



**SUNNYSIDE COAL PROJECT
ENVIRONMENTAL
MANAGEMENT SYSTEM**

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WHC_PLN_SUN_WATER MANAGEMENT PLAN

WATER MANAGEMENT PLAN



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ACRONYMS USED THROUGHOUT THIS DOCUMENT

ANZECC	-	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
DP&E	-	Department of Planning and Environment
DPI-Water	-	Department of Primary Industries - Water
EA	-	Environmental Assessment
EC	-	Electrical Conductivity
EMS	-	Environmental Management System
EPA	-	Environment Protection Authority
EPL	-	Environment Protection Licence
ESCP	-	Erosion and Sediment Control Plan
GWMP	-	Groundwater Monitoring Program
LDP	-	Licensed Discharge Point
ML	-	Mining Lease
NMPL	-	Namoi Mining Pty Ltd
NATA	-	National Association of Testing Authorities
PA	-	Project Approval
SWL	-	Standing Water Level
SWMP	-	Surface Water Monitoring Program
WAL	-	Water Access Licence
WMP	-	Water Management Plan



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1 INTRODUCTION

This Water Management Plan (WMP) has been prepared in accordance Conditions 3(22) to 3(27) of Project Approval (PA) 06_0308 for the Sunnyside Coal Project (Sunnyside). Sunnyside is operated by Namoi Mining Pty Ltd (NMPL), a subsidiary company of Whitehaven Coal Limited. Mining operations at Sunnyside were suspended in late November 2012 and recommenced in late 2017. This document considers the area of land corresponding to the project site boundary for Sunnyside, referred to as the “mine site”.

As illustrated in Figure 1, Sunnyside is located approximately 15km west of Gunnedah. The project layout is shown in Figure 2.

The WMP was originally prepared by NMPL with assistance from Colin Davies (Carbon Based Environmental) and Andrew Dawkins (Geoterra) as the suitably qualified experts in relation to surface and groundwater assessment.



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LEGEND

- National Park
- Nature Reserve
- State Conservation Area
- Aboriginal Area
- NSW State Forest
- Local Government Area Boundary
- Mining Lease Boundary
- Mine Site
- Mine Project

Source: Geoscience Australia (2006), NSW Department of Premier and Cabinet, Office of Environment and Heritage (2011) and Minerals NSW (2012)

WHITEHAVEN COAL
SUNNYSIDE COAL MINE
 Regional Location

Figure 1 - Regional Location



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Figure 2 - Project Layout



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2 SITE WATER BALANCE

2.1 Sources and Security of Water Supply

The primary objective in managing the quantity of water captured/discharged on the mine site is to ensure sufficient water is captured to meet the operational requirements of the proposal. The capture of dirty water is maximised such that clean water captured and used by the mine remains within the maximum harvestable right for the mine site.

Based on the harvestable rights for the project site, NMPL could capture and use 26.32MLpa of clean surface water. NMPL also holds WAL 29537 that licences the extraction of up to 120ML of groundwater in any given calendar year.

The water required by the Project when operational is between 75 and 100ML/yr depending on the seasonal conditions. To date the harvestable right for the project has provided part of the water requirement with the remaining maximum water requirement for the project 73.68ML being obtained from a combination of the following sources:

- Capture of dirty water which flows over exposed surfaces within the Project Site.
- Extraction of groundwater from one or more existing or constructed bores on and/or offsite.
- From groundwater and surface water retained within the mine void. None of these sources has been assessed as part of the Project Site maximum harvestable right.

2.2 Water Use Onsite

Water use on site is limited to dust suppression, ablutions and potable supply. Ablutions and potable water are trucked in from off site. Operational water needs are preferentially sourced from the on-site sediment basins and surface and groundwater flows into the open cut, with water sourced from offsite if required.

2.3 Water Management Onsite

For management purposes, the water within the mine site has been divided into four classes: clean water, dirty water, contaminated water, and pit water.

Water that has come into contact with coal (coal contact water) may be contaminated with dissolved salts and metals. Following advice from the EPA, Sunnyside has identified that dirty water dams SB4, SB5 and SD4 (licensed discharge point) may contain coal contact water runoff. As such, these dams have been reclassified as “dirty water dams with potential coal contact water”. This change in interpretation is as directed by the Department of Planning & Environment (DP&E dated 24th October 2014) and EPA (EPA dated 13th October 2014, EPA dated 21st August 2015) despite the previous approvals PA 06_0308 and EPL 12957 approving the coal stockpile catchments to be within dirty water discharge catchments.



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As directed by the EPA (EPA letter dated 21st August 2015), where runoff from coal contact areas is captured in storage dams designed for sediment control, Sunnyside will need to establish whether the discharge from SD4 contains pollutants that pose a risk of non-trivial harm to human health and/or the environment. As directed by the EPA, trivial versus non-trivial pollutant concentrations can be defined with reference to the default trigger values for toxicants and physical/chemical stressors in the ANZECC (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. If a pollutant exceeds the relevant trigger value, it can be considered that it poses a risk of non-trivial harm to human health and/or the environment.

At this stage there is insufficient water quality data available for SD4 to make an assessment against the ANZECC trigger values and to ascertain the risk associated with regard to the impact of coal contact water discharged from Sunnyside on human health or the receiving environment. Sunnyside will implement a monitoring program to address this data deficiency.

It is not possible to provide a definitive timeline to gather sufficient data for a robust analysis of the potential impact of coal contact water. Notwithstanding this, once sufficient data becomes available and on completion of detailed analysis, Sunnyside will consult with the EPA in regard to the outcomes of the monitoring.

2.3.1 Clean Water

The diversion of clean waters away from disturbed areas reduces the potential for erosion and contamination. Diversion, collection and storage of “clean” water has been achieved using a series of diversion banks, waterways and storage dams which were constructed prior to surface disturbance activities within the adjacent upslope catchments.

The clean water catchment area south of the open cut area has been directed around the most easterly edge of the open cut area, such that no clean water enters the open cut.

The design for all structures has been consistent with the requirements of *Managing Urban Stormwater, Soils and Construction Manual* (Landcom 2004), or its latest version.

All structures will be inspected following significant storm events of >25 mm in 24 hours to ensure the structures have been able to sustain those flow velocities.

2.3.2 Dirty Water

Dirty water structures collect water that may have suspended solids concentrations that would be outside the range of those prescribed by EPA guidelines, presented in Table 1.

Table 1 – Discharge Parameter Limits

Parameter	100 th Percentile Limit
pH	6.5 to 8.5
Suspended Solids (mg/l)	≤ 50
Total Oil and Grease(mg/l)	≤ 10



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Catch banks/drains have been constructed to divert potentially sediment-laden waters into sediment basins below sites that can potentially generate significant quantities of sediment laden water.

The sediment basin locations are presented in Figure 3. They store and settle out potentially sediment laden waters.

Sediment basins are managed to ensure retention of sufficient capacity to reduce the potential for discharge off site. The management practices to be employed to ensure this is achieved are as follows:

- Preferential sourcing of dirty water for dust suppression purposes. Preference is given to sourcing water from the discharge points. Each discharge dam has a water level gauge for monitoring water levels.
- Each sediment basin will have a marker indicating 25% sediment storage capacity level, to enable clean out of basins upon reaching that storage mark.
- Regular water quality analysis to assess effectiveness of sediment system. Where sediment levels are determined to be at greater levels than discharge limits, consideration will be given to ameliorative measures including use of flocculants, and increase in sizing or additional sediment basin construction.

As recommended in the Blue Book Landcom guidelines, sediment basin capacity has been calculated on a 90thile 5 day storm event. Application of this measure results in an overall required sediment basin capacity of 35.3ML.

Calculation of settling zone volume, storage zone volume and total basin volume for the dirty water catchment is presented in Table 2.



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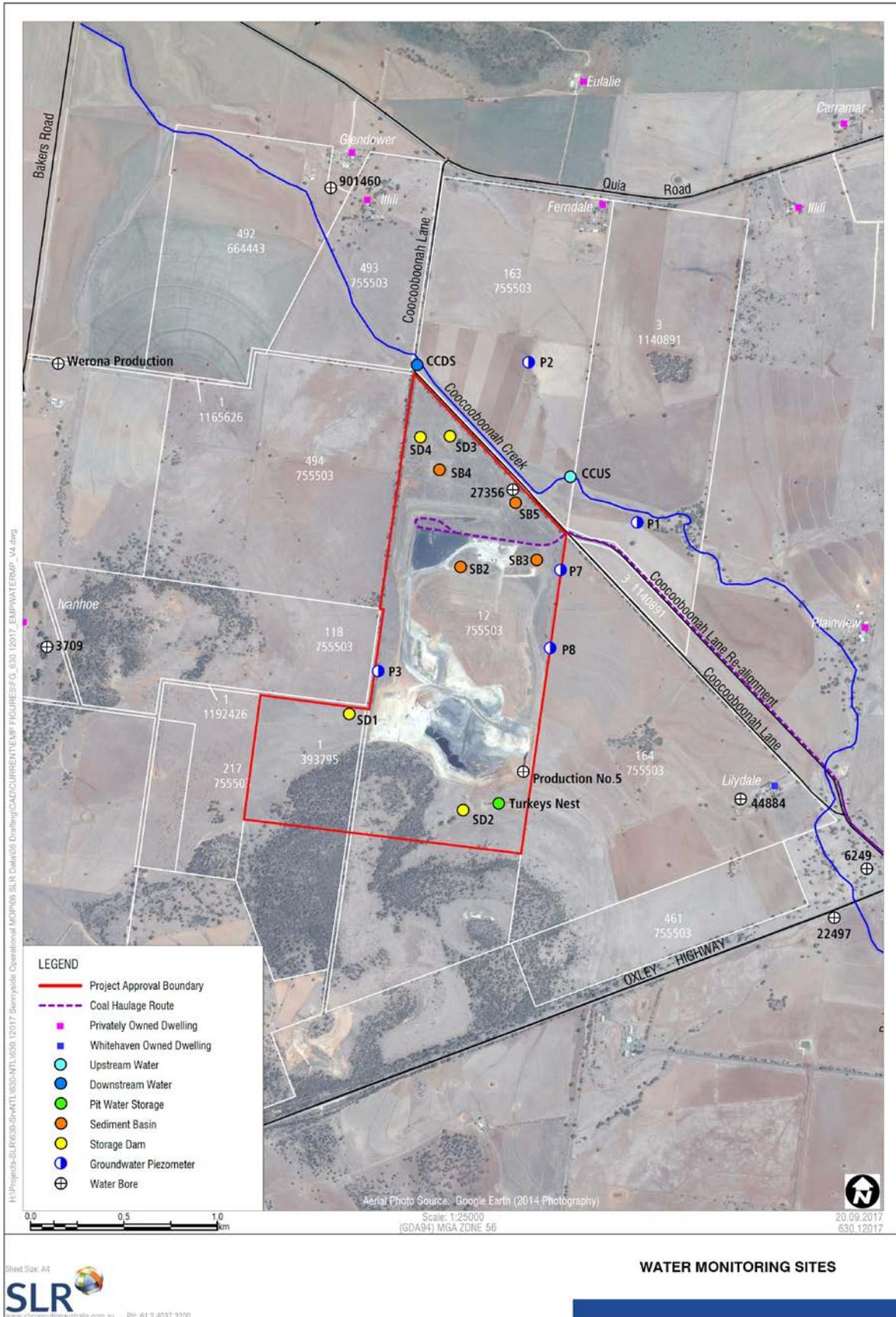


Figure 3 - Water Management Structures and Monitoring



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Table 2 - Sediment Basin Design Capacity (90%ile 5 day storm event)

Site	Volumetric runoff coefficient	Rainfall depth (mm)	Total Catchment Area (ha)	Settling Zone Volume (ML)	Sediment Storage Volume (12 month) (ML)	Total Basin Volume (ML)
Disturbed dirty water area	0.64	39	109	26.8	8.5	35.3

This quantity of water can be captured in any number of basins of suitable dimensions that totals 35.3ML capacity. The indicative catchment areas and available volumes of sediment basins are shown in Table 3.

Table 3 - Sediment Basin Catchment Areas and Available Volumes

Structure ID	Catchment Area Total contributing (ha)	Available Volume (m3)
SB2	40	7,200
SB3	20	6,700
SB4	70	10,300
SB5	90	7,000
Total Volume	-	31,200

The final sediment basin in the chain, SB4, spills into SD3 and SD4 which have a combined available volume of 19.3ML. This capacity ensures there is always storage basins with capacity greater than 35.3ML to achieve the 90th %ile 5 day event criteria.

2.3.3 Contaminated Water

Water containing hydrocarbons may be generated from areas such as:

- Any fuel, oil and grease storage,
- Maintenance workshop and
- Refuelling bays.

These areas are managed by the following means.

- All water from these areas would be directed to oil separators and/or containment systems for subsequent removal.
- Storage tanks would have an impermeable surface and bunding so as to contain at least 110% of the storage capacity of the largest tank.
- All hydrocarbon products are securely stored.

2.3.4 Pit Water

Pit water is managed in pit or in pit water surface storage onsite.

The Sunnyside EA 2008 stated that two turkey's nest dams would be constructed for pit water. However, due to the lower quantity of pit water encountered during operations



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(compared to EA predictions) the construction of only one turkey's nest dam has been required. At this stage there is no intention to construct the second turkey's nest dam.

Pit water is used for dust suppression.

2.3.5 Site Water Balance

A site water balance was prepared prior to initial mining to assess whether sufficient surface water was available for capture onsite during dry years for the water requirements outlined, and if significant discharge would be required in wet years.

NMPL obtain the bulk of the mine water supply from pit inflows which were predicted to average 374ML/year. These predicted pit inflows did not occur, and the expected need for discharge of surface water from the Project Site under all types of rainfall years given such pit inflow has not eventuated.

The water balance was reviewed in 2017 using Goldsim, with the following conclusions:

- The water management system has the capacity to be operated to meet the system water management requirements of the site;
- Rainfall runoff captured in the sediment and pit water dams would provide for the majority of water demand in the dry, median and wet years;
- Water will be required from external sources during some years to supplement water supply. The water balance simulation suggests that the 120ML available in existing water licenses will be sufficient to meet operational demands during periods of drought.
- All pit water will be contained on-site;
- Wet weather overflows over the 117 year period assessed in the model are typically associated with a substantial rainfall event in a short period of 1 to 2 days and preceding periods of high precipitation during which there is insufficient capacity to lower water storage levels by controlled means.

2.4 Measures to Minimise Water Use

Whilst the site has access to water via the means described above, operations are managed to minimise water use on the project site as much as possible. The measures adopted to assist include:

- Minimising the extent of exposed surfaces as much as possible;
- Regular road maintenance in pit to minimise dust lift off from dump truck operations;
- Minimise number of vehicular access points on site to reduce potential for dust lift off;
- Targeting of areas most conducive to dust lift off by site water cart;
- Sealing site access road and coal transport route;



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- Standing down from operations during significantly dry and windy conditions where site water carts are ineffective in controlling dust lift off;
- Progressive rehabilitation of construction areas including road verges, drainage paths, site facilities areas to establish groundcover and reduce potential for dust lift off;
- Progressive rehabilitation of waste emplacements to establish groundcover and reduce potential for dust lift off; and
- Ongoing monitoring of site conditions to determine any additional requirements which may include consideration to application of dust suppression agents in site water to provide for enhanced dust minimisation and water saving techniques.

2.4.1 Water Balance Review

A review of the site water balance will be undertaken on an annual basis.

3 EROSION AND SEDIMENT CONTROL PLAN

3.1 Introduction

In accordance with Schedule 3, Condition 24 of PA 06_0308, this Erosion and Sediment Control Plan (ESCP) is consistent with the requirements of the Department of Housing's *Managing Urban Stormwater: Soils and Construction Manual* (Landcom, 2004), or its latest versions. All erosion and sediment control structures have been constructed or erected in accordance with the recommendations identified in the relevant standard drawing and construction notes of Landcom (2004).

3.2 Sources of Erosion and Sedimentation

During operations, erosion and sedimentation could potentially result directly or indirectly from:

- Surface water runoff from areas disturbed in advance of, and during mining;
- Surface water runoff from topsoil, subsoil and overburden stockpiles and emplacements prior to rehabilitation;
- Surface water runoff from the coal processing area;
- Surface water runoff from rehabilitated areas prior to full stabilisation;
- Discharges of water at erosive velocities; and
- Runoff from roads at erosive velocities.

Surface runoff from areas prior to their final rehabilitation is considered the primary potential source of erosion and sedimentation during care and maintenance.



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3.3 Erosion and Sediment Control Measures

Although all structures have been designed in accordance with the requirements of *Managing Urban Stormwater, Soils and Construction Manual* (Landcom 2004) or its latest version, the following additional procedures and management practices will be implemented to further reduce the risk of erosion and sedimentation.

- Any structure required to control erosion and sedimentation, including temporary structures, will be constructed or installed prior to the commencement of activities in that area;
- Areas on the mine site without some form of vegetation cover will be minimised;
- As part of a surface water monitoring program, water flowing from the nominated discharge points will be sampled for suspended sediments; and
- All surface water flows from flumes will flow to sediment basins.

3.4 Erosion and Sediment Control Structures

As the final landform is created, additional erosion controls such as contour banks and rock or grass-lined flumes, will be progressively constructed.

The contour banks on the sloped surfaces of the final landform direct surface water flows to a number of flumes which control the flow of water off the constructed final landform and therefore assist in reducing erosion and maintaining the long term stability of the landform.

It is the preference of NMPL to construct the flumes with a grass substrate. However, if rock flumes are deemed more appropriate, these will be constructed with >80% of rock with a diameter of at least 200mm and to the following design.

- Channel width >1m.
- Bank height >500mm
- Channel parabolic in shape
- Excavated batters of 1:4 (V:H) or shallower.

All design works for erosion and sediment control are in accordance with the requirements of *Managing Urban Stormwater, Soils and Construction Manual* (Landcom 2004) or its latest version.

3.5 Monitoring and Maintenance of Erosion and Sediment Control Structures

The erosion and sediment control structures (including temporary structures) as well as areas previously identified as exhibiting erosion and treated to prevent further erosion will be inspected monthly, or after a rainfall event of >25mm/24hr, to assess their success in preventing erosion, identify signs of potential erosion and determine the retained capacity, especially within the sediment basins.



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The erosion and sediment control structures will be cleaned of accumulated sediment material (or extended or replaced) as soon as practicable when 25% capacity is lost due to the accumulation of material such that the specified capacities are maintained.

If, following heavy rain, erosion is identified on the final rehabilitated landform, it will be remediated using one or a combination of the following:

- Filling the erosion channels
- Cross-ripping (along the contour) to assist infiltration
- Installation of additional controls, eg banks sown with a non-persistent cover crop.

4 SURFACE WATER MONITORING PROGRAM

4.1 Introduction

This Surface Water Monitoring Program (SWMP) has been prepared in accordance with Schedule 3, Condition 25 of PA 06_0308 and includes:

- Provision of baseline data on surface water flows and quality in adjoining creeks and that could be affected by the project;
- Surface water impact assessment criteria;
- A program to monitor the impact of the project on surface water flows and quality; and
- Procedures for reporting the results of this monitoring.

4.2 Baseline Surface Water Quality

Baseline studies of field pH and electrical conductivity measurements were recorded in 2008 for the Environmental Assessment. Essentially, the surface water has low electrical conductivity and above neutral pH. Detailed baseline data on surface water flows and quality in creeks and other water bodies that could be affected by the project is presented in the project Environmental Assessment (2008).

4.3 Surface Water Impact Assessment Criteria

4.3.1 Environment Protection Licence

Impact assessment criteria for surface water are only relevant to water actually discharged from the site. EPL 12957 contains two Licence Discharge Points (LDPs) for wet weather discharge. The concentration limits set in EPL 12957 for both discharge locations are presented in Table 4.



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Table 4 - Concentration Limits for Licenced Discharge Points

Pollutant	Unit of Measure	100 th percentile Concentration Limit
Oil and Grease	mg/L	10
pH	pH	6.5 – 8.5
Total Suspended Solids	mg/L	50*

* The total suspended solids concentration limits may be exceeded for water discharge provided that:

- The discharge occurs solely as a result of rainfall measured at the premises that exceeds 38.4 mm over any consecutive 5 day period immediately prior to the discharge occurring; and
- All practical measures have been implemented to dewater all sediment dams within 5 days of rainfall such that they have sufficient capacity to store rainfall runoff from a 38.4 mm, 5 day rainfall event.

Whilst there are no concentration limits for Conductivity and Total Organic Carbon, these parameters also have to be monitored at the LDPs. There are no volumetric limits on the LDPs.

4.3.2 ANZECC Guidelines

Downstream and upstream water quality monitoring results are assessed, for each monitoring event, against key default trigger values presented in Table 5 and sourced from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000).

Table 5 - Key Default Trigger Values for Slightly Disturbed Upland NSW Rivers (ANZECC 2000)

Indicator	Trigger Value
pH	6.5 – 8.0
Conductivity (µS/cm)	30 - 350
Turbidity (NTU)	2 - 25
Total Phosphorus (µg/L)	20
Total Nitrogen (µg/L)	250
Dissolved Oxygen (% saturation)	90 -100%
Aluminium (mg/L)	0.055
Cadmium (mg/L)	0.0005 ¹
Copper (mg/L)	0.004 ¹
Lead (mg/L)	0.014 ¹
Nickel (mg/L)	0.028 ¹
Zinc (mg/L)	0.020 ¹

1. Range based on lower 85% saturation limit and typical water temperature range 13- 20°C

2. Trigger values for the slightly disturbed lowland river aquatic ecosystems

3. Modified trigger levels, factored based on typical moderate water hardness (60-119 mg/L as CaCO₃)

Whitehaven adopts the concentration limits for discharge waters stated in EPL 12957 as the assessment criteria for pH and Total Suspended Solids (TSS) as opposed to the ANZECC Guidelines.



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In the event of trigger values for any of the indicators included in Table 5 being reached, a review of upstream water quality results will be undertaken, along with a general review of the water management practices undertaken on site, to determine whether exceedances relate to background water quality or site impact.

4.4 Surface Water Monitoring

NMPL has implemented a surface water monitoring program to enable appropriate auditing and management of surface water quality. The frequency of monitoring reflects the parameters to be monitored, the locations to be monitored and the potential for environmental impact. Table 6 presents the monitoring schedule to be implemented.

Table 6 - Surface Water Monitoring Schedule

Location	Parameter	Frequency
Storage Dams SD3 and SD4	Electrical Conductivity, pH, Total Suspended Solids, Oil and Grease, Total Organic Carbon	Once when discharging water
Pit Void water	Electrical Conductivity, pH, Total Suspended Solids, Oil and Grease, Total Organic Carbon, Total Metals, Nutrients	Annually Prior to discharge into underground workings
Upstream and downstream of the Project Site's runoff into Coocooboonah Creek.	Electrical Conductivity, pH, Total Suspended Solids, Oil and Grease, Total Metals, Nutrients, Total Organic Carbon.	Once discharging from the site

Total Metals will include Iron (Fe), Copper (Cu), Zinc (Zn), Lead (Pb), Arsenic (As), Cadmium (Cd), Aluminium (Al), Mercury (Hg), Molybdenum (Mo), Manganese (Mn) and Nickel (Ni). Nutrients will include Total Phosphorus and Total Nitrogen.

The monitoring results are reviewed on an annual basis and review will occur over time to determine relevancy of monitoring locations and parameters.

4.5 Reporting of Monitoring Results

The results of water quality analysis will be reported in the Annual Review.

5 GROUNDWATER MONITORING PROGRAM

5.1 Introduction

This Groundwater Monitoring Program (GWMP) has been developed in accordance with Schedule 3, Condition 26 of PA 06_0308, and includes a Groundwater Contingency Plan (refer section 7), as required by Schedule 3, Condition 27 of PA 06_0308.



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5.2 Groundwater Model

Golder Associates Pty Limited (Golders) undertook groundwater modelling to assess the likely impact of Sunnyside on the local groundwater.

The report of their assessment is included as Appendix 5 in GeoTerra (2008) and the following summarises the relevant information from their study. GeoTerra (2015) concluded that *“Groundwater monitoring conducted since 2008 during the operational life of the Sunnyside Coal Mine supports the predictions of the 2008 Groundwater Assessment (e.g. limited change in groundwater levels and no impacts at private bores).”*

Post Mining Pit Void Water Levels

The combined groundwater inflow and surface water capture in the pit would not generate a pit void lake, as there is insufficient inflow to raise the pit water level above the proposed basal level of 305m AHD.

Potential Impact on Local Streams

It is not anticipated that stream flow in Coocooboonah Creek or Rock Well Creek would be affected by mining as the cone of groundwater depression from the void does not extend as far as the creek channels.

Potential Impact on the Namoi River and its Associated Alluvial Groundwater Resources

Groundwater drawdown from mining the proposed Sunnyside Pit would not extend significantly into or within the alluvium of Coocooboonah Creek, and would not extend into the alluvium of Native Cat Creek, Rock Well Creek or tributaries of the Namoi River.

Mining the Sunnyside open cut to date has not affected river flow or groundwater supplies associated with the Namoi River alluvium.

Potential Impact on Groundwater

Dewatering associated with the Sunnyside pit is not anticipated to have an adverse impact on groundwater quality within the Hoskissons Seam, or the strata over or underlying the Seam.

No adverse effect is anticipated on the surface water quality in Coocooboonah Creek and other streams due to groundwater movement as the Sunnyside cone of depression does not extend as far as the creek channel. Depressurisation in the basement strata under or near the creek is not anticipated due to the isolated dewatering of the Hoskissons Seam.

No adverse effect is anticipated on water quality within Rock Well Creek as depressurisation of the Hoskissons Seam is not anticipated to sufficiently propagate up through strata above the Hoskissons Seam to the creek bed.

Potential Salt and Contaminant Migration Pathways

It is not anticipated that an increase in salinity levels in Coocooboonah Creek would occur due to leakage of groundwater out of the proposed pit or abandoned underground working. This is a result of the pit forming an inward cone of depression and the underground workings to the south being mostly dry.



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It is also anticipated that no contaminants would be transported off site via the groundwater system due to the inward flowing cone of depression. Off-site migration of contaminants via the surface water system should be contained within the mine dirty water system.

Potential Impacts on Groundwater-Dependent Ecosystems

No groundwater-dependent ecosystems (GDEs) have been identified within the site, and therefore there are no anticipated adverse effects on GDEs in the study area.

Private Bore and Well Groundwater Levels, Yield and Quality

A total of 24 stock and domestic bores, one irrigation bore and eight piezometers are registered within a 3km radius of the Sunnyside open cut as shown in Table 7.

These bores have yields ranging up to 0.9L/sec. The depth of the stock and domestic bores range from 12.2m to 85.3m. Three bores (GW27356, 45097 and 45098) are on the "Sunnyside" property.

The registered bores directly west and southwest of the proposed open cut pit have their water supply intakes located stratigraphically above the Hoskissons Seam, those to the west of and down dip of the subcropping Hoskissons Seam generally obtain supplies from either or both the Hoskissons and Melville Seams, whilst those to the east of the Hoskissons Seam Subcrop generally obtain water from the Upper and or Lower Melville Seams.

Table 7 - Registered Bore Data

Bore	Registered Use	Drilled	Depth	Water Intersection	Drilled Standing Water Level	Yield	Aquifer Intake
INTAKE ABOVE HOSKISSONS COAL SEAM							
3706	Stock	1940	15.2	9.1 / 13.4-15.2	6.4	0.4	Sandstone
3709	Stock	1940	37.5	36.6	19.2	0.46	Shale
3715	Stock	1940	45.1	30.5 / 42.1	? / 28.7	0.04 / 0.2	Shale / sandstone
8810	Stock?	N.A.	53.3	N.A.	N.A.	N.A.	N.A.
15665	Stock	1957	24.4	15.8-16.1	12.2	0.03	Basalt
16789	Stock	1961	23.2	16.8-17.1 / 18.9-21.3	12.2/12.2	0.06 / 0.51	Conglomerate
901803	Stock Domestic Irrigation	N.A.	58	N.A.	N.A.	N.A.	N.A.
966680	Piezometer	1990	5.4	N.A.	N.A.	N.A.	N.A.
966681	Piezometer	1990	2.1	N.A.	N.A.	N.A.	N.A.
967523	Stock domestic	1997	42.36	N.A.	N.A.	N.A.	N.A.
INTAKE WITHIN HOSKISSONS COAL SEAM							
22497	Stock	1965	45.7	28.7-32.1	24.4	0.25	? / coal
44677	Stock Domestic	1926	75.9	N.A.	15.2	N.A.	? / coal
45098	Stock Domestic	1965	44.2	26.5 / 39.6-40.8	N.A.	N.A.	? / coal
INTAKE BENEATH HOSKISSONS COAL SEAM AND / OR WITHIN MELVILLE COAL SEAM							
6249	Stock	N.A.	70.7	68.9	20.7	0.25	Sandstone / coal
17082	Stock	1947	24.4	N.A.	N.A.	N.A.	? / coal
27356	Stock	1966	35.4	27.1 / 31.4-33.5	27.1 / 24.7	0.01 / 0.63	Shale / coal



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44580	Stock Domestic	1977	34.0	N.A.	18.0	N.A.	? / coal
44581	Stock Domestic	1977	35	N.A.	18.0	N.A.	? / coal
44884	Stock domestic	?	73.2	N.A.	N.A.	N.A.	? / coal
44885	Domestic	1976	36.6	N.A.	15.3	N.A.	? / coal
45013	Stock	?	76.2	N.A.	N.A.	N.A.	? / coal
45061	Stock	N.A.	84.1	N.A.	N.A.	N.A.	? / coal
45044	Stock domestic	1942	34.1	14.6 / 34.1	N.A.	N.A.	? / coal
45045	Stock	1965	62.5	61	N.A.	N.A.	? / coal
45097	Stock Domestic	1934	85.3	54.9 / 85.3	N.A.	N.A.	? / coal
48701	Stock Domestic	1978	61.0	N.A.	45.7	0.51	? / coal
901460	Stock Domestic	1920	34	N.A.	16.0	N.A.	? / coal

Note: N.A. DPI-Water data not supplied Shading indicates bore in use as at 2008

Source: GeoTerra (2008) – Table 1

The 27 bores and piezometers were all installed between 1920 and 1997 with groundwater generally extracted by low flow windmills, and to a lesser degree, submersible pumps.

Five of the 27 bores and the two piezometers are no longer used. Of the remainder, 14 are low, variable yield windmills, and 6 obtain water by submersible pumps.

Water quality ranges from 6.61 to 9.37pH and 1,704µS/cm to 8,440µS/cm electrical conductivity.

All water is extracted from the fractured basement aquifers, with no inspected bores obtaining groundwater from the alluvium of Coocooboonah Creek or Rock Well Creek.

The majority of groundwater in the Rock Well Creek catchment is obtained from basement fractured rocks rather than valley fill alluvium. Standing water levels ranged from 4.9m to 28.7m below surface.

5.3 Groundwater Chemistry

DPI-Water data presented in GeoTerra (2008) shows that groundwater in the Sunnyside area has low to moderate salinity within the basement fractured rock aquifers, with electrical conductivity values of between 510µS/cm and 10,080µS/cm and pH between 3.81 and 8.7. The Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000) (ANZECC) guidelines for stock watering (cattle) are used when reviewing groundwater quality results.

5.4 Groundwater Flow

Due to its confined nature and 2° to 3° dip to the south and west of the pit, groundwater flow within the Hoskissons Seam is down dip along the seam to the southwest, into the hills, with a modification due to topographical effects to the east giving an overall south-easterly flow direction within the pit area.

Groundwater flow in the combined, underlying Shallow Marine Formation, Melville Seams and Lower Delta Plain Facies is to the northwest, which is in the opposite direction to the Hoskissons Seam and conforms to the influence of topography.

The flow pattern represents a combination of:



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- Recharge within the hills to the southwest of the open cut, with gravity driven flow from the hills to the valleys;
- Flow down dip in confined lithologies to the southwest, with modification for topographical effects; and
- Unconfined flow to the northeast then north-northwest along the Coocooboonah Creek and Rock Well Creek valleys.
- Flow within the area would also be modified by the effect of strata dislocation from faulting;
- Possible flow along higher permeability faults; and
- The reduction in Hoskissons Seam and overburden permeability due to the presence of weathered doleritic sills and dykes.

5.5 Groundwater Monitoring Program

A groundwater monitoring program has been conducted since October 2006. The proposed monitoring program is outlined in Table 8.

All bores used for groundwater monitoring are licensed.

5.5.1 Groundwater Levels and Groundwater Quality

The monitoring program has emphasis on capturing data from piezometers and bores located in the vicinity of surface water systems, open cut pit, abandoned underground workings, and the predicted drawdown area.

Bores are measured for Standing Water Level (SWL), field pH and electrical conductivity (EC) on a quarterly basis. Groundwater samples are collected on a six monthly basis and analysed for major ions (TDS, Na, K, Ca, Mg, Cl, HCO₃, NO₃, SO₄ and hardness) and selected filtered (0.45µm) metals including Iron (Fe), Copper (Cu), Zinc (Zn), Lead (Pb), Arsenic (As), Cadmium (Cd), Aluminium (Al), Mercury (Hg), Manganese (Mn), Boron (B), Barium (Ba), Beryllium (Be), Cobalt (Co), Chromium (Cr), Nickel (Ni), Selenium (Se), Vanadium (V), at a NATA registered laboratory.



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Table 8 - Groundwater Monitoring Program

Location	Parameters
Coocooboonah Ck Alluvium Bores P1 and P2	Manual SWL, field pH, EC Detailed Analysis
Hoskisson Coal Seam Bore P3	Manual SWL, field pH, EC Detailed Analysis
Shallow Marine Facies and Melville Seam Bores P7 and P8	Manual SWL, field pH, EC Detailed Analysis
Potential Drawdown Bore intake above Hoskisson Seam Bore 3709 Ivanhoe	Manual SWL, field pH, EC Detailed Analysis
Potential drawdown intake within Hoskisson seam Bores 22497 Coocooboonah and 44677 (and production bore) "Werona"	Manual SWL, field pH, EC Detailed Analysis
Potential drawdown intake beneath Hoskisson seam or within Melville seam Bores 44884 and 6249 "Lilydale"	Manual SWL, field pH, EC Detailed Analysis
Bores 27356, 45061, and 901460	Manual SWL, field pH, EC Detailed Analysis

The monitoring results are reviewed on an annual basis and review will occur over time to determine relevancy of monitoring locations and parameters.

5.6 Reporting of Monitoring Results

The results of water quality analysis will be reported in the Annual Review.

6 GROUNDWATER CONTINGENCY PLAN

6.1 Introduction

This Groundwater Response Plan describes the response procedures for managing groundwater if or when trigger levels are exceeded, in accordance with relevant statutory requirements. This Groundwater Response Plan provides procedures for exceedance of trigger levels, complaints from nearby users, and measures for excessive leakage from alluvial aquifers.

The objective of this Groundwater Response Plan is to present a set of procedures to be followed and actions for implementation should the groundwater trigger levels be exceeded.

Impact assessment criteria investigation trigger levels will be set at an overall 3m sustained reduction in monitored groundwater levels in a private bore over a 3 month period. In accordance with Statement of Commitment 7.11, remedial action will be undertaken if the



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available groundwater for existing groundwater users is reduced by over 15% due to mine activities.

6.2 Identification, Notification and Mitigation of Identified Groundwater Exceedances or Non Compliances

Where exceedances to the trigger values occur, the following procedure will be adopted. It should be noted that due to the high variability in data, the trigger levels are reviewed annually to revise and improve the environmental performance of the project over time.

Groundwater exceedance procedure:

1. Check and validate the data which indicates an exceedance of the assessment criteria / trigger level (as soon as possible and within 7 days).
2. Notify NSW Department of Planning and Environment (DP&E) and any other relevant department as soon as practicable (within 7 days after becoming aware of the exceedance).
3. A preliminary investigation will be undertaken to identify the cause and determine whether changes to the groundwater management system are required. This will comprise analysis of the exceedance result, baseline groundwater monitoring, current monitoring results in the vicinity of the exceedance, meteorological conditions of the period, current site activities and adjacent land use activities, including pumping from nearby irrigation bores.
4. A preliminary investigation report of the exceedance is to be prepared and submitted to the DP&E and any other relevant department (within 28 days of the incident).
5. Any further investigations recommended by the preliminary investigation report will be conducted in consultation with DP&E and any other relevant departments (timeframe to be determined in consultation with DP&E).
6. Remedial measures will be developed in consultation with DP&E and any other relevant department and implemented in response to the outcomes of the investigations (timeframe to be determined in consultation with DP&E).
7. In emergency situations water will be supplied to the impacted landholder within 7 days of the exceedance, at least on an interim basis, until investigations are completed.
8. Additional monitoring would be implemented to measure the effectiveness of contingency measures where necessary (timeframe to be determined in consultation with DP&E).

6.3 Procedure to Address Complaints from Nearby Groundwater Users

In the event that a complaint is received from nearby groundwater users, the following procedure will be followed:



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1. Check and validate the nature of the complaint (as soon as possible and within 7 days).
2. If Whitehaven groundwater data shows constant or increased groundwater levels, and it is determined therefore to be unlikely to be attributed to Sunnyside, this advice will be provided to the complainant with no further action. However if levels are consistently dropping across multiple bores, a groundwater specialist will be engaged to review groundwater and climatic data. Where the complaint is potentially attributable to Sunnyside's mining operations, as determined by the groundwater specialist, DP&E and any other relevant department will be notified within 7 days of receipt of the complaint (where practical).
3. An investigation will be undertaken to establish the cause and mitigation measures to improve the groundwater supply to the affected property (within 28 days of complaint).
4. In the event that the investigation identifies an adverse impact to the existing groundwater supply due to Sunnyside operations, Sunnyside will investigate appropriate remedial and contingency measures (timeframe to be determined in consultation with landholder, DP&E and any other relevant department). The details of the contingency measures (including water source) will be determined in consultation and agreement with the affected landholder.
5. In emergency situations water will be supplied to the impacted landholder within 7 days of the exceedance, at least on an interim basis, until investigations are completed.

6.4 Unforeseen Impacts

The potential for unforeseen impacts associated with the continued operation of Sunnyside are generally considered to be quite low, however, in order to protect against any unforeseen environmental impacts associated with groundwater, the following procedure will be followed:

1. Review the unforeseen impact inclusive of any available monitoring data and existing operational activities or catchment activities which may potentially have contributed to the unforeseen impact;
2. An investigation will be commissioned by suitably qualified persons to determine the nature and extent of the impact;
3. Relevant and appropriate ameliorative action measures will be developed based on the results of investigations into the impact;
4. Prepare an action plan in consultation with the appropriate regulatory agency; and
5. Additional monitoring will be implemented where relevant to measure the effectiveness of any improvement measures implemented.



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The implementation of any mitigation measures will be undertaken in consultation with the appropriate regulatory agency and will be reported in the Annual Review.

7 INCIDENTS

Incident reporting will be undertaken in accordance with Conditions 5(3) and 5(4) of PA 06_0308.

8 DOCUMENT REVIEW AND CONTINUOUS IMPROVEMENT

This document will be reviewed in accordance with the requirements of Condition 5(5A) of PA 06_0308.