NAMOI MINING PTY LTD

ABN: 24 071 158 373

Sunnyside Coal Project

via Gunnedah

Surface Water Assessment

Prepared by

Soil Conservation Service

October, 2007

Specialist Consultant Studies Compendium
Part 4

Surface Water Assessment

of the

Sunnyside Coal Project
via Gunnedah

Prepared for: Olsen Environmental Consulting Pty Ltd
PO Box 101
FIGTREE NSW 2525

Tel: 02 4228 3144
Fax: 02 4294 1948
Email: olsen@oecconsulting.com.au

On behalf of: Namoi Mining Pty Ltd
PO Box 2440
FORTITUDE VALLEY QLD 4006

Tel: 07 3000 5693
Fax: 07 3000 5699
Email: CBurgess@whitehaven.net.au

Prepared by: Soil Conservation Service (Department of Lands)
108 Faulkner Street
PO Box 199A
ARMIDALE NSW 2350

Tel: 02 67703100
Fax: 02 6772 8782
Email: david.howley@lands.nsw.gov.au

October, 2007

CONTENTS

Page

APPENDICES

CONTENTS

Page

FIGURES

TABLES

EXECUTIVE SUMMARY

This report details the findings of a surface water assessment undertaken on behalf of Olsen Environmental Consulting Pty Limited for the Sunnyside Coal Project for Namoi Mining Pty Ltd.

The report would form part of a Specialist Consultant Studies Compendium accompanying an *Environmental Assessment* for the proposed Sunnyside Coal Project. The main aims of the assessment are to provide guidance on the most appropriate approach to water management and to predict the likely impacts of the Project on the surface water within the Project Site and surrounds assuming all safeguards and management requirements are adopted.

The results of the assessment can be summarised as follows.

The Project could potentially impact on:

- surface water quantity;
  - flooding; and
  - water usage;
- surface water quality;
  - pH;
  - suspended solids;
  - electrical conductivity;
  - heavy metal concentrations; and
  - oils (hydrocarbons);
- soil erosion; and
- dryland salinity.

Recommendations to mitigate these impacts include:

- diverting clean water around disturbed areas and capturing a proportion of this water within the harvestable right of the Project Site to meet the Project's water requirements;
- constructing transport routes at current ground levels and flow depression bed levels;
- capturing dirty water, using it for dust suppression and other environmental purposes or treating it so that it can be discharged within acceptable guidelines. There would be limitations with providing sufficient water for the suppression of dust. This can be managed by limiting dust generation practices, maximising water storages, limiting evaporative losses and by supplementing water requirements from groundwater reserves;
- by maintaining and enhancing as much vegetation on-site as possible; and
- monitoring water, soil and vegetation parameters.

This page has intentionally been left blank

1 INTRODUCTION

1.1 Background

This Surface Water Assessment (SWA) been produced by Soil Conservation Service, a Division of the NSW Department of Lands for Olsen Environmental Consulting on behalf of Namoi Mining Pty Ltd (NMPL). This document is to form part of the Specialist Consultant Studies Compendium prepared in support of the *Environmental Assessment* for the proposed Sunnyside Coal Project (the Project), located approximately 15km west of Gunnedah (see **Figure 1**).

Soil Conservation Service was commissioned to describe the Project Site in relation to surface water characteristics and parameters, undertake a literature review identifying and discussing surface water studies previously undertaken, State and National legislation and best practice that is pertinent to surface water management. Soil Conservation Service was also commissioned to identify the most appropriate way to mitigate potential impacts associated with the proposed development. Recommendations are also given for the long term management of the Project Site.

Please Note: When environment is referred to within this document, it pertains to the total environment, being the interaction of the physical, biological and social environments.

1.2 Objectives

The objectives of this SWA are to:

- describe the existing environmental factors and characteristics of the Project Site and surrounds;
- describe the impact that the Project may have on the Project Site and surrounds;
- provide measures by which to mitigate any possible impacts. Such measures may consist of:
  - diverting “clean” water flows additional to the maximum harvestable right of the Project Site, around the proposed areas of disturbance within the Project Site (thus reducing the potential for erosion), and to maintain existing water flows for the environment further down the catchment;
  - divert water flows on the Project Site around areas that have high potential to erode;
  - disturb the least amount of vegetation as possible, particularly grasses, and enable grasses to re-establish;
  - limit erosion of soils within the Project Site via structural earthworks and other management practices; and
  - treat “dirty” water containing high sediment levels, contaminated or potentially contaminated water, to current acceptable guidelines before discharge into the surrounding environment.

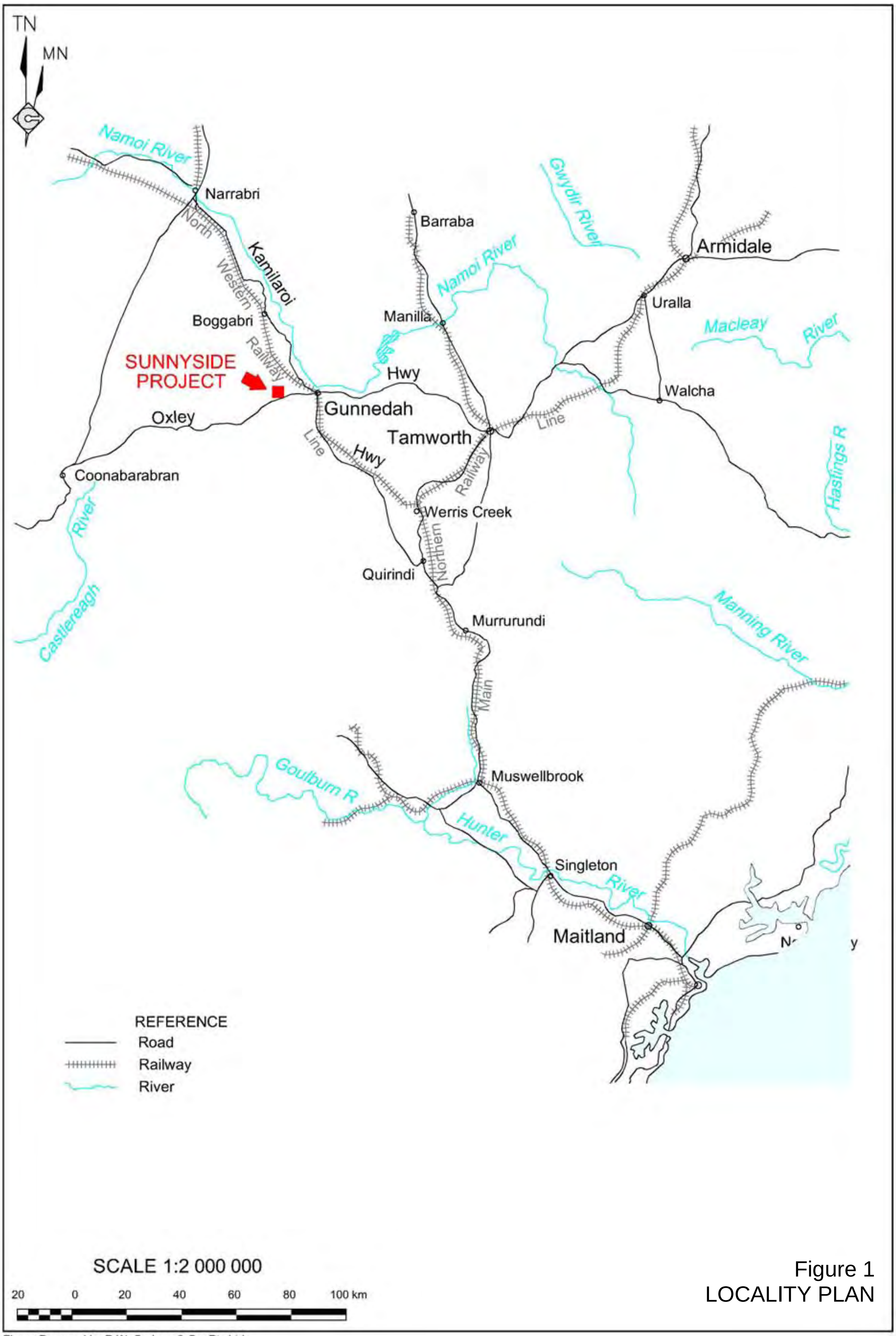

Figure 1
LOCALITY PLAN

Figure Prepared by R.W. Corkery & Co. Pty Ltd

Note: A colour version of this figure is presented on the Project CD

2 PROJECT SITE

2.1 Site Description

The Project Site covers an area of approximately 231ha, 15km west of Gunnedah. Catchments extend beyond the Project Site and this SWA concentrates on an area of approximately 376ha on and around the Project Site which is essentially the “Sunnyside” property. **Figure 2** shows the Project Site within the “Sunnyside” property.

The Project Site is located north of the Oxley Highway and southwest of Coocooboonah Lane. The majority of the Project Site’s surface water runoff runs northwards across the Project Site. It then runs into Coocooboonah Creek which flows northwest within a constructed waterway paralleling Coocooboonah Lane. From here it flows into Rock Well Creek then into Native Cat Creek which continues to flow northwest for 6km then heads north within Collygra Creek where it flows across a floodplain area before flowing into the Namoi River some 25km north of the Project Site. The remainder of the Project Site’s surface water flows south into Coocooboonah Creek ultimately flowing into the Namoi River to the north.

The area of interest around the Project Site has been divided into three separate sub-catchments with these described in **Table 1** and presented on **Figure 2**.

Table 1
Catchments of the Project Site and Surrounds

Catchment No.	Approximate Area (Ha)	Description of Catchment
1	61+42+67*	This western catchment generally flows north within the Project Site then north into Coocooboonah Creek. Includes DW1 and DW2 Catchments.
1(a)	54	Part of “Ivanhoe” property.
1(b)	94	Part of “Ivanhoe” and/or “Rosmar” properties.
2	131	This eastern catchment generally flows northwards within the Project Site then north into Coocooboonah Creek.
3	54	This catchment flows southwards across the Oxley highway into Coocooboonah Creek south of the Project Site.
4	21	This small catchment generally falls westwards and then south into Coocooboonah Creek south of the Project Site.
Total	**376ha**	

* Catchment 1 includes 61ha of clean water catchment and 42ha and 67ha of dirty water catchment in Areas DW1 and DW2w respectively.

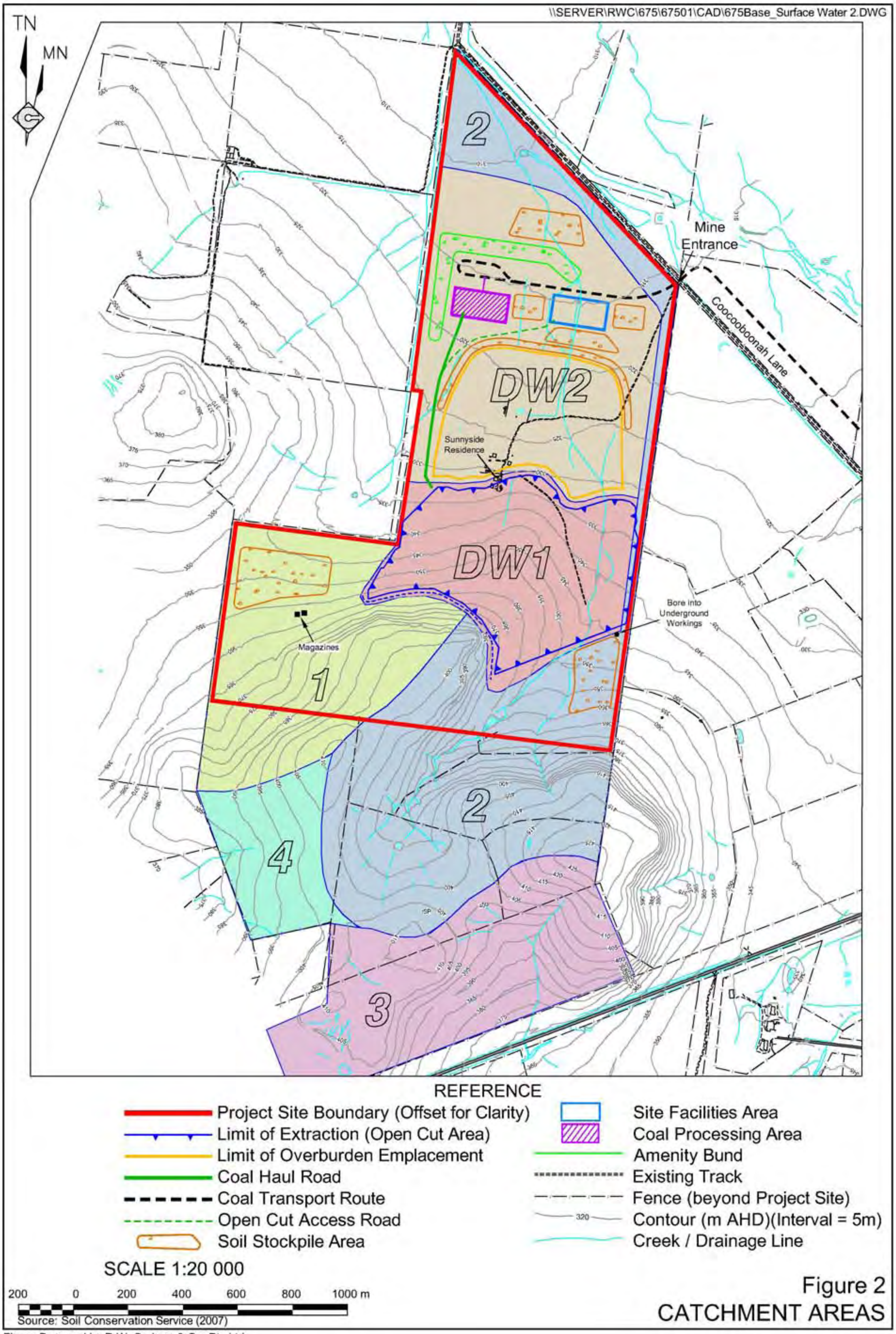

Figure 2
CATCHMENT AREAS

Figure Prepared by R.W. Corkery & Co. Pty Ltd

Note: A colour version of this figure is presented on the Project CD

2.2 Existing Water Storage and Harvestable Right

Four substantial farm dams occur within the Project Site. **Table 2** lists their approximate capacity with their location presented on both **Figure 3** and **Figure 4**.

Table 2
Dam Capacities and Locations

Dam Number	**Capacity** (m^3)
1	500
2	2000
3	2000
4	1000
Total	5500

The capacity of existing water storages on the Project Site is approximately 5500m^3. Throughout the life of the Project, one of these dams (2000m^3) would be removed as it is within the overburden emplacement footprint area. There would be approximately 3500m^3 of water storage retained and available for use after the open cut area and overburden emplacements are at their fullest extents.

The harvestable right for the Project Site is determined by the following calculation.

Harvestable Right = Catchment Area x Multiplier Value
= 376 x 0.07
= 26.32ML

This calculation is based on the determination of the maximum harvestable rights dam capacity (MHRDC) using the folder supplied by Department of Land and Water Conservation (DLWC) now Department of Natural Resources (DNR) titled *Rural Production and Water Sharing Landholders Information Package*. Given that the MHRDC is 26.32ML, there is potential to store, through the construction of additional dams, an additional 22.82ML (26.32ML minus 3.5ML) on the Project Site which can be used for any purpose.

It is noted that the maximum harvestable right does not include storages that are to be used for environmental purposes. For the Project, environmental purposes include the capture of predominantly “dirty” or sediment-laden water. The water within these storages can be used for other environmental purposes, such as dust suppression and watering rehabilitated areas.

2.3 Flooding

The only flooding issue that is considered relevant for the Project Site is the water that flows from southeast to northwest along Coocooboonah Creek. This has potential to interfere with the transportation of coal from the Project Site to the Whitehaven Coal Handling and Preparation Plant (CHPP) and the Rail Loading Facility. Coocooboonah Creek is ephemeral and based on anecdotal evidence only runs after rainfall events and may run for approximately two days after a large rainfall event that occurs over its entire catchment.

The Proponent is intending to construct the proposed coal transport route at current ground level and wherever necessary cross any gullies via concrete causeways. This type of gully crossing and road construction would not inhibit the overland flow of water and thus would not impact on localised flooding of the area.

3 LITERATURE REVIEW

This section details literature that is pertinent to the surface water management of the Project. It discusses State legislation and best management practice guidelines.

The following legislation was reviewed to ascertain how the management of surface water on the Project Site would affect the intent of each Act.

- *Fisheries Management Act 1994*
  - This Act deals with the management of fisheries and how they are regulated. Works associated with the proposed coal transport route and its crossing of Coocooboonah Creek may require input and permission from NSW Fisheries.
- *Protection of the Environment Operations Act 1997*
  - This Act is concerned with the control of various polluting activities. Such activities must be licensed if they meet specified thresholds. Even if not licensed the activity may be required to comply with orders issued by the Department of Environment and Conservation (DEC) formerly Environment Protection Authority (EPA) or local council. Often the works undertaken that have potential to pollute require an exemption or at least a notification to the DEC who administer this Act. An Environment Protection Licence would be required for the Project.
- *Water Act 1912*
  - This Act principally deals with water licensing and water allocations. Sections of it have been repealed and replaced with sections of the *Water Management Act 2000*. A groundwater extractive licence from the Department of Natural Resources (DNR) would be required for the Project to extract water from the old Gunnedah Mine No5 Entry underground workings.
- *Water Management Act 2000*
  - This Act deals with a whole variety of issues associated with the management of water. The issues that are pertinent here refer to the construction of water holding structures, water diverting structures and water pumping devices. Harvestable rights fall under this Act and would apply to the Project.
- *Contaminated Land Management Act 1997*
  - This Act establishes a system in NSW for investigation and remediation of land contamination which presents significant public health or environmental risks. This would only apply if there is lingering contamination caused by the spillage of pollutants or if the nature (salinity, acidity and heavy metal contents etc) of the earth being uncovered is outside those acceptable levels as prescribed.

- *Soil Conservation Act 1938*
  - This Act covers the issues involved in soil conservation within the State. By diverting clean water onto stable ground and by treating and capturing dirty water, soil erosion would be minimised. The issue of development consent and the grant of a mining lease would supersede the requirements of this Act.

- *Environmental Planning and Assessment Act 1979*
  - The principal objectives of this Act are to co-ordinate policies, programs and activities as they relate to total catchment management, and to achieve active community participation in natural resource management. The Namoi Catchment Blueprint produced by the Namoi Catchment Management Board has been reviewed and its issues and targets have been considered within this document.

- *Local Government Act 1993*
  - The principal objectives of this Act are to provide the legal framework for an effective, efficient, environmentally responsible and open system of local government in New South Wales. To regulate the relationships between the people and bodies comprising the system of local government in New South Wales. To encourage and assist the effective participation of local communities in the affairs of local government. The issues raised by Gunnedah Shire Council have been considered in the development of the SWA.

- *Rivers and Foreshore Improvement Act 1948*
  - An Act to provide for the carrying out of works for the removal of obstructions from and the improvement of rivers and foreshores and the prevention of erosion of lands by tidal and non-tidal waters. Works involved with the construction of the proposed coal transport route would require the application for a Part 3A permit issued by DNR.

A number of other documents have been reviewed and issues that have been collated from them relating to surface water on and around the Project Site and the ramifications that has for the receiving waters environment are:

- water quantity;
- water quality;
- soil erosion; and
- dryland salinity.

These identified issues are discussed in Section 5.

4 OVERVIEW OF THE PROJECT

The proposed Sunnyside Open Cut Coal Mine would involve the following activities.

- Coal mining by conventional open cut methods and potentially highwall auger mining over an area of approximately 43 hectares. This area has been identified and further delineated from recent exploratory drilling undertaken during September and December 2005 and has an overall overburden to coal insitu stripping ratio of 4.0 to 4.5 :1.

  (Under the current economic climate and taking the current export thermal coal market into account, it is considered that any reserves of typical Sunnyside product quality (15 – 19% ash content or 6200 – 6200 kcal/kg, air dried, beyond 6:1) would not be economically extractable.)

- After ramp establishment, mining would commence from a box cut area and then progress from west to east.
- After completion of the box cut to its maximum length extent, then 50 – 70m width strip development would be possible thereafter down dip.
- It would be necessary for the initial overburden from the box cut to be hauled to an out-of-pit emplacement area to the immediate north of the box cut. Subsequent overburden from progressive strip/block mining down dip would be progressively placed in the box cut and later, into and over the formerly mined areas of the open cut.
- It is intended to progressively shape the out-of-pit overburden emplacement to facilitate earliest overburden reclamation, top soil re-emplacement, contour bank construction and revegetation. The final landform would have maximum slopes of 10 degrees and revert to an agricultural (grazing) land use.
- Facilities are to be established onsite within the Project Site for the ROM coal crushing, blending and temporary stockpiling of an unwashed thermal coal product.
- Mining would be undertaken up to 15 hours per day and up to 6 days per week whilst road haulage of product coal would be undertaken up to 14 hours per day and for 6 days per week.
- Crushed coal blending operations would be undertaken predominantly on site at the Sunnyside Open Cut Stockpile Facility. Occasionally, however, there may be the need to undertake secondary blending at the Whitehaven CHPP and Rail Loading Facility to achieve final export quality specifications before railing to Port Newcastle.
- Facilities to be installed on the Project Site would include:-
  - transportable offices;
  - bath-house;
  - crib room;

  - fuel & lubricants storage facility;
  - stores and first aid buildings;
  - sheltered workshop facility;
  - equipment lay-down and park-up area; and
  - light vehicle car park for the projected workforce of approximately 25 to 30 persons.

- Power for the Project Site would be provided via on-site diesel-powered generators.
- Bath-house and potable water would be provided from off-site.
- Dust suppression water would be provided and stored on site in appropriately located dams. This water would be derived from both run-off harvesting from up slope of the mine via catchment/diversion drains around the perimeter of the actual pit area and from in-pit groundwater seepage and run off capture. A bore would be established to extract water from the Gunnedah Mine No 5 Entry underground workings. Water from this bore would augment captured surface water and water removed from the pit. It would also provide a guaranteed start-up water supply.

Figure 3 presents the proposed Project Site.

5 WATER MANAGEMENT ISSUES

5.1 Introduction

When considering the potential impacts that the Project could have on the surface water of the Project Site and surrounds, water quantity and quality must be considered. Substantial changes in either of these factors beyond what are recognised to be natural variations in both would potentially be detrimental to the Project Site and/or surrounding environment. There are a number of potential sources associated with the Project that could change the Project Site and surrounding area surface water characteristics. The sources that can affect both quantity and quality of surface water on-site and ultimately affect the water entering the surrounding environment include:

- run-off from any area that has been denuded of vegetation;
- run-off from stockpiles of topsoil, subsoil, overburden and raw and processed coal and rehabilitated areas;
- discharge of mine waters;
- runoff into mining void;
- run-off from hardstand areas including roads, processing areas, site facilities and load-out facilities; and
- leaking or spillage of hydrocarbon products.

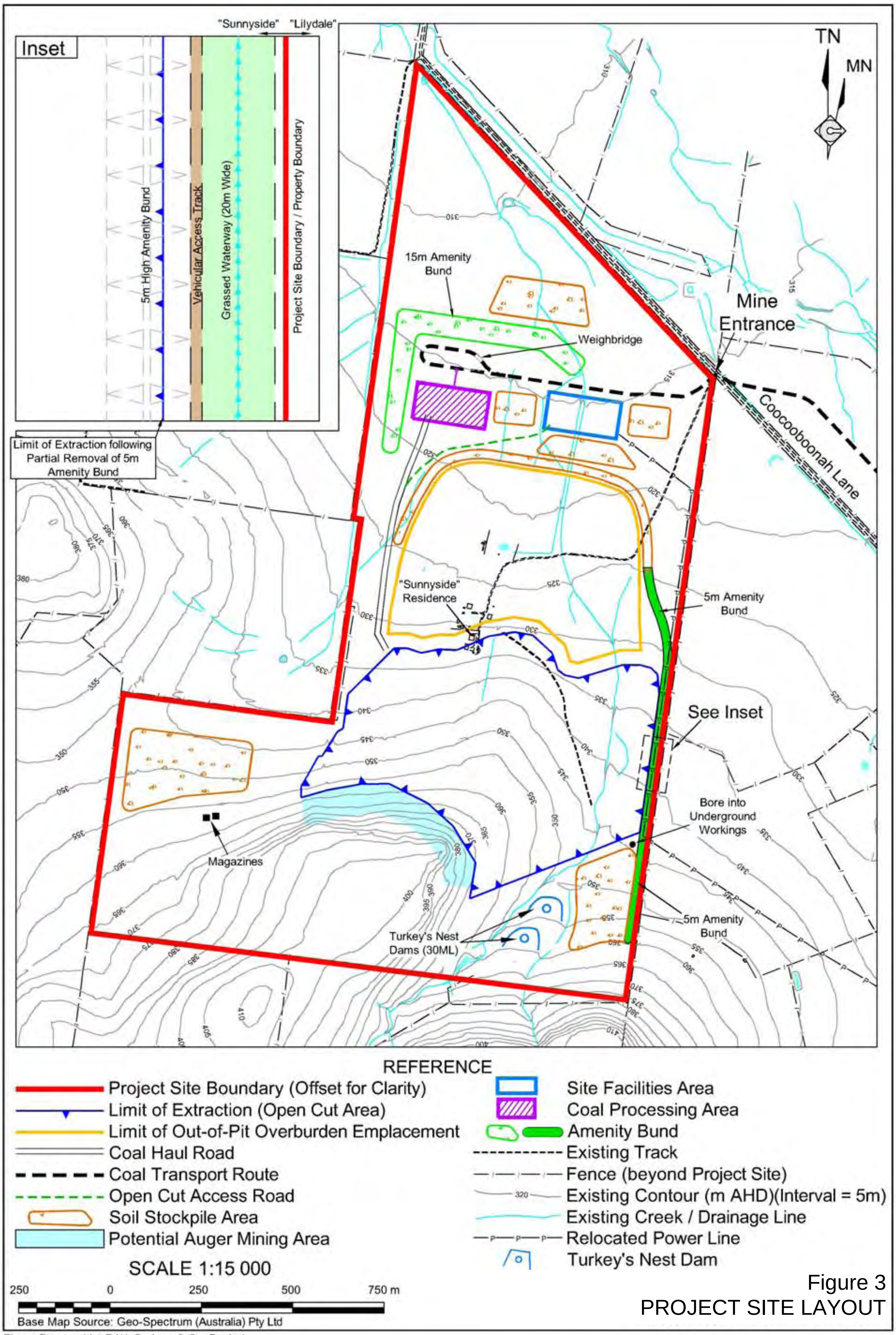

Figure 3
PROJECT SITE LAYOUT

Figure Prepared by R.W. Corkery & Co. Pty Ltd
Note: A colour version of this figure is presented on the Project CD

5.2 Water Quantity

The Project could potentially increase the amount of run-off leaving the Project Site due to the disturbance of vegetation and increases in hardstand areas. This increase in water quantity could increase the soil erosion of the Project Site and surrounding areas. The amount of runoff leaving the Project Site could be reduced due to the capture of water within the void and other water retention structures. This water would then be unavailable to the surrounding environment and other water users further down the catchment.

5.3 Water Quality

Parameters that may be affected by the potential sources identified in Section 5.1 include:

- pH;
- suspended solids;
- electrical conductivity;
- heavy metal concentrations; and
- hydrocarbon products (fuel, oil and lubricants).

Water that has a suspended solids concentration equal to or lower than that specified within **Table 3** is referred to as “clean water”. Water that has a suspended solids concentration greater than those specified within **Table 3** is referred to as “dirty water”. Water that displays substantial changes in pH, electrical conductivity or contains concentrations of heavy metals or hydrocarbons above nominated levels is referred to as “contaminated water”.

The current water quality parameters that are appropriate for assessment of activities proposed within the Project Site and their current possible acceptable guidelines are presented in **Table 3** (as prescribed by the Department of Environment and Climate Change (DECC)).

Table 3
Possible Discharge Parameter Limits

Parameter	50th Percentile Limit	70th Percentile Limit	100th Percentile Limit
pH	-	-	6.5 to 8.5
Suspended Solids (mg/L)	≤ 20	≤ 35	≤ 50
Grease and Oil (mg/L)	-	-	≤ 10

5.4 Soil Erosion

Surface water flows can cause sheet, rill and gully erosion, all of which have been identified within a number of reference documents as of significance. Wind may lead to soil erosion and transportation from its origin. Although erosion is a natural occurrence, changes in vegetative cover and concentration of water accelerates its occurrence and its severity. The lost soil reduces the productive capacity of the land and in addition changes the environmental characteristics of receiving waters and catchments. The Project would alter the vegetative cover and concentrated flow of water so it could potentially lead to increased erosion. The SWA addresses this issue via a variety of mitigation management practices.

5.5 Dryland Salinity

Dryland salinity is the accumulation of salts within the soil profile that hinder plant growth and ultimately denude areas and increase the salt concentration in surface water flows into creeks and rivers. Dryland salinity has been identified as an issue within the Namoi Valley (NCMB 2003). The acceleration of dryland salinity is a result of a reduction in the number of deep rooted vegetation species that keep the water table lower within the soil profile and thus not allow the salts to accumulate. This area of the Gunnedah region is not recognised as a dryland salinity hot spot (Namoi Catchment Management Authority – pers. comm., 19 September 2006). Vegetation would be disturbed by the Project although it is recognised that a substantially greater number of trees are to be planted on the Project Site than are to be removed. This additional planting of vegetation could also be planned so as to provide wind breaks particularly over bare earth areas so as to reduce the likelihood of wind erosion. The management of vegetation would aid in reducing any dryland salinity issues that may develop as a result of the Project.

6 SURFACE WATER IMPACT MITIGATION MEASURES

6.1 Introduction

Section 6 provides a series of recommendations against the potential impacts identified and outlined in Section 5.

When managing water around any area where vegetation and soil is disturbed, the key principles are to:

- divert “clean” water away from the disturbed area;
- maintain as much vegetation (particularly grass), on the Project Site as possible; and
- capture “dirty” water and treat it so that it can be discharged to meet accepted guidelines.

The SWA firstly considers management of water quantity (see Section 6.2) followed by the water quality aspects (see Section 6.3), contingency plans (see Section 6.4), monitoring and long term management of the landforms within the Project Site (see Section 6.5). The SWA has been designed on the basis of the worst case scenario, that being the proposed mine being in full operation with the overburden emplacements at their fullest extent and without any vegetative cover. The design criteria, design procedures and data sources are shown in **Appendix 1**. The specification of dam positions and sizes provided is indicative, these specifications may vary with specific mine management requirements and a desire to capture all dirty water that is generated by the Project.

6.2 Water Quantity

6.2.1 Project Site Catchment Yields

Based on the harvestable rights for the "Sunnyside" property, there is provision to capture and use 26.32ML of clean surface water. This water storage would lengthen the time of concentration thus reducing any localised flooding impact associated with the increase in peak discharge that may occur with the increased surface water flows from the denuded and hardstand areas. Larger flooding issues for the Project Site and proposed coal transport route have been discussed within Section 2.3.

The water required annually by the Project would be between 75ML and 100ML depending on seasonal conditions. Once the Project Site is fully committed in capturing its harvestable right there would be 26.32ML available annually (subject to availability) to use. **Table 4** summarises the catchment yield calculations for the "Sunnyside" property clean water catchments.

Table 4
Annual Catchment Yields for the Project Sites Clean Water Catchments (based on rainfall Data collected at the Gunnedah Pool)

Rainfall Event (mm)	Decile 1 Rainfall (373.6mm)	Mean Rainfall (616.4mm)	Decile 9 Rainfall (843.4mm)
Catchment Area 1 Yield 61ha (ML/year)	22.8	37.6	51.5
Catchment Area 2 Yield 131ha (ML/year)	48.9	80.7	110.5
Catchment Area 3 Yield 54ha (ML/year)	20.2	33.3	45.5
Catchment Area 4 Yield 21ha (ML/year)	7.8	12.9	17.7
TOTAL ML/year	99.8	164.6	225.2

Based on the calculations of Project Sites clean water catchment yields, the maximum harvestable right of 26.32ML/yr could be easily obtained through the construction of appropriately placed storage dams. The remaining water requirement for the Project 73.68ML (ie. 100 – 26.32ML) could be obtained from one of three sources:

(i) capture of dirty water which flows over exposed surfaces within the Project Site;

(ii) extraction of groundwater from a bore obtaining water from the Gunnedah No 5 Entry underground workings; and

(iii) from groundwater and surface water retained within the mine void.

None of these sources would be assessed as part of the "Sunnyside" property maximum harvestable right. It would also be possible for the Proponent to obtain a licence to capture and use additional clean water and thereby increase the maximum harvestable right, however, given the other opportunities available to obtain the required volume of water, this is not considered necessary.

6.2.2 Water Balance

The site water balance calculates the volume of water that would be captured within each of the water catchments (see **Figure 2**) and has been prepared for dry years (10th percentile rainfall), wet years (90th percentile rainfall) and for the Median Year (50th percentile rainfall). The site water balance has been prepared to assess:

(i) whether sufficient surface water is available for capture onsite during dry years for the water requirements outlined; and

(ii) if significant discharge would be required in wet years.

Table 5 outlines the catchment yields under varying rainfall events, the type of water captured and the water storages associated with these catchments. These catchments reflect the surface water management controls proposed by the Proponent and presented on **Figure 4**.

Table 5
Annual Catchment Yields

Catchment with approximate area	Yield (10th percentile) ML/yr	Yield (50th percentile) ML/yr	Yield (90th percentile) ML/yr	Associated Water Storage and volume ML
"Dirty" Water from around out-of-pit dump and ROM etc (67ha)	37.55	61.95	84.76	13ML
Open Cut Area potential (42ha)	15.69	25.89	35.42	9ML
Groundwater Inflow into Void	Not Considered within Yield Calculations Approximately 374ML/Year			
Total Dirty Water	**53.24**	**87.84**	**120.18**	
"Clean" from western and northern fall (192ha)	71.73	118.35	161.93	26.32ML/yr
"Clean" from around the western and southern fall (75ha)	28.02	46.23	63.26	
Total Clean Water	**99.75**	**164.58**	**225.19**	
Totals (Dirty and Clean Water)	**152.99**	**252.42**	**345.37**	**48.32**
Mine Water Requirements	**100**	**100**	**100**	
TOTAL BALANCE	**52.99**	**152.42**	**245.37**	

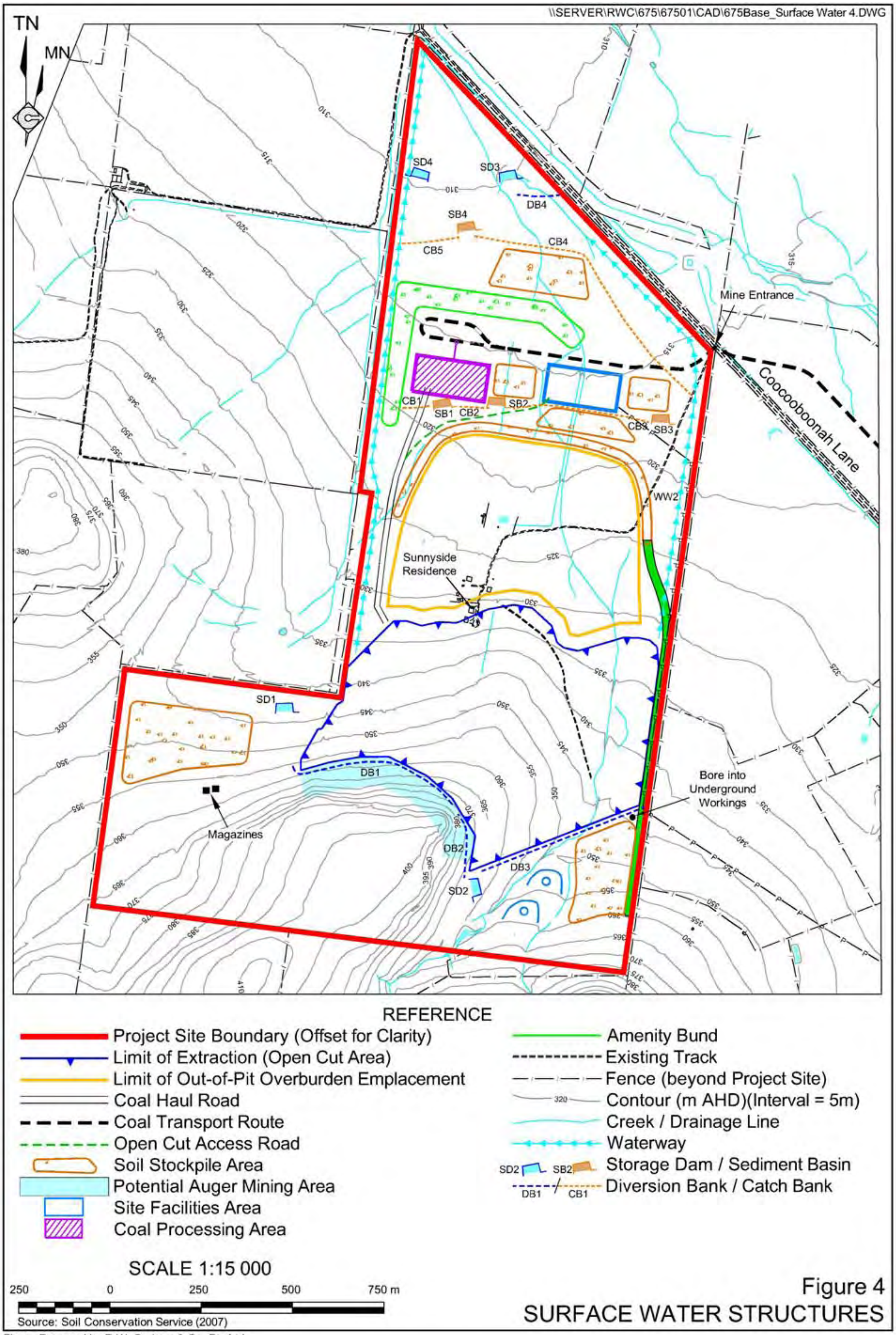

Figure 4
SURFACE WATER STRUCTURES

Figure Prepared by R.W. Corkery & Co. Pty Ltd
Note: A colour version of this figure is presented on the Project CD

During dry years (10th percentile rainfall), sufficient water would be available from a combination of dirty water (including the open cut area), void inflow groundwater and clean water sources to meet operational water requirements. Given the catchment yields also exceed water storage volumes in the median years (50th percentile) and wet years (90th percentile), it is expected that a discharge of surface water may occur.

Groundwater inflows into the open cut area were not considered in the water balance calculations as the modelled inflows over the 5-year modelling period averaged an inflow of 1024m^3/day (GeoTerra Pty Ltd, 2007). This equates to an estimated 374ML/Year and given the area available to capture this quantity of water and associated evaporative losses the quantity of water to manage is excessive. Even if this inflow water was used to satisfy the mine's water requirements provided the inflow water quality met water quality guidelines, there would still be excessive water to manage. Consequently this water would have to be pumped into the old underground workings. Provided the water quality of this inflow meets acceptable water quality guidelines this water may be used on mine start up and during operation for dust suppression and other uses as it is required, with the balance pumped underground.

6.3 Water Quality

6.3.1 Diversion of Clean Water

The diversion of clean waters away from disturbed areas would reduce erosion and its potential for contamination. This would be achieved by constructing diversion banks, waterways and storage dams. The waterways are to be constructed prior to ground disturbance and allowed to vegetate before mining commences. The indicative positions of these structures are shown on **Figure 4** and their specifications listed in **Tables 6** and **7**. The clean water catchment area south of the open cut area would be directed around the most easterly edge of the open cut area, such that no clean water enters the Open Cut. Note the grade on banks may vary once final survey is undertaken and some banks may need to be split to achieve start and finish positions.

Table 6
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	6	0.5	0.8	14	4
DB2	131	10	0.5	1	20	3
DB3/WW1	10	6	0.5	0.8	12	1
	Waterway Width (m)		**Bank Height (m)**			
WW1	20		1			
WW2	20		1			

Table 7
Storage Dam Specifications

Structure ID	Catchment Area (ha)	Volume (m^3)	Depth (m)	Dimensions length x width (mxm)	Outlet Width (m)	Sill Width (m)
SD1	24	1000	3	28x25	6	12
SD2	125	4000	4	37x50	10	20
SD3	150	8900	4	58x60	10	20
SD4	115	8900	4	58x60	10	20

The dimensions for each diversion bank are based on the upslope catchment area and topography. Generally the following should be followed for each bank, namely:

- the channel of the bank is to be trapezoidal;
- bank batters between 1:3 to 1:6 (Vertical : Horizontal);
- 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 kept well grassed;
- level sill outlet to each channel;
- stable grass cover to be maintained below sill outlets; and
- sill width approximately 1.5 x channel base width.

The requirements for each storage dam would consist of the following, namely:

- 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 that there would be an allowance made of 0.1m/m 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 channel;
- stable grass cover to be maintained below sill outlets; and
- sill width of approximately 1.5 x channel base width.

6.3.2 Capture of Dirty Water

6.3.2.1 Design Specifications

The capture of dirty or sediment-laden water aims to collect water that may have suspended solids concentrations that would be outside the range of those prescribed by DECC guidelines (see **Table 3**). Hydrocarbon products are considered in Section 6.3.2.4.

Catch banks/drains would be constructed to divert potentially sediment-laden waters into sediment basins below sites that can potentially generate significant quantities of sediment laden water. One of these catch banks/drains are directed directly downslope and in this circumstance this bank is to be a back push bank so that no vegetation is disturbed within the bank channel. This bank would effectively act as a one-sided waterway.

Sediment basins have been design for Type D soils according to Landcom (2004). Accordingly based on a potential dirty water area of 109ha there is a requirement to be able to capture 22ML of dirty water. This quantity of water can be capture in any number of basins of suitable dimensions that totals 22ML capacity. Thus, the positions of the sediment basins shown are indicative only. The indicative positions of all of these structures are shown on **Figure 4** and their specifications are listed in **Tables 8** and **9**. Note the grade on banks may vary once final survey is undertaken and some banks may need to be split to achieve start and finish positions.

Table 8
Catch Bank/Drain Specifications

Structure ID	Catchment Area (ha)	Channel Bottom Width (m)	Channel Grade (%)	Bank Height (m)	Sill Width (m)	Slope Below Sill (%)
CB1	15	6	0.5	0.7	12	1
CB2	35	6	0.5	0.7	12	1
CB3	15	6	0.5	0.7	12	1
CB4	65	8	0.5	0.7	12	1
CB5	28	6	0.5	0.7	12	1

Table 9
Sediment Basin Specifications

Structure ID	Catchment Area Total contributing (ha)	Volume (m^3)	Depth (m)	Dimensions length x width (mxm)	Outlet Width (m)	Sill Width (m)
SB1	20	5000	3	49x50	6	12
SB2	40	6000	3	50x57	6	12
SB3	20	5000	3	49x50	8	16
SB4	70	6000	3	50x57	6	12

The dimensions for each catch bank are based on the upslope catchment area and topography. Generally the following would be followed for each bank, namely:

- the channel of the bank is to be trapezoidal;
- 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; and
- sill width approximately 1.5 x channel base width.

The requirements for each sediment basin would consist of the following, namely:

- 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 that there would be an allowance made of 0.1m/m 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 channel;
- stable grass cover to be maintained below sill outlets; and
- sill width of approximately 1.5 x channel base width.

6.3.2.2 Mine Access Road Design

The proposed coal transport route from the Project Site to the Oxley Highway would be constructed with a crown. This road would be constructed at ground level with causeways used to cross water flow depressions along the proposed route. The mine access road into the Project Site would be constructed with an infall over its entire length so that any water that falls on the road is directed towards the mine area. This would enable this potentially dirty water to be captured by the sediment basins that capture the water that runs off the overburden emplacement. The infall would be no less then 1% or 1 in 100. In addition, the batters of this road are to be topsoiled and seeded so that vegetation can limit their erosion.

6.3.2.3 Hydrocarbon Products

Water that discharges from areas where mine plant, equipment and vehicles may be used or serviced may potentially contain hydrocarbons. These areas on the Project Site would include:

- a coal stockpiling area;
- mine facilities area;
- any fuel, oil and grease storage; and
- refuelling bays.

These areas would be managed by the following means.

- All water from these areas would be directed to oil separators and containment systems for subsequent removal.
- Storage tanks would have an impermeable surface and bunding so as to contain at least 110% of its storage capacity of the largest tank.
- All hydrocarbon products would be securely stored.
- There would be a designated refuelling, oiling and greasing area.

6.3.3 Maintenance of Vegetation on the Project Site

The maintenance of vegetation, in this instance ground cover, would be a critical factor in the containment, and where possible improvement in water quality. It reduces the erosion of soil and also reduces the quantity of suspended solids being transported by filtering the water. As a general rule a ground cover would be maintained on all the land that is not being used for processing facilities, administration / maintenance facilities, roads, mining activities and the overburden emplacements. Ideally this ground cover would be 70% or better. This value would fluctuate with seasonal conditions but 70% cover would be aimed for.

Vegetation, particularly trees, also reduces the potential for dryland salinity by reducing the depth of the water table relative to the root zone of plants. This reduction in water table depth keeps salts within the soil profile further from the surface thus reducing the potential for dryland salinity and loss of productive lands. By maintaining and/or enhancing as much vegetation on the Project Site as possible, particularly trees, the potential for dryland salinity would be reduced.

A number of critical areas are identified on **Figure 4** that would remain in a 70% or better ground cover. These areas would be subjected to large quantities of diverted water and large quantities of potentially dirty water. In order to limit soil erosion and to improve water quality, it is imperative that these areas are well maintained. Buffer areas between the overburden emplacements, catch banks and sediment basins would be a minimum of 10m.

6.3.4 Sewage

Sewage effluent is a factor which has the potential to contaminate surface water. As a result, a sewage management system would be installed and managed based on the requirements of the Gunnedah Shire Council and DECC.

6.4 Contingency Plans

A contingency plan would be implemented for surface water management if the following occur.

- Discharges from the various sediment basins exceed the discharge parameter limits in **Table 3**. If this occurs, one or more of the following actions would be implemented.
  - Add flocculants to expedite settlement of sediments.
  - Enlarge sediment basins or construct additional ones.
  - Monitor water quality both upstream and downstream of the confluence of the discharged waters.

- In the event of a major hydrocarbon spill occurring the following would be implemented.
  - Recover as much as possible at the source by collecting the contaminated ground. This would be put under cover on an impermeable surface to be later remediated and/or transported to an approved waste depot.
  - Excavate one or more holes within or around the spill site to create a hydraulic gradient so that soil water and the spilled material would congregate within the holes thus enabling pumping out.
  - Monitor groundwater for any continued contamination. Treat this water or utilise this water on-site provided that process is under a DEC licence.

6.5 Long Term Surface Water Management and Final Landform

The installation of all storage dams, diversion banks, catch banks and sediment basins would occur before any other soil disturbance works are undertaken in the respective catchments. The disturbance of vegetation associated with any works would be limited and would be staged so that the maximum vegetation cover is retained for as long as possible. The overburden emplacement would be rehabilitated as the mine progresses thus reducing the amount of denuded earth exposed to rainfall and thus potential erosion. The rehabilitation of the overburden emplacement would be commenced as soon as practicable and completed in stages as the final landform develops.

By designing the water diversion and water storage structures for the worst case scenario, all the structures would need to be in place before the mine becomes operational. These structures would be maintained for the duration of the mine and until the landform is fully revegetated. The sediment basins would be cleaned when their capacity is reduced by 20% and any erosion repaired throughout the life of the mine and subsequent maintenance period.

It is recommended that the final landform of the overburden emplacement would be directed upon the overburden emplacement via graded banks into large rock flumes. The graded banks would be equally spaced down the overburden emplacements. Some basic specification for these graded banks are:

- maximum grade of 0.25% or 1 in 400;
- a channel width of not less than 3m;
- bank height of not less than 1m;
- channel is to be trapezoidal in shape; and
- excavation batters are to be at least 1 : 4 (V:H).

Each catchments rock flume would direct water from the top of the emplacement batter down to the original ground level. This water can then be directed into the existing sediment basin system. The flumes would be constructed to have the following minimum specifications.

- Parabolic shape with minimum 1m turn up either side.
- 80% of rock used must be >200mm in diameter.
- Minimum 10m width.

7 ASSESSMENT OF IMPACTS

This SWA and assessment has been undertaken for the Sunnyside Coal Project. It considers the environmental characteristics of the Project Site and surrounding areas. The plan has identified the sources that are likely to cause impacts to the Project Site and surrounds as the following.

- From any area that has been denuded of vegetation.
- Surface water flows from stockpiles of topsoil, subsoil, overburden and raw and processed material.
- Discharge of mine waters.
- Surface water flows from hardstand areas including roads, processing areas, site facilities and load-out facilities.
- Leaking or spillage of hydrocarbon products.

These potential sources would potentially impact on:

- surface water quantity;
  - flooding; and
  - water usage;
- surface water quality;
  - pH;
  - suspended solids;
  - electrical conductivity;
  - heavy metal concentrations; and
  - oils (hydrocarbons);
- soil erosion; and
- dryland salinity.

These impacts have been mitigated within this plan by:

- diverting clean water around disturbed areas and capturing this water to form part of the harvestable right in which this water can be used within the operation of the mine;
- constructing transport routes at current ground levels and creek bed levels;
- capturing dirty water, using it for dust suppression and other environmental purposes or treating it so that it can be discharged within acceptable guidelines; and
- by maintaining and enhancing as much vegetation on-site as possible.

8 RECOMMENDED MONITORING

The following monitoring is recommended, ie. parameters and locations. It is recognised that only parameters likely to change as a result of the Proponent's activities in the respective catchment need to be monitored.

- Parameters to monitor:
  - electrical conductivity;
  - pH;
  - suspended solids;

  - hydrocarbons;
  - heavy metals;
  - nutrients; and
  - water usage.

- Locations to monitor:
  - all storage dams;
  - all sediment basins;
  - water within void;
  - any groundwater sources used; and
  - upstream and downstream of the confluence of the northern catchment.

The frequency of monitoring would reflect the parameters to be monitored, the locations to be monitored and the potential for environmental impact. **Table 10** presents the recommended monitoring schedule.

Table 10
Recommended Surface Water Monitoring Schedule

Location	**Parameter**	**Frequency**
Selected Storage Dam and Sediment Basins	EC, pH, suspended solids, hydrocarbons	Quarterly or in the event of a significant rain event
Selected Storage Dam and Sediment Basins	EC, pH, suspended solids, hydrocarbons, heavy metals, nutrients.	Annually
Void water	EC, pH, suspended solids, hydrocarbons	Quarterly
Void water	EC, pH, suspended solids, hydrocarbons, heavy metals, nutrients.	Annually
Upstream and downstream of the Projects Sites influence on Coocooboonah Creek.	EC, pH, suspended solids, hydrocarbons, heavy metals, nutrients.	Annually or in the event of a significant rain event

The monitoring results would be reviewed on an annual basis and the frequency, locations and/or parameters re-assessed to ensure meaningful data is being collected. All monitoring results would be presented in the relevant AEMR.

Monitoring of soil erosion and vegetative cover would also be undertaken. In the event any soil erosion greater then 300mm deep for a maximum of 10m long is identified, this would be corrected via conservation earthworks and or re-vegetation. If rehabilitated areas with groundcover <70% are identified, these areas would be reseeded, fertilised and watered so that percentage groundcover can be maintained.

9 REFERENCES AND BIBLIOGRAPHY

ANZECC (Australian and New Zealand Environment and Conservation Council) and NH&MRC (National Health and Medical Research Council) 1992. Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites. Australian and New Zealand Environment and Conservation Council. Canberra.

Department of Land and Water Conservation (DLWC) (1999). *Rural Production and Water Sharing Landholders Information Package.* Department of Land and Water Conservation, Sydney.

Environment Protection Authority (1999). *Water Quality and River Flow Interim Environmental Objectives: Guidelines for River, Groundwater and Water Management Committees: Namoi River Catchment*. Environment Protection Authority, Sydney.

GeoTerra Pty Ltd (2007). *Groundwater Assessment for the Sunnyside Coal Project.* Prepared on behalf of Namoi Mining Pty Limited – Part 1 of the *Specialist Consultant Studies Compendium.*

Institution of Engineers (1987). *Austrian Rainfall and Run-off: A Guide to Flood Estimation*. Institution of Engineers, Australia, Barton, ACT.

Namoi Catchment Management Board (NCMB) (2003). *Namoi Catchment: a blueprint for the future*. Department of Land and Water Conservation.

Landcom (2004). *Managing Urban Stormwater: Soils and Construction, 4th Edition.* Landcom, NSW, Sydney.

NWQMS (National Water Quality Management Strategy) 1996*. Australian Drinking water Guidelines Summary*. National Health and Medical Research Council and Agricultural and Resource Management Council of Australia and New Zealand. Canberra.

NWQMS (National Water Quality Management Strategy) 2000*. Australian and New Zealand Guidelines for fresh and Marine Waters. Section 3.4 Water Quality Guidelines for Toxicants. Section 3.5 Sediment Quality Guidelines.* National Water Quality Management Strategy.

Soil Conservation Service (SCS) (1980). Gunnedah *Technical Manual*. Soil Conservation Service of NSW.

Soil Conservation Service (SCS) (1989). *Farm water Supplies Manual. Technical Handbook No. 7*. Soil Conservation Service of NSW.

Soil Conservation Service (SCS) (1990). *Design Manual for Soil Conservation Works. Technical Handbook No. 5*. Soil Conservation Service of NSW.

This page has intentionally been left blank

APPENDICES

(No. of pages excluding this page = 1)

Appendix 1 Design Procedures and Data Sources

This page has intentionally been left blank

Appendix 1

Design Procedures and Data Sources

(No. of pages excluding this page = 1)

Run-off Estimation and Catchment Yields

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 Gunnedah 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 Average Recurrence Interval (ARI). Catchment yields were determined by utilising Bureau of Meteorology web site (http://www.bom.gov.au/climate/averages/tables/ca_nsw_names.shtml) and design information within SCS (1990).

Diversion, Catch Bank and Storage Dam Design

The design of diversion and catch banks was undertaken by using the procedures within SCS (1990) and Soil Services' design computer. The quantities allowed for water storages were ascertained by the harvestable right allowance policy (DLWC 1999), this allowed for the Project Site to harvest 26.32MLpa.

Sediment Basin Design

The sediment basins were designed according to the procedures within Landcom (2004) and SCS (1990).