SITE WATER MANAGEMENT PLAN

Tarrawonga Coal Pty Ltd

Site Water Management Plan
for the
Tarrawonga Coal Mine

Prepared by:

R.W CORKERY & CO. PTY. LIMITED

in conjunction with

SOIL SERVICES
(A division of the NSW Department of Lands)

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for the

Tarrawonga Coal Mine

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FOREWORD

Tarrawonga Coal Pty Ltd is required under its development consent issued on 9 November 2005 (DA 88-4-2005, see **Appendix 1**) to prepare a Site Water Management Plan (SWMP) to guide the management of water resources through the 8 to 10 year operational life of the Tarrawonga Coal Mine. The SWMP incorporates a predicted site water balance, an Erosion and Sediment Control Plan, a Surface Water Monitoring Program and a Groundwater Monitoring Program. A Groundwater Contingency Plan is to be prepared under separate cover.

All issues relating to surface water management along the Transport Route are documented in the Transport Route Management Plan.

This document has been revised from the original and noted as Report No. 643/06(Rev 1.0). Revision was undertaken in August 2007 to amend the locality of surface water management structures on the western boundary of the mining lease and correct the locality of the nominated discharge point on that boundary.

GLOSSARY OF ACRONYMS

AEMR	-	Annual Environmental Management Report
DA	-	Development Application
DEC (EPA)	-	Department of Environment and Conservation (Environment Protection Authority)
DNR	-	Department of Natural Resources
DoP	-	Department of Planning
DPI (MR)	-	Department of Primary Industries (Mineral Resources)
TCM	-	Tarrawonga Coal Pty Ltd
EIS	-	Environmental Impact Statement
ESCP	-	Erosion and Sediment Control Plan
GTAs	-	General Terms of Approval
GWMP	-	Groundwater Monitoring Program
IBC	-	Idemitsu Boggabri Coal Pty Ltd
SWMonP	-	Surface Water Monitoring Program
SWMP	-	Site Water Management Plan
WCM	-	Whitehaven Coal Mining Pty Ltd

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1 INTRODUCTION

This Site Water Management Plan (SWMP) for the Tarrawonga Coal Mine ("the mine"), has been prepared in compliance with *Condition 4(26)*[1] of a development consent issued for the Tarrawonga Coal Mine (DA 88-4-2005) and to satisfy the monitoring requirements contained with the General Terms of Approval (GTAs) of the Department of Environment and Conservation (DEC). Throughout the SWMP, reference to *Condition 4(26)* relates to that consent condition of DA 88-4-2005.

The Tarrawonga Coal Mine is to be managed by the newly formed company Tarrawonga Coal Pty Ltd (TCM), a joint venture between Whitehaven Coal Mining Pty Ltd (WCM) and Idemitsu Boggabri Coal Pty Ltd (IBC). The consent was issued in the name of the Joint Venture before the management company was incorporated. The SWMP incorporates:

- a description of water management of the mine site including objectives and the design and location of the surface water management structures for the mine site (**Section 2**);
- the predicted site water balance (**Section 3**);
- an Erosion and Sediment Control Plan (**Section 4**);
- a Surface Water Monitoring Program (**Section 5**); and
- a Groundwater Monitoring Program (**Section 6**).

The SWMP has been prepared in conjunction with Soil Services, a division of the NSW Department of Lands, hydrological consultants to TCM. The SWMP builds upon and refines the water management concepts in the 2005 Environmental Impact Statement (EIS) for the mine and has been prepared for the life of the mine. In the event that refinements to mine design result in altered water management requirements, or operational experience and/or monitoring leads to changes to the method of managing or monitoring water, the SWMP will be updated. Any updated SWMP will be submitted to the Director-General for endorsement.

To assist in keeping the SWMP as concise as possible, the document has been prepared with reference to five figures of the mining lease ("the mine site"). **Figure 1, Figure 2** and **Figure 3** present the sequential development of the mine illustrating the development of surface water management structures in relation to the changing catchments on the mine site over Years 1 and 2, 4 and 6 and the final landform respectively. **Figure 4** presents the representative catchments from which annual surface water yields for the mine site have been based. **Figure 4** also presents the generalised design of erosion and sediment control features to be employed on the mine site. **Figure 5** presents the location of surface water and groundwater monitoring points for the mine site and surrounds.

For management purposes, the water within the mine site has been divided into three classes.

1. **"Clean" water** - surface runoff from catchments undisturbed or relatively undisturbed by mining or related activities and rehabilitated catchments. Clean water is captured in two catchments on the mine site, referred to as the "supply" and "rehabilitated" clean water catchments on **Figures 1** and **2**. Clean water will

[1] See Appendix 1 for full condition.

also flow over parts of the mine site where it is not captured for operational use. This is referred to as the "undisturbed" clean water catchment on **Figures** 1 and **2**. All surface water emanating from the final landform will be clean, with the final catchments and storage structures presented on **Figure 3.**

2. **"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 areas (until stabilised), all of which could contain sediments. Dirty water used to supply the water requirements of the mine site is captured within two catchments on the mine site, referred to as the "disturbed areas" and "open cut" catchments on **Figures 1** and **2**. It should be noted that a proportion of the water in these catchments will not flow over disturbed areas or within the open cut, rather, the catchment itself contains either areas of disturbance or the open cut void.
3. **"Contaminated" water** – surface runoff which could potentially contain hydrocarbons.

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 groundwater to meet the requirements for 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, and sediment basin discharge 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 maximise the use of "dirty" water for dust suppression purposes and minimise the necessity to harvest "clean" run-on water.

(iv) 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 criteria of *Condition 4(24)*.

(v) To minimise erosion and sedimentation from all active and rehabilitated areas of the mine site.

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

(vii) To monitor the impact on groundwater level, quality and availability.

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

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

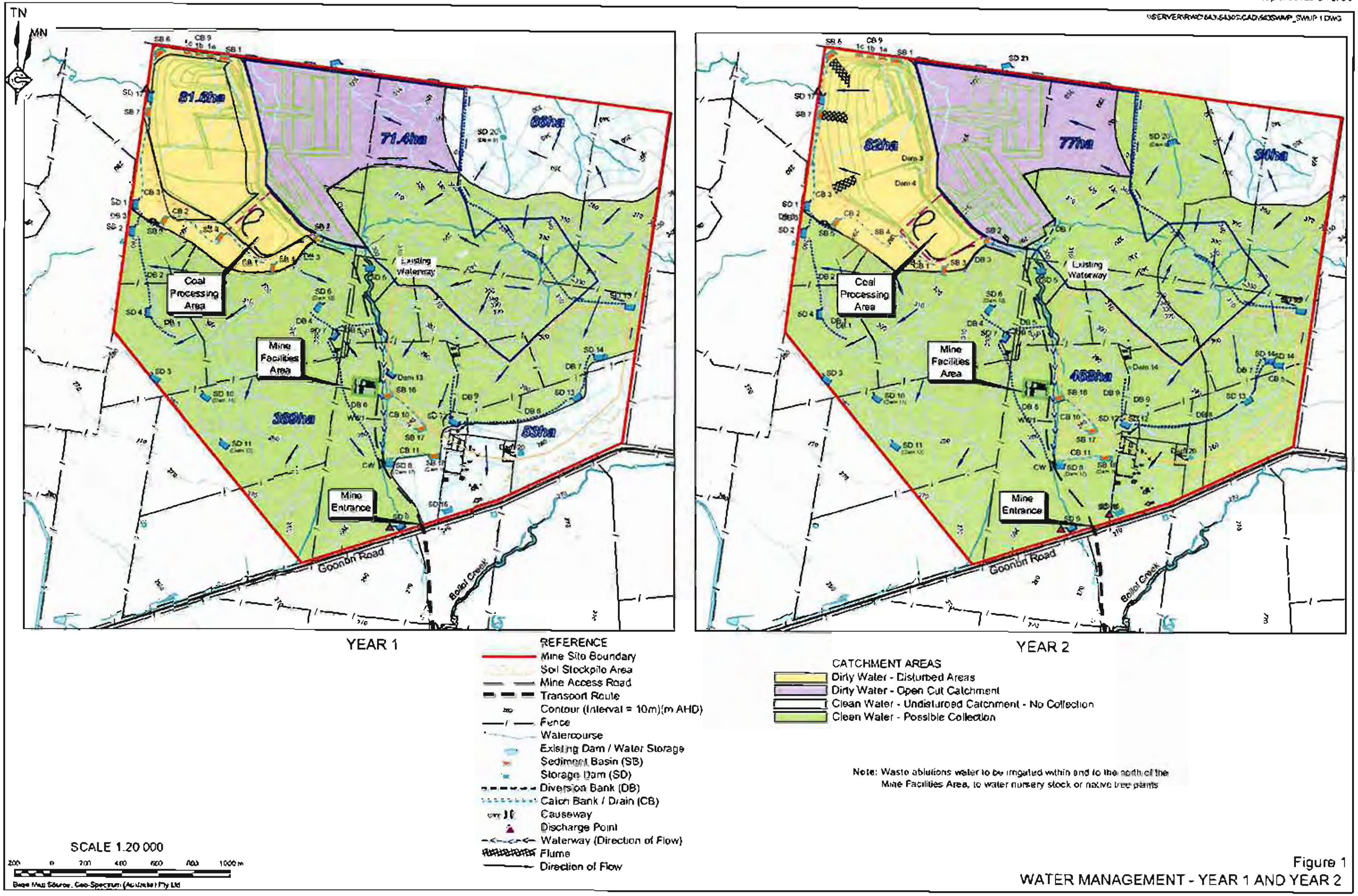
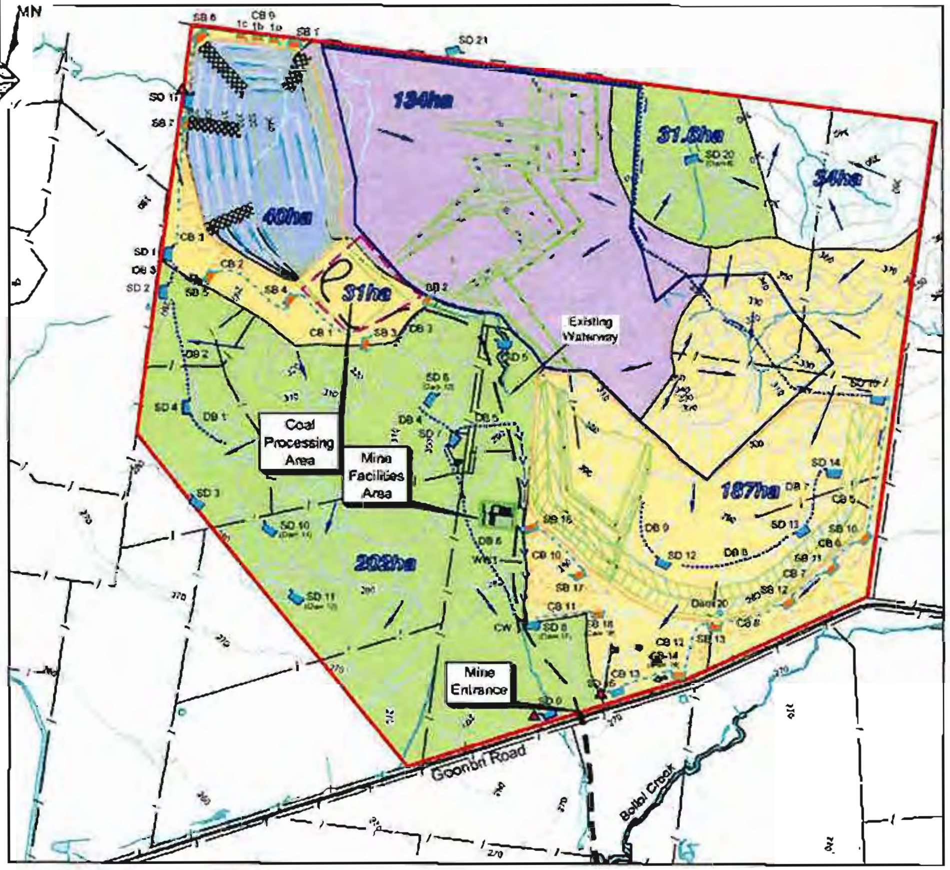
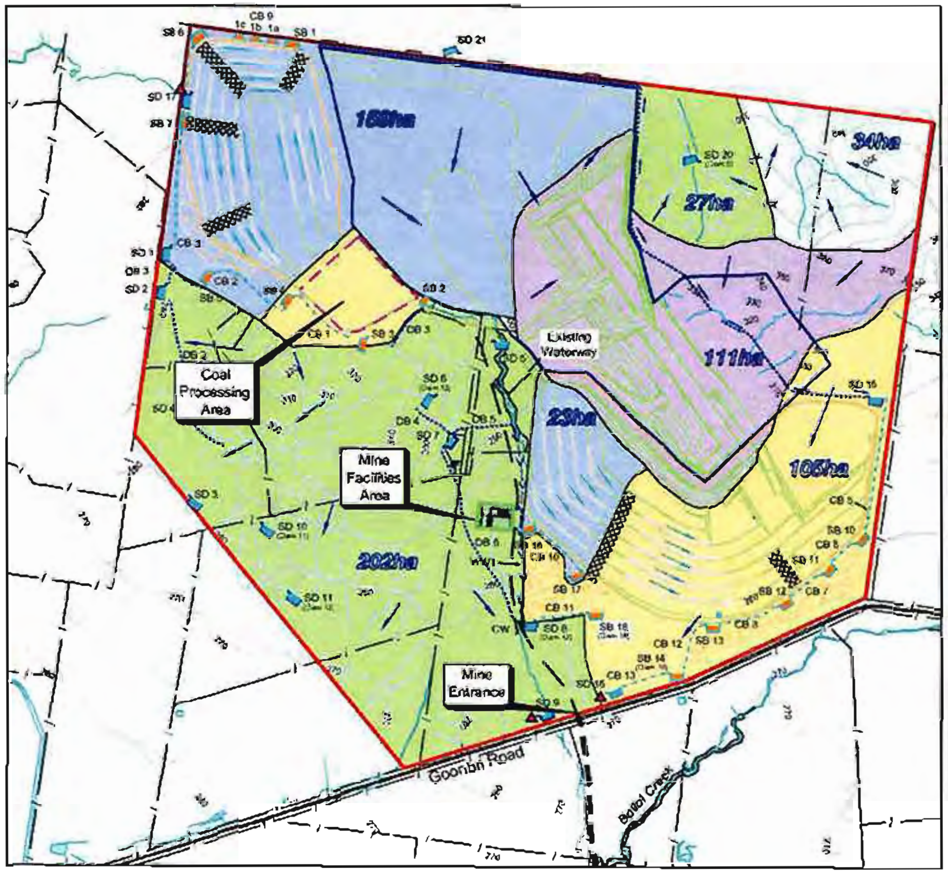


Figure 1
WATER MANAGEMENT - YEAR 1 AND YEAR 2





REFERENCE
- Mine Site Boundary
- Soil Stockpile Area
- Mine Access Road
- Transport Route
- Contour (Interval = 10m)(m AHD)
- Fence
- Watercourse
- Existing Dam / Water Storage
- Sediment Basin (SB)
- Storage Dam (SD)
- Diversion Bank (DB)
- Catch Bank / Drain (CB)
- Causeway
- Discharge Point
- Waterway (Direction of Flow)
- Flume
- Direction of Flow

CATCHMENT AREAS
- Dirty Water - Disturbed Areas
- Dirty Water - Open Cut Catchment
- Clean Water - Undisturbed Catchment - No Collection
- Clean Water - Possible Collection
- Clean Water - Rehabilitated Catchment

Notes: Waste ablutions water to be irrigated within and to the north of the Mine Facilities Area, to water nursery stock or native tree plants

SB1(a,b and c), SB6, 7 and 8 become clean water storages (storage dams) in year 6

SCALE 1:20 000

Base Map Source: Geo-Spectrum (Australia) Pty Ltd

Figure 2
WATER MANAGEMENT - YEAR 4 AND YEAR 6

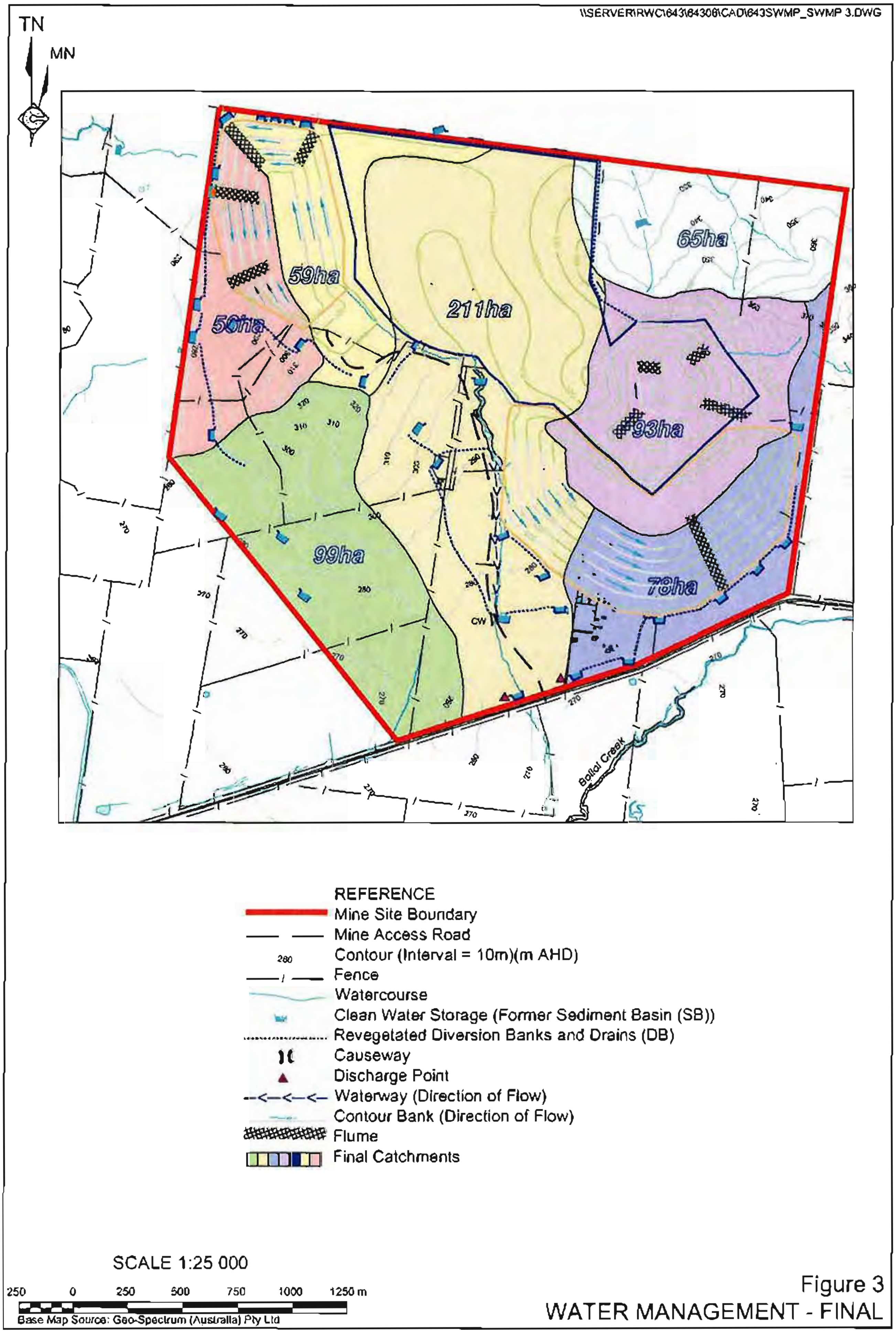


Figure 3
WATER MANAGEMENT - FINAL

2.2 Surface Water Management Structures

2.2.1 Introduction

Operational water requirements will be preferentially sourced from "dirty" water run-off collected on site, together with any surface water and groundwater which accumulates in the open cut. Any shortfall will be supplemented by harvested "clean" water. **Figures 1, 2** and **3** present the progressive construction of surface water management structures within the mine site catchments over the life of the mine.

A general description of the design of these surface water management structures along with more specific detail on the dimensions of each and the timing of construction 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 will be achieved using a series of diversion banks (prefix DB) and Storage Dams (prefix SD) which will be constructed prior to surface disturbance activities within the adjacent upslope water catchments.

The design period for all diversion bank and storage dam structures has been 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).

<u>Diversion Banks</u>

Each diversion bank will exhibit 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 are to be 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 to be constructed with minimum 1.5 x channel base width.

Table 2.1 presents the specifications of the diversion banks illustrated on **Figures 1** and **2**.

Table 2.1
Diversion Bank Specifications

Diversion Bank ID	Catchment Area (ha)	Channel Bottom Width (m)	Channel Grade (%)	Bank Height (m)	Sill Width (m)	Slope Below Sill (%)	Construction Timing[1]
DB1	4	3	0.2	0.8	6	5	1
DB2	16	6	0.2	0.8	9	4	1
DB3	20	6	0.2	0.8	9	3.5	1
DB4	3	3	0.2	0.8	6	8	1
DB5	4	3	0.2	0.8	6	4.5	1
DB6	8	3	0.2	0.8	6	4	1
DB7	8	3	0.2	0.8	6	4.5	1
DB8	70	20	0.2	1.0	30	4	1
DB9	8	3	0.2	0.8	6	4	1

[1] Construction Timing refers to the year in which each structure is to be constructed.
* This is the maximum catchment area for the structure although it is noted this will vary dependant on the progress of mine and site development.
Source: Soil Services

All diversion bank structures have been designed to cater for water velocity of 1.2m/s, an acceptable rate considering these would be well grassed. If a larger storm is encountered then maintenance of these spillways may be required.

Storage Dams

Figures 1 and **2** identify the 20 storage dams to be installed, each of which will exhibit the following features.

- Excavation and dam bank batters to be at least 1:3 (V:H).
- Crest width to be a minimum 3m wide.
- Freeboard to be a minimum 1m above top water level up to a wall height of 3m. Above 3m there will be an increase in freeboard of 0.1m for every 1m increase in wall height.
- Inlet and outlet channel batters are to be 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 to be constructed with minimum 1.5 x channel base width.

Table 2.2 presents the specific dimensions of each storage dam identified on **Figure 1, Figures 2** and **3** as well as the timing for the construction and the average annual storage expected within each storage dam.

The storage dams will be constructed before the construction of the associated diversion bank(s) and sized to accommodate the more dispersive Type D soils on the mine site (GCNRC, 2005).

Table 2.2
Storage Dam Specifications

Storage Dam ID	Catchment Area (ha)	Volume (m^3)	Dimensions length x width (m x m)	Depth (m)	Outlet Width (m)	Sill Width (m)	Construction Timing[1]
SD1	20	5000	50 x 50	3	6	9	1
SD2	16	5000	50 x 50	3	6	9	1
SD3	4	1300	25 x 37	2.5	3	6	1
SD4	4	2000	34 x 34	3	3	6	1
SD5	30	7000	54 x 60	3	8	14	1
SD6 - Existing Dam 10	4	200	15 x 16	2	3	6	1
SD7	6	1000	25 x 28	3	3	6	1
SD8 - Existing Dam 17	32	700	25 x 25	2	8	14	1
SD9	120	11000	60 x 80	3	30	45	1
SD10 - Existing Dam 11	10	100	10 x 15	1.5	3	6	1
SD11 - Existing Dam 12	35	3000	39 x 45	2.5	8	14	1
SD12 - Existing Dam 16	90	4000	45 x 45	3	25	38	1 (increase by 9ML in year 4 or 5)
SD13	70	2000	34 x 34	3	20	30	1 (removed year 4 or 5)
SD14 - Existing Dam 15	4	1900	33 x 34	3	3	6	1 (removed year 4 or 5)
SD15	25	1900	33 x 34	3	8	14	1
SD16	32	700	25 x 25	2	8	14	1
SD17	85	6800	38 x 85	3	10	12	1
SD20 – Existing Dam 6	15	1300	25 x 37	2.5	6	9	1
SD-21	Unsized existing dam off the mining lease						
Existing Dam 7	8	2000	34 x 34	3	3	6	removed year 4 or 5
Existing Dam 8	10	100	10 x 15	1.5	6	9	removed year 3 or 4
Existing Dam 9	4	100	10 x 15	1.5	3	6	removed year 3 or 4

[1] Construction Timing refers to the year in which each structure is to be constructed

Source: Soil Services

2.2.3 Dirty Water Management

Figures 1 and **2** also present the proposed dirty water management controls noting all surface water flowing across the final landform will be clean. Catchment banks/drains (prefix CB) will be constructed 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 – Department of Housing, 2004) present on the mine site (based on GCNRC, 2005).

The design period for all catchment bank/drain and sediment basin structures has been a minimum of a 1 in 10 year average recurrence interval (ARI).

Catch Banks/Drains

The general features for each of the catch banks/drains presented on **Figures 1** and **2** will be the same as for the diversion banks, ie. designed for a minimum of a 1 in 10 year ARI, based on SCS (1990). **Table 2.3** provides the specifications and construction timing for each catch identified bank/drain.

In addition to the catch bank/drains, a waterway (prefix WW) will be re-instated on the mine site replacing an existing drainage line aligned roughly between the Southern Emplacement and mine access road. **Table 2.3** provides the specifications and construction timing for the waterway.

Table 2.3
Catch Bank Specifications

Catch Bank ID	Catchment Area (ha)	Channel Bottom Width (m)	Channel Grade (%)	Bank Height (m)	Sill Width (m)	Slope Below Sill (%)	Construction Timing[1]
CB1	8	3	0.2	0.8	6	4.0	1
CB2	12	3	0.2	0.8	6	3.5	1
CB3	20	6	0.2	0.8	9	3.5	1
CB4	40	10	0.2	1.0	20	3.0	1
CB5	15	6	0.2	0.8	9	4.0	4
CB6	20	6	0.2	0.8	9	4.0	4
CB7	28	8	0.2	1.0	14	4.0	4
CB8	48	10	0.2	1.0	20	3.5	4
CB9	10	3	0.2	0.8	6	4.0	1
CB10	12	3	0.2	0.8	9	3.5	4
CB11	28	8	0.2	1.0	14	3.0	4
CB12	52	10	0.2	1.0	20	2.5	4
CB13	88	25	0.2	1.0	38	2.5	4
	Waterway Width (m)			**Bank Height (m)**			
WW1	20			1.0			1
[1] Construction Timing refers to the year in which each structure is to be constructed.							
Source: Soil Services							

All catchment bank/drains and the waterway have been designed to cater for water velocity of 1.2m/s, an acceptable rate considering these would be well grassed. If a larger storm is encountered then maintenance of these spillways may be required.

<u>Sediment Basins</u>

Sediment basin design has been based on the Landcom (2004) 'Managing Urban Storm Water: Soils and Construction'. To bring the Landcom document into line with large scale disturbance activities, reference has been made to SCS (1990) which was developed for soil and water conservation earthworks for broad scale agricultural practices.

The sediment basins have been designed to allow for settling and storage of "dirty" water collected on site, with the volume also reflecting the dispersive nature of the mine site soils (GCNRC, 2005). **Table 2.4** presents the specifications for each sediment basin identified on **Figure 1** and **Figure 2** along with the average annual storage volume and construction timing.

The sediment basins will be constructed before any other drainage control or water management structure and sized to accommodate the more dispersive Type D soils of the mine site.

Table 2.4
Sediment Basin Specifications

Sediment Basin ID	Catchment Area (ha)*	Volume (m^3)	Dimensions length x width x depth (m x m x m)	Outlet Width (m)	Sill Width (m)	Construction Timing[1]
SB1 (including a. b and c)	12	1000	27 x 27 x 3	3	6	1
SB2	5	1000	27 x 27 x 3	3	6	1
SB3	5	1000	27 x 27 x 3	3	6	1
SB4	8	1000	27 x 27 x 3	3	6	1
SB5	12	1000	27 x 27 x 3	3	6	1
SB6	80	7000	54 x 60 x 3	25	38	1
SB7	15	4640	32 x 85 x 3	12	22	1
SB10	15	1000	27 x 27 x 3	6	9	4
SB11	20	1000	27 x 27 x 3	6	9	4
SB12	48	3000	39 x 45 x 3	10	20	4
SB13	50	4000	45 x 45 x 3	10	20	4
SB14 Enlarge Existing Dam 14	52	7000	54 x 60 x 3	10	20	4
SB16	8	1000	27 x 27 x 3	3	6	4
SB17	12	1000	27 x 27 x 3	3	6	4

[1] Construction Timing refers to the year in which each structures is to be constructed.

Source: Soil Services

The design of sediment basins has considered the basic requirements and experiences at other coal mines to make the sediment storage capacities generous. For example for the Southern Emplacement if the maximum 90 percentile rainfall events for a two month period are used this catchment would yield approximately 13ML. Not considering evaporation or use of this water within the mine for this two month period and given the total capacity in the southern sediment basins ie. 20ML, there is a 7ML buffer. Additionally the size and layout of the sediment basins aids in the settling of entrapped particles via dispersion over grassed areas and multiple sediment basins in which to settle its sediment load. Hence when the water reaches the final sediment basin this water will be relatively clean and if it doesn't meet discharge levels it can be easily expedited by the use of flocculants to achieve such levels.

As far as available water for mine use there is sufficient water available for use from dirty and clean water sources. Additionally, the company have since purchased adjoining properties and now have additional harvestable rights that they could utilised for mine operations if necessary.

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 the operational requirements of the proposal. The capture of dirty water will be maximised such that clean water captured and used by the mine remains within the maximum harvestable right for the mine site. Section 2.1 and **Figures** 1 and 2 present the location, design and capacity of surface water management structures to be installed to capture (and potentially discharge) water from the clean and dirty water catchments of the mine. 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 WCM and IBC). Section 3.4 balances the mine site requirements against water availability over the life of the mine.

3.2 Site Water Requirements

Water is required on the mine site primarily for dust suppression, with minor quantities required for potable and toilet/ablutions purposes. **Table 3.1** presents the annual water requirements of the mine based on the area covered by exposed surfaces, the production rates and number of employees managed on the mine site each day. The water requirements will be reviewed annually and updated based on operational experience and/or changing mine plans.

Table 3.1
Site Water Requirements

Water Use	Rate of Usage	Predicted Annual Use (ML)						
		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Operational Water Requirements								
Internal roads and exposed areas		50	54	60	60	60	60	60
Crushing and screening operations	1.5L/t	3	4	4	4	4	4	4
Hardstand and stockpiles		20	22	25	25	25	25	25
Total		73	80	89	89	89	89	89
Amenities*1								
Potable Water		0.06–0.1	0.06–0.1	0.06–0.1	0.06–0.1	0.06–0.1	0.06–0.1	0.06–0.1
Ablutions Water		0.5–1.0	0.5–1.0	0.5–1.0	0.5–1.0	0.5–1.0	0.5–1.0	0.5–1.0
Rehabilitation								
Supplementary watering of planted trees*2		0	0	5	5	5	5	5

Note *1: Not sourced from water collected on-site
Note *2: Watering of planted trees will only be undertaken in the event extreme weather resulted in high level plant stress.

Operational water requirements will be preferentially sourced from "dirty" water run-off and groundwater accumulation collected within the "disturbed area" and "open cut" catchments. Any shortfall will be supplemented by harvested "clean" water. **Figure 1** and **Figure 2** present the drainage controls and water management structures that will segregate "clean" and "dirty" water as well as provide storage for operational water to be used on the mine site.

3.3 Water Availability

3.3.1 Maximum Harvestable Right

Of the "clean" water that could be captured on the mine site each year, TCM 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[3] Value

= 726 x 0.07

= 50.8ML

[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 TCM's landholdings in the vicinity and including the mine site exceed more than 1 500ha allowing for an additional harvestable right of more than 105ML.

3.3.2 Annual Water Availability

Table 3.2 provides the total "clean" and "dirty" water available annually on the mine site for low (10th percentile), average (50th percentile) and high (90th percentile) rainfall years. It is noted that the quantity of water captured within "dirty" and "clean" water catchments changes over time in response to the areas disturbed by the mine and the rehabilitation of completed sections of the open cut area and overburden emplacements. As the mine site develops, the area covered by "dirty" water catchments first increases, due to surface disturbance related to development of the open cut and overburden emplacements, and then decreases, as these areas of disturbance are rehabilitated. Ultimately, a catchment will be considered "clean" if the water quality meets criteria of Condition 4(24) of the development consent (reproduced as Table 5.1), however, as this may not be practicable to continually measure, a groundcover of around 70% may give a better indication of successful rehabilitation. Those areas on **Figures** 1 and 2 referred to as "Clean Catchment – Rehabilitated Catchment" have been estimated based on the proposed rehabilitation program of EBC.

In determining the availability of water, Soil Services considered the changing storage capacity of the site (see **Figures 1, 2** and **3** and **Tables 2.1** to **2.4**), the size of each water storage catchment (see **Figures 1** and **2** and **Tables 2.1** to **2.4**) and the following:

- daily rainfall data aggregated over 12 months and then averaged to provide a yearly figure for the 10th, 50th and 90th percentile from which the catchment yields were determined;
- data collected for a 99 year period; and
- runoff coefficients that vary depending on the nature of the runoff surface, eg. for determining the dirty catchment runoff, the area was considered to be denuded and void of any depression storage and mostly hard packed soil, giving a runoff coefficient of around 0.5 to 0.6. This is particularly high given that current farming practices on these properties might generate a runoff coefficient of 0.2 – 0.3.

The annual water availability has been calculated by Soil Services by considering both the available catchments created by the catch and diversion banks and the storage volume created by the storage dams and sediment basins. As a consequence, while the available storage in Years 1 and 2 is the same, the available water differs slightly based on the altered catchment size.

Table 3.2
Annual Water Availability

Yield	Available Catchment (ha)	Available Storage (ML)	Available Water (ML)	Available Catchment (ha)	Available Storage (ML)	Available Water (ML)
Dirty Water						
	Year 1			Year 2		
10th percentile	153	16	28.6	159	16	29.7
50th percentile	153	16	47.4	159	16	49.2
90th percentile	153	16	64.5	159	16	67.1
	Year 4			Year 6 onwards		
10th percentile	352	35	65.8	216	35	40.4
50th percentile	352	35	108.9	216	35	66.9
90th percentile	352	35	148.4	216	35	91.1
Clean Water						
	Year 1			Year 2		
10th percentile	508	50.8	94.9	502	48.9	93.8
50th percentile	508	50.8	157.2	502	48.9	155.4
90th percentile	508	50.8	214.2	502	48.9	211.7
	Year 4			Year 6 onwards		
10th percentile	308	48.7	57.5	445	50.6	83.1
50th percentile	308	48.7	95.2	445	50.6	137.7
90th percentile	308	48.7	129.7	445	50.6	187.7

Source: Soil Services

It is noted that the estimated available water exceeds the storage capacities in **Table 3.2**. However, as water will be continually taken from the water storages, either for operational purposes at the rates presented in **Table 3.1** or through evaporation, Soil Services only predicts discharges in Years 3, 4 and 5. This prediction was based on the following, which was also provided in a surface water assessment prepared for the Tarrawonga Coal Mine EIS.

- Peak discharges were calculated using both the deterministic and statistical rational method, as described in the design manual by the SCS (1990) and the Institution of Engineers (1987).
- An Intensity/Frequency/Distribution (IFD) table for the Project Site was created using the rainfall information from SCS (1990) and the Rainer computer program.
- The design storms for all channels and structures with outlet channels, unless stated, are for a 1 in 10 ARI and catchment yields were determined by utilising Bureau of Meteorology web site http://www.bom.gov.au/climate/averages/tables/canswnames.shtml) and design information within SCS (1990).

Given the predictions of RCA (2005) that even when mine inflow rates are at their highest [700m^3/day in Year 6], this would be well below the evaporative rate at the same time, 1 120m^3/day. The site water balance does not include groundwater which may seep into the mine void and accumulate in in-pit sumps or sediment basins.

3.4 Water Balance

Table 3.3 presents the predicted annual water balance for the mine site, based on the predicted annual water requirements (**Table 3.1**) and availability (**Table 3.2**). **Table 3.3** illustrates that during most years, there will be sufficient dirty water available such that the maximum harvestable right of 50.8ML will not be exceeded. During the later years of the mine, the reduced dirty water catchment area and storage capacity may require the use of clean water additional to the maximum harvestable right although this is only expected to occur during low rainfall years and by a limited volume (2.8ML). The Department of Natural Resources will be informed if clean water use during any given year is likely to exceed 50.8ML.

Table 3.3
Site Water Balance

Water Use	Predicted Annual Use (ML)						
	Year 1	Year 2	Year 3*	Year 4	Year 5'	Year 6	Year 7@
Water Requirements							
Operational	73	80	89	89	89	89	89
Rehabilitation	0	0	5	5	5	5	5
Total	73	80	94	94	94	94	94
Water Availability							
Dirty Water'							
Low Rainfall	28.6	29.7	65.8	66.8	53.1	40.4	40.4
Average Rainfall	47.4	49.2	108.9	108.9	87.9	66.9	66.9
High Rainfall	84.6	67.1	148.4	148.4	119.8	91.1	91.1
Clean Water''							
Low Rainfall	94.9	93.8	57.5	57.5	70.3	83.1	83.1
Average Rainfall	157.2	155.4	95.2	95.2	116.5	137.7	137.7
High Rainfall	214.2	211.7	129.7	129.7	158.7	187.7	187.7
Water Balance							
Dirty Water							
Low Rainfall	-44.4	-50.3	-28.2	-28.2	-40.9	-53.6	-53.6
Average Rainfall	-25.6	-30.8	14.9	14.9	-6.1	-27.1	-27.1
High Rainfall	-8.5	-12.9	54.4	54.4	25.8	-2.9	-2.9
Clean Water							
Low Rainfall	50.6	43.5	29.3	29.3	29.4	29.6	29.6
Average Rainfall	131.6	124.6	110.1	110.1	110.4	110.6	110.6
High Rainfall	205.7	198.8	184.1	184.1	184.6	184.8	184.8
Harvestable Right Not Required+							
Low Rainfall	6.4	0.6	22.6	22.6	9.9	-2.8	-2.8
Average Rainfall	25.2	20	65.7	66.7	44.7	23.7	23.7
High Rainfall	42.3	37.9	105.2	106.2	76.6	47.9	47.9

* Assumed to approximate Year 4 given the necessity to construct the acoustic bund prior to the commencement of overburden placement activities within the southern overburden emplacement in Year 4, ie. in Year 3.
' Assumed to be mid-way between the "dirty" and "clean" water capture of Years 4 and 6 given the proposed progression of rehabilitation of the mine site.
@ Assumed to approximate Year 6 given the minimal change to size and location of water management and capture structures.
\+ This has been calculated by adding the "dirty" water balance value to 50.8 (the maximum harvestable right), ie. (Year 3 – low rainfall) -28.2 + 50.8 = 22.6
Water available for capture within dirty water catchments.
Water available for capture within clean water catchments.

The volume of water available to the mine each year will be affected by evaporation rates, which in turn will be affected by annual rainfall, the number of rain days each year and other variables. However, as quantifying the variation in evaporation rates is difficult (due to the high number of influencing variables), the site water balance has been prepared using average values. The annual water balance review (see Section 3.5) will provide TCM with an opportunity to alter the site water balance based on on-site information obtained each year.

Based on the water balance which has been determined using annually averaged data there will be no discharges from dirty water storages except in Years 3, 4 and 5. When discharge occurs or if discharges become more prevalent then predicted, the following procedures will be considered:

- Alternative management practises of disturbed areas to increase infiltration rates 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.

3.5 Water Balance Review

A more accurate water balance will be developed as the mine progresses and as data is gathered. It is noted monthly or daily averages could have been used in determining the water balance, however, as it is expected that discharges are likely, it was considered more important to ensure that these occurrences are catered for (see Section 3.4).

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 of **Table 3.3** 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 SWMP 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.

4 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 sediment basins, 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 into a sediment basin. While much of the groundwater is considered to be of suitable quality for discharge, if this water is found to be too saline to meet the discharge criteria then one or both of the following management options will be undertaken.

- The groundwater will be mixed with surface water within the sediment basin to achieve discharge criteria.
- If the quantity of groundwater is significant, a turkeys nest storage structure may be constructed and lined with an appropriate liner. This structure would be used to store the saline water until such a time it can be mixed with cleaner water and discharged according to the criteria.

5 EROSION AND SEDIMENT CONTROL PLAN

5.1 Introduction

In accordance with *Condition 4(28)*[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* (DoH, 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 DoH (2004). **Figure 4** presents the generalised design of each of the erosion and sediment control structures identified in **Figures 1, 2** and **3** (as drainage control and water management structures).

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

(i) Section 4.2 - identifies activities for the construction and operational phases of the mine 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.

5.2 Sources of Erosion and Sedimentation

5.2.1 Construction

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

(i) surface water runoff over exposed surfaces, eg. cleared areas, stockpiles etc.; and

(ii) surface water runoff from roads under construction.

Elevated winds may also result in erosion of finer material during clearing and soil stripping activities, and from exposed surfaces and stockpiles.

5.2.2 Operations

During to the operational phases, 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] See Appendix 1 for full condition

5.3 Erosion and Sediment Control Structures

The structures presented on **Figure 1** and **Figure 2** and described in **Tables 2.1** to **2.4**, will be the primary erosion and sediment control structures as these will 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- or grass-lined flumes, will be progressively constructed (see **Figure 3**). The contour banks on the sloped surfaces of the final landform will direct surface water flows to a number of 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 TCM 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 DoH (2004).

Silt-stop fencing will be installed as required, especially during the construction phase, to assist in reducing the suspended sediment level in surface water flows from road construction and other areas of activity. **Figure 4** also presents the design features to be adhered to when installing the silt-stop fencing.

5.4 Erosion and Sediment Control Management

TCM will remain vigilant in managing erosion and sedimentation on the mine site and, by only discharging water which satisfies the criteria identified in *Condition 4(24)*, 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 vegetation 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 20% 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 following discharge points will be sampled for suspended sediment (SD-17, SD-9, SD-16).

(vii) In the event the suspended sediment concentration in any discharged water exceeds 50mg/L:

a. DEC will be advised and salient preceding weather information will be provided;

b. the upstream structures will be inspected and cleaned of consolidated sediment as required; and/or

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

d. an additional storage dam will be constructed downstream with this becoming the new site discharge point and monitoring location. DEC will be advised to enable amendment to the Environment Protection Licence; and/or

e. a flocculant will be added to the water contained within the sediment basin or storage dam 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 sediment basins identified in **Figure 1** and **Figure 2**. The electrical conductivity of water from five representative groundwater bores (within each of the aquifers to be encountered by the mine) was between 1100μS/cm and 3700μS/cm. This is within the ANZECC (2000) guidelines for irrigation, and livestock and as such increased salinity levels are not expected in the water accumulating in the mine void and subsequently discharged to the sediment basins identified in **Figure 1** and **Figure 2**. This notwithstanding, salinity levels of water accumulating in the mine void will be monitored quarterly (see Section 5).

(ix) All discharges 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.

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

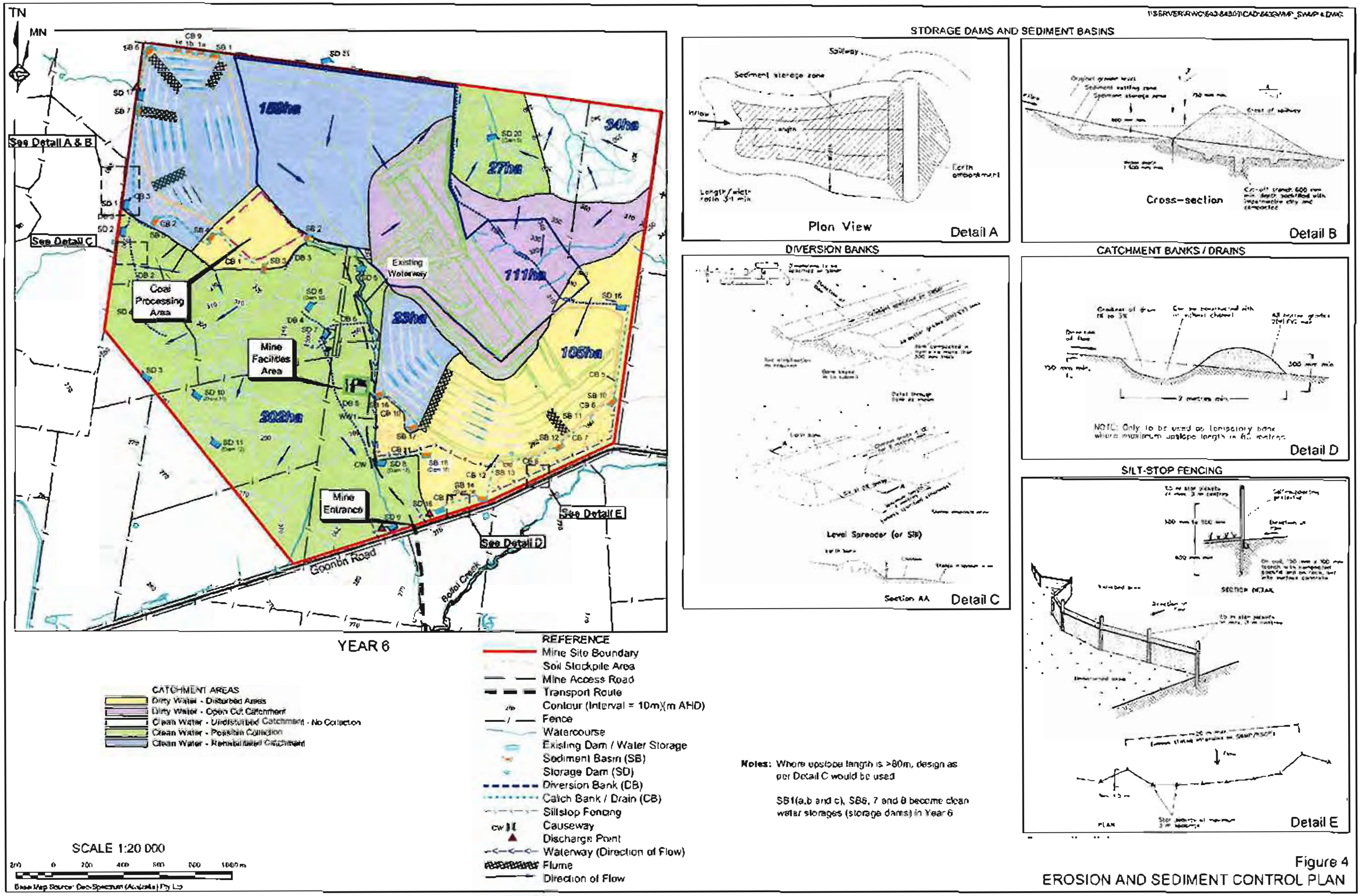


Figure 4
EROSION AND SEDIMENT CONTROL PLAN

R.W. CORKERY & CO. PTY. LIMITED

6 SURFACE WATER MONITORING PROGRAM

6.1 Introduction

This **Surface Water Monitoring Program (SWMonP)** has been prepared in compliance with *Condition 4(29)*[5] and includes:

(i) surface water impact assessment criteria; and

(ii) a program to monitor:

a. the quality of water contained in, or discharged from, water storages (including the mining void) associated with the mine;

b. surface water quality upstream and downstream of the mine site; and

c. the effectiveness of the ESCP.

6.2 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), electrical conductivity and Grease and Oil from water discharged from the mine site will be compared against the criteria presented in **Table 6.1**.

Table 6.1
Assessment Criteria

Parameter	Unit of measure	50% concentration limit	90% concentration limit	3DGM concentration limit	100% concentration limit
Total Suspended Solids	mg/L	20	35	-	50
Electrical Conductivity	µS/cm				4 000*
Grease & Oil	mg/L			-	10
pH	pH				6.5 – 8.5

* In the absence of definitive criteria, the ANZECC (2000) criteria for moderately tolerant crops has been used.

The recorded values for any other parameters measured will be plotted to identify any trends over time. DEC will be notified in the event of increasing levels of any parameter.

6.3 Monitoring Point Locations

The location of all surface water monitoring points are presented on **Figure 5** and are based on the GTAs of the DEC and the monitoring requirements of *Condition 4(29)*.

[5] See Appendix 1 for full condition

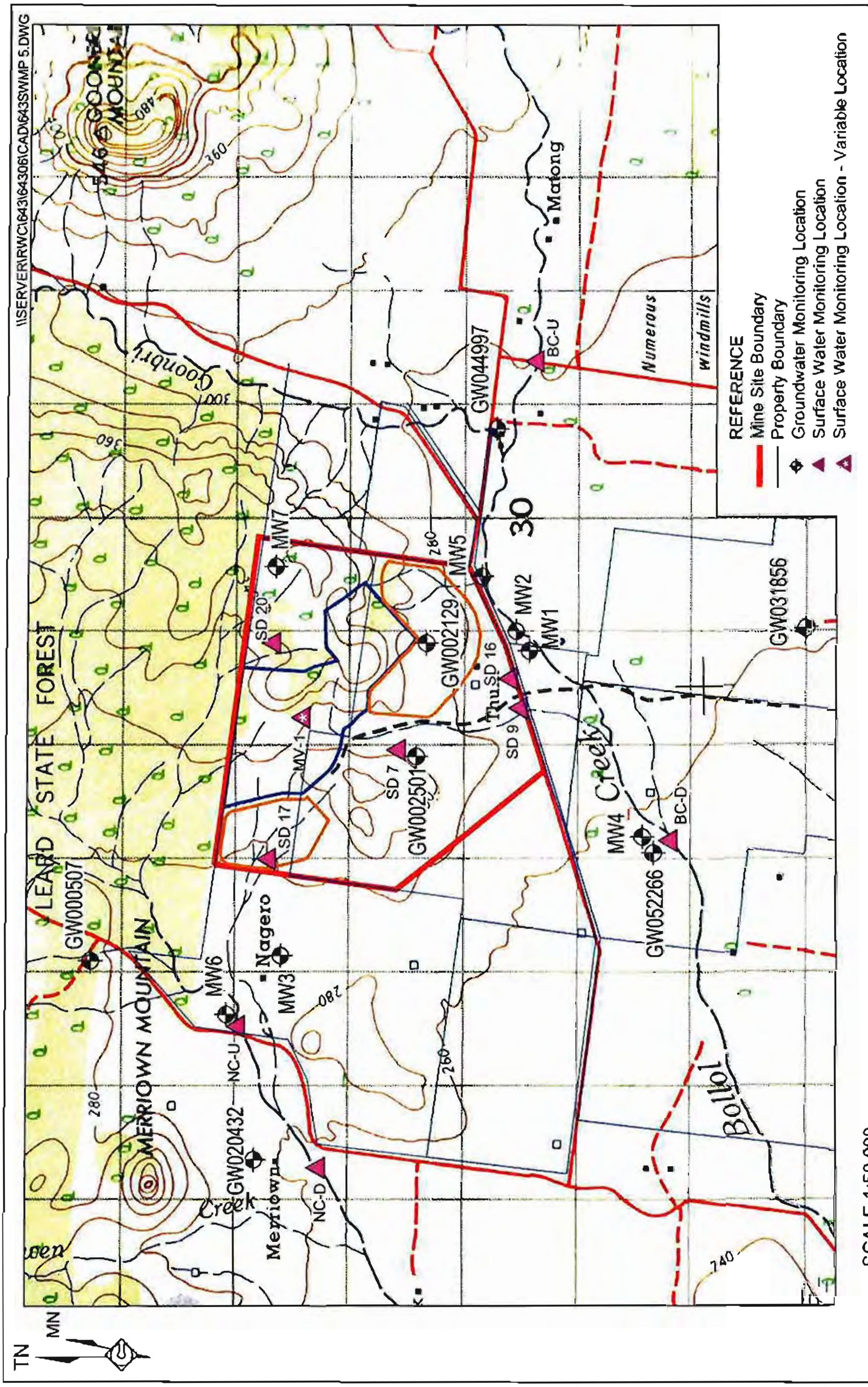


Figure 5
WATER MONITORING LOCATIONS

Table 6.2 identifies the monitoring point locations, the type of monitoring point along with a brief description (where relevant) of the location.

Table 6.2
Monitoring Locations

EPA Identification No.		Type of Monitoring Point	Description of Location
Year 1	SD-17, SD-9	Wet Weather Discharge	All storage dam overflow points where the overflow exits the mine site
Year 2	SD-17, SD-9, SD-20		
Year 4	SD-17, SD-9, SD-16, SD-20		
Year 6 >	SD-17, SD-9, SD-16, SD-20		
BC-U, BC-D, NC-U, NC-D		Water Quality	Upstream and downstream of the confluence of Bollol Creek and Nagero Creek
SD 1-10, MV-1		Water Quality	All storage dams and the mining void on the mine site
All DBs, CBs, SBs, SDs, WW-1 and identified areas of erosion or sedimentation		Erosion and Sediment Control	All noted surface water management structures and areas of previously identified erosion or sedimentation.
SD = Storage Dam SB = Sediment Basin	MV = Mine Void WW = Waterway	DB = Diversion Bank	CB = Catch Bank

6.4 Monitoring Parameters and Frequency

Tables 6.3 to **6.6** present the parameters to be monitored, the frequency of monitoring and the sampling method for each parameter.

Table 6.3
Wet Weather Discharge Points*

Parameter	Unit of measure	Frequency	Sampling Method
Total Suspended Solids	mg/L	As soon as practicable after overflow commences and not more than 12 hours after the commencement of overflow#.	Representative sample
Grease & Oil	mg/L		Representative sample
pH	pH		Representative sample
Electrical Conductivity	µS/cm		Representative sample

* As identified in **Table 5.2** and **Figure 5**
\# As far as practicable, an attempt will be made to sample the water discharge early in the runoff event.

Table 6.4
Bollol Creek and Nagero Creek*

Parameter	Unit of measure	Frequency	Sampling Method
Total Suspended Solids	mg/L	As soon as practicable after overflow commences and not more than 12 hours after the commencement of over flow#.	Representative sample
Grease & Oil	mg/L		Representative sample
pH	pH		Representative sample
Electrical Conductivity	µS/cm		Representative sample

* As identified in **Table 5.2** and **Figure 5**
\# As far as practicable, an attempt will be made to sample the water discharge early in the runoff event.

Table 6.5
Storage Dams and Mining Void*

Parameter	Unit of measure	Frequency	Sampling Method
Total Suspended Solids	mg/L	Quarterly	Representative sample
Grease & Oil	mg/L		Representative sample
pH	pH		Representative sample
Electrical Conductivity	µS/cm		Representative sample
Representative Metals	mg/L	Annual	Representative sample
Representative Ions	mg/L		Representative sample
* As identified in Table 5.2 and Figure 5			

Table 6.6
Storage Dams, Mining Void*

Parameter	Unit of measure	Frequency	Sampling Method
Erosion	-	Quarterly or following rainfall of >25mm/24hr	Visual Inspection
Sedimentation	-		Visual Inspection
* As identified in Table 5.2 and Figure 5			

7 GROUNDWATER MONITORING PROGRAM

7.1 Introduction

In compliance with *Condition 4(30)*[6], this Groundwater Monitoring Program (GWMP) has been prepared for monitoring:

(i) the volume of groundwater seeping into the open cut mine workings; and

(ii) groundwater levels and quality in:

(a) surrounding regional aquifers;

(b) representative bores and wells used by surrounding landowners; and

(c) alluvial aquifers in the vicinity of the development.

The GWMP includes the following elements.

(i) Identification of the monitoring locations.

(ii) A description of parameters to be monitored, monitoring frequency and procedures.

(iii) An assessment and reporting protocol.

[6] See Appendix 1 for full conditions

The GWMP also includes monitoring of the natural variability of groundwater quality and quantity within the aquifers potentially affected by the mine, which is a requirement the Groundwater Contingency Plan to be prepared in accordance with *Condition 4(31)*.

7.2 Groundwater Seepage

7.2.1 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. Water accumulating in mine void sumps will be periodically pumped to sediment basins for storage and/or operational use. To record the volume of water pumped from these sumps, and therefore a relatively accurate estimate of groundwater accumulating in these, the following will be undertaken, either:

- the pump will be fitted with a water meter and the readings recorded monthly; or
- mine personnel will be required to record the approximate pumping rate and time period each time water is pumped from the sumps.

Water meter records or individual pumping records will be recorded with the information reconciled each year as part of the AEMR.

It is acknowledged that this method of monitoring groundwater seepage volumes will not be entirely accurate as rainfall and other water flows will increase the recorded volume while evaporation will lead to a decrease. However, by recording the pumping details, a relatively accurate record of the volume of groundwater seeping into the open cut will be obtained.

7.2.2 Groundwater Seepage Storage

As evaporation rates are expected to exceed seepage rates over the life of the mine, the volume of groundwater requiring storage will be relatively small. This groundwater seepage will be directed towards a sump or sumps within the open cut and as this fills be pumped to sediment basins located outside the open cut area. This pumped groundwater (which is expected to be diluted by surface water from dust suppression and/or rainfall) may ultimately be discharged following heavy rainfall as a wet weather discharge. As noted in Section 4.4, the electrical conductivity of groundwater likely to be encountered by the mine has been analysed (RCA, 2005) and would fall below the ANECC (2000) criteria for irrigation to moderately salt tolerant crops (4 000μS/cm). Considering this water would be further diluted by surface water accumulating in the sediment basins and storage dams of the mine site, it is not expected that this would create any salinity related issues. This notwithstanding, salinity levels of water accumulating in the mine void and storage dams will be monitored quarterly (see Section 5).

7.3 Groundwater Level and Quality

7.3.1 Monitoring Locations

The GWMP applies to a total of thirteen locations where both groundwater levels and quality will be measured. The locations are presented on **Figure 5**. Four of these locations will comprise specifically installed piezometers, positioned to provide relevant information on groundwater in close proximity to the mine.

- MW-1: within the Permian coal measures aquifer on the "Thuin" property.
- MW-2: within the alluvial aquifer on the "Templemore" property.
- MW-3: within the Boggabri Volcanics aquifer on the "Nagero" property.
- MW-4: within the alluvial aquifer on the "Tarrawonga" property.
- MW-5: within the surface water drainage line to the southwest of the mine. This location would also serve as an indicator to impacts on the alluvial aquifer servicing the "Bollol Creek Station" aquifer.
- MW-6: within the alluvial aquifer of Nagero Creek.
- MW-7: within the Permian sediment up hydraulic gradient of the mine area.

In addition to these seven piezometers, TCM will monitor groundwater levels within five representative bores on and surrounding the mine site, namely:

- GW002501 – within the mine site for as long as this bore exists (prior to destruction by the advancing footprint of the mine).
- GW002129 – within the mine site for as long as this bore exists (prior to destruction by the advancing footprint of the mine).
- GW044997 – within the alluvial aquifer on the "Templemore" property;
- GW031856 – within the alluvial aquifer on the "Ambardo" property; and
- GW000507 – within the Permian coal measures and interburden on IBC's "Merriown" property

In order to monitor for natural variation in groundwater level and quality, the following bores will also be monitored.

- GW052266 – within the alluvial aquifer on the "Tarrawonga" property.
- GW020432 – within the volcanics aquifer on the "Merriown" property.

These latter two bores ("background" bores), whilst located within the aquifers potentially affected by the mine, are sufficiently distant such that any impact is highly unlikely.

All bores used for groundwater monitoring will be licensed by the DEC.

7.3.2 Monitoring Parameters, Frequency and Procedures

Baseline monitoring of water chemistry is to be conducted within GW002569 and GW002550 prior to the commencement of mining given the proximity of these to the mine and the predicted direction of groundwater flow. Baseline monitoring of Standing Water Level (SWL), electrical conductivity and pH will be undertaken at the remaining 11 piezometers and groundwater bores. Groundwater levels will be assessed to the nearest 0.01m and all monitoring locations surveyed to AHD so relative levels can be determined.

For those groundwater bores that are currently a source of water for one or more local properties, the existing yield will be established for future comparison should a complaint over the impact of the mine on groundwater availability be registered.

Subsequent measurement of groundwater levels will be undertaken at quarterly intervals with assessment of chemical parameters every six months. **Table 7.1** presents the parameters to be measured, frequency of monitoring and sampling method. Monitoring will continue for a period of up to 10 years after mining has ceased. However the frequency will be reassessed after mining is complete as it may be possible, depending on results, to lengthen the intervals between monitoring campaigns.

Data loggers will be placed in MW-1 and MW-2 to continually monitor water levels in the alluvial aquifer.

Table 7.1
Groundwater Monitoring

Parameter	Unit of measure	Frequency	Sampling Method
SWL	m AHD	Quarterly	Bore Dipping
Conductivity	µS/cm	Initial sample to establish background levels and then every six months.	Representative Sample
pH	pH		Representative Sample
Lead	mg/L		Representative Sample

Note: The frequency of monitoring and the pollutant/s to be monitored may be varied by the DEC (EPA) 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 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 laboratory within appropriate holding times.

In addition to those parameters presented in **Table 7.1**, 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 7.1**), copper, manganese and zinc.
- Major cations and anions – to assess overall changes in groundwater chemistry.

7.3.3 Review of Monitoring

In compliance with *Condition 4(32)*, within 3 years of commencement, and every 3 years thereafter, a review and report on surface and groundwater monitoring and observable trends will be prepared. The report will be completed by a suitably qualified, independent and Director-General approved hydrogeologist.

7.3.4 Assessment and Reporting

Changes in groundwater level, quality or availability will be assessed against established baseline levels and natural fluctuations. Should a result vary by 15% or greater from the established baseline levels be identified, it will be compared against the monitoring results of the background bore within the relevant aquifer. An identified substantive variation from the results of the background bore will be cause to suggest the mine is having an impact on that aquifer and a trigger for further investigations. In this case the DEC will be contacted to review the available data and discuss possible remedial or compensatory options.

The results from each monitoring location will also be graphed over time to determine if any trends develop. Once again, any identified trends will be compared against the background bore of the relevant aquifer to determine if it is a possible consequence of the mine or simply a result of natural variation. The results of the groundwater monitoring will be reported in the relevant AEMR, which will be made available to DoP, DEC, DNR and DPI (MR).

7.3.5 Groundwater Contingency Plan

A Groundwater Contingency Plan (GCP) will be prepared for the mine within six months of commencement. This GCP will provide further detail on the identification of impacts on the local groundwater and the potential corrective or remedial measures to counter these impacts. It should be noted, however, that given the location of the mine and the permeability and transmissivity of the local aquifers, it is considered unlikely that any groundwater impacts, which are a consequence of mining activities will be observable within the groundwater bores identified on non-project related properties.

8 REFERENCES

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Appendix 1

Relevant Development Consent Conditions

(DA 88-4-2005)

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Table A1
Relevant Development Consent Conditions

<table>
<tr><th>Reference</th><th>Condition</th><th>Section / Reference in SWMP</th></tr>
<tr><td>24</td><td>Except as may be expressly provided by a DEC Environment Protection Licence, the Applicant shall only discharge water from the development in compliance with the limits in Table 13.

Table 13: Discharge Limits
<table>
<tr><th>Pollutant</th><th>Units of measure</th><th>50 percentile concentration limit</th><th>90 percentile concentration limit</th><th>100 percentile concentration limit</th></tr>
<tr><td>pH</td><td></td><td></td><td></td><td>$6.5 \le pH \le 8.5$</td></tr>
<tr><td>Total Suspended Solids</td><td>mg/L</td><td>20</td><td>35</td><td>50</td></tr>
<tr><td>Grease & Oil</td><td>mg/L</td><td></td><td></td><td>10</td></tr>
</table></td><td>Section 5.2</td></tr>
<tr><td>26</td><td>Site Water Management Plan
Prior to carrying out any development on the mine site, the Applicant shall prepare a Site Water Management Plan for the development in consultation with DEC, and to the satisfaction of the Director-General. This plan must include:

(a) the predicted site water balance;

(b) an Erosion and Sediment Control Plan;

(c) a Surface Water Monitoring Program;

(d) a Groundwater Monitoring Program; and

(e) a Groundwater Contingency Plan.</td><td>

Section 3

Section 5

Section 6

Section 7

Not this document</td></tr>
<tr><td>27</td><td>Site Water Balance
Each year, the Applicant shall:

(a) review the mine site water balance for the development against the predictions in the EIS;

(b) re-calculate the mine site water balance for the development; and

(c) report the results of this review in the AEMR,

to the satisfaction of the Director-General.</td><td>Section 3.4 / 3.5</td></tr>
<tr><td>28</td><td>Erosion and Sediment Control Plan
The Erosion and Sediment Control Plan shall:

(a) be consistent with the requirements of the Department of Housing's Managing Urban Stormwater: Soils and Construction manual;

(b) identify activities for the construction and operational phases of the development that could cause soil erosion and generate sediment;

(c) describe the location, function, and capacity of erosion and sediment control structures; and

(d) describe measures to minimise soil erosion and the potential for the migration of sediments to downstream waters,

to the satisfaction of the Director-General.</td><td>

Section 2.2

Section 5.2

Section 5.3 & Figure 4

Section 5.4</td></tr>
</table>

Table A1
Relevant Development Consent Conditions

Page 2 of 2

Reference	Condition	Section / Reference in SWMP
29	**Surface Water Monitoring** The Surface Water Monitoring Program shall include:	
	(a) surface water impact assessment criteria;	Section 6.2
	(b) a program to monitor the land in waste water utilisation area(s) and receiving waters;	Section 6.2 - 6.4
	(c) a program to monitor the quality of water contained in, or discharged from, water storages (including the mining void) associated with the development;	Section 6.2 - 6.4
	(d) a program to monitor surface water quality upstream and downstream of the development; and	Section 6.2
	(d) a program to monitor the effectiveness of the Erosion and Sediment Control Plan.	Section 6.2
31	**Groundwater Monitoring** The Groundwater Monitoring Program shall include:	
	(a) a program to regularly monitor the volume of groundwater seeping into the open cut mine workings;	Section 7.2
	(b) a program to regularly monitor groundwater levels and quality in: • surrounding regional aquifers; • representative bores and wells used by surrounding landowners; and • alluvial aquifers in the vicinity of the development;	Section 7.3
	(c) report the results of this monitoring in the AEMR,	Section 7.3.3
	to the satisfaction of the Director-General.	