Whitehaven Coal Mining Pty Ltd

ABN: 65 086 426 253

Water Management Plan

for the

Rocglen Coal Mine

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*To be revised at least every 2 years or following relevant significant changes

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CONTENTS

Acronyms Used Throughout This Plan v
1 Introduction 1
2 SITE WATER MANAGEMENT 2
2.1 Objectives 2
2.2 Surface Water Management Structures 3
2.2.1 Introduction 3
2.2.2 Clean Water Management 3
2.2.3 Dirty Water Management 6
2.2.4 Pit Water Management 11
3 SITE WATER BALANCE 11
3.1 Introduction 11
3.2 Site Water Requirements 12
3.3 Water Availability 12
3.3.1 Maximum Dam Capacity 12
3.3.2 Annual Water Availability 13
3.3.3 Site Water Balance 14
3.4 Water Balance Review 15
3.5 Groundwater – Surface Water Interaction 15
4 EROSION AND SEDIMENT CONTROL PLAN 16
4.1 Introduction 16
4.2 Sources of Erosion and Sedimentation 16
4.2.1 Operations 16
4.3 Erosion and Sediment Control Structures 17
4.4 Erosion and Sediment Control Management 17
5 SURFACE WATER MONITORING PROGRAM 19
5.1 Introduction 19
5.2 Baseline surface water quality 19
5.3 Surface Water Impact Assessment Criteria 21
5.4 Surface Water Monitoring Locations 21
5.5 Monitoring Parameters and Frequency 22
5.6 Reporting of Monitoring Results 23
6 GROUNDWATER MONITORING PROGRAM 23
6.1 Introduction 23
6.2 Groundwater Model 23
6.2.1 Groundwater Seepage Volume 24
6.2.2 Groundwater Drawdown 24
6.3 Groundwater Monitoring 25
6.3.1 Monitoring Locations 25

6.3.2 Monitoring Parameters, Frequency and Procedures 25
6.3.3 Assessment and Reporting 27
7 SURFACE AND GROUNDWATER RESPONSE PLAN 27
7.1 Procedure 27
7.2 Unforeseen Impacts 29
7.3 Review 29
8 REFERENCES 30

TABLES

Table 2.1 - Diversion Bank Specifications 4
Table 2.2 - Waterway Specifications 5
Table 2.3 - Storage Dam Specifications 5
Table 2.4 - Assumptions for Sediment Basin Capacity Calculations 7
Table 2.5 - Catch Bank Specifications 7
Table 2.6 - Sediment Basin Specifications 10
Table 3.1 - Annual Water Requirements 12
Table 3.2 - Annual Catchment Yields 13
Table 3.3 - Mine Site Water Balance 14
Table 5.1 - Local and Project Site Water Quality 20
Table 5.2 - Assessment Criteria 21
Table 5.3 - Monitoring Locations 21
Table 5.4 - Wet Weather Discharge Points (EPL Points 11 & 12) 22
Table 5.5 - Driggle Draggle Creek, Unnamed Drainage Channel and SD7 22
Table 5.6 - Storage Dams and Mine Void 22
Table 5.7 - Storage Dams and Mine Void 22
Table 6.1 - Groundwater Monitoring 26
Table 7.1 - Unforeseen Impact Procedure 29

APPENDICES

Appendix 1 Relevant Project Approval Conditions
Appendix 2 Figures 1- 6

- Figure 1 – Rocglen Coal Mine Location
- Figure 2 – Surface Water Management Structures
- Figure 3 – Catchment Areas
- Figure 4 – Erosion and Sediment Control Plan
- Figure 5a – Surface Water Monitoring Locations
- Figure 5b – Groundwater Monitoring Locations
- Figure 6 – Surface Water Management for the Final Landform

ACRONYMS USED THROUGHOUT THIS PLAN

AEMR	-	Annual Environmental Management Report
DECC	-	Department of Environment and Climate Change
DoP	-	Department of Planning
DPI-MR	-	Department of Primary Industries - Mineral Resources
DWE	-	Department of Water and Energy
EA	-	Environmental Assessment
EPL	-	Environment Protection Licence
ESCP	-	Erosion and Sediment Control Plan
GWMP	-	Groundwater Monitoring Program
PA	-	Project Approval
SWMonP	-	Surface Water Monitoring Program
WCMPL	-	Whitehaven Coal Mining Pty Ltd
WMP	-	Water Management Plan

1 INTRODUCTION

This Water Management Plan (WMP) for the Rocglen Coal Mine ("the mine"), formerly known as the Belmont Coal Project, has been prepared in compliance with Condition 2 of Schedule 3 of the Project Approval issued by the Department of Planning (PA 06_0198). The WMP satisfies the requirement of the consent while also addressing monitoring requirements as specified within Environment Protection Licence (EPL) 12870 as issued by the DECC. Throughout the WMP, reference to Condition 2 relates to that consent condition within Schedule 3 of PA 06_0198.

The Rocglen Coal Mine is managed by Whitehaven Coal Mining Pty Ltd (WCMPL). The WMP incorporates:

- A description of water management of the mine site including objectives and the design and location of the surface water management structures **(Section 2)**;
- The predicted site water balance **(Section 3)**;
- An erosion and sediment control plan **(Section 4)**;
- A surface water monitoring program **(Section 5)**;
- A groundwater monitoring program **(Section 6)**; and
- A surface and groundwater response plan **(Section 7)**.

The initial WMP was prepared by RCA Australia (RCA) as the suitably qualified experts in relation to groundwater assessment, and the Soil Conservation Service, a business unit of the NSW Department of Lands, as the suitably qualified experts for the surface water component of the plan. The WMP built upon and refined the water management concepts in the 2007 Environmental Assessment (EA) for the mine, and was prepared for the life of the mine.

A revision of the WMP has been undertaken to update water storage details and wet weather discharge locations (as per the EPL). The revised WMP has been endorsed by the Director-General. Future refinements to water management or monitoring requirements will result in subsequent revisions of the WMP which will be submitted to the Director-General for endorsement.

To assist in keeping the WMP as concise as possible, the document has been prepared with reference to six figures of the mining lease ("the mine site"). **Figure 1** presents the general locality of the mine site. **Figure 2** presents the location and function of surface water management structures. **Figure 3** presents the representative catchments from which annual surface water yields for the mine site have been based. **Figure 4** presents the generalised design of erosion and sediment control features to be employed on the mine site. **Figure 5a and 5b** present the location of surface water and groundwater monitoring points for the mine site and surrounds. **Figure 6** presents the conceptual final landform and surface water management features.

For management purposes, the water within the mine site has been divided into four classes:

i. **"Clean" water** – surface runoff from catchments undisturbed or relatively undisturbed by mining or related activities and rehabilitated catchments. Clean water flows are shown on **Figure 2**. All surface water emanating from the final landform will be clean, with the final landform surface water management presented in **Figure 6**.

ii. **"Dirty" water** – surface runoff from disturbed catchments such as the active mine area and overburden emplacement, ROM and product coal stockpiles, soil and subsoil stockpiles and rehabilitated area (until stabilised), all of which could contain sediments. Dirty water used to supply the water requirements of the mine site is captured within 2 catchments on the mine site, referred to as the "disturbed area" and "open cut" catchments. It should be noted that a proportion of the water in these catchments will not flow over disturbed areas or within the cut, rather, the catchment itself contains either areas of disturbance or the open cut void.

iii. **"Contaminated" water** – surface runoff which could potentially contain hydrocarbons.

iv. **"Pit" water** – water from the void which will be retained in sumps within the void or pumped to segregated storages specifically for storage of pit water.

2 SITE WATER MANAGEMENT

2.1 Objectives

The principal objectives of site water management are as follows.

i. To ensure sufficient quantities of water can be obtained through the capture of "dirty" water, harvesting of "clean" water, and extraction/harvesting of groundwater to meet the requirements of dust suppression on the mine site.

ii. To ensure the segregation of "dirty" water from "clean" water, with "dirty" water directed to and detained in sediment basins which, on discharge, flow to storage dams. "Clean" water, comprising clarified water originating from the sediment basins and run-on water collected in accordance with the Company's harvestable right, will be directed to and/or collected in storage dams.

iii. To ensure the treatment and separation of "contaminated" water from the workshop and wash bay area by diversion to an oil separating unit, with clarified water reporting to sediment basins.

iv. To ensure segregation of "pit" water from surface flows by collection in isolated pit dewatering dams.

v. To maximise the use of "dirty" and "pit" water for dust suppression purposes and minimise the necessity to harvest "clean" run-on water.

vi. To minimise the volume of water discharged from the mine site, but, should the discharge of water prove necessary, ensure sufficient settlement time is provided prior to discharge such that suspended sediment within the water meets the water quality criteria as specified in the DECC Environment Protection Licence.

vii. To minimise erosion and sedimentation from all active and rehabilitated areas of the mine site.

viii. To monitor the effectiveness of surface water controls and ensure all relevant surface and groundwater quality criteria are met.

ix. To monitor the impact on groundwater level, quality and availability.

x. To minimise any impacts on the availability of surface water or groundwater to surrounding residents and landholders.

xi. To establish a method of assessing the level of impact on groundwater supply attributable to the mine.

2.2 Surface Water Management Structures

2.2.1 Introduction

Operational water requirements are preferentially sourced from “dirty” water run-off collected on site, together with any surface water and groundwater which accumulates in the open cut and pumped to designated pit de-watering dams. Any shortfall is supplemented by harvested “clean” water. **Figure 2** presents the surface water management structures and their function for the life of the mine. **Figure 4** provides the general construction detail for erosion and sediment control.

A general description of the design of these surface water management structures along with more specific detail on the dimensions of each is presented in sub-sections 2.2.2 and 2.2.3.

2.2.2 Clean Water Management

Diversion, collection and storage of “clean” water is achieved using a series of diversion banks (prefix DB), waterways (WW) and storage dams (SD) which are constructed prior to surface disturbance activities within the adjacent upslope catchments.

The design period for all diversion bank and storage dam structures has been at a minimum of a 1 in 10 year average recurrence interval (ARI). The design for all structures has been based on the Soil Conservation Service Design Manual, SCS (1990).

Diversion Banks

Each diversion bank exhibits the features identified below, with the dimensions for each diversion bank based on the upslope catchment area and slope.

- Trapezoidal channel.
- Bank batters between 1:3 to 1:6 (V:H).
- Channel batters of 1:6 (V:H).
- Channel grade 1:400 (5cm/20m) if channel is bare.
- Channel grade 1:200 (10cm/20m) if channel is to be kept well grassed.
- Level sill outlet to each channel.
- Stable grass cover to be maintained below sill outlets.
- Sill width constructed with minimum 1.5 x channel base width.

Table 2.1 presents the specifications of the diversion banks as illustrated on **Figure 2.**

Table 2.1 - Diversion Bank Specifications

Structure ID	Catchment Area (ha)	Channel Bottom Width (m)	Channel Grade (%)	Bank Height (m)	Sill Width (m)	Slope Below Sill (%)
DB1	15	3	0.2	0.8	6	2
DB2	5	2	0.2	0.8	6	2
DB3	25	3	0.2	0.8	6	2
Source: Soil Conservation Service						

All diversion bank structures have been designed to cater for water velocity of 1.2m/s, an acceptable rate considering these structures will be maintained and well grassed. Where conditions are unfavourable to establishment of sufficient groundcover over these structures, additional actions of rock or mesh lining will be considered for appropriate erosion control. All structures are inspected following significant storm events to ensure the structures have been able to sustain those flow velocities.

Waterways

Waterways provide a drainage path for water flowing from the east and west of the mine site. Waterway 1 is located on the western boundary of the mine site and directs surface flows from Vickery State Forest to the north and south to ensure clean water flows do not interact with disturbed areas. Waterway 2 (WW2) is located on the south-eastern side of the mine site and directs flows south via a series of sediment basins and storage dams prior to being able to discharge off the mine site. WW2 provides for capture of surface water flows originating from off site and will be extended as the pit progresses to the west. Storage dams are located

immediately upstream of the access point to the mine area to assist in water capture and limit velocity of flow.

The waterways were sown following construction to establish a cover crop to further reduce potential for erosion and sedimentation. The seasonal conditions will have a direct influence on the effective operation of the waterways, and in the event that groundcover establishment has been ineffective, alternate options such as rock armouring will be introduced to ensure effective erosion and sediment control. Specifications for the waterways are presented in **Table 2.2**.

Table 2.2 - Waterway Specifications

Structure ID	Waterway Width (m)	Bank Height (m)
WW1	12	0.7
WW2	Initially 25 and widen the 35 once it links with central drainage depression	0.8-1.0
Source: Modified after Soil Conservation Service (2007)		

Storage Dams

Storage dam locations are illustrated on **Figure 2**, with specifications identified in **Table 2.3**.

Table 2.3 - Storage Dam Specifications

Structure ID		Catchment Area (ha)	Volume (m^3)	Depth (m)	Dimensions length * width (m*m)	Outlet Width (m)	Sill Width (m)
Driggle Draggle Creek Catchment							
GBD-1	Gully Block Dam to capture water from Vickery SF catchment prior to diversion to Driggle Draggle Creek Catchment	60	1000	3	28*26	4	8
SD-1	On the northern boundary of the Project Site.	124	2500	3.8	9*17	6	9
SD-2	Outside northern boundary of project site	144	6100	2.4	21*26	15	35
SD-6	On the northern boundary of the Project Site, spilling to SD1	124	1100	3.5	6*6	4	8
Southern Catchment							
SD-3	On southern boundary of Project Site	888	8400	3.7	30*44	20	40
SD-4	Upstream of relocated Wean Road at crossing of Jaegar Lane	177(1)	4800	4	22*22	4	8
SD-4A	Adjacent to north-eastern corner of the mine site	177	1800	3.8	8*9	4	8
SD-7	On eastern side of relocated Wean road south of Jaegar Lane	773	5000	3	50*50	20	40
Note 1: Majority of runoff diverted away from the dam to the south via existing contour banks. Effective catchment estimated at <30ha. Sources: Modified after Soil Conservation Service (2007), Horizon Surveying Pty Ltd, Rocglen Mine Dam Quantities 21/4/09 (Drawing No. 0056-2104.1)							

Figure 2 identifies the storage dams, each of which has the following features.

- Excavation and dam bank batters of at least 1:3 (V:H).
- Crest width with a minimum of 3m wide.
- Minimum freeboard of 1m above top water level up to a wall height of 3m. Above 3m there is an increase in freeboard of 0.1m for every 1m increase in wall height.
- Inlet and outlet channel batters of 1:6 (V:H).
- Outlet channel grade 1:400 (5cm/20m) if channel is bare.
- Outlet channel grade 1:200 (10cm/20m) if channel is to be kept well grassed.
- Level sill outlet to each outlet channel.
- Stable grass cover to be maintained below sill outlets.
- Sill width constructed with minimum 1.5 * channel base width.

2.2.3 Dirty Water Management

Figure 2 also presents the dirty water management controls. Catch banks (prefix CB) are constructed prior to disturbance to divert potentially sediment-laden waters into sediment basins (prefix SB) constructed downstream of these areas of disturbance. The size and storage capacity of the sediment basins have been determined based on the settlement time requirements of the most common soil type (Soil Type D – Landcom, 2004) present on the mine site (based on GCNRC, 2007). This soil type has a predominantly moderate to high dispersibility which requires a designated settling zone volume and sediment storage zone volume. This design allows water that is potentially laden with suspended solids or sediments to settle out prior to any discharge from the storage.

The storage size has also been based on a 90% 5 day storm event. Application of this measure results in an overall sediment basin capacity on site of 35.129ML. **Table 2.6** identifies the storage capacity of individual sediment basins, with a combined overall capacity of 38ML, excluding the void and dams that have not yet been constructed (SB1 & SB20). This demonstrates sufficient capacity in the sediment basin system as required under the 90% 5 day storm event parameters recommended in the Blue Book Landcom guidelines.

The assumptions used in determining the required sediment basin capacity are as follows:

The percentile Vs Rainfall Depth for the Gunnedah Station 055023 as presented in Appendix L of the Blue Book determined a rainfall depth of 39mm. The volumetric runoff coefficient defined as the portion of rainfall that runs off as stormwater was set at 0.5. Calculation of settling zone volume, storage zone volume and total basin volume for the dirty water catchments is as presented in **Table 2.4**.

Table 2.4 - Assumptions for Sediment Basin Capacity Calculations

Site	Cv	$R_{xday, y\%}$	Total Catchment Area	Settling Zone Volume (m3)	Sediment Storage Volume (m3)	Total Basin Volume (m3)
Western Emplacement	0.5	39	74	14430	3749	18179
Northern Emplacement	0.5	39	9	1755	456	2211
Void	0.5	39	60	11700	3039	14739

Catch Banks

The general features for each of the catch banks presented on **Figure 2** is the same as for the diversion banks (ie. designed for a minimum of a 1 in 10 year ARI), based on SCS (1990). **Table 2.5** provides the specifications for each catch bank.

Table 2.5 - Catch Bank Specifications

Structure ID	Catchment Area (ha)	Channel Bottom Width (m)	Channel Grade (%)	Bank Height (m)	Sill Width (m)	Slope Below Sill (%)
Northern Emplacement						
CB1	4	3	0.3	0.7	6	2.0
CB2	4	3	0.3	0.7	6	2.0
Western Emplacement						
CB3	25	3	0.2	0.7	6	2.0
CB4	30	4	0.2	0.7	8	2.0
CB6	4	3	0.3	0.7	6	2.0
CB9	4	3	0.3	0.7	6	2.0
CB10	10	3	0.3	0.7	6	2.0
CB11	4	3	0.3	0.6	6	2.0
CB12	5	3	0.3	0.7	6	2.0
Coal Handling Area						
CB5	4	3	0.3	0.7	6	2.0
Site Facilities Area						
CB7	4	3	0.3	0.7	6	2.0
Northern Soil Stockpile Area						
CB8	10	3	0.2	0.7	6	2.0
Source: Soil Conservation Service						

All catch banks have been designed to cater for water velocity of 1.2m/s, an acceptable rate considering these banks will be well grassed. Where conditions are unfavourable to establishment of sufficient groundcover over these structures, additional actions of rock or mesh lining will be considered for appropriate erosion control. All structures are inspected

following significant storm events to ensure the structures have been able to sustain those flow velocities.

Catch banks have been constructed on the following basis:

- The channel of the bank is trapezoidal.
- Bank batters between 1:3 to 1:6 (V:H).
- Channel batters are 1:6 (V:H).
- Channel grade 1:400 (5cm/20m) if channel is bare.
- Channel grade 1:200 (10cm/20m) if channel is well grassed.
- Level sill outlet to each channel.
- Stable grass cover to be maintained below sill outlets.
- Sill width approximately 1.5* channel base width.

Sediment Basins

The sediment basins are presented in **Figure 2** and store and settle out potentially sediment laden waters as directed by the constructed catch banks. The sediment basins have the following attributes:

- Excavation and dam bank batters at least 1:3 (V:H).
- Crest width a minimum of 3m wide.
- Minimum freeboard of 1m above top water level up to a wall height of 3m. Above 3m there is an increase in freeboard of 0.1m for every 1m increase in wall height.
- Inlet and outlet channel batters of 1:6 (V:H).
- Outlet channel grade 1:400 (5cm/20m) if channel is bare.
- Outlet channel grade 1:200 (10cm/20m) if channel well grassed.
- Level sill outlet to each channel.
- Stable grass cover to be maintained below sill outlets; and
- Sill width of approximately 1.5* channel base width.
- The sediment level in each sediment basin is monitored on an annual basis.

Sediment basin design specifications are presented in **Table 2.6**. The design specifications are based on sizing relative to catchment area as defined in the Northern and Western Emplacement, Coal Handling and Site Facilities Area, and Northern and Southern Stockpile Areas. It should be noted that some storages receive waters from more than one catchment, thereby increasing their required storage volume. This is relevant to basins SB7 and SB19,

which receive waters off the western emplacement as well as from the eastern catchment via WW2.

It should be noted that Sediment Basins 4 and 8 (SB4 & SB8), located adjacent to the coal handling and site facilities area serve a dual purpose of retention of sediment laden waters, as well as potentially contaminated surface flows from the coal stockpile area and surface facilities area. The potential for contaminated flows to these storages is considered to be minimal as drainage is diverted away from these areas, with waters from the workshop area reporting to an oil separator to ensure hydrocarbon contaminated water is captured for off site disposal.

Sediment Basin 20 (SB20) will be located in the southern soil stockpile area and will be positioned to capture any sediment flows from the soil stockpile area to minimise potential for sediment laden waters to flow through WW2. When constructed, any discharge of water from this storage will result in discharge to clean receiving waters. SB20 will be included as a nominated discharge point on the Environment Protection Licence which will require sampling at each discharge event.

As indicated on **Figure 2**, dirty water from the western emplacement runs north and south. For the southern flows, sediment basins 9-15 are strategically located to direct flows from the western edge of the emplacement, with SB3 capturing southern flows on the eastern edge of the emplacement. Sediment basins 5, 6 and 7 are located on the southern edge of the emplacement. The southern flows from the western emplacement are directed to Sediment Basin 19 (SB19). Water from SB19 is directed to Storage Dam 3 (SD3), which acts as the final discharge point to receiving waters.

Northerly flows from the western emplacement are directed via sediment basins 16 and 17 on the western edge and Sediment Basin 2 on the eastern edge. Water from these sediment basins is directed to Sediment Basin 18 (SB18). Overflow from SB18 flows to the northern boundary site exit which acts as the final discharge point to receiving waters.

The northern emplacement will direct surface water flows on the south-western side via a catch bank to Sediment Basin 1 (SB1). On construction of SB1, any discharge will be directed on the eastern side of the emplacement where it will be captured via catch bank 8 and into SB18. Overflow from SB18 flows to the northern boundary site exit which acts as the final discharge point to receiving waters.

Surface water flows from the coal handling area are directed to SB4. Discharge from SB4 results in flows into WW2 prior to filtration through SB7 and SB19 and final collection in SD3. SD3 acts as a final discharge point to receiving waters.

Surface water flows from the site facilities area are directed to SB8. Discharge from SB8 flows into SD3 prior to release off site.

Table 2.6 - Sediment Basin Specifications

Structure ID	Catchment Area (ha)	Volume (m^3)	Depth (m)	Dimensions length * width (m * m)	Outlet Width (m)	Sill Width (m)
Northern Emplacement						
SB1*	9	2500	3	35*35	3	6
Western Emplacement						
SB2	4	1700	2	19*31	3	6
SB3	25	2000	3	35*35	3	6
SB5	2.5	1700	3	5*30	3	6
SB6	3	1200	3.2	5*18	4	8
SB7	3.5	3000	3	40*40	4	8
SB9	7	400	2	7*10	3	6
SB10	2.5	1000	2.7	4.5*23	3	6
SB11	2.5	1000	2.3	5*28	3	6
SB12	2.5	1200	2.8	5*23	3	6
SB13	2.5	1300	3	3.5*18	3	6
SB14	2.5	1200	3	3.5*21	3	6
SB15	5.5	1600	4	8*10	3	6
SB16	3	600	2.6	5*10	3	6
SB17	4	1700	2.4	18*22	3	6
SB19	3	5000	3	50*50	15	35
Coal Handling Area						
SB4	4	1800	2.7	18*19	3	6
Site Facilities Area						
SB8	4	1100	3	8*9	3	6
Northern Soil Stockpile Area						
SB18	20	2100	3.8	8*19	3	6
Southern Soil Stockpile Area						
SB20*	4	2500	3	35*35	3	6

* Not yet constructed
Source: Modified after Soil Conservation Service(2007), Horizon Surveying Pty Ltd, Rocglen Mine Dam Quantities 21/4/09 (Drawing No. 0056-2104.1)

Sediment Basins are managed to ensure retention of sufficient capacity to reduce the potential for discharge off site. The management practices 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 final discharge dam has a water level gauge for monitoring water levels and to enable preferential use to reduce potential for discharge.

- The sediment level in each sediment basin is monitored on an annual basis. Sediment basins will be cleaned out as required to ensure sediment levels do not exceed the 25% sediment storage capacity level.
- Regular water quality analysis to assess effectiveness of sediment system. Where sediment levels are determined to be at higher volumes than discharge limits, consideration will given to ameliorative measures including use of flocculants, and increase in sizing or additional sediment basin construction.

Following construction of the surface water management structures, a survey was carried out to ensure the originally stated capacities were achieved. A final construction plan was issued to the DECC to confirm sizing of structures on site. The effectiveness of the surface water management system will be monitored on a regular basis, particularly as the open cut advances, and additional areas are stripped of soil. Where additional sediment controls are required, they will be implemented in accordance with an amended Water Management Plan.

2.2.4 Pit Water Management

Capacity for pit water storage needs to be retained during the operation of the mine and will be managed either as sumps within the open cut and/or surface storages isolated and contained to ensure it does not mix with surface water flows. A capacity of 11,000m^3 needs to be retained for pit water purposes in these storages or sumps based on water balance calculations as conducted in the EA for the project. This capacity was based on the assumption of negligible groundwater inflows as predicted in the groundwater assessment.

Any construction of out of pit dams for the storage of pit water would be based on a design to minimise potential for seepage from the dams. Design will be based on lining the dams with material of hydraulic conductivity $<1x10^{-9}$ and where possible, location of the dam within a backfilled section of the open cut void such that in the event that overflow occurs, the water would drain back in to the open cut void. The current Void Water Dam and other potential locations for pit water surface dams are identified on **Figure 2**. Actual final location of such structures will be based on operational requirements at the time to ensure proximity to active void. Any construction of a surface pit water storage dam will include the provision for access to enable direct pumping of pit water to water carts for use in dust suppression. Water levels in the pit water dam will be monitored on a weekly basis with capacity to pump back to the void in the event that discharge is considered likely.

3 SITE WATER BALANCE

3.1 Introduction

The primary objective in managing the quantity of water captured/discharged on the mine site is to ensure sufficient water is captured to meet operational requirements. 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. Section 3.2 presents the annual site water

requirements and, based on the surface water management structures of the mine site, Section 3.3 identifies the surface water available for capture (including a calculation of maximum harvestable right for the mine site and additional land owned by WCMPL). Section 3.4 balances the mine site requirements against water availability over the life of the mine.

3.2 Site Water Requirements

Water requirements on the mine site will vary over the life of the operation. The majority of water will be used for dust suppression throughout the life of the mine.

Annual water requirements of the mine are expected are listed in **Table 3.1**:

Table 3.1 - Annual Water Requirements

Activity	Predicted Use (ML)
Mine Site – exposed surfaces and internal roads	50-55
Hardstand Areas and Stockpiles	20-25
Crushing and Screening Operations	3-4
TOTAL	**73-84**

Ablutions and potable water is trucked in from off site and is not included in these calculations. Climatic factors will play a significant role in water requirements for dust suppression and will be assessed on a year to year basis. Operational water needs are preferentially sourced from the on-site sediment basins and surface and groundwater flows into the open cut. Any shortfall is supplemented by storage dams on site as well as through surface water harvesting from adjacent properties owned by WCMPL.

3.3 Water Availability

3.3.1 Maximum Dam Capacity

Of the "clean" water that could be captured on the mine site each year, WCMPL has a right to collect and use only a proportion of this, ie. the maximum harvestable right[2]. The maximum harvestable right for the mine site was determined in the following manner.

Maximum Harvestable Right = Catchment Area (ha) x Multiplier Value[3]

= 366 x 0.07

= 25.6ML

2 "dirty" water used for environmental purposes, eg. Dust suppression is not considered as part of the maximum harvestable right for the mine site.

3 The calculation is based on the Department of Natural Resources document Rural Production and Water Sharing Landholders Information Package (1999).

It should be noted, however, that WCMPL's landholdings in the vicinity and including the mine site exceed more than 3000ha allowing for an additional maximum dam capacity of more than 184ML available (3000ha – 366ha = 2634 X 0.07 = 184ML).

3.3.2 Annual Water Availability

Table 3.2 provides the total "clean" and "dirty" water from associated catchments both within the mine site and from adjacent catchment areas. The catchment yields are presented for low (10^{th} percentile), average (50^{th} percentile) and high (90^{th} percentile) rainfall years.

This information demonstrates the capacity for WCMPL to utilise clean water from off the project site, on WCMPL owned lands, to make up any shortfall in dirty water captured on site for required dust suppression purposes.

Table 3.2 - Annual Catchment Yields

Catchment	Area (ha)	Yield (10^{th} Percentile 373.6mm) (ML/year)	Yield (50^{th} Percentile 619.9mm) (ML/year)	Yield (90^{th} Percentile 843.4mm) (ML/Yr)	Associated Water Storage (ML)
"Dirty" water from northern emplacement	9	3.36	5.58	7.59	2.1
"Dirty" water from western emplacement and ROM coal stockpiles	74	27.65	45.87	62.41	35.9
Open Cut Area	60	22.42	37.19	50.60	13.3
Total Dirty Water		**53.42**	**88.65**	**120.61**	**51.3**
"Clean" water within the mine site northern catchment	50	18.68	31.00	42.17	3.6
"Clean" water external to the mine site but within the project site catchments and on proponent owned properties	634	236.86	393.02	534.72	51.4
Total Clean Water		**587.30**	**974.48**	**1325.82**	**55.0**
Total Clean and Dirty Water		**640.72**	**1063.13**	**1446.43**	**106.3**

Source: Modified after Soil Conservation Service (2007), Horizon Surveying Pty Ltd, Rocglen Mine Dam Quantities 21/4/09 (Drawing No. 0056-2104.1)

3.3.3 Site Water Balance

A site water balance for the mine site, identifying site water requirements (averaged at 80ML/yr) is presented in **Table 3.3**. Site water use is based on sourcing water requirements from the dirty water system. As demonstrated in **Table 3.3** there will be a shortfall in dirty water for dry years, with an excess in dirty water in average rainfall and wet years. The shortfall in dirty water will be supplemented by on site clean water storage. The "clean water" component also comprises clean water runoff generated from the eastern catchment. Off-site water storages SD4, SD7 and SD2 will capture some of this water, with excess water directed via WW2 through the south-east corner of the mine site as per the natural drainage path through to the southern drainage channel. The water balance assumes a negligible inflow of groundwater into the void, with all surface runoff and groundwater inflow to the void comprised within the dirty water component presented below.

Table 3.3 - Mine Site Water Balance

	10% Yield (ML/Year)	50% Yield (ML/Year)	90% Yield (ML/Year)	Mine Site Water Storage (ML)
"Dirty Water"	53.42	88.65	120.61	51.3
Site Water Requirements	80	80	80	
"Dirty Water" Balance	-26.58	+8.65	+40.61	
"Clean Water"	350.44	581.47	841.11	3.6
"Clean Water" Balance	+323.86	+581.47	+841.11	

It is noted that the estimated available water exceeds the storage capacities both on site and those off the mine site**.** However, as the majority of water will be continually taken from the on site dirty water storages, with supplementary amounts from on site clean water storage, either for operational purposes or through evaporation, dirty water discharge from the site is expected to occur infrequently. In the event that discharge does occur, a sample will be obtained from the discharge source to verify water quality is within required parameters. The water management system has been designed to reduce potential for discharge of sediment laden waters through sediment basin capacities as well as the in-line placement thereby ensuring a settling process as water travels through the sediment basin system.

In addition to the above commitments, water for dust suppression purposes on site is preferentially sourced from the nominated discharge storages to assist in reducing potential for discharge. Monitoring of these points on a regular basis determines relative water quality to enable adequate planning for ameliorative measures if required.

Should discharges become more prevalent than predicted, the following procedures will be considered:

- Alternative management practices of disturbed areas to increase infiltration rates by increased establishment of vegetative cover to improve water take up and reduce runoff rates.

- Construction of additional sediment basins or enlargement of existing sediment basins.
- Flocculation of sediment basins to acceptable discharge level of water quality to expedite the draining of basins.

WCMPL will endeavour to minimise water use on site to ensure surface water flows that existed pre-mining are not significantly affected and does not reduce water availability to downstream users. WCMPL commitment to maximising water use from the dirty water system and only obtaining supplementary water requirements from clean water storages will aid in this process. On site water requirements will be monitored each year, and opportunities investigated for any opportunities for improved water efficiency, particularly in terms of dust suppression.

3.4 Water Balance Review

A more accurate water balance will be developed as the mine progresses and as data is gathered.

For operational purposes, an excel spreadsheet has been developed for the mine site which allows for a monthly calculation of water availability in the Storage Dams and Sediment Basins. The mine site water balance will be updated each year to reflect the recorded use and storage of water as well as any changes to the progression of mining on the mine site.

Rather than update the WMP each year, a summary of site water use and storage will be supplied in each AEMR for the mine along with the updated site water balance for the remaining life of the mine.

3.5 Groundwater – Surface Water Interaction

While the site water balance does not include groundwater which may seep into the mine void and accumulate in in-pit sumps or designated “pit water” dams, it is acknowledged that should there be extended periods of rainfall and therefore reduced evaporation or greater than expected seepage, in-pit management of the accumulated groundwater will be difficult and therefore pumped to the designated pit water dams which will be isolated from surface water flows.

Water levels within the designated “pit water” dams will be managed by pumping direct to water carts for use in dust suppression across the site, or in the unlikely event that pit water volumes exceed requirements, pit water will be retained within the sumps in the void of the pit to ensure discharge of pit water does not occur.

4 EROSION AND SEDIMENT CONTROL PLAN

4.1 Introduction

In accordance with Condition 3(4), 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). All erosion and sediment control structures will be constructed or erected in accordance with the recommendations identified in the relevant standard drawing and construction notes of Landcom (2004). Figure 4 presents the generalised design of each of the erosion and sediment control structures identified in Figure 2 (as drainage control and water management structures).

The **ESCP** has been structured as follows:

i. Section 4.2 – identifies activities that could cause soil erosion and/or generate sediment.

ii. Section 4.3 – describes the location, function, and capacity of erosion and sediment control structures.

iii. Section 4.4 – describes measures to be employed to minimise soil erosion and the potential for the migration of sediments to downstream waters, and measures to monitor and maintain structures over time.

4.2 Sources of Erosion and Sedimentation

4.2.1 Operations

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

i. Surface water runoff from areas disturbed in advance of, and during mining;

ii. Surface water runoff from topsoil, subsoil and overburden stockpiles and emplacements prior to rehabilitation;

iii. Surface water runoff from the coal processing area;

iv. Surface water runoff from rehabilitated areas prior to full stabilisation;

v. Discharges of water at erosive velocities; and

vi. Runoff from roads at erosive velocities.

Elevated winds may also result in erosion from exposed surfaces.

4.3 Erosion and Sediment Control Structures

The structures presented on **Figure 2** and described in **Section 2** are the primary erosion and sediment control structures as these direct and control the velocity of surface water and prevent uncontrolled flows and discharges of water. As the final landform is created, additional erosion controls in the form of contour banks and rock-lined or grass-lined flumes, will be progressively constructed (see **Figure 6**). The contour banks on the sloped surfaces of the final landform will direct surface water flows to a number of flumes which will 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 WCMPL 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.

Figure 4 presents the design features of each of the referenced structures which have been based on the recommendations of Landcom (2004).

Silt-stop fencing will be installed as required to assist in reducing the suspended sediment level in surface water flows from disturbed areas. **Figure 4** also presents the design features to be adhered to when installing the silt-stop fencing.

4.4 Erosion and Sediment Control Management

WCMPL will remain vigilant in managing erosion and sedimentation on the mine site and, by only discharging water which satisfies the criteria identified by DECC in the Environment Protection Licence, will minimise the potential for migration of sediments to downstream waters. Although the structures presented on **Figure 4** have been designed to enable the movement of surface water on the mine site at non-erosive velocities, the following additional procedures and management practices will be implemented to further reduce the risk of erosion and sedimentation.

i. Any structure required to control erosion and sedimentation will be constructed or installed prior to the commencement of activities in that area.

ii. Areas on the mine site without some form of vegetative cover will be minimised. A non-persistent cover crop will be sown on any exposed surfaces not required for operational purposes or stockpiles retained in excess of three months.

iii. The erosion and sediment control structures 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.

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

v. Access to areas of the mine site affected by localised flooding will be restricted until such time as the ground is no longer waterlogged. This will reduce the potential for vehicular traffic to further disturb the soil surface which in turn may result in greater erosion potential over these areas.

vi. As part of a surface water monitoring program, water flowing from the nominated discharge points will be sampled for suspended sediments and other parameters as specified in the EPL.

vii. In the event the suspended sediment concentration in any discharged water exceeds 50mg/l, DECC will be advised and salient preceding weather information will be provided. The upstream structures will be inspected and cleaned of consolidated sediment as required. Ongoing monitoring will occur, in consultation with DECC, and the following options will be considered in the event of additional exceedances:

    a. The sediment basin(s) will be enlarged to provide for greater settlement time for the sediment laden water; and/or

    b. An additional storage dam will be constructed downstream with this becoming the new site discharge point and monitoring location. DECC will be advised to enable amendment to the EPL and/or

    c. A flocculant will be added to the water contained within the sediment basin or storage dam to increase the efficiency of sediment settlement.

viii. Water captured in the open cut void will be allowed time to settle within the sumps before being pumped to one or more of the designated “pit water” dams identified in **Figure 2** if required. Salinity levels of water accumulating in the mine void will be monitored on a quarterly basis to assess water quality (see **Section 5**).

ix. All surface water flows from the flumes will flow to sediment basins.

x. If, following heavy rain, erosion is identified on the rehabilitated landform or in operational areas, it will be remediated quickly using one or a combination of the following:

    a. Filling the erosion channels

    b. Cross-ripping (along the contour) to assist infiltration

    c. Installation of additional controls, eg banks sown with a non-persistent cover crop.

xi. Areas previously identified as exhibiting erosion and treated to prevent erosion will be monitored on a minimum monthly basis or following a rainfall event of >25mm/24hr.

5 SURFACE WATER MONITORING PROGRAM

5.1 Introduction

This Surface Water Monitoring Program (SWMonP) has been prepared in compliance with Condition 3(5) and includes:

i. Provision of baseline data on surface water flows and quality in adjoining creeks and waterbodies that could be affected by the project;

ii. Surface water impact assessment criteria;

iii. A program to monitor the impact of the project on surface water flows and quality; and

iv. Procedures for reporting the results of this monitoring.

5.2 Baseline surface water quality

Due to the intermittent nature of the unnamed drainage channel and Driggle Draggle Creek adjacent to the project site, limited data has been collected for the provision of baseline water quality information. **Table 5.1** provides water quality data from a sample obtained from the central drainage channel within the Rocglen site in 2002 (BS-1), together with samples from Driggle Draggle Creek (WW1-6) taken prior to the Canyon Mine development (approximately 9 km north-west of Rocglen Mine). The results indicate a similarity in water quality in Driggle Draggle Creek and the drainage line within the Rocglen site which is not unexpected given the similarity in catchments, land use and geology.

Table 5.1 - Local and Project Site Water Quality

Parameter	Unit	Sample Site						
		BS-1	**WW-1**	**WW-2**	**WW-3**	**WW-4**	**WW-5**	**WW-6**
Total P	mg/L	4.7	NR	96.0	97.2	98.7	102.3	NR
Nitrogen (Nitrate)	mg/L	<0.01	NR	6	2	4	5	NR
Sulphate	mg/L	11	1	10	9	9	8	1
Bicarbonate	mg/L	41	48	81	96	107	73	50
Chloride	mg/L	56	2	6	4	5	8	3
Cadmium	mg/L	<0.001	NR	<0.001	<0.001	<0.001	<0.001	NR
Lead	mg/L	<0.001	NR	0.02	0.02	<0.001	0.02	NR
Zinc	mg/L	0.01	NR	0.02	0.02	0.01	0.02	NR
Copper	mg/L	0.006	NR	<0.01	0.01	0.01	0.01	NR
Manganese	mg/L	0.008	NR	0.15	0.05	0.12	0.20	NR
Iron	mg/L	29	5	13	8	7	19	20
Potassium	mg/L	27	5	14	9	13	5	5
Sodium	mg/L	43	11	12	13	14	42	19
Magnesium	mg/L	3	2	5	10	5	4	2
Calcium	mg/L	8	6	12	12	19	9	5
Conductivity	us/cm	360	98	151	165	185	154	98
pH		6.9	6.8	8.8	8.4	9.1	8.4	7.8

Source: Whitehaven Coal Mining Pty Ltd (2002)

The above water quality results provide only a snapshot of local water quality and will need to be further developed to provide for more relevant data. WCMPL initially proposed to conduct further sampling prior to the commencement of mining to allow for long-term comparisons with water quality results obtained once mining commenced. Additional samples have not been obtained due to lack of flow in the intermittent streams. Sampling will occur during water flow events at points along Driggle Draggle Creek to the north and the unnamed drainage depression to the south over the life of the mine, and during discharge events for ongoing water quality monitoring.

It is also acknowledged that there is limited information currently available in terms of catchment flows, and the impact of the mine on reduced or increased catchment flows and its impact on water quality. In order to improve current knowledge of existing catchment flows, and the impact of the mine on future catchment flows, WCMPL proposed to establish flow monitoring devices, in conjunction with DWE, at the Driggle Draggle Creek monitoring point and southern drainage channel monitoring point to enable data collection and analysis. To date, lack of flows has diminished the viability of installing flow meters. Installation will be further assessed as the mine develops and any data obtained will also be provided to DWE for their records and analysis as required.

5.3 Surface Water Impact Assessment Criteria

Impact assessment criteria for surface water are only relevant to water actually discharged from the mine site.

Recorded values for pH, Total Suspended Solids (TSS) and oil and grease from water discharged from the mine site will be compared against the criteria presented in **Table 5.2**. This criteria is as prescribed by the DECC in the EPL 12870.

Table 5.2 - Assessment Criteria

Parameter	Unit of Measure	50% concentration limit	90% concentration limit	100% Concentration limit
Total Suspended Solids	mg/L	-	-	≤50
Grease and Oil	mg/L	-	-	≤10
pH		-	-	6.5-8.5

The recorded values will be measured and plotted to identify any trends over time. DECC will be notified in the event of increasing levels of any parameter.

5.4 Surface Water Monitoring Locations

The location of all surface water monitoring points are presented on **Figure 5a** and are based on the Statement of Commitments produced by WCMPL and requirements of the EPL.

Table 5.3 identifies the monitoring point locations, the type of monitoring point along with a brief description (where relevant) of the location. Details of monitoring points will be updated following any future variations to the EPL.

Table 5.3 - Monitoring Locations

Location	Type of Monitoring Point	Description of Location
SD3 & Northern Boundary Site Exit	Wet Weather Discharge	Discharge points (northern and southern boundary) from dirty water system to the environment
DDCK (Driggle Draggle Creek), UNDC (Unnamed drainage channel) and SD7	Baseline data and wet weather discharge	Driggle Draggle Creek north of mine site, Unnamed Drainage channel south of the mine site and SD7 (west of mine site)
Void Water Dam (VWD1)	Surface water quality monitoring	Adjacent to NE boundary of pit
SD1, SD2, SD3, SD4, SD4A, SD7, SB2 – SB19	Erosion and Sediment Control and Water Quality	Selected Storage Dams and Sediment Basins within the Mining Lease (not all water storages will be sampled during every monitoring event)
SD=Storage Dam, SB=Sediment Basin.		

5.5 Monitoring Parameters and Frequency

Tables 5.4 to **5.7** present the parameters to be monitored, the frequency of monitoring and the sampling method for each parameter.

Table 5.4 - Wet Weather Discharge Points (EPL Points 11 & 12)

Parameter	Unit of measure	Frequency	Sampling Method
Conductivity	us/cm	EPL Special Frequency 1 - As soon as practicable after each discharge commences and in any case not more than 12 hours after each discharge commences.	In situ
Oil and Grease	mg/L		Grab sample
Total organic carbon	mg/L		Grab sample
Total suspended solids	mg/L		Grab sample
pH	pH		Grab sample

Table 5.5 - Driggle Draggle Creek, Unnamed Drainage Channel and SD7

Parameter	Unit of measure	Frequency	Sampling Method
Conductivity	us/cm	EPL Special Frequency 2 – Quarterly (in the event of a flow during the quarter) at a time when there is flow and as soon as practicable after each wet weather discharge from points 11 and 12 commences and in any case not more than 12 hours after each discharge commences.	In situ
Oil and Grease	mg/L		Grab sample
Total organic carbon	mg/L		Grab sample
Total suspended solids	mg/L		Grab sample
pH	pH		Grab sample

Table 5.6 - Storage Dams and Mine Void

Parameter	Unit of measure	Frequency	Sampling Method
Erosion	-	Quarterly or following rainfall of >25mm/24hr	Visual Inspection
Sedimentation	-		Visual Inspection

Table 5.7 - Storage Dams and Mine Void

Parameter	Unit of measure	Frequency	Sampling Method
Total Suspended Solids	mg/L	Quarterly	Grab sample
Oil and Grease	mg/L		Grab sample
pH	pH		In situ
Conductivity	us/cm		In situ
Total Organic Carbon	mg/L		Grab sample
Representative Metals	mg/L	Annual	Grab sample
Representative Ions	mg/L		Grab sample

5.6 Reporting of Monitoring Results

WCMPL collates surface water analysis data and maintains an up to date record of analysis results both in hard copy (laboratory reports) and electronic (results) format. These results are reviewed and interpreted as they are received in order to ensure appropriate operational guidance on maintaining water quality within desired parameters.

The results of water quality analysis will be reported in the Annual Environmental Management Report (AEMR) and will be made available to the Community Consultative Committee members on a regular basis as part of the Environmental Monitoring Reporting process, as well as to Gunnedah Shire Council.

In the event that an exceedance in surface water quality criteria is identified, the exceedance will be reported to the relevant agencies in accordance with Condition 5(3) and 5(4).

6 GROUNDWATER MONITORING PROGRAM

6.1 Introduction

In compliance with Condition 3(6), this Groundwater Monitoring Program (GWMP) has been prepared to include:

i. Further development of the regional and local groundwater model;

ii. Detailed baseline data to benchmark the natural variation in groundwater levels, yield and quality (including at any privately owned bores in the vicinity of the site);

iii. Groundwater impact assessment criteria;

iv. A program to monitor the impact of the project on groundwater levels, yield and quality; and

v. Procedures for reporting the results of this monitoring.

The GWMP also comprises Groundwater Contingency measures, as per the requirement of condition 3(2c).

6.2 Groundwater Model

A hydrogeological model for the project site was developed by RCA Australia as part of the initial Environmental Assessment for the development. The model identified groundwater flows within the strata as flowing from east to west following the regional topographic fall from the Kelvin Range in the east to the Namoi River in the west. The depth of groundwater within the mine site is relatively constant at 35 metres.

The modelling undertaken for the mine was based on the best available information, however it is recognised that the monitoring program being undertaken by WCMPL will provide the opportunity to utilise the data obtained for assessment against the initial model. This will also enable updates to be made to the groundwater model as is required in the project approval.

6.2.1 Groundwater Seepage Volume

Water accumulating in the open cut mine workings will comprise a combination of accumulated rainfall, surface water run-off (from within the "open cut" catchment and dust suppression activities etc.) and groundwater seepage.

Based on model simulations, the average inflow of groundwater to the open cut is predicted to average 1,643m^3/day during years 1 to 3, increasing to an average of 2,235m^3/day during years 4 to 5 and decreasing during years 6 and 7 to 1,813m^3/day. These predictions are expected to be an overestimate of actual inflows as they were based on the assumption that the bulk of material for each stage is removed instantaneously rather than by progressive excavation. Even comparing these levels of inflow against likely evaporation rates, it is considered likely that there may be a small surplus of water accumulating in the open cut, which would be captured by the use of sumps and used for dust suppression purposes across the site. In the event that inflows are greater than that predicted, surface storages will be constructed to enable pumping from the void to the designated "pit water" dams which will be isolated from surface water flows.

Validation of predicted inflows to the pit sumps will be made by use of a meter on pumps to ascertain the amount of water pumped either direct to water carts or to surface "pit water" storages. Whilst this will include surface flows within the pit itself, it will provide a reasonable estimate of the extent of groundwater inflow.

WCMPL has a 700ML aquifer interference licence for the groundwater which seeps into the pit.

6.2.2 Groundwater Drawdown

The drawdown in the regional water table predicted by the groundwater model at the completion of the project is expected at 11m at the project site boundary, and down to 2m or less within 5km of the limit of open cut mining. In view of the properties in proximity to the mine site that are mine related, it is considered that the only non-project related bores that may be affected by the mining operation are located on the "Surrey" and "Carlton" properties.

Despite the limited potential for significant impact on groundwater levels on adjacent properties, WCMPL will undertake a monitoring program over the life of the mine to provide validation of drawdown prediction, and undertake mitigation measures in the event that monitoring confirms that mining activity is impacting on groundwater depth and yield on adjacent properties. In addition, where monitoring indicates a significant difference to predictions in the initial groundwater model, WCMPL will engage a suitably qualified consultant to reassess the groundwater impacts and provide for further development and refinement of the groundwater model.

6.3 Groundwater Monitoring

6.3.1 Monitoring Locations

The GWMP applies to a total of thirteen registered bores where groundwater levels, saturated thickness and quality are measured. In addition to these sites, five piezometers have been installed. Two of the piezometers have remained consistently dry. At this stage, data loggers will be installed in the remaining three piezometers. MP1, MP2 and MP3 are located between the open cut and the nearest non project related bores. MP4 is located further to the south to provide additional information from the zone between the mine and the alluvial system, and would provide the capacity for triangulation of these points to indicate general water table depths. MP5 is located to the west of the project site to provide monitoring data on the western edge of the project. This piezometer is located on the adjacent "Yarrawonga" property. The locations are presented on **Figure 5**.

- WB-1 (GW000743) on the "Costa Vale" property
- WB-2 (GW050395) on the "Roseberry" property
- WB-3 (GW050166) on the "Glenroc" property
- WB-4 (GW045621) on the "Yarrawonga" property
- WB-5 (GW011066) on the "Roseberry" property
- WB-6 (GW044068) on the "Yarrari" property
- WB-7 (GW022319) on the "Roseberry" property
- WB-8 (GW052958) on the "Surrey" property
- WB-9 on the "Carlton" property
- WB-10, WB-11 & WB-12 on the "Brolga" property
- MP-1 (GW968533) at the Rocglen Coal Mine.
- MP-2 (GW968534) at the Rocglen Coal Mine.
- MP-3 (GW968535) on the "Stratford" property.
- MP-4 (GW968536) on Surrey Lane.
- MP-5 (GW968537) on the "Yarrawonga" property.

6.3.2 Monitoring Parameters, Frequency and Procedures

Baseline monitoring of water chemistry, SWL, available drawdown and yield was conducted at all bores identified above prior to the commencement of mining. This will provide a basis for comparison with future monitoring events to be undertaken as mining progresses. Baseline monitoring of water chemistry included those parameters listed in **Table 6.1** and groundwater levels were assessed to the nearest 0.01m.

Subsequent measurement of groundwater levels will be undertaken at quarterly intervals, with data loggers downloaded at quarterly intervals. Assessment of electrical conductivity and pH at the identified sites will be undertaken quarterly, with yield and other chemical parameters assessed on a six monthly basis. **Table 6.1** presents the parameters to be measured, frequency of monitoring and sampling method. Monitoring will continue for a period of up to 5 years after mining has ceased, however this will be assessed in accordance with monitoring results of the life of the mine and extent of impact as confirmed by those results.

Table 6.1 - Groundwater Monitoring

Parameter	Unit of Measure	Frequency	Sampling Method
SWL	m AHD	Quarterly	Bore Dipping
Conductivity	us/cm		In situ
pH	pH		In situ
Lead	mg/L	6 monthly	Grab sample
Alkalinity	mg/L		Grab sample
Chloride	mg/L		Grab sample
Sulphate	mg/L		Grab sample
Sodium	mg/L		Grab sample
Potassium	mg/L		Grab sample
Nitrite	mg/L		Grab sample
Nitrate	mg/L		Grab sample
Manganese	mg/L		Grab sample
Magnesium	mg/L		Grab sample
Iron	mg/L		Grab sample
Arsenic	mg/L		Grab sample
Aluminium	mg/L		Grab sample
Note: Frequency of monitoring and the pollutant/s to be monitored may be varied by the DECC once the variability of the groundwater quality is established.			

Bores will be purged prior to sampling until pH and salinity measurements have become stable. This usually involves sampling using a low flow pump, or removal of at least three bore volumes of groundwater, or purging until dry. Samples will be collected and placed in appropriately preserved containers and kept cool. Samples will be transported under chain of custody documentation and arrive at the NATA accredited laboratory within appropriate holding times. WCMPL will ensure that the methodologies in place for groundwater sampling procedures and utilised by the contracted sampler are in accordance with standard procedures consistent with those utilised by DWE and in accordance with:-

> Jiwan, J.S & Gates, G., (1992), *A Practical Guide For Groundwater Sampling (1st Ed.),* DWR Technical Services Division Report TS92.080.

In addition to those parameters presented in **Table 6.1,** additional parameters may be monitored annually to assess any trends in groundwater chemistry over time. These include the following.

- Total Petroleum Hydrocarbons – these contaminants (typically oils and diesel) will be used during mining.
- Heavy Metals – some heavy metals may be associated with waste oils. These may include arsenic, cadmium, chromium, nickel, lead (already included in **Table 6.1**), copper, manganese and zinc.
- Major cations and anions – to assess overall changes in groundwater chemistry.

6.3.3 Assessment and Reporting

Monitoring results obtained as a result of the groundwater monitoring program will be collated and assessed by WCMPL personnel. Monitoring results will be made available to the members of the Community Consultative Committee on a regular basis through the committee meetings. Monitoring results will also be made available to Gunnedah Shire Council and will be presented in the Annual Environmental Management Report.

The monitoring results will provide the capacity for WCMPL to assess any impacts of the mining operation on background levels. In the event that monitoring confirms a significant shift in water quality parameters, or water depth and yield of adjacent bore sites, then WCMPL will liaise with DWE with regard to restorative measures at these sites, and in accordance with the Groundwater Contingency Plan.

7 SURFACE AND GROUNDWATER RESPONSE PLAN

A response plan for surface and groundwater monitoring is required in the event that assessment criteria is exceeded, and to respond to any unforeseen impact of the project. The plan sets out the procedure which will be followed in order to ensure a timely and co-ordinated response.

7.1 Procedure

The procedure for exceedances in surface water and groundwater quality is as follows:

i. Exceedance in surface water quality or groundwater quality and/or level is identified;

ii. Record the timing, location, environmental conditions and any other contributing factors to any exceedance;

iii. Advice issued to relevant agencies within 24 hours;

iv. Sampling point and areas upstream inspected to ascertain cause of exceedance;

v. Operational practices reviewed to determine if any current operational practice contributed to the exceedance;

vi. Implementation on ameliorative measures on site to minimise the potential for future exceedance, which may include clean out, redesign or alteration to structures and/or operational practice;

vii. Written advice to relevant agencies identifying actions undertaken to reduce further risk of exceedance;

viii. Where specific cause of exceedance cannot be identified, external advice may be sought;

ix. Ongoing future monitoring to ensure ameliorative measures have been successful with assessment criteria being met;

x. Where ameliorative measures cannot be achieved evaluate compensation options.

The assessment criteria for surface water has been identified in Section 5.3. The assessment criteria for groundwater is described below.

Investigations into the reliance of groundwater bores in the area have provided a contingency level on which actions would be required by WCMPL to address groundwater quantity and quality.

In terms of groundwater quantity, where it is identified that standing water levels within bores on non-project related properties reduce by more than 10% from the baseline pre-mining levels, and it is assessed as being as a result of mining, WCMPL will deepen the existing bore or establish a new bore in the impacted area to achieve a yield that is at least equal to that which existed pre-mining. In assessing the cause of reduction in groundwater level, consideration will be given to monitoring results obtained over time, yield measurements determined pre-mining, current pumping regimes on each site, and seasonal conditions. An independent qualified hydrogeologist will be engaged to provide the determination as to the cause of the reduction in standing water levels and report findings to the relevant agencies.

Where it is identified that deepening or re-drilling a bore would not be sufficient to provide a replacement source of comparable quality, WCMPL will investigate the possibility of constructing additional surface water containment structures, or providing direct transfer of comparable quality water from other sources. This action would be undertaken in consultation with the affected property owner.

Groundwater quality will be assessed in accordance with the baseline water quality measures first and then NEPM agricultural irrigation guideline levels, with the ANZECC guideline levels to be used where no NEPM guidelines have been published. This will generally reflect the fact that the existing water quality does not meet aesthetic drinking water guideline levels. Impacts on water quality parameters of pH, TDS, other anions and heavy metals (not considered by NEPM criteria) will be based on comparisons with baseline monitoring data.

If groundwater quality criteria, as described in this section, is exceeded the data will be analysed and the impacted bore re-sampled. If an exceedance is still observed, additional bores will be installed around the affected bore to assess the extent of impact. This will confirm

the risk of impact to adjoining groundwater users. Any such assessment of this impact would be based on sound advice from an appropriately qualified hydrogeological consultant.

7.2 Unforeseen Impacts

The potential for unforseen impacts as a result of the mine are considered low, however, in order to ensure against material harm to the environment an unforeseen impact procedure will be followed as per **Table 7.1**:

Table 7.1 - Unforeseen Impact Procedure

Stage	Procedure
1	Review the unforseen impact, including consideration of: • Any relevant monitoring data; and • Current mine activities and land management practices in the relevant catchment.
2	Commission an investigation by an appropriate specialist into the unforseen impact, if considered appropriate by the Environmental Specialist.
3	Develop appropriate ameliorative measures based on the results of the above investigations, in consultation with the relevant authorities.
4	Implement additional monitoring where relevant to measure the effectiveness of the improvement measures.

7.3 Review

The adequacy and relevance of the response plan will be assessed on a daily basis through operational practice. In the event where operational procedures demonstrate inefficiencies or gaps in the response procedures, amendment to the plan will be made in consultation with relevant agencies.

8 REFERENCES

ANZECC, 2000. Fresh and Marine Water Quality Guideline, Australian Water Association, Artarmon, NSW

Landcom, 2004. Managing Urban Stormwater: Soils and Construction Manual, Sydney

RCA Australia, 2007. Groundwater Impact Assessment of the proposed Belmont Coal Project, Prepared on behalf of Whitehaven Coal Mining Pty Ltd – Part 1 of the Specialist Consultant Studies Compendium.

R.W Corkery & Co Pty. Limited, 2007. Environmental Assessment for the proposed Belmont Coal Project, Orange, NSW

Soil Conservation Service, 2007. Surface Water Assessment for the Proposed Belmont Coal Project. Prepared on behalf of Whitehaven Coal Mining Pty Ltd – Part 6 of the Specialist Consultant Studies Compendium

APPENDIX 1

RELEVANT PROJECT APPROVAL CONDITIONS

(PA 06_0198)

(No. of pages excluding this page = 2)

Schedule 3

Specific Environmental Conditions

SOIL AND WATER

Note: These conditions should be read in conjunction with sections 4, 5, 10, 13 and 17 of the Statement of Commitments.

Discharge

1. Except as may be expressly provided for by an EPL, the Proponent shall not discharge any surface waters from the site.

WATER MANAGEMENT PLAN

2. The Proponent shall prepare and implement a Water Management Plan for the project to the satisfaction of the Director-General. This plan must:

(a) be prepared in consultation with DWE and DECC by suitably qualified expert/s whose appointment/s have been approved by the Director-General;
(b) be submitted to the Director General prior to the commencement of construction activities (not including construction of the Kamilaroi Highway and Hoad Lane intersections or sections 1 and 2 of the road transport route); and
(c) include a:
- Site Water Balance;
- Erosion and Sediment Control Plan;
- Surface Water Monitoring Plan;
- Groundwater Monitoring Program; and
- Surface and Groundwater Response Plan, setting out the procedures for:
  - investigating, and if necessary mitigating, any exceedances of the surface or groundwater assessment criteria (see below); and
  - responding to any unforeseen impacts of the project.

SITE WATER BALANCE

3. The Site Water Balance must:

(a) include details of:
- sources and security of water supply;
- water use on site;
- water management on site;
- any off-site water transfers;
(b) describe measures to minimise water use by the project; and
(c) be reviewed and recalculated each year in the light of the most recent water monitoring data.

EROSION AND SEDIMENT CONTROL

4. The Erosion and Sediment Control Plan must:

(a) be consistent with the requirements of *Managing Urban Stormwater: Soils and Construction* manual (Landcom 2004, or its latest version);
(b) identify activities that could cause soil erosion and generate sediment;
(c) describe measures to minimise soil erosion and the potential for transport of sediment to downstream waters;
(d) describe the location, function, and capacity of erosion and sediment control structures; and
(e) describe what measures would be implemented to monitor and maintain the structures over time.

SURFACE WATER MONITORING PROGRAM

5. The Surface Water Monitoring Plan must include:

(a) detailed baseline data on surface water flows and quality in creeks and other waterbodies that could be affected by the project;
(b) surface water impact assessment criteria;
(c) a program to monitor the impact of the project on surface water flows and quality; and
(d) procedures for reporting the results of this monitoring.

GROUNDWATER MONITORING PROGRAM

6. The Groundwater Monitoring Program must include:
(a) further development of the regional and local groundwater model;
(b) detailed baseline data to benchmark the natural variation in groundwater levels, yield and quality (including at any privately owned bores in the vicinity of the site);
(c) groundwater impact assessment criteria;
(d) a program to monitor the impact of the project on groundwater levels, yield and quality; and
(e) procedures for reporting the results of this monitoring.

APPENDIX 2

FIGURES 1-6

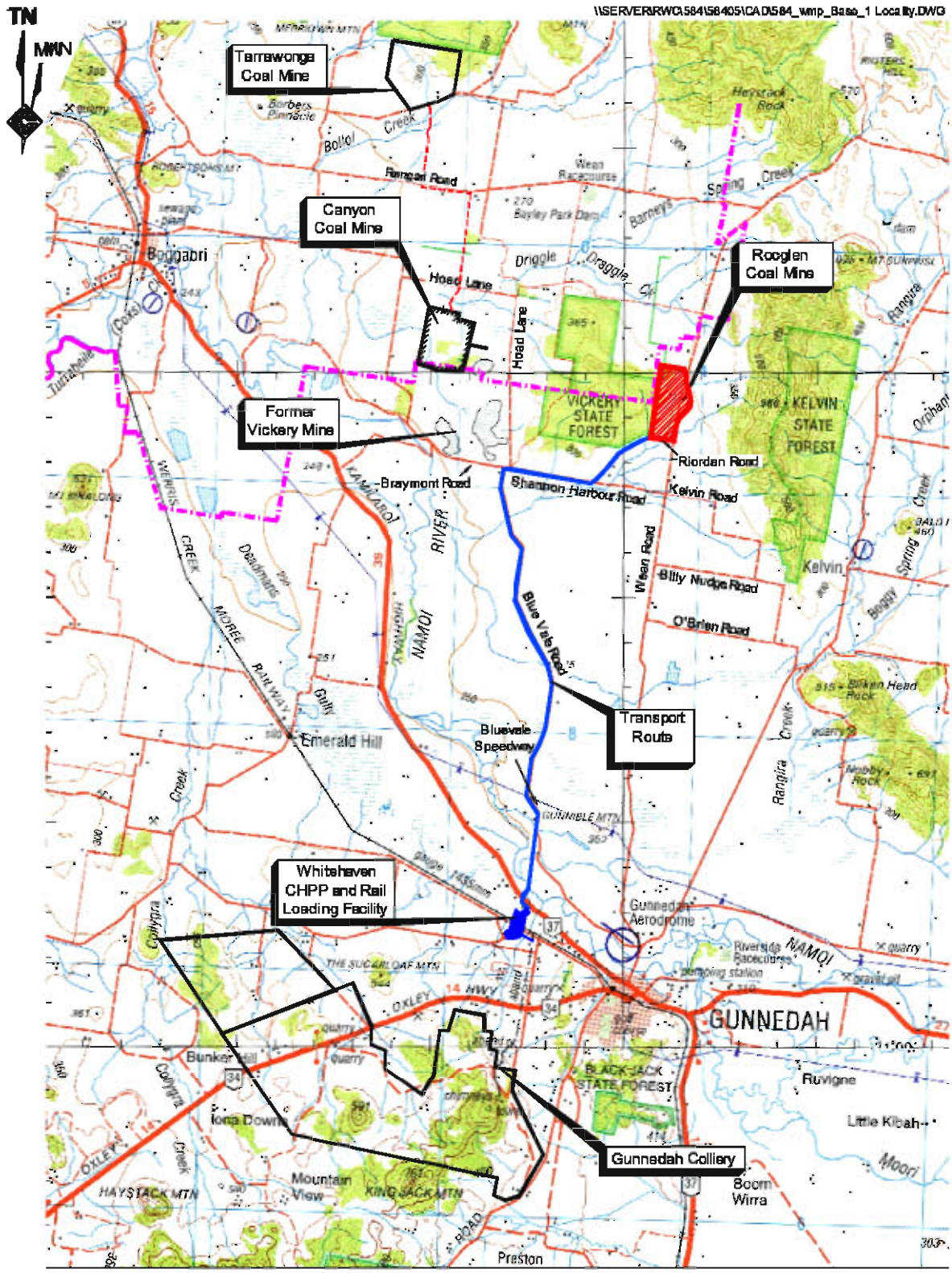


Figure 1
ROCGLEN COAL MINE
LOCATION

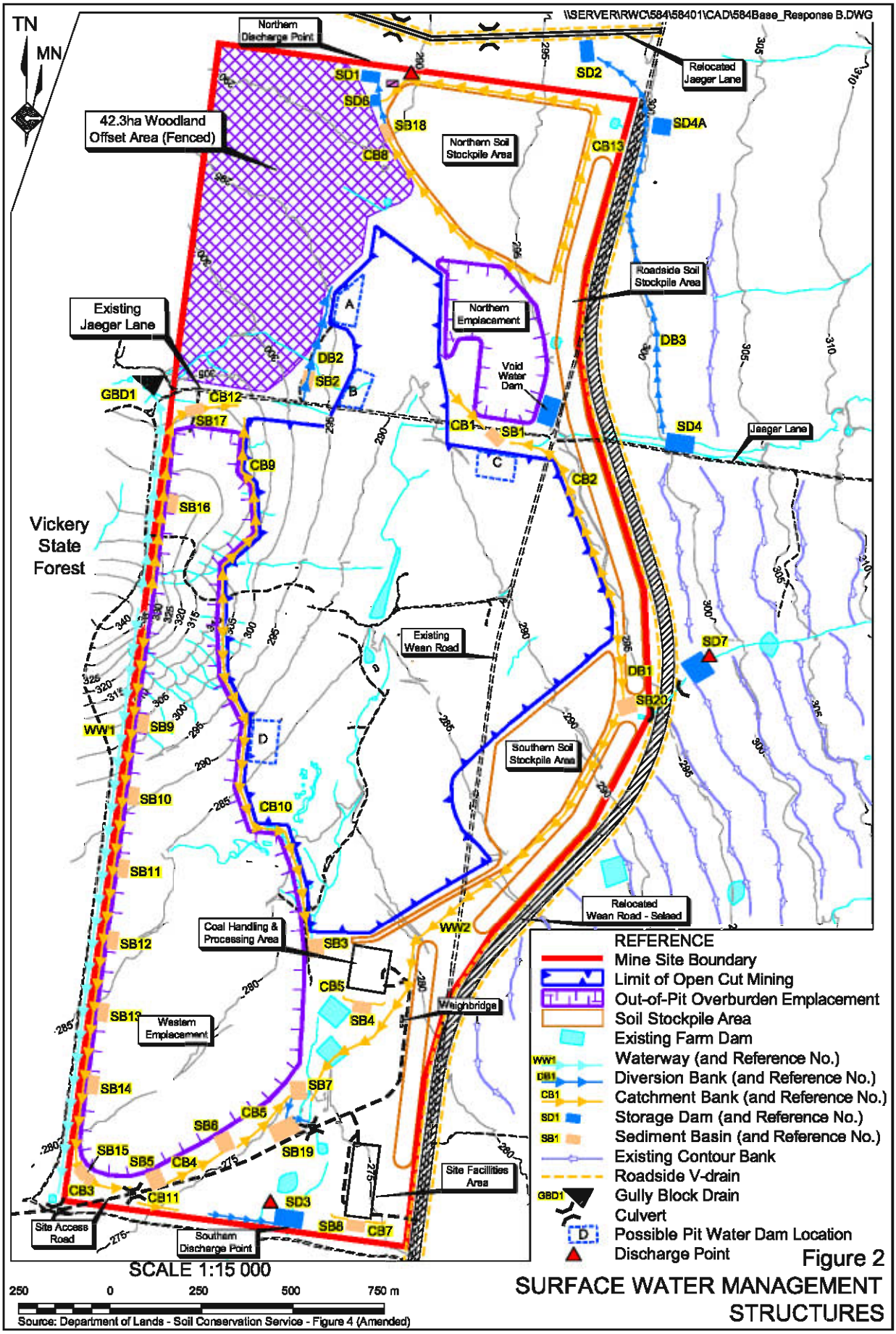


Figure 2
SURFACE WATER MANAGEMENT STRUCTURES

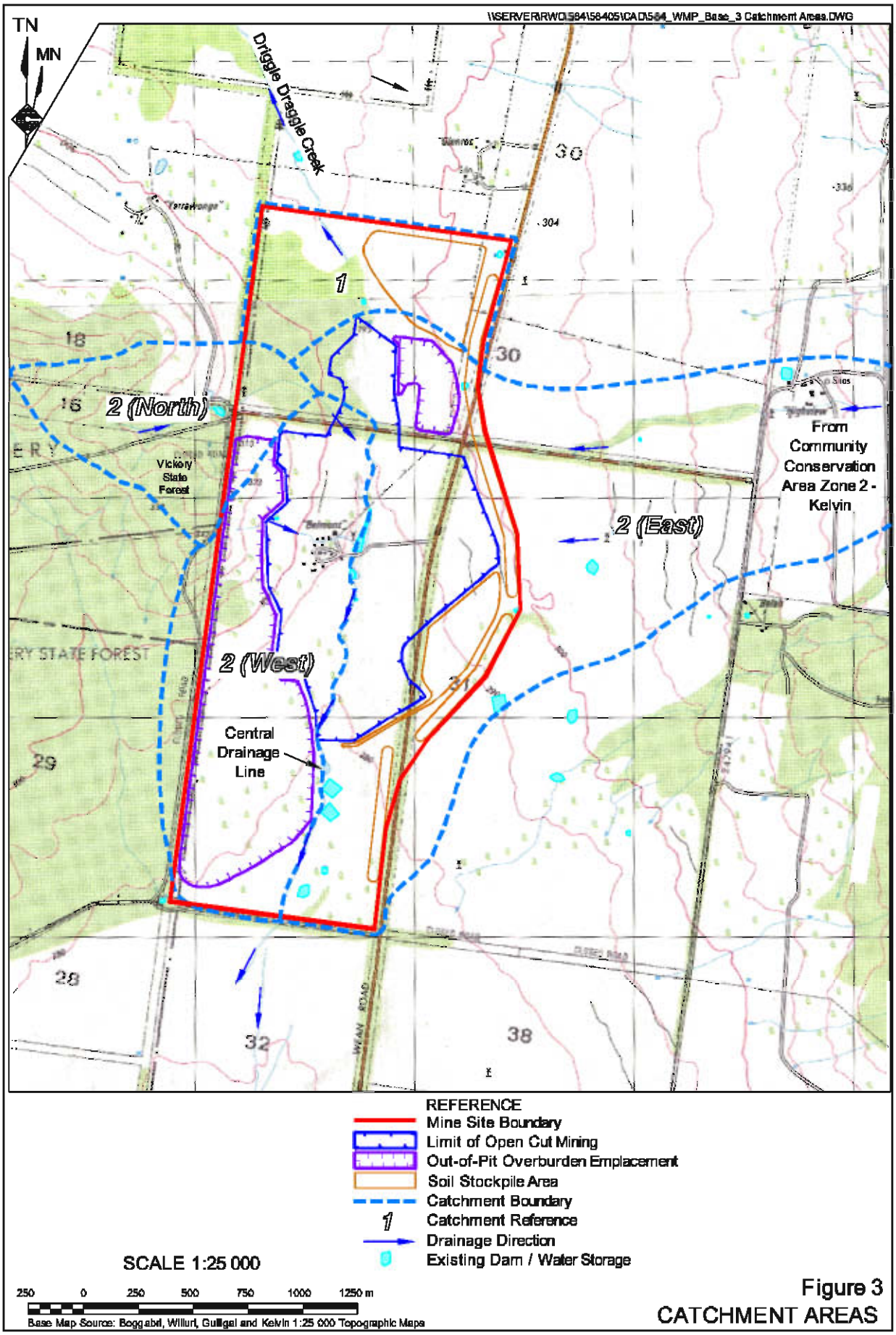
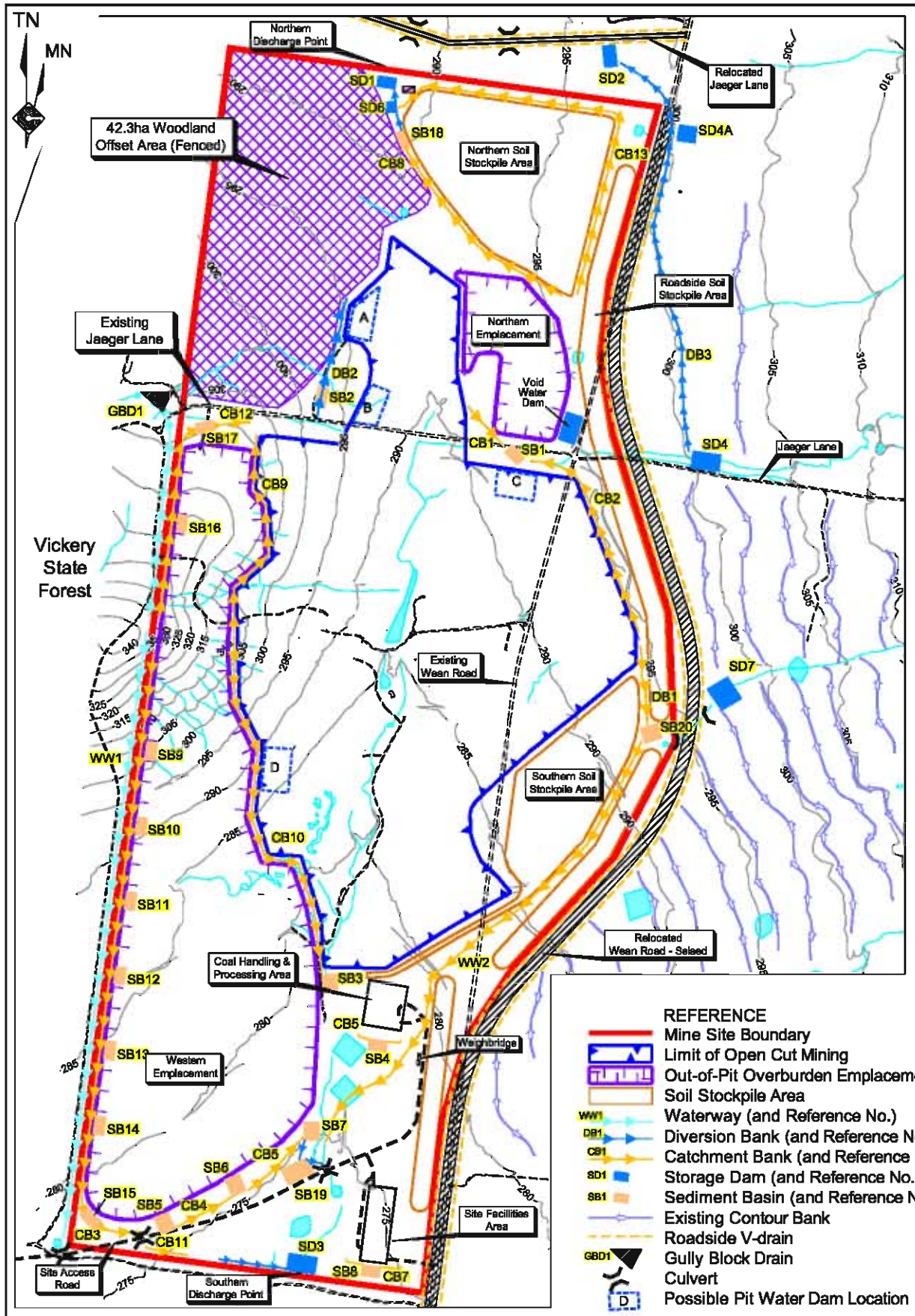


Figure 3
CATCHMENT AREAS

\\SERVER\RWC\584\58401\CAD\584Base_WMP 4 Sed Control Plan.DWG



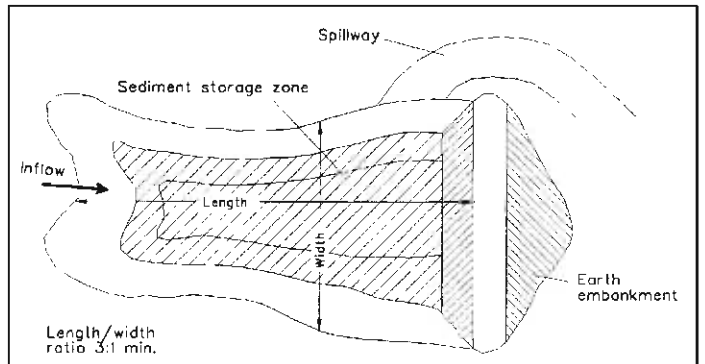
REFERENCE
- Mine Site Boundary
- Limit of Open Cut Mining
- Out-of-Pit Overburden Emplacement
- Soil Stockpile Area
- WW1 Waterway (and Reference No.)
- DB1 Diversion Bank (and Reference No.)
- CB1 Catchment Bank (and Reference No.)
- SD1 Storage Dam (and Reference No.)
- SB1 Sediment Basin (and Reference No.)
- Existing Contour Bank
- Roadside V-drain
- GBD1 Gully Block Drain
- Culvert
- D Possible Pit Water Dam Location

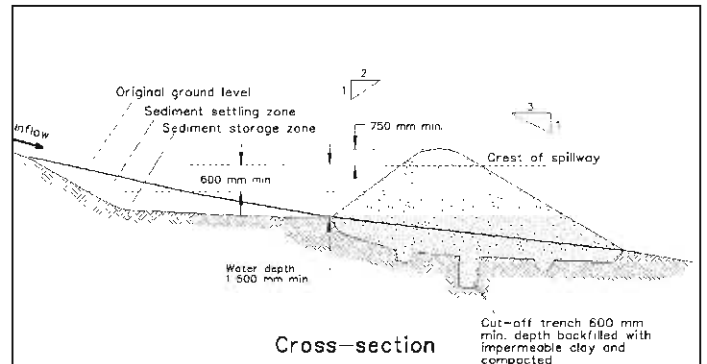
SCALE 1:15 000

250 0 250 500 750 m

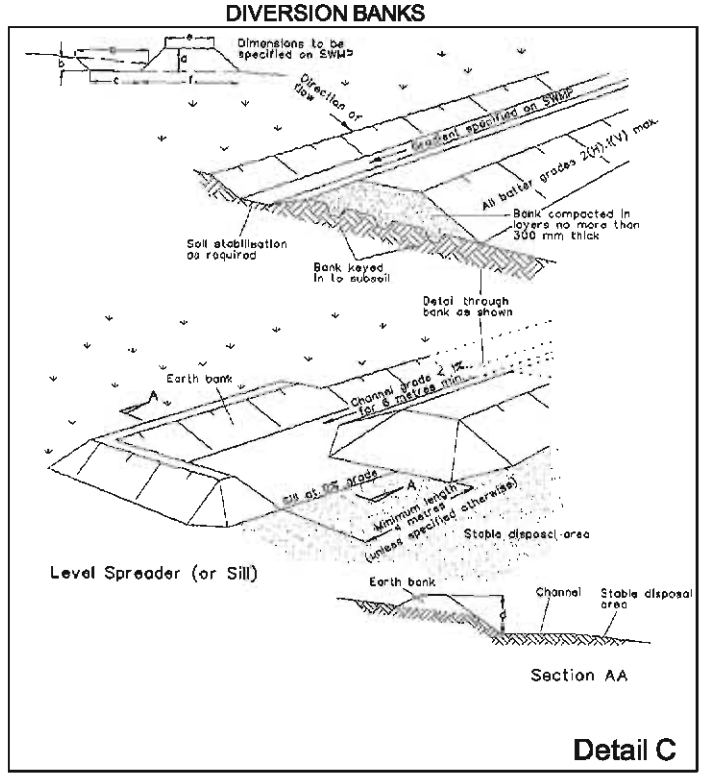
Source: Department of Lands - Soil Conservation Service - Figure 4 (Amended)

STORAGE DAMS AND SEDIMENT BASINS

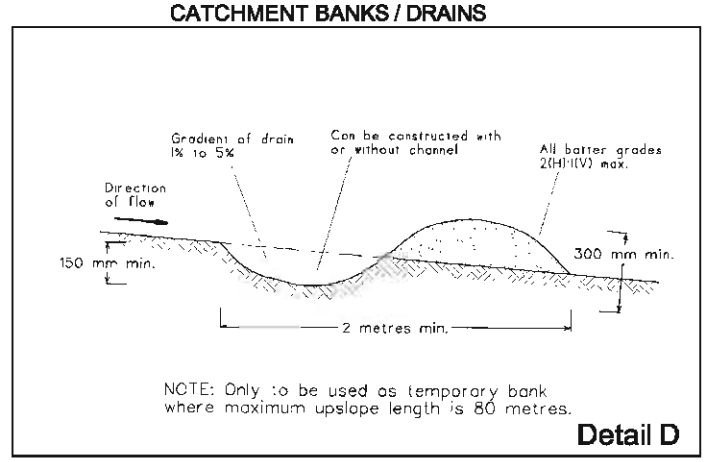




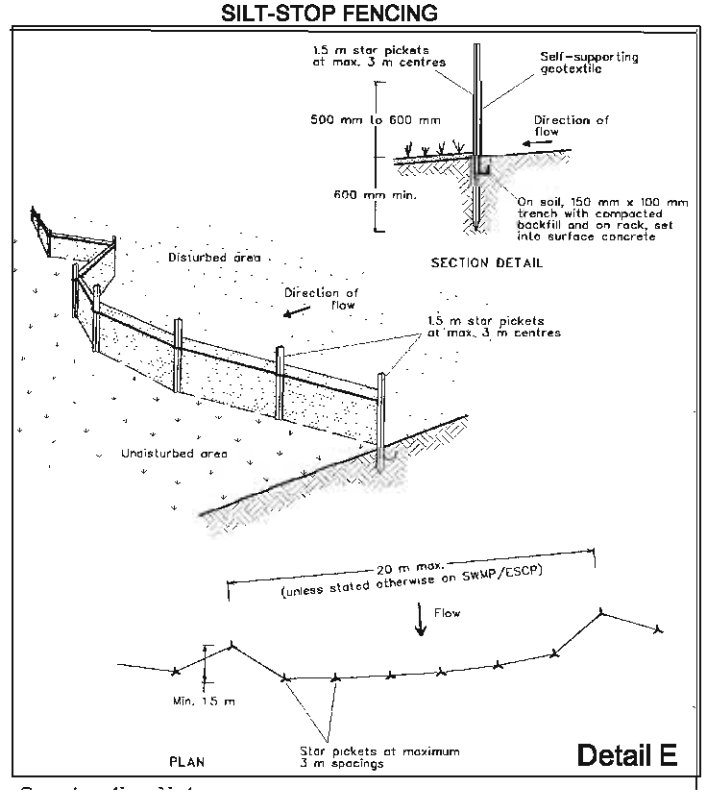
DIVERSION BANKS



CATCHMENT BANKS / DRAINS



SILT-STOP FENCING



Where upslope length is >80m, design as per Detail C would be used

Figure 4
EROSION AND SEDIMENT CONTROL PLAN

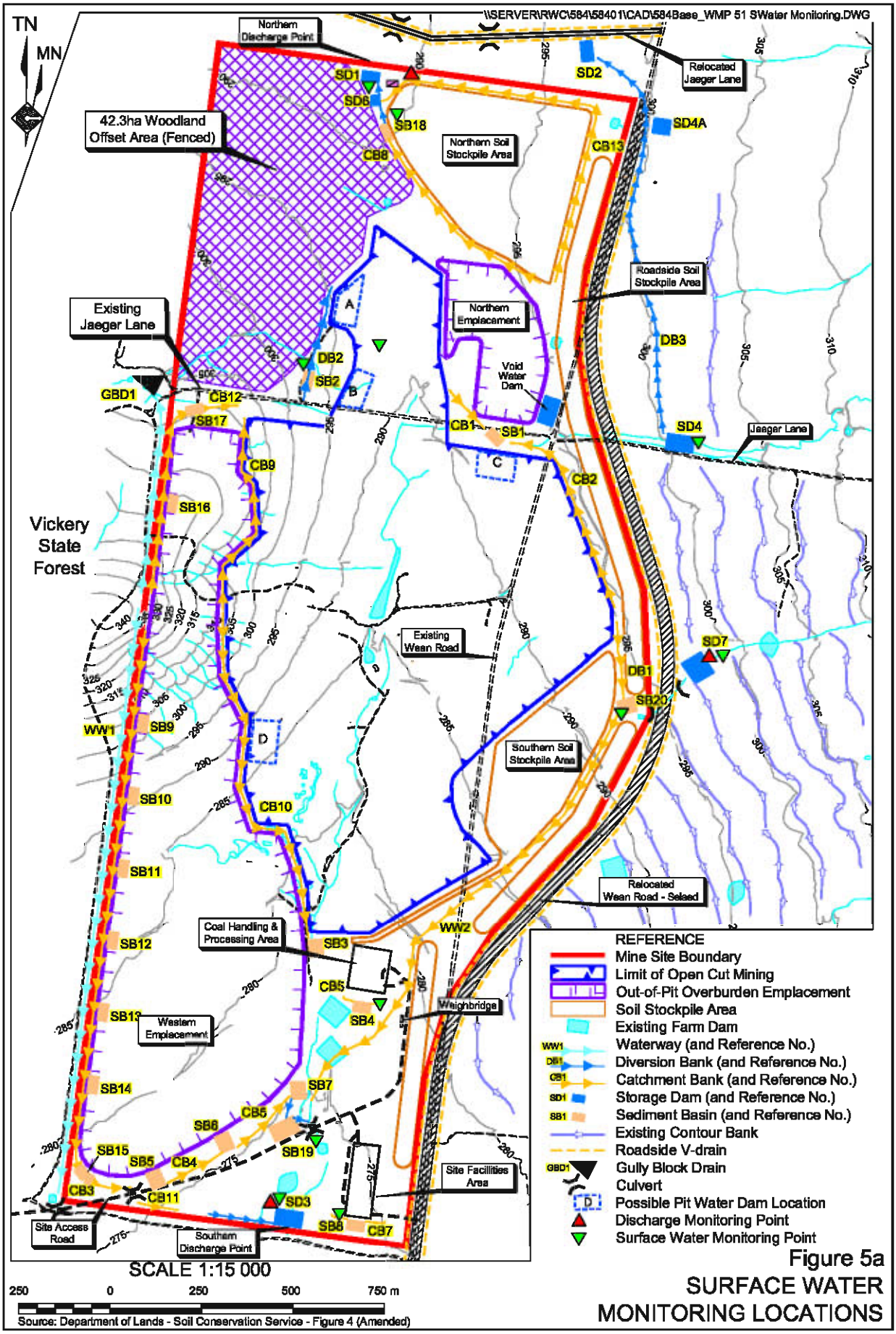


Figure 5a
SURFACE WATER MONITORING LOCATIONS

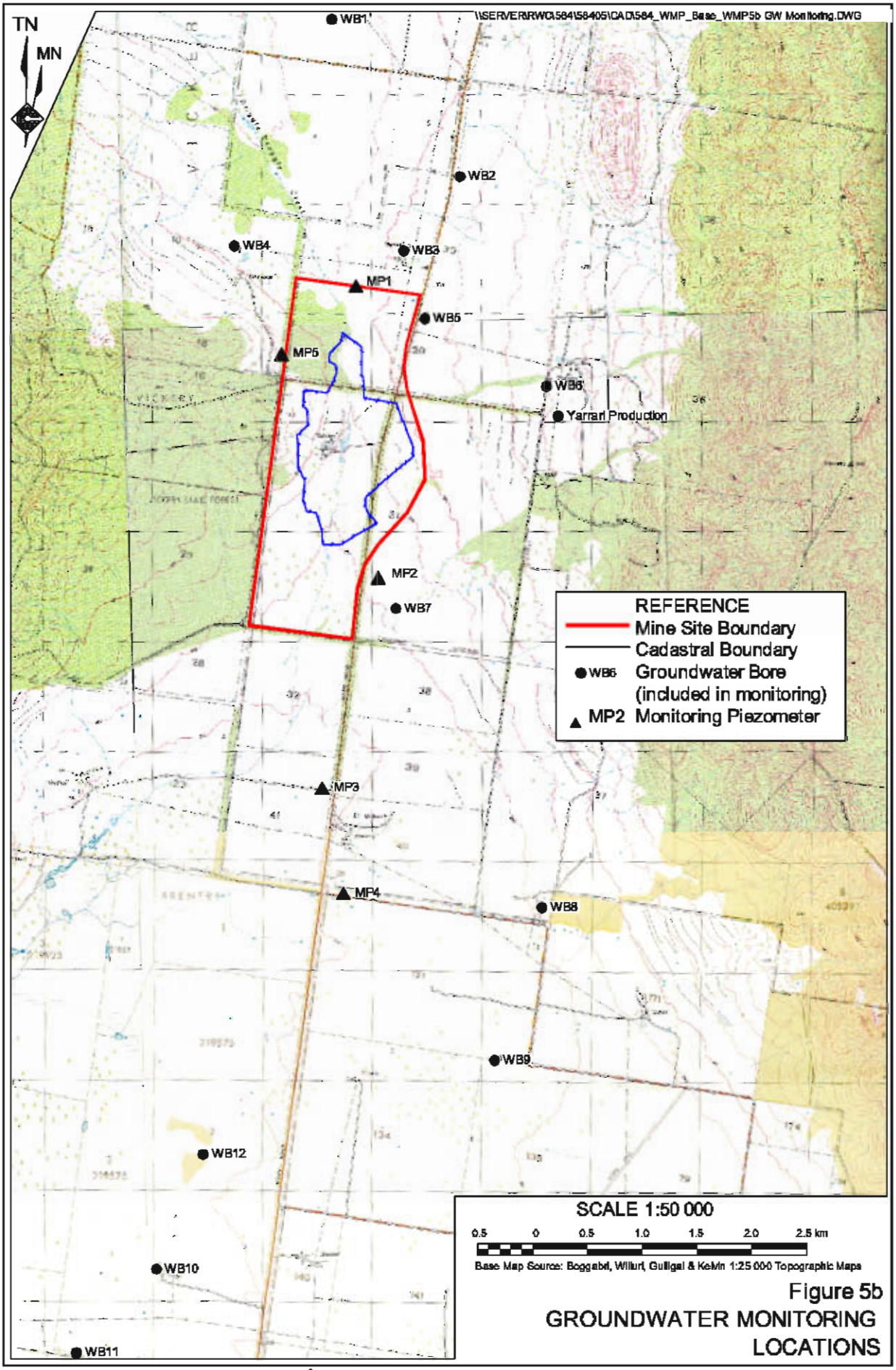


Figure 5b
GROUNDWATER MONITORING LOCATIONS

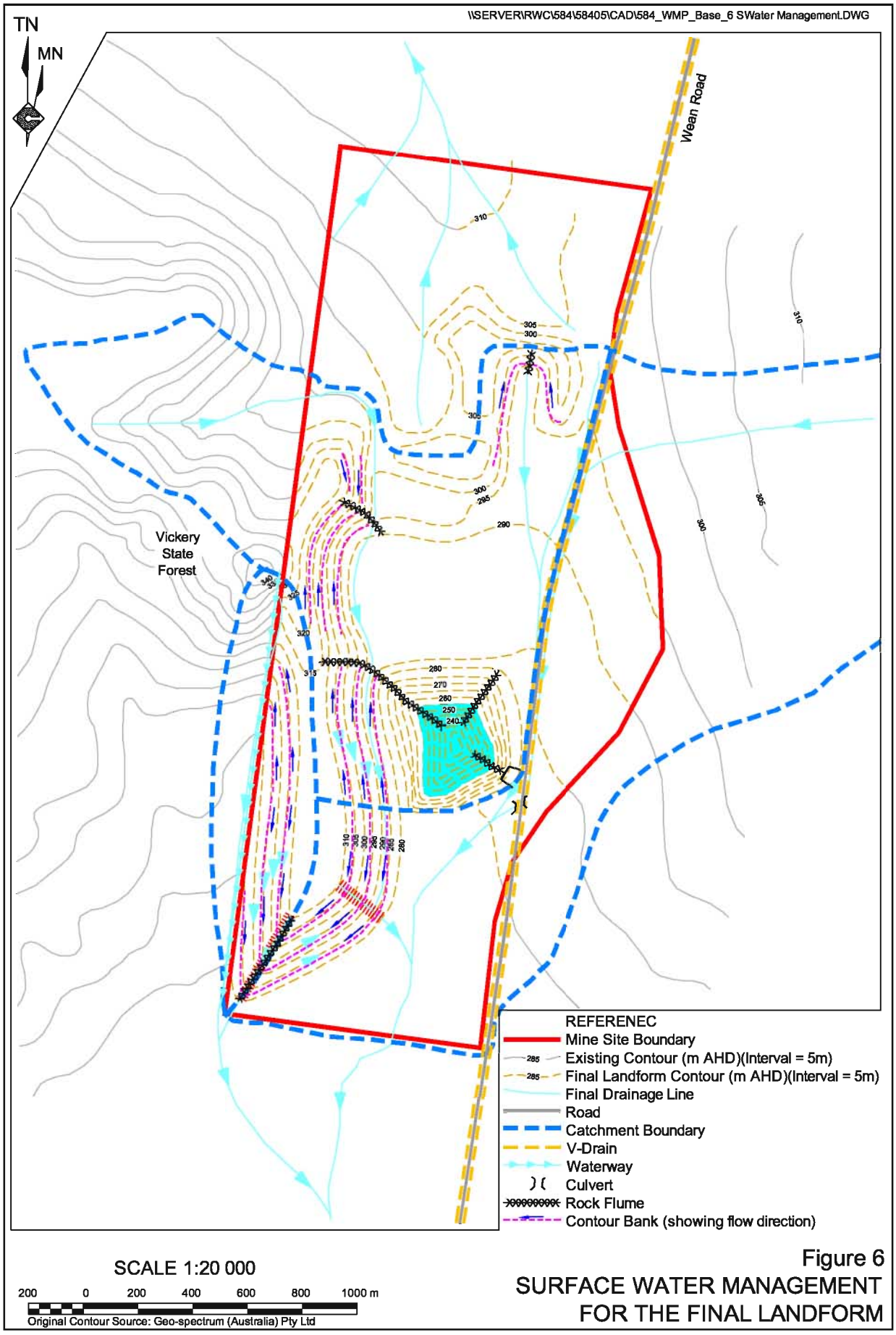


Figure 6
SURFACE WATER MANAGEMENT
FOR THE FINAL LANDFORM