter River flood risk to infrastructure on the eastern side of the operation.

The existing Salt Pan Creek (known as the Charlton Levee) levee provides flooding protection from Wollombi Brook) to the MTO pit. The HEC-RAS steady state hydraulic model was used to estimate the 100 year ARI design flood levels in the Wollombi Brook adjacent to the mine site. The 100 year ARI design flood event peaks at approximately 66mRL, about 3.5 m below the crest levee (approximately 69.5mRL). The levee was constructed to protect the mine from floods to the 500 year ARI design flood event, which peaks at approximately 69.3mRL. On this basis there is significant freeboard to mitigate flood impacts.

The Office of Environment and Heritage is currently working with Singleton Council on the Wollombi Brook Flood Study, which will determine the Probable Maximum Flood (PMF) level adjacent to the site. Should the PMF be higher than the existing levee crest Yancoal will investigate whether the levee should be raised for the remaining duration of the activities occurring at MTO, in consultation with DP&E.

7.5.3 Erosion and Sediment Controls

Overview

A Ground Disturbance Permit is required for all disturbance activities. Prior to disturbance, appropriate erosion and sediment controls consistent with current best practice standards will be established. Where ground conditions allow, erosion and sediment controls will be 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 MTW 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 or placement of topsoil;
- Increased sediment and pollutant load entering the natural water system; and
- 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.

Erosion and Sediment Control Structures

Contour banks have been positioned at MTW to direct runoff from rehabilitated areas and disturbed areas to sedimentation dams. The locations of the erosion and sediment control structures are shown in **Figure 2**. Temporary contours and erosion and sediment control structures constructed ahead of mining are not shown in the figure, however are designed and implemented as part of the Ground Disturbance Approvals process.

7.6 Detailed Plans

7.6.1 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. The Mine Operations Plan can be viewed via MTW's webpage (https://insite.yancoal.com.au/document-library/mops).

7.6.2 Emplacement Facilities

The rehabilitation objective of the mine site, including the emplacement facilities (waste dumps) is to be safe, stable and non-polluting. Design and management of the waste dumps will be in accordance with the Mine Operations Plan (https://insite.yancoal.com.au/document-library/mops).

7.6.3 Final Rehabilitation Drainage

The rehabilitation objective of the mine site, including the final landform drainage is to be safe, stable and non-polluting. Design and management of the final landform hydrology will be in accordance with the Mine Operations Plan (https://insite.yancoal.com.au/document-library/mops).

8. GROUNDWATER MANAGEMENT PLAN

8.1 Overview

Detailed assessments of the potential groundwater impacts of mining at MTW were undertaken using a numerical groundwater model during the EIS for the Project Approval (2014). The model calculated groundwater seepage and drawdown responses for the development.

Since the EIS was completed a further model update was undertaken in early 2015 (AGE, 2015), to include new and refined datasets to improve the models. This resulted in a refinement to the predicted water takes during mining and post-closure. The datasets included:

- A revised map of the highly productive alluvium of the Hunter River Regulated Water Source, resulting in a significant contraction of the mapped alluvial extent of the Wollombi Brook west of MTO;
- Historical mine plan shells;
- Final post-closure landform;
- Inclusion of the Charlton Road flood levee; and
- Glencore Bulga Mine final void extents.

An integrated management approach is employed at MTW 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; and
4. 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 programme given in **Appendix C**. MTW will continue to meet all commitments under the relevant water sharing and Hunter River Salinity Trading Scheme. Continued groundwater monitoring combined with an independent review of the site numerical groundwater model with every independent environmental audit will inform future decision making with respect to quantifying impacts on the groundwater environment.

Overall the studies to date have highlighted that the Project Approval 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 Levels, Yield and Quality

Baseline data for MTW, including water levels, quality and yield estimates are detailed in the EIS for the Warkworth Continuation (2014) and Mount Thorley Operations (2014). MTW's Environmental Assessments can be viewed via MTW's webpage (https://insite.yancoal.com.au/document-library/licences-and-approvals-mtw).

An extensive network of groundwater monitoring bores and piezometers, screening the alluvium, coal seams and interburden is routinely monitored. Recent data is presented in the 2017 MTW Annual Review Environmental monitoring data is presented on MTW's webpage (https://insite.yancoal.com.au/document-library/mtw). The current groundwater monitoring network is shown in **Appendix C.**

8.3 Impacts on Groundwater and Monitoring

MTW has developed a knowledge base from more than 20 years of groundwater monitoring to provide detailed baseline data of groundwater levels, yield and quality in the immediate region.

Groundwater monitoring will be undertaken in accordance with the Groundwater Monitoring Programme in **Appendix C**. 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 3, condition 27(b) of the Warkworth Consent and Schedule 3, condition 25(b) of the Mount Thorley Consent, the Groundwater Monitoring Programme 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 C**

8.3.1 Groundwater Inflows to the Open Cut Pits

Groundwater inflows to the pit are a combination of leakage through spoil and seepage through the Permian coal measures (coal seams). Inflows from spoil are a result of rainfall seepage and leakage from TSFs and therefore are not groundwater and not required to be licenced.

Modelling results (AGE, 2015) indicate peak inflows from the Permian to the pit are 275ML/year at WML and 298ML/year at MTO. Current inflows to the pit are modelled at 258ML/year at WML and 168ML/year at MTO, however little to no groundwater reports to the pit floor. Typically, due to the low rate of seepage, any seepage from the pit wall evaporates at the pit face and as a result is not measurable. On this basis modelled rates of groundwater inflow are adopted for water balance purposes.

Should any unexpected increased groundwater inflow occur the time, location and volume shall be recorded. Groundwater inflows will be reported annually in the AR.

8.3.2 Seepage/Leachate from Water Storages, Emplacements, Backfilled Voids and Final Voids

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 level 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 sufficient to verify that leachate release along the eastern and western side of the mine is being managed.

8.3.3 Regional and Local Aquifers

Historical water level data from the bores within the alluvium indicate that there has been minimal change to aquifer storage as a result of MTW mining operations. The water table does not appear to be declining in response to the depressurisation of the underlying coal measures. Groundwater modelling conservatively predicts drawdown in the Wollombi Brook alluvium (to the west of MTW) to be less than 1m at the end of mining. The maximum water take under the Project Approval from the Wollombi Brook alluvium during mining is predicted at 28ML/year (16.7ML/year and 11.3ML/year from WML and MTO respectively) (AGE, 2015). WAL18558 has an approved extraction of 50ML/year from the Lower Wollombi Brook Water Source (Table 5.2).

There are six permanent nested monitoring bores constructed in the shallow alluvium and underlying Permian overburden along the Wollombi Brook (Sites PZ7, PZ8 and PZ9). Three nested monitoring bores along the Wollombi Brook (MB15MTW01(D and S),

MB15MTW02(D and S) and MB15MTW03) were constructed in 2016. Following the acquisition of a neighbouring property, five monitoring bores adjacent to the Wollombi Brook have also been added to the groundwater monitoring programme. Locations for the bores have been undertaken in consultation with DPI Water.

Within the Hunter River alluvium the maximum take during mining is predicted at 4.1ML/year (3.5ML/year and 0.6ML/year from WML and MTO respectively) (AGE, 2015).

The existing Groundwater Monitoring Programme is sufficient to verify any impacts on regional and local aquifers are consistent with those predicted.

8.3.4 Groundwater Supply of Potentially Affected Landowners

It is not anticipated that MTW mining operations will result in any unreasonable loss of groundwater yield at existing privately owned water bores in the local area. The township of Bulga is the only population centre close to MTW where there is significant use of groundwater. On this basis the existing network of groundwater monitoring bores (including proposed additional bores), covering both the coal seams and the alluvium, is sufficient to ascertain whether a change in private water bore production could be attributed to the MTW operation or not.

Trigger levels (using statistical methodologies) will be established for the proposed Wollombi Brook alluvial bores to monitor groundwater levels. These will be established once a statistically valid data set has been collected. In the interim data will be routinely reviewed to determine if any trend exists that may warrant further investigation.

Privately owned groundwater bores will not be routinely monitored by MTW. A bore census was completed in 2010 as part of the groundwater impact assessment study (AGE, 2010). This data will form the baseline in the event of any future claim that the mine has impacted on the productivity of a private bore or well.

8.3.5 Groundwater Dependent Ecosystems and Riparian Vegetation

Groundwater dependent ecosystems (GDEs) within the vicinity of the MTW mine include areas of Hunter Valley Oak Forest and River Red Gum Floodplain Woodland Ecological Communities along the Wollombi Brook alluvium, at least 2.5km from the site. These vegetation communities are likely to be extracting groundwater from the shallow alluvial aquifer, which would not be impacted by water table drawdown in this location. The groundwater model does not predict significant changes in the water level or water quality along the alluvium of the Wollombi Brook that will result in stress to the associated vegetation communities.

The water table formed at the base of the Warkworth Sands is perched and is not directly connected with the underlying Permian. Further, the Warkworth Sands does not occur as one large sand sheet, but many smaller isolated sheets, separated by areas where sand is not present. In between these sand sheets, clay based bedrock derived soils occur at the surface. The topography of the area also means that these separate sand sheets can be considered different and not interconnected hydrogeologic units. The northern boundary of the proposed 2014 disturbance area largely follows a natural division between the sand sheets (AGE, 2010). Groundwater flow in the area to be disturbed by mining is predominantly to the west, whereas groundwater in the sand sheets outside the proposed 2014 disturbance area flows to north.

Therefore, the proposal is not expected to impact on the Warkworth Sands ephemeral groundwater system or the associated vegetation community outside the proposed 2014 disturbance area. Eight monitoring bores were constructed in 2016 in the Warkworth Sands system and have been added to the groundwater monitoring programme. These monitoring bores will assist in the monitoring of shallow groundwater of the Warkworth Sands and the WSW during mining activities.

Potential impact on GDEs will be monitored via the existing groundwater monitoring programme.

8.3.6 Base Flows to the Wollombi Brook and Loders Creek

Modelling indicates that current and historical mining has depressurised the Permian strata reducing the rate of flow of groundwater from the Permian to the alluvium. This reduction in groundwater discharge to the Wollombi Brook alluvium reduces the base flow to the Wollombi Brook.

Modelling shows that the majority of the loss in Wollombi Brook base flow is predicted to be in the upper reach above the stream gauge at Bulga and the mid reach to the stream gauge north of Warkworth Mine, with only negligible loss in the lower reach to the confluence with the Hunter River. Base flow reduction from historical and, current operations and proposed mining for Wollombi Brook (all reaches) is predicted to less than 28ML/year (the reduction of flow to the Wollombi Brook Alluvium – loss of baseflow will be a fraction of this).

Given the predicted base flow reduction is less than 0.1% of the mean annual flow in the Wollombi Brook above Bulga the impact of mining will be undetectable. Monitoring bores installed in the Wollombi Brook alluvium will be used to assess the potential for impact upon base flows as a result of MTW operations.

There is no impact to base flows of Loders Creek as a result of the MTO continuation. The Jerrys Plains Formation sub-crops along the eastern boundary of mining operations, forming a natural groundwater divide and constraining any mining related impacts to the west of the divide. No additional monitoring is proposed on this basis. Further detail is provided in the MTO EIS (2014) (https://insite.yancoal.com.au/document-library/licences-and-approvals-mtw).

8.4 Validation of Groundwater Model

With every independent environmental audit MTW will instigate an independent review of the groundwater model, including comparison of monitoring results with modelled predictions.

9. ASSESSMENT, REPORTING AND REVIEW

9.1 Performance Criteria & Trigger Levels

Trigger values provide the measurable basis for identifying adverse water quality 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).

MTW EPL's 1376 and 1976 stipulate 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 - 9.0[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 monthly reviews of monitoring data. Site specific triggers are given in **Appendix B and C**.

9.1.1 Channel Stability, Stream and Riparian Vegetation Health

Trigger levels have been established to prompt investigation to determine any potentially adverse impact on Loders Creek and Wollombi Brook has occurred due to the development. The triggers set will ensure baseline channel stability will be maintained or improved, plus riparian health improved, for Loders Creek.

Table 9.11 outlines the performance criteria related to Loders Creek and Wollombi Brook for the four prescribed monitoring sites.

Table 9.11: stream health performance criteria

Performance Indicator	Trigger Level
Channel Stability	A decrease in the CSIRO Ephemeral Stream Assessment Classification
Stream and Vegetation Health	A decrease in the RARC Stream Heath Assessment Classification

9.2 Response to Exceedance & Performance Indicators

In the event that a water quality measurement exceeds a predetermined trigger value, exceedances will be recorded and MTW will initiate a site specific investigation if:

- professional judgement determines that the single deviation or a developing trend could result in environmental harm; or
- three consecutive measurements of EC or pH exceed trigger values.
- One measurement of TSS exceeds the trigger value
- Channel stability and/or stream and vegetation health declines

The investigation will:

- Determine the source and risk of impact on downstream water quality or channel stability/stream and vegetation health.
- Determine the need for and extent of contingency measures.
- Communicate outcomes to senior management
- Be reported in the AR.

9.3 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 MTW's water allocation is not exceeded;
6. Undertake works to improve/arrest channel stability decline and/or stream and vegetation health.

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. 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.

Should the water supply to the owner of any privately-owned land whose basic landholder water rights as defined in the Water Management Act 2000 be adversely and directly impacted as a result of the development, MTW shall provide a compensatory water supply. This supply shall be provided in consultation with DPI Water, and to the satisfaction of the Secretary.

The compensatory water supply shall provide an alternative long-term supply of water that is equivalent to the loss attributable to the Project Approval. Equivalent water supply shall be provided (at least on an interim basis) as soon as practicable from the loss being identified, unless otherwise agreed with the landowner.

If MTW and the landowner cannot agree on the measures to be implemented, or there is a dispute about the implementation of these measures, then either party may refer the matter to the Secretary for resolution.

If MTW is unable to provide an alternative long-term supply of water, then MTW shall provide alternative compensation to the satisfaction of the Secretary.

9.4 Reporting

The process for compliance reporting is described in **Table 9.2**.

Table 9.2: 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 11 of Schedule 5 of the Warkworth Consent (SSD-6464) & Condition 11 of Schedule 5 of Mount Thorley Consent (SSD-6465)	Monitoring results	Monthly	Public MTW's webpage (https://insite.yancoal.com.au/mount-thorley-warkworth/data) in accordance with the MTW Online Communication Plan. & The MTW 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 Yancoal Australia website (monthly summary)	Public
Annual Review	Condition 4 of Schedule 5 of the Warkworth Consent (SSD-6465) & Condition 4 of Schedule 5 of Mount Thorley Consent (SSD-6464)	All water monitoring results for the corresponding year. The Annual Review will also detail any complaints relating to water quality received at MTW	By the end of March each year	Relevant stakeholders including but not limited to EPA, DP&E, DPI Water, Singleton Council and Community Consultative Committee (CCC)
Annual Groundwater Impact Assessment	Warkworth Consent (SSD-6464) Statement of Commitments	Depressurisation of Coal Measures and alluvium by a suitably qualified Hydrogeologist	By the end of March each year	Relevant stakeholders including but not limited to EPA, DP&E, DPI Water, Singleton Council and Community Consultative Committee (CCC)
Potential or confirmed exceedance / noncompliance of water triggers (internal reporting)	Yancoal Australia Environmental Management Strategy	Details of potential or confirmed exceedance / noncompliance of water triggers incidents	By exception	The Environmental Specialist reports to the Environmental Services Manager

Reporting aspect	Relevant Legislation	What is reported	When	Who to report to
Trigger exceedance investigation determines contingency measures required	Yancoal Australia Environmental Management Strategy	Details of the trigger exceedance investigation and contingency measures to be enacted	Following exceedance investigation	DPI Water via email to water.referrals@dpi.nsw.gov.au
Incident causing or threatening to cause Environmental harm	PoEO Act, Section 148	Details of incident	Immediately following receipt of information indicating actual or potential harm	The Environmental Specialist – Operations in writing to the DP&E, and EPA
Water use	Water Access Licence under the WMA	Water supply and use NB: Where conditions of Water Licences issued by DPI Water dictate, a compliance report, which reports on the results of the Groundwater Monitoring and Contingency Plan required by a Water Licence, will be lodged with the DPI Water	Annually	Reported on in the AR and in accordance with Water Licence requirements.

9.5 Complaints Management

Community Complaints are lodged via the Community Complaints line (1800 656 892). The hotline number will be prominently displayed on MTW's webpage 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 MTW 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 EPL's 1376 and 1976 relating to handling of pollution complaints, MTW 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.

9.6 Continuous Improvement

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

10. ROLES AND RESPONSIBILITIES

Table 10.1: Roles and Responsibilities

Manager – Mining

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

Manager – Environment & Community

- Ensure a site Water Management Plan is prepared, implemented & maintained.
- Ensure surface and groundwater monitoring programmes are implemented and current.
- Ensure review and reporting of water data is consistent with regulatory requirements.
- Administer and ensure compliance with water licenses.
- 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 – CHPP and Maintenance

- Ensure that water is managed in compliance with the WMP and Yancoal Water Management procedures with this Water Management Plan.
- Delegate a representative for the Water Management Operations Team.
- Ensure water infrastructure in the CHPP and Maintenance area of accountability is regularly inspected and maintained. Specifically:
  - Ensure preferential use of poor quality water over river water.
  - Mitigate spills, leaks and unlicensed discharges.
- Ensure water is ordered and administered in accordance with the WMA.
- Ensure water management infrastructure is designed and constructed in accordance with this WMP and Yancoal 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 and Maintenance area.

Manager – Technical Services

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

Manager Operations Support and Projects

- Ensure that water is managed in compliance with the WMP and Yancoal Water Management procedures within area of accountability.

- Delegate a representative for the Water Management Operations Team.
- Ensure 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. .
- Design and budget for the construction of small to medium cleanwater diversions and, sediment/erosion control structures and discharge facilities.
- 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 Secretary of the DP&E where necessary.

The WMP will also be reviewed within three months of the completion of an independent environmental audit, submission of an incident report (as defined in the Approvals), any exceedance of the Approvals' criteria or any modification to the conditions of the Approvals.

The WMP may also be reviewed/revised at any time (e.g. other than at triggered events described above), to ensure it is updated on a regular basis.

Any amendments to this WMP that affect its application will be undertaken in consultation with the appropriate regulatory authorities specified in the Approvals, and to the satisfaction of the Secretary.

•

REFERENCES

- Mt Thorley Continuation Project Development Consent - SSD-6465.
- Warkworth Continuation Project Development Consent – SSD-6464.
- The Environmental Impact Statement titled *"Warkworth Continuation 2014"*, dated June 2014, and prepared by EMM.
- The Environmental Impact Statement titled *"Mount Thorley Operations 2014"*, dated June 2014, and prepared by EMM.
- Report titled *"Warkworth Mine Extension Groundwater Impact Assessment"* , dated February 2010, and prepared by AGE Consultants.
- Report titled *"Mount Thorley and Warkworth Mines, Long Term Approvals Model Update"* , dated February 2015, and prepared by AGE Consultants.

Appendix A – Correspondence with DPI Water, EPA and the OEH

DOC18/502102-01, EF16/906 and EF13/3817

Yancoal Mt Thorley Warkworth
Via e-mail at: gary.mulhearn@yancoal.com.au
PO BOX 267
SINGLETON NSW 2330
Attention: Mr Gary Mulhearn

19 July 2018

Dear Mr Mulhearn

Environment Protection Licences 1376 and 1976
Environment Management Plans

Reference is made to your letter dated 18 July 2018 to the Environment Protection Authority ("EPA") in relation consultation for Mt Thorley Warkworth's draft noise, air quality, blasting and water management plans.

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

The EPA notes that you have not provided us with a copy of the plans, and reminds you that you must comply with your Environment Protection Licences.

If you require any further information regarding this matter please contact Natasha Ryan on (02) 4908 6833.

Yours sincerely

NATASHA RYAN
Regional Operations Officer
Environment Protection Authority

Phone 131 555
Phone 02 4908 6800
Fax 02 4908 6810
TTY 133 677
ABN 43 692 285 758
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NSW 2300 Australia
117 Bull Street
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NSW 2302 Australia
www.epa.nsw.gov.au
hunter.region@epa.nsw.gov.au

NSW GOVERNMENT | Office of Environment & Heritage

Our reference:DOC15/497240-2
Contact: Angela Halcrow, 4320 4243

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

Dear Mr New

RE: MOUNT THORLEY WARKWORTH DRAFT WATER MANAGEMENT PLAN – DECEMBER 2015

I refer to your email dated 2 December 2015 seeking comments on the draft Mount Thorley Warkworth Water Management Plan, Version 3.0, prepared by Rio Tinto Coal Australia and dated 2 December 2015. The Office of Environment and Heritage (OEH) notes that development consent for the Mount Thorley and Warkworth Continuation Projects (SSD-6464 and SSD-6465 respectively) were granted on 26th November 2015. The Mount Thorley Warkworth draft Water Management Plan has been reviewed and the following comments provided.

OEH considers that the document provides insufficient detail to be adequately assessed against the conditions of consent. To satisfy most of the consent conditions for both developments, the draft Water Management Plan includes a statement of intent to carry out the works in accordance with the conditions of consent, or proposed conformance with "*best practice guideline documents*", without any supporting design or calculations. For some conditions of consent there is no corresponding response in the document. Where the conditions of consent include the design of particular elements, it would be anticipated that documentation would be provided that included detailed design together with supporting calculations to enable assessment to occur so that meaningful feedback can be provided. OEH cannot provide such feedback based on the current draft Water Management Plan, dated December 2015.

The following are examples of where information is missing, however, there are a number of issues similar to these that have not been adequately addressed in the information provided:

- Schedule 3, Condition 26 of the Warkworth Development Consent and Schedule 2 Condition 24 of the Mount Thorley Development Consent relate to flood mitigation measures relative to the probable maximum flood (PMF) level. The draft Water Management Plan references the 1% annual exceedance probability (AEP) flood level only.

- Schedule 3, Condition 27 of the Warkworth Development Consent and Schedule 2 Condition 25 of the Mount Thorley Development Consent required development of a Surface Water Management Plan that includes performance criteria and trigger levels. No trigger levels or performance criteria have been indicated for surface water flows, stream and riparian health and channel stability. Section 9.1 of the draft Water Management Plan includes a statement of intent to develop a monitoring plan within the first 12 months of the Project Approval being granted, upon which performance criteria will be established. This is considered inadequate, and these parameters should be established at this stage. Parameters such as stream and riparian vegetation health should have baseline and trigger levels provided at the earliest stage possible, so that a management plan, in conjunction with a

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monitoring program, can ascertain whether there are adverse impacts on them, from the commencement of works, and what actions can be taken to manage and mitigate these impacts.

If you require any further information regarding this matter, please contact Angela Halcrow, Senior Natural Resource Officer – Floodplain, on 4320 4243.

Yours sincerely

14 DEC 2015

RICHARD BATH
Senior Team Leader Planning, Hunter Central Coast Region
Regional Operations

Department of Primary Industries Water

Chris New
Environmental Specialist – Operations
Rio Tinto
By email: chris.new@riotinto.com

Contact Rohan Macdonald
Phone 02 49042642
Email rohan.macdonald@dpi.nsw.gov.au

Our ref V15/3875#44

Dear Mr New

Mt Thorley Warkworth Draft Water Management Plan

The Department of Primary Industries Water (DPI Water) has reviewed the draft Water Management Plan (WMP) for Mount Thorley Warkworth (MTW) and provides the following comments for consideration in finalisation of the plan.

Groundwater trigger values

The trigger value for changes in electrical conductivity (EC) for monitoring bores targeting the Hunter River alluvium is nominated in Appendix B of the WMP as the 95th percentile EC value for the alluvial bores over the period 2011-2014 and set at a value of 24,000 units. DPI Water has previously expressed concern regarding the nominated trigger values with selected comments and recommendations reproduced at **Attachment A**. These concerns have not been addressed in the current draft WMP.

DPI Water requests that the Hunter River alluvium EC trigger values are reviewed and updated, prior to finalisation of the WMP, to better reflect the likely ambient groundwater quality and to provide adequate protection against adverse changes in quality. DPI Water also requests the following data/information be provided to enable comprehensive evaluation of the proposed trigger values:

- bore logs and construction details for bores OH786, OH787, OH788, OH942, OH943 and OH944,
- all available historical monitoring data for these bores, and
- technical/statistical analysis used to derive EC trigger values identified in the WMP for these bores.

The requested data should be provided in an electronic format suitable for analysis in Microsoft Excel.

References to DPI Water

- The former NSW Office of Water is now known as the *Department of Primary Industries Water* (DPI Water). The WMP should be updated to reflect this change.
- Table 9.2 in the WMP outlines environmental reporting requirements. It is requested that DPI Water be included as a recipient for the Annual Review and Annual Groundwater Impact Assessment.
- The referral email for the reporting aspect “trigger exceedance determines contingency measures required” in table 9.2 should be updated from information@water.nsw.gov.au to **water.referrals@dpi.nsw.gov.au**.

If you have questions about this submission, please contact Rohan Macdonald, Water Regulation Officer at DPI Water, on (02) 4904 2642 or rohan.macdonald@dpi.nsw.gov.au

Yours sincerely

Brendan Fletcher
Acting/ Manager Assessments, DPI
19 January 2016

ATTACHMENT A

DPI Water comments on Hunter alluvium monitoring

1 August 2014

Comments

Appendix D 'Groundwater Monitoring Programme', lists the bores monitored and the 95% percentile trigger values for a 1st stage and 2nd stage. It is not clear if the defined trigger values represent a reading from an individual bore in the list or is the amalgamated bore average.

A review of the water quality data for the alluvial monitoring bores as provided in Appendix B of the Mount Thorley Groundwater Impact Assessment shows 9 alluvial bores from which the trigger values appear to have been derived. Six bores are located on the Hunter River side of the mine, and some are outside of the mapped alluvial extent, or only marginally within it. A further is located on the Warkworth Sands and well outside the mapped alluvial extent, and two other bores are located within the Wollombi Brook alluvium one of which is in close proximity to mine disturbance.

A review of the NOW GDS records show that the majority of private bores within the Wollombi alluvium are used for irrigation, stock and potable use. Only one of salinity record for these bores was found; 371 mg/L dated 1998. It is highly unlikely that the nearby groundwater users would not be reliant on a saline groundwater resource for the purpose of irrigation. Data collected from NOW monitoring bores within the Lower Wollombi Brook Water Source identifies the resource to be fresh to marginal in quality.

The proponent's 95% percentile 1st stage trigger for salinity in the Hunter River Alluvium is 24,000 EC units, and for Wollombi Alluvium it is 15,345 EC units. The 2nd stage trigger is double these values. Given that the alluvial aquifers of the Hunter Valley typically have water quality suitable for irrigation and supplementary town water supply, the proposed triggers would appear to allow the possibility for the alluvial aquifers to deteriorate across several beneficial use categories before any action is undertaken.

The MTO salinity results are inconsistent with NOW's observations. This indicates that the proponent's piezometers may not be representative of the alluvial aquifers highest beneficial use, or alternatively that these observation bores are already picking up impacts from the existing mining activities. There are no bore construction details in the EA's or the WMP for the proponent's observation bores, and there is no raw water quality data provided to review how MTO categorised the aquifers. The median and the 5 percentile salinity values are reported as the same. This must be in error and needs to be rectified.

This section will require further consideration and investigation into the adequacy of the alluvial monitoring programme.

Recommendations

2. NOW queries the adequacy of the alluvial monitoring programme given the proponent's findings are inconsistent with other information sources. Copies of bore logs and raw water quality data should be provided for further assessment. The nominated trigger values are unsupported given the level of information provided. The assessment criteria and triggers values require further consideration and investigation.

---

26 September 2014

Comments

The proponent having categorised the alluvial aquifer as being saline inappropriately sets the trigger action and response plan (TARP) values for salinity in the Hunter River Alluvium and Wollombi Brook Alluvium at levels that offer no real protection to the aquifers highest beneficial use. In contrast nearby private bores in the alluvium indicate low (fresh) salinity groundwater

suitable to sustain a number of irrigation licences. There are concerns with the adequacy of the MTW alluvial bore monitoring network to either (i) detect if the mine is impacting on water quality within the alluvial aquifer; or (ii) if the existing MTW alluvial bore data reflects an aquifer already compromised by the mines activities.

The MTW proposed salinity triggers allow the possibility for alluvial aquifers to deteriorate across several beneficial use categories before any consideration by MTW. Hence, NOW recommends the the private bores (upon landholder agreement) are included within the monitoring network. This will establish sufficient baseline monitoring with the capacity to identify any long term trends. For example, a rise of 200 EC units at the private irrigation bore would be far more significant than at a MTW observation bore measuring 8,000 EC units. A check of the NOW licensing database shows 8 active alluvial bores (3 licence holders) within Table 8.2 of the Mt Thorley GIA that should be included for water quality monitoring.

It is recommended the private active bores (shown in Table 8.2 of the Mt Thorley GIA) be included in the suite of monitoring bores.

Recommendations

2. MTW undertake additional monitoring bore installation (minimum of three bores in each alluvial water source). The sites selected to be in consultation with NOW. A copy of the bore logs and raw water quality data is made available to NOW for all new bores, along with the data previously requested for the existing alluvial monitoring bores. The trigger action and response plan will need to be revisited based upon the additional information.
4. Additional monitoring will be required within the alluvial aquifers of the Hunter River and Wollombi Brook developed in consultation with NOW. The trigger action and response plan will need to be revisited based upon the additional information.

---

10 November 2015

Comments and recommendations

2. The updated information for the Wollombi Brook is accepted on provision the commitment to complete the drilling and re-evaluate the water quality triggers is fulfilled. However it is noted that no additional monitoring for the Hunter Regulated Alluvium has been proposed, and DPI Water maintains the concern that the Hunter Alluvium water quality trigger is inappropriate. DPI Water seeks commitment from Coal & Allied to re-evaluate the water quality trigger for the Hunter River Alluvium.

END ATTACHMENT A

COAL & ALLIED

Managed by Rio Tinto Coal Australia

3 February 2016

Brendan Fletcher
A/Manager Assessments
Department of Primary Industries - Water
E: brendan.fletcher@dpi.nsw.gov.au
(cc: rohan.macdonald@dpi.nsw.gov.au
& water.referrals@dpi.nsw.gov.au)

Dear Mr Fletcher

RE: Mt Thorley Warkworth – Draft Water Management Plan:
Response to DPI Water comments

We refer to comments received from DPI Water on 19 January 2016 (DPI Water Ref. V15/3875#44) regarding the Draft Water Management Plan (WMP) for the Mt Thorley Warkworth (MTW) mine complex. The WMP was updated following issue of Development Consents for the Warkworth and Mount Thorley Continuation Projects (SSD-6464 and SSD-6465 respectively) on 26 November 2015. A response to the comments summarised by DPI Water with respect to the WMP is provided below.

Groundwater Trigger Values:

The following information for the Hunter River alluvium bores is provided as requested: bore construction details (no bore logs are available), historical monitoring data and statistical analyses used to derive trigger values.

Trigger limits for electrical conductivity (EC) are calculated as the 95th percentile maximum value from data collected since 2011; this is supported by the larger historical trend. Trigger levels have been calculated using the combined dataset for the six Hunter River alluvium bores. The establishment of trigger levels based on geographical proximity and target stratigraphy typically allows a more robust means for identifying and managing potential impacts due to mining.

The MTW Hunter River alluvium monitoring bores are on the margin of the alluvial floodplain, where thin, interbedded finer-grained alluvium would persist and therefore is less likely to receive fresh water recharge via direct infiltration or baseflow

recharge from the Hunter River. The bores are not sited to monitor the highly productive alluvium of the Hunter River Regulated Water Source; variable water quality reflects this and is consistent with observed trends in our Wollombi Brook monitoring bores located on the margins of the mapped alluvial extent. Given the limited construction information available, it is acknowledged that monitoring bores may also be screened across the underlying Archerfield Sandstone unit.

To address DPI Water's comments Coal & Allied has reviewed and updated the Hunter River alluvium EC and pH trigger values. Triggers have been revised and calculated for each bore, reflecting the highly variable water qualities measured. This will assist in identifying and investigating potentially adverse groundwater impacts due to MTW operations. A copy of the updated Groundwater Monitoring Programme is attached for reference.

It should be noted that the Jerrys Plains subgroup (incorporating the coal seams targeted by mining) subcrops to the west of the alluvium. Historical monitoring data and the MTW Continuation EIS groundwater modelling results show there is little impact to the Hunter River alluvium given these structural controls, supported by mining operations advancing at the West, away from the Hunter River.

Coal & Allied will continue to monitor water quality and water levels in these bores, as outlined in the monitoring programme.

References to DPI Water:

- All references to the NSW Office of Water have been altered to the Department of Primary Industries Water.
- Table 9.2 of the WMP has been updated to include DPI Water as a recipient for the Annual Review and Annual Groundwater Impact Assessment.
- The email address for reporting trigger exceedances has been updated to water.referrals@dpi.nsw.gov.au.

Should you have any queries with the above, please do not hesitate to contact me on (02) 6570 0375 or alternatively via email Chris.New@riotinto.com.

Yours sincerely

Chris New
Environmental Specialist
T: +61 (0) 2 6570 0375 M: +61 (0)438 982 005
chris.new@riotinto.com

Appendix B – Surface Water Monitoring Programme

Mount Thorley Warkworth
Surface Water Monitoring Programme

Purpose

This document provides a summary of the surface water monitoring programme for Mount Thorley Warkworth 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

Location	Parameters & Frequency			
Sample Point	**EC**	**pH**	**Comprehensive Analysis[1]**	**TSS**
Dam 1N	Q, C, D	Q, D	A	Q, D
Dam 6S	M	M	A	M
Dam 9S	Q, C, D	Q, D	A	Q, D
Dam 10S (Ramp 22)	M	M	A	M
SP culvert	RE	RE	A*	RE
SP1	RE	RE	A*	RE
SP2	RE	RE	A*	RE
SW40 – Wollombi Brook Downstream	Q	Q	A	Q
W1 - Hunter River	Q	Q	A	Q
W14 - Doctors Creek	RE	RE	A*	RE
W15 - Loders Creek	RE	RE	A*	RE
W2 - Hunter River	Q	Q	A	Q
W27 - Longford Creek	RE	RE	A*	RE
W28 - Wallaby Scrub	RE	RE	A*	RE
W29	RE	RE	A*	RE
W3 - Hunter River	Q	Q	A	Q
W4 - Doctors Creek	RE	RE	A*	RE
W5 - Loders Creek	M and/or RE[2]	M and/or RE[2]	A	M and/or RE[2]
WB(a)	RE	RE	A*	RE
Wetlands Dam	RE	RE	A*	RE
Wollombi Brook	Q	Q	A	Q
Wollombi Brook Upstream	Q	Q	A	Q
WW5 - Dights Creek	Q	Q	A	Q
DC Upstream	RE	RE	A*	RE

[1]Comprehensive analysis includes major ions TDS, Al, As, B, Ca, Cd, Cl, CO_3, Cu, Hg, K, Mg, Na, Ni, Pb, Se, SO_4 (or S), Zn, Total Alkalinity, Bicarbonate Alkalinity, Carbonate Alkalinity, Hydroxide Alkalinity.
[2] Monthly and/or rain event; depending on timing of rain event sampling and whether results consistent with historical trending.

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

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 level exceedances is detailed in Mount Thorley Warkworth Water Management Plan 2018.

Table 2: Surface Water Trigger Limits (revised March 2018)

Site	Electrical Conductivity µS/cm	pH		Total Suspended Solids mg/L
	95th	5th	95th	
SP1	23690	6.8	9.0	50
W1	1164	7.2	8.6	50
W2	4382	7.5	8.7	50
W3	991	7.7	8.5	50
W4	11760	7.4	8.9	50
W5	14140	7.6	8.9	50
W14	6636	7.2	8.8	50
W15	11911	7.2	8.8	50
W27	443	6.8	8.0	50
W28	209	6.2	7.9	50
W29	20015	7.9	9.1	50
Wollombi Brook	931	6.8	8.2	50
Wollombi Brook Upstream	1125	6.8	8.3	50
SW40	889	7.0	8.2	50
WW5	869	6.8	8.2	50

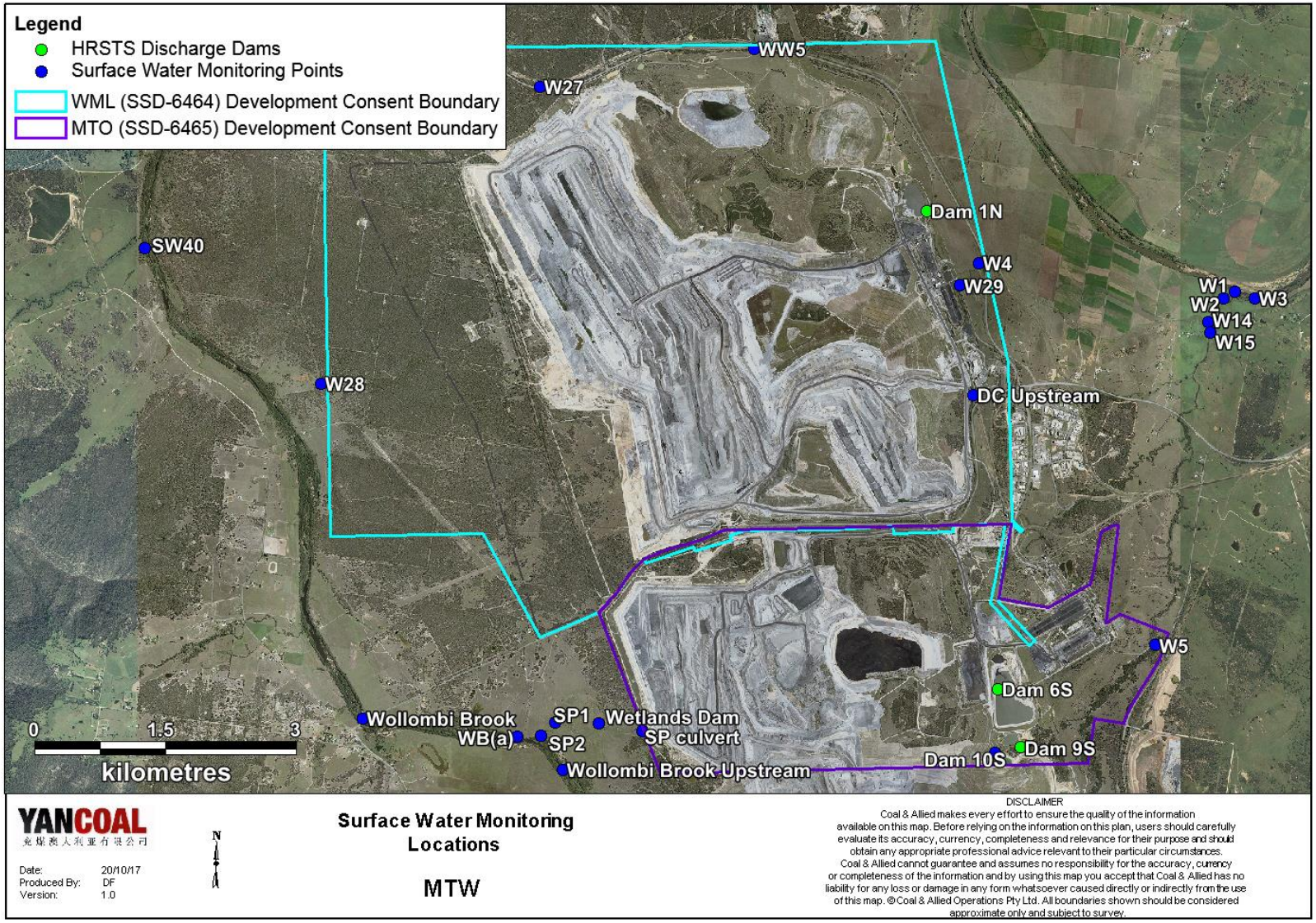

Figure B1: MTW Surface Water Monitoring Location Plan

Appendix C – Groundwater Monitoring Programme

Mount Thorley Warkworth
Groundwater Monitoring Programme

Purpose

This document provides a summary of the ground water monitoring programme for Mount Thorley Warkworth.

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[1]
OH 786	Q	Q	Q	A
OH 787	Q	Q	Q	A*
OH 788	Q	Q	Q	A
OH 942	Q	Q	Q	A*
OH 943	Q	Q	Q	A
OH 944	Q	Q	Q	A
OH1121	Q	Q	Q	A
OH1122(1)	Q	Q	Q	A*
OH 1125(1)	Q	Q	Q	A*
OH 1125(3)	Q	Q	Q	A*
OH 1126	Q	Q	Q	A
OH 1127	Q	Q	Q	A
OH 1137	Q	Q	Q	A
OH 1138(1)	Q	Q	Q	A
OH 1138(2)	Q	Q	Q	A
WOH2139A	Q	Q	Q	A*
WOH2153A	Q	Q	Q	A
WOH2153B	Q	Q	Q	A
WOH2154A	Q	Q	Q	A
WOH2154B	Q	Q	Q	A
WOH2155A	Q	Q	Q	A
WOH2155B	Q	Q	Q	A
WOH2156A	Q	Q	Q	A
WOH2156B	Q	Q	Q	A
WOH2141A	Q	Q	Q	A
PZ7D	Q	Q	Q	A
PZ7S	Q	Q	Q	A
PZ8D	Q	Q	Q	A
PZ8S	Q	Q	Q	A
PZ9D	Q	Q	Q	A
PZ9S	Q	Q	Q	A
GW9706	Q	Q	Q	A
GW9707	Q	Q	Q	A

GW9708	Q	Q	Q	A
GW9709	Q	Q	Q	A
GW98MTCL1	Q	Q	Q	A
GW98MTCL2	Q	Q	Q	A
PZ2 (VWP)	Q			
WD609A (VWP)	Q			
WD615 (VWP)	Q			
WD625 (VWP)	Q			
WD625P	Q	Q	Q	A
WD622 (VWP)	Q			
WD622P	Q	Q	Q	A
MTD616 (VWP)	Q			
MTD616P	Q	Q	Q	A
MTD613 (VWP)	Q			
MTD605 (VWP)	Q			
MTD605P	Q	Q	Q	A
MTD614 (VWP)	Q			
MTD614P	Q	Q	Q	A
MTD518 (VWP)	Q			
MB15MTW01S	Q	Q	Q	A
MB15MTW01D	Q	Q	Q	A
MB15MTW02S	Q	Q	Q	A
MB15MTW02D	Q	Q	Q	A
MB15MTW03	Q	Q	Q	A
MB15MTW04	Q	Q	Q	A
MB15MTW05	Q	Q	Q	A
MB15MTW06	Q	Q	Q	A
MB15MTW07	Q	Q	Q	A
MB15MTW08	Q	Q	Q	A
MB15MTW09	Q	Q	Q	A
MB15MTW10	Q	Q	Q	A
MB15MTW11	Q	Q	Q	A
MBW01	Q	Q	Q	A
MBW02	Q	Q	Q	A
MBW03	Q	Q	Q	A
MBW04	Q	Q	Q	A
MBW6A	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.

*=Comprehensive analysis also includes: Mo, V and Cr

(VWP) denotes vibrating wire piezometer.

Q – Quarterly, A - Annual

Baseline Data & 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 percentile maximum value and the 5th percentile minimum value from data collected since 2011. Trigger levels have been set on the basis of geographical proximity and target stratigraphy.

Bores not listed in Table 2 below do not have 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 sufficient data becomes available.

The response to trigger levels is detailed in Mount Thorley Warkworth Water Management Plan 2018.

Table 2: Groundwater Trigger Limits

Sample Point	Target Seam	Electrical Conductivity	pH	
		95th	5th	95th
OH 786	Hunter River Alluvium	950	6.8	7.7
OH 787	Hunter River Alluvium	18185	7.2	7.7
OH 942	Hunter River Alluvium	25380	6.4	7.0
OH 943	Hunter River Alluvium	8415	7.1	7.6
OH 788	Hunter River Alluvium	11742	7.0	7.9
PZ8S	Wollombi Brook Alluvium	15126	6.5	7.0
PZ9S	Wollombi Brook Alluvium	16202	6.8	7.0
PZ7S	Aeolian Warkworth Sands	1752	6.7	7.5
GW9706	Bayswater	22991	6.6	7.5
GW9707				
GW9708				
GW9709				
GW98MTCL1				
GW98MTCL2				
OH 1127				
OH1125(3)	Bowfield Seam	14696	6.6	7.0
OH1122 (1)	Blakefield	15161	6.6	7.6
WOH2139A				
OH1125(1)				
WOH2153A	Redbank	16123	7.0	7.9
WOH2154A				
WOH2155A				
WOH2156A				
MTD614P	Shallow Overburden	17490	6.9	8.1
MTD616P				
MTD605P				
PZ7D				
MBW02				
MB15MTW01D				
MB15MTW02D				
MB15MTW03				
PZ8D				
PZ9D				
OH 1137	Vaux		6.7	7.1

OH 1126		17745		
OH1121				
WD622P	Wambo	13843	7.2	7.8
WOH2153B				
WOH2154B				
WOH2155B				
MBW04				
WOH2156B				
WD625P	Woodlands Hill	11996	7.1	7.3
OH 1138(2)	Warkworth	19657	6.3	7.0
OH 1138(1)				

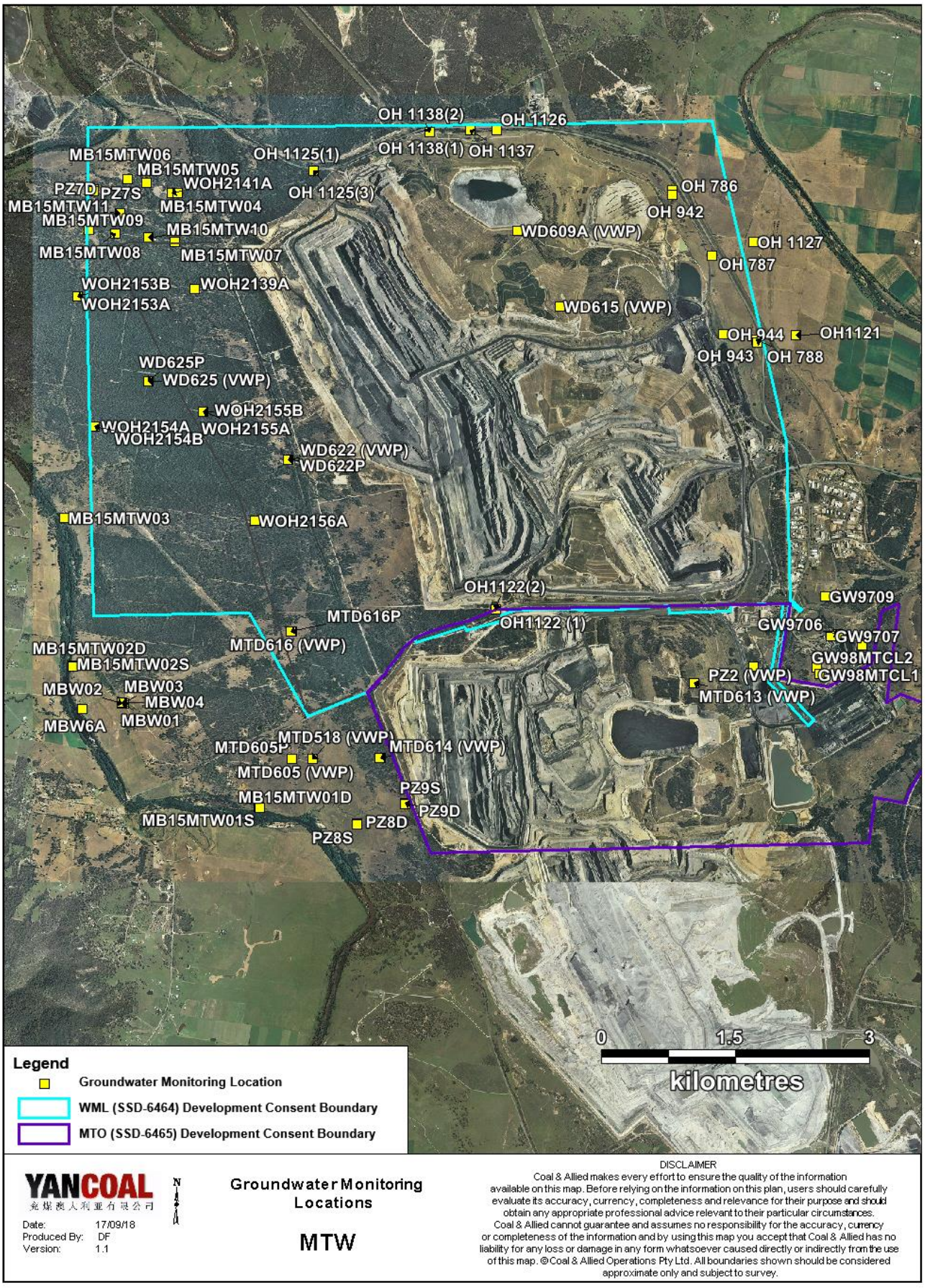

Figure C2: MTW Groundwater Monitoring Plan