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SHEC MANAGEMENT SYSTEM

DARTBROOK MINE

EROSION AND SEDIMENT CONTROL PLAN

DBK Doc No: 1031

AAMC Doc No: AAMC_8-1-1_STD_Erosion Sediment Control Standard

Approval: J Fittler

Issue	*Issue Date*	*Originator*	*Reviewed*	*Approved*
1	9 August 2002	Hansen Consulting	Ed Wegner	Ed Wegner
2	15 August 2002	Hansen Consulting	Ed Wegner	Ed Wegner
3	9 September 2002	Hansen Consulting	Tony Willmott	Tony Willmott
4	12 September 2002	Hansen Consulting	Tony Willmott	Tony Willmott
5	10 December 2002	Hansen Consulting	Tony Willmott	Tony Willmott
6	30 November 2005	Hansen Consulting	Fiona Yench	Fiona Yench
7	16 January 2006	Hansen Consulting	Fiona Yench	Fiona Yench
8	21 July 2013	Hansen Consulting	D Stewart	J Fittler
9	17 March 2014	Hansen Consulting	D Stewart	J Fittler
10	21 October 2014	Hansen Consulting	D Stewart	J Fittler

Amendments

Issue	*Date:*	*Description*	*Initial*
1	09/08/02	Draft for Dartbrook Coal Review	EW
2	15/08/02	Draft for DLWC Review	EW
3	09/09/02	Revised Draft for DLWC Review	TW
4	12/09/02	Version for Planning NSW Approval	TW
5	10/12/02	Version Approved by Planning NSW on 09/12/02	TW
6	02/12/2005	Revision to include management of REA, new ROM stockpiles, disposal of tailings to Wynn Seam Goaf and Nitrogen Injection Plant for ACDM for DPI review	FY
7	16/01/2006	Version Addressing DPI Comments for Department of Planning Approval	FY
8	21/07/2013	Scheduled review	DS
9	17/03/2014	Include Met Coal ESC Standards	DS
10	21/10/2014	Include DP&E recommended changes	DS

Distribution List

COPY No.	Distributed To:
1	Planning and Infrastructure
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4	Upper Hunter Shire Council
5	Dartbrook Document Control System

Table of Contents

List of Tables

List of Figures

Appendices

1 INTRODUCTION

1.1 Background

Anglo Coal (Dartbrook Management) Pty Ltd (ACDM) was granted Development Consent (DA 231-07-2000) on 28 August 2001 for an extension to the Dartbrook Underground Coal Mine. The approved development involved extending the Dartbrook Mine's life for another 21 years and increasing raw coal production from 3.5 Mtpa to 6.0 Mtpa. The Development Consent was then modified on the 4th May 2005 to extend the Reject Emplacement Area's (REA) footprint, height and slope. A further modification was obtained on the 16 November 2005 to approve the establishment of additional ROM stockpiling capacity, disposal of tailings underground in the Wynn Seam goaf area, and operation of a Nitrogen Injection Plant over the Kayuga Seam mine workings.

Longwall mining operations commenced in the Wynn Seam in 1996 and ceased in May 2004. At this time the longwall was relocated from the Wynn Seam to the Kayuga Seam. Construction of mine access and development roadways for the Kayuga Seam commenced in 2001. Mining of the Kayuga seam ceased in October 2006 due to on-going geological difficulties, and the mine was placed on and is currently operating under Care and Maintenance.

1.2 Erosion And Sediment Control Plan

This Erosion and Sediment Control Plan has been developed in accordance with the conditions of the current Dartbrook Development Consent. The plan includes erosion and sediment control measures for all components of the Dartbrook mining operations, including:

- operation of the West Site Surface Facilities including Mine surface facilities, Kayuga Seam Access Slot and Kayuga Seam Access Road;
- underground development and longwall mining operations in the Kayuga, Piercefield and Mt Arthur seams;
- operation of the Coal Handling and Preparation Plant (CHPP) at the East Site, construction and operation of existing and new Run of Mine (ROM) coal stockpiles, and construction and operation of a tailings filter press plant at the CHPP;
- disposal of tailings underground in the Wynn Seam goaf;
- construction, operation, and progressive rehabilitation of the current and the expanded REA at the East Site;
- operation of a Nitrogen Injection Plant over the Kayuga Seam mine workings; and
- construction and operation of ventilation shafts, gas drainage boreholes and plants, electrical substations, mine dewatering boreholes, drop-holes and associated pipelines, and the tailings return water pipelines and pumping system.

Figure 1 shows the location of Dartbrook mining operations.

1.3 Management Plan Requirements

The Erosion and Sediment Control Plan documents the prevention and control measures to manage erosion and sedimentation for the Dartbrook Care and Maintenance operations. The primary objective of the plan is to minimise erosion on the mine site and subsequent sedimentation of downstream waterways. This objective will be met through the implementation of the control measures specified in **Section 2**.

The specific requirements of the Erosion and Sediment Control Plan are contained in development consent conditions 3.6 (a), and (b). These requirements are listed in **Table 1** with a reference to where each specific requirement is addressed in the management plan.

Table 1

Management Plan Requirements Checklist

Development Consent Condition	Status and Section of Document
3.6 Prevention of Soil Erosion (a) The Applicant shall prepare an Erosion and Sediment Control Plan for the surface facilities and extension to the rejects emplacement area in consultation with the DLWC, taking account of the DLWC *"Draft Guideline for Establishment of Stable Drainage Areas on Rehabilitated Minesites"* or its latest version, and to the satisfaction of DLWC and the Director-General. The Plan shall be prepared and implemented prior to the commencement of construction and/or the expansion of the rejects emplacement area.	This document is the Erosion and Sediment Control Plan, which was revised to include erosion and sediment control for the Extended REA, the new ROM stockpiles, underground disposal of tailings to the Wynn Seam goaf and operation of a Nitrogen Plant. It was approved by the Department of Planning (DoP) prior to the commencement of construction of the REA. The plan was prepared to be consistent with the general processes and principles described in the Department of Natural Resources (DNR) (former DLWC) draft guideline.
(b) The Erosion and Sediment Control Plan shall include but not be limited to:	
(i) details of temporary and permanent erosion and sediment control systems to be used during both construction and/or the expansion of the rejects emplacement area, including earthworks associated with landscaping;	**Included see Section 2.3**
(ii) details of soil salinity management where relevant;	Soil salinity is not an issue on the Dartbrook site.
(iii) measures that will be employed to minimise soil erosion and the discharge of sediment and other pollutants to lands and/or waters during construction and/or the expansion of the rejects emplacement area. The Plan should be prepared in accordance with the requirements for such plans outlined in Managing Urban Stormwater: Soils and Construction (available from the Department of Housing) or its latest version;	**Completed see Section 2.3**
(iv) the consideration of the location and purpose of structures in the erosion and sediment control plan to maximise similarities between pre-development and post-development drainage networks with reference to catchment areas, drainage densities and discharge characteristics;	The Dartbrook mining operations did not significantly alter the site drainage network.
(v) consideration and management of erosion and sedimentation of surface watercourses/waterbodies, including affected creeklines within the DA areas;	**Section 2**

Development Consent Condition	Status and Section of Document
(vi) measures to construct banks, channels and similar works to divert stormwater away from disturbed and contaminated land surfaces such as mine workings, coal handling areas and wastewater treatment facilities. All diversion banks, channels and points of discharge must be constructed or stabilised so as to minimise erosion and scouring; and	**Section 2**
(vii) a program for reporting on the effectiveness of the erosion and sediment control systems and performance against objectives contained in the approved Erosion and Sediment Control Management Plan, and EIS.	**Section 3**

1.4 Reference and Relationship with other Environmental Documentation.

This Plan also conforms with:

- AAMC Erosion and Sediment Control Standard January 2011.
- Managing Urban Stormwater – Soil and construction – Volume 2EMines and Quarries, prepared by NSW DECC (2008)
- Muswellbrook Shire Development Control Plan, Section 20 Erosion and Sediment Control, April 2009.

2 EROSION AND SEDIMENT CONTROL

2.1 Introduction

This section describes the drainage systems, and erosion and sediment control measures for relevant components of the Dartbrook mining operations. These are:

- West Site Surface Facilities, including the Mine Surface Facilities, Kayuga Seam Surface Facilities, Kayuga Seam Access Slot, Kayuga Seam Access Road and the Evaporation Ponds;
- Dartbrook East Site, including the REA and CHPP area;
- surface areas affected by mining subsidence; and
- minor infrastructure including ventilation shafts, gas goaf drainage plants, a Nitrogen Injection Plant, the Wynn Seam goaf dewatering bores, associated electrical transformer station and return water pipelines, and other minor surface infrastructure areas (Figure 1).

All components of the Dartbrook mining operations will be subject to the following general principles for erosion and sediment control:

- runoff from undisturbed areas will be diverted around disturbed areas via diversion drains and allowed to drain from the site;
- runoff from disturbed areas will be collected in catch drains and directed to sediment traps, and/or settling dams to remove suspended sediment prior to drainage from the site;
- disturbed areas, not required for on-going mining operations, will be rehabilitated in accordance with industry best practice and the Mining Operation Plan requirements;
- erosion and sediment control works will be located to ensure that known Aboriginal sites are not impacted and to minimise the impact on flora and fauna;

- erosion and sediment control structures will be inspected following significant runoff events;
- maintenance of erosion and sediment control structures will be undertaken regularly in accordance with the requirements of the Department of Primary Industries; and
- erosion and sediment control structures will be maintained with sufficient freeboard to accommodate the relevant design storm event.

General design criteria were:

Table 2
General Design Criteria

Description	Design Criteria
Design Settling Capacity	6 hour, 1 in 10 year ARI[1] Rainfall Event
Spillway Capacity	Peak 20 year ARI event
Minimum operating design capacity prior to desilting	90%

Note: 1. ARI = Average Recurrence Interval

Appendices A and B contain the AAMC Erosion and Sediment Control Standard's design criteria for specific structures and the maintenance checklist template for guidance.

2.2 West Site Surface Facilities

The West Site Surface Facilities comprise the Mine Surface Facilities, Kayuga Seam Facilities, the Kayuga Seam Access Slot and the Kayuga Seam Access Road, and the Evaporation Ponds.

The Mine Surface Facilities at the West Site include the Dartbrook Mine administration building, bathhouse, workshop, store yard lay-down area, diesel fuelling bay, wash-down area, and the Western Holding Dam. The drainage management plan for this area is shown in **Figure 2**.

The Mine Surface Facilities are located within an isolated catchment formed by a ridge line and perimeter bunds. Site runoff is collected in perimeter drains and directed to the Western Holding Dam (WHD). WHD water is contained on site and re-used for mine water supply. In 2011 the WHD was desilted and restored to full design capacity.

The Staged Discharge Dam (SDD)water is stored for re-use as a mine water supply or discharged to the Hunter River in accordance with ACDM's Environment Protection Licence.

The Kayuga Seam Access Slot and Kayuga Seam Access Road were constructed in accordance with an approved Construction Erosion and Sediment Control Plan. The access slot visual bund batters have been constructed at stable slopes and have been topsoiled and revegetated to minimise erosion. The access slot overburden emplacement has been located away from creeks and drainage lines. Runoff from the spoil dump is collected in a catch drain along the northern toe of the dump and directed to Sedimentation Dam No. 2.
The design parameters for the dam are shown in **Table 3**. The dump has been constructed with stable batters and has been topsoiled and revegetated with grass to minimise erosion.

The drainage management plan for these facilities is also shown in **Figure 2**. The main features of the plan are discussed below.

Drainage is diverted away from the Kayuga Seam Access Slot by a drain to the north, and the visual bund to the west. A sump has been installed in the base of the access slot to collect runoff water. Sump water is pumped to underground. The design parameters for the dam are shown in **Table 3**. Any overflow from this dam is captured in the Staged Discharge Dam.

Topsoil stockpiles have been located away from creeks and drainage lines and constructed with stable batters and revegetated with grass and legumes. The Access Road excavation and embankment

batters have been constructed at stable slopes and stabilised/revegetated, where necessary. Runoff from the Access Road cutting in the vicinity of Blairmore Lane collects in sumps and drains to the Western Holding Dam. Western Holding Dam water is re-used for mine water supply.

Table 3
Sedimentation Dams – Design Parameters

Description	Design Criteria
Nominal Catchment Area	<5.5 ha
Design Settling Capacity	6 hour, 1 in 10 year ARI Rainfall Event
Storage Volume	1.35 ML
Spillway Capacity	Peak 20 year ARI1 event

Note: 1. ARI = Average Recurrence Interval

2.3 Dartbrook East Site

2.3.1 Introduction

The Dartbrook East Site is located on the western side of Browns Mountain (**Figure 3**). The crest of Browns Mountain forms a catchment boundary and water in the catchment drains towards the west. The Dartbrook East Site contains existing infrastructure, including the CHPP and existing Dartbrook Rejects Emplacement Area (REA). **Section 2.3.2** describes the approved drainage and sediment control works that are in place for the Dartbrook East Site infrastructure and the ROM coal stockpiles and tailings discharge pipeline.

2.3.2 Existing Erosion and Sediment Controls

The East Site currently contains the CHPP, rail loop, existing Dartbrook REA, the Eastern Holding Dam (EHD) and product and ROM coal stockpiles. The existing drainage management plan for this area is shown in **Figure 3**. The disturbed area associated with the CHPP and the existing rejects disposal area is within an isolated catchment formed by upstream diversion drains. Runoff from this area, including runoff from the ROM coal stockpiles, is collected in catch drains and directed via a series of smaller dams to the EHD. Water from the EHD is contained on site and used in the stockpile spray system to get rid of excess water, transferred to the WHD and SDD or to the Wynn goaf.

Runoff from undisturbed catchments to the east of the CHPP is diverted around the disturbed catchment area and directed to sedimentation dams (the Northern and Southern Dams) prior to discharging from the site.

The existing, approved drainage works will be maintained and, as discussed in **Section 2.3.3**, expanded to accommodate for the Dartbrook REA.

2.3.3 Rejects Emplacement Area Controls

Although Dartbrook's Development Consent authorises an extension to the existing Dartbrook REA the Care and Maintenance management did not undertake this strategy. The REA was completed and rehabilitated into a generally self-sustaining landform. The key components of the drainage plan for REA are also illustrated in **Figure 4.**

Figure 5 provides a typical cross section of the REA, including drainage works. Drainage works include diversion drains, catch drains, collection dams
and sediment dams.

Table 4 provides the design parameters for these structures.

Drainage from undisturbed parts of the catchment is diverted around disturbed areas by diversion drains prior to passive drainage from the site. Drainage from the northern part and southern part of the Browns Mountain catchment will be diverted to the north and south of the rehabilitated emplacement areas, respectively.

Runoff from disturbed areas, including the rehabilitated emplacement areas is directed via catch drains to collection dams. Water from collection dams flows to the EHD. Catch drains have been constructed according to the Anglo Standard (see **Table 3**) with sufficient storage and transfer pump capacity to ensure that they are unlikely to overflow.

Runoff from areas of established rehabilitation is directed by intermediate contour drains to sediment dams prior to passive discharge from the site. Runoff from the reclaimed and rehabilitated clay and topsoil stockpile is directed by catch drains to sediment dams prior to passive discharge from the site. All earthworks have been constructed to meet the Anglo Standard (see Table 3).

Additional detail on the management of topsoil stockpiles is provided in the Topsoil Stripping Management Plan.

Soil erosion was limited by clearing only the minimum area required to be disturbed for the development of the REA and by progressively rehabilitating the REA with grass species appropriate for the control of soil erosion. The REA was contour ripped and the contour drains minimised the potential for erosion by limiting the effective slope length. Rehabilitated areas are inspected periodically and any necessary maintenance, including re-sowing and/or maintenance application of fertilizers will be conducted.

All sediment control works are regularly inspected and maintained as per this Plan.

Table 4
REA Drainage Management Plan Components

Component/Purpose	Design/Construction Criteria
Diversion Drains	
Divert runoff from undisturbed catchment areas around disturbed areas.	• Drains constructed as either excavated channels and/or diversion banks depending on cross slope of the topography. • Maximum longitudinal grades of 0.5%. • Cross section batters constructed to stable slopes (< 3:1) and revegetated to minimise erosion. • Channel capacity designed for the 50 year ARI peak flow. • Maximum flow velocity of 1.5 m/s.
Contour Drain	
• Installed on all rehabilitated slopes to minimise the potential for erosion by limiting the effective slope length • Collect runoff from rehabilitated slopes and direct to sediment traps and settling dams prior to passive drainage from the site.	• Installed every 10-20 m increase in elevation. • Maximum longitudinal grades of 0.5- 1.0%. • Channel capacity designed for the 50 year ARI peak flow. • Maximum flow velocity of 1.0 m/s.

Component/Purpose	Design/Construction Criteria
Sediment Dams	
• Sediment dams - constructed on-site downstream of disturbed areas (rehabilitated areas and clay and topsoil stockpiles) to remove suspended sediment from runoff prior to passive drainage from the site.	• Sediment dams - volume sufficient to cater for the hydraulic through rate equivalent to the average runoff rate for the 6 hour duration, 10 year ARI storm event. • Spillway sized for the 20 year ARI peak flow

2.4 Surface Areas Affected by Mining Subsidence

Only two drainage catchments have been affected by subsidence to some degree caused by the Kayuga Seam workings as part of the mining operations. All drainage lines within the area affected by subsidence are low order (1st or 2nd order), and ephemeral. The larger tributaries of Sandy Creek, Dart Brook and the Hunter River have not been undermined.

Subsidence of land overlying Dartbrook longwall panels took place progressively over the life of the mine. Subsidence resulted in the formation of shallow trough depressions (relative to existing topography) above longwall panels. Minor surface cracking has also occurred due to tensile strain on the ground surface. Total surface subsidence in the Dartbrook mining area appears to range from 1 m to 1.5 m.

The surface drainage effects of subsidence have varied as follows:

- initiation of erosion due to surface cracking;
- localised alteration of surface drainage paths;
- initiation of stream bed erosion due to local steepening of stream bed grades; and
- formation of ponding areas.

As necessary, remedial drainage, and erosion and sediment control works were conducted to mitigate the effects of subsidence. Such remedial works included:

- rehabilitation of surface cracks by ripping and seeding;
- remedial drainage works to redirect drainage paths, where necessary;
- cut and/or fill drainage earthworks to re-establish free drainage in ponding areas; and
- drainage works or stabilisation works to remediate any areas prone to erosion.

It should be noted that a significant surface area that has been undermined, and subject to subsidence effects, is privately owned. The management of all impacts on private properties, including erosion and sediment control measures, was managed in accordance with Property Subsidence Management Plans (PSMPs) that were developed in accordance with the Development Consent conditions and in consultation with the landowners. ACDM has not implemented any erosion and sediment control measures on privately owned property without the agreement of the landowner.

For land owned by ACDM, areas affected by mining subsidence are inspected annually. The active subsidence phase was found to only last up to 12 months after undermining with no significant subsidence since.

2.5 Ventilation Shafts And Other Minor Infrastructure Areas

Of the two ventilation shafts originally constructed only shaft No1 remains operational. Each shaft has a relatively small surface footprint of approximately 60 m x 60 m. Other minor surface infrastructure, such as gas drainage plants and pipelines, mine dewatering boreholes and drop-holes have generally been decommissioned and rehabilitated.

The November 2005 Development Consent modification also approved the installation of a Nitrogen Injection Plant, Wynn Seam goaf dewatering bores and associated electrical sub-station and return water pipelines. The Nitrogen Injection Plant has since been removed and the site successfully rehabilitated.

The general principles for erosion and sediment control described in **Section 2.1** will be adopted in the design and construction, and eventual removal, of any remaining infrastructure, where necessary.

3 MONITORING AND REPORTING

The following monitoring will be conducted to ensure that effective erosion and sediment control is implemented and maintained during Dartbrook's Care and Maintenance operations:

- Mine surface infrastructure areas will be inspected after significant runoff events* to ensure that erosion and sedimentation are being effectively controlled. Any areas that are eroding will have appropriate controls installed.
- Drainage and sediment control structures will be inspected after significant runoff events* to check for scouring of diversion drains and sedimentation of sediment traps and settling dams. Sediment control structures will be desilted as necessary as per the General Design Criteria (see **Table 2**) and any scouring of drains will be stabilised.
- ACDM land affected by mining subsidence will be inspected annually and appropriate erosion and sediment controls will be installed, if necessary.
- Erosion and sediment control on privately owned land affected by mining subsidence will be monitored in accordance with the monitoring program specified in the PSMP, developed in consultation with the landowner.

Details of erosion and sediment control measures implemented during the Care and Maintenance phase will be reported in the Annual Environmental Management Reports (AEMRs). In accordance with Development Consent condition 9.2 (c), AEMRs will be submitted to the Department of Planning & Infrastructure (DP&I), DSW Trade & Investment – Division of Resources and Energy, Office of Environment and Heritage – Environment Protection Authority (EPA) and National Parks and Wildlife Services; Muswellbrook Shire Council (MSC), Upper Hunter Shire Council (formally Scone Shire Council), and the Dartbrook Community Consultative Committee, and will be made available to the public at the MSC Library and office.

*A storm event is taken to be a rainfall event where >20mm of rainfall is received within a 24-hour period.

4 RESPONSIBILITIES

The Environmental Coordinator will be responsible for ensuring that the requirements of this management plan are implemented. Specific responsibilities of the Environmental Coordinator will include:

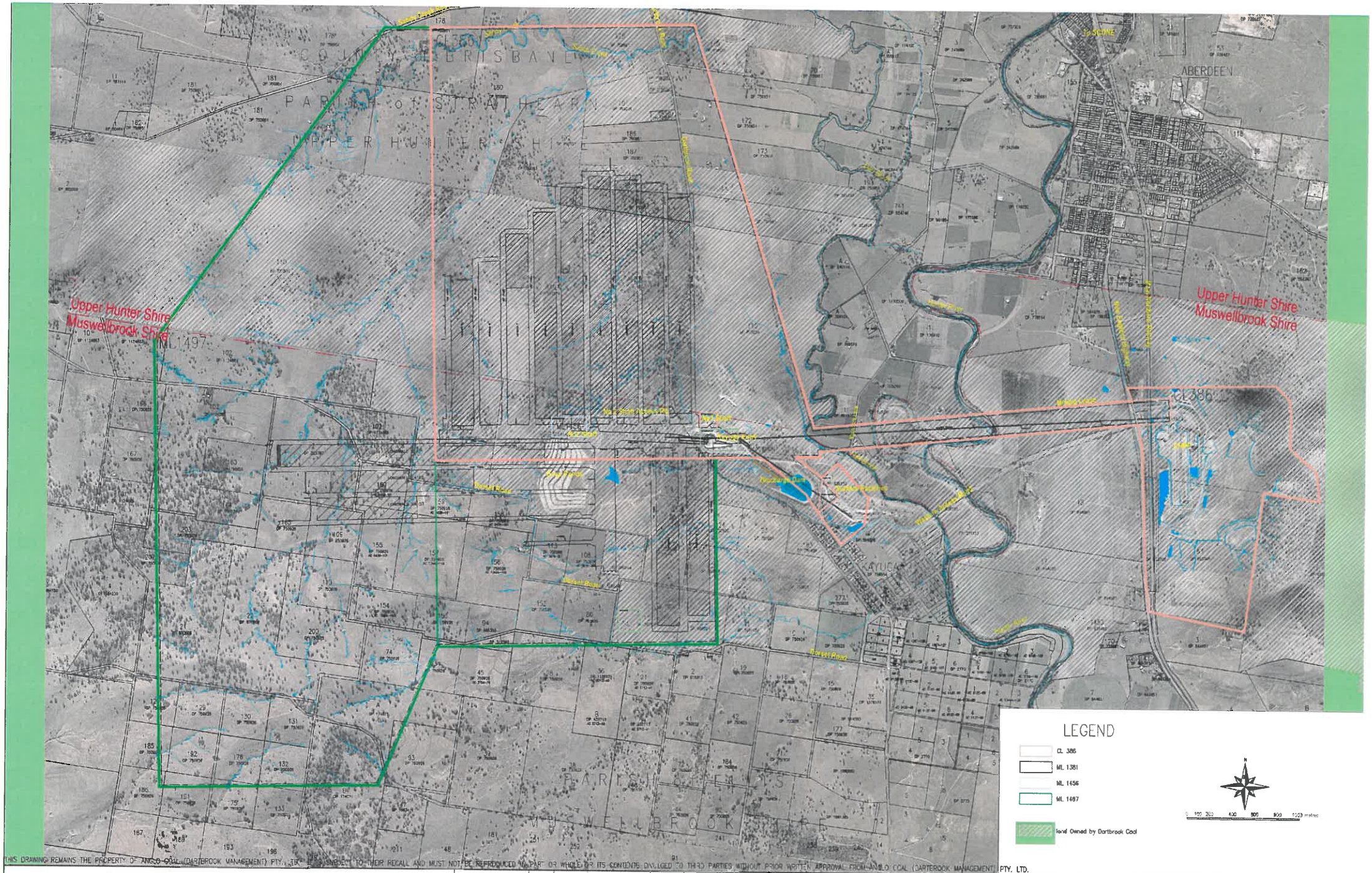
- ensuring that all personnel are given adequate training in environmental awareness, legal responsibilities, and erosion and sediment control methods;
- ensuring mine personnel are aware of the appropriate erosion and sediment control works required to be installed in areas disturbed by mining operations;
- erosion and sediment control monitoring in accordance with **Section 3**; and
- undertaking inspections to ensure erosion and sediment control works are adequately maintained.

5 REVIEW REQUIREMENTS

In accordance with condition 3.2 (f) of the Dartbrook Extended Development Consent, this Plan will be reviewed every five years.

Anglo American Metallurgical Coal ESC Standard is to reviewed and updated on a biannual basis.

FIGURES



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DRAWN	REVISIONS					
PC	REV.	DATE	BY	DESCRIPTION	CHK.
26/08/11	A	26/08/11	PC	Initial Issue	DS

Dartbrook Mine
Site Layout at Care & Maintenance & Current Mining Lease Areas

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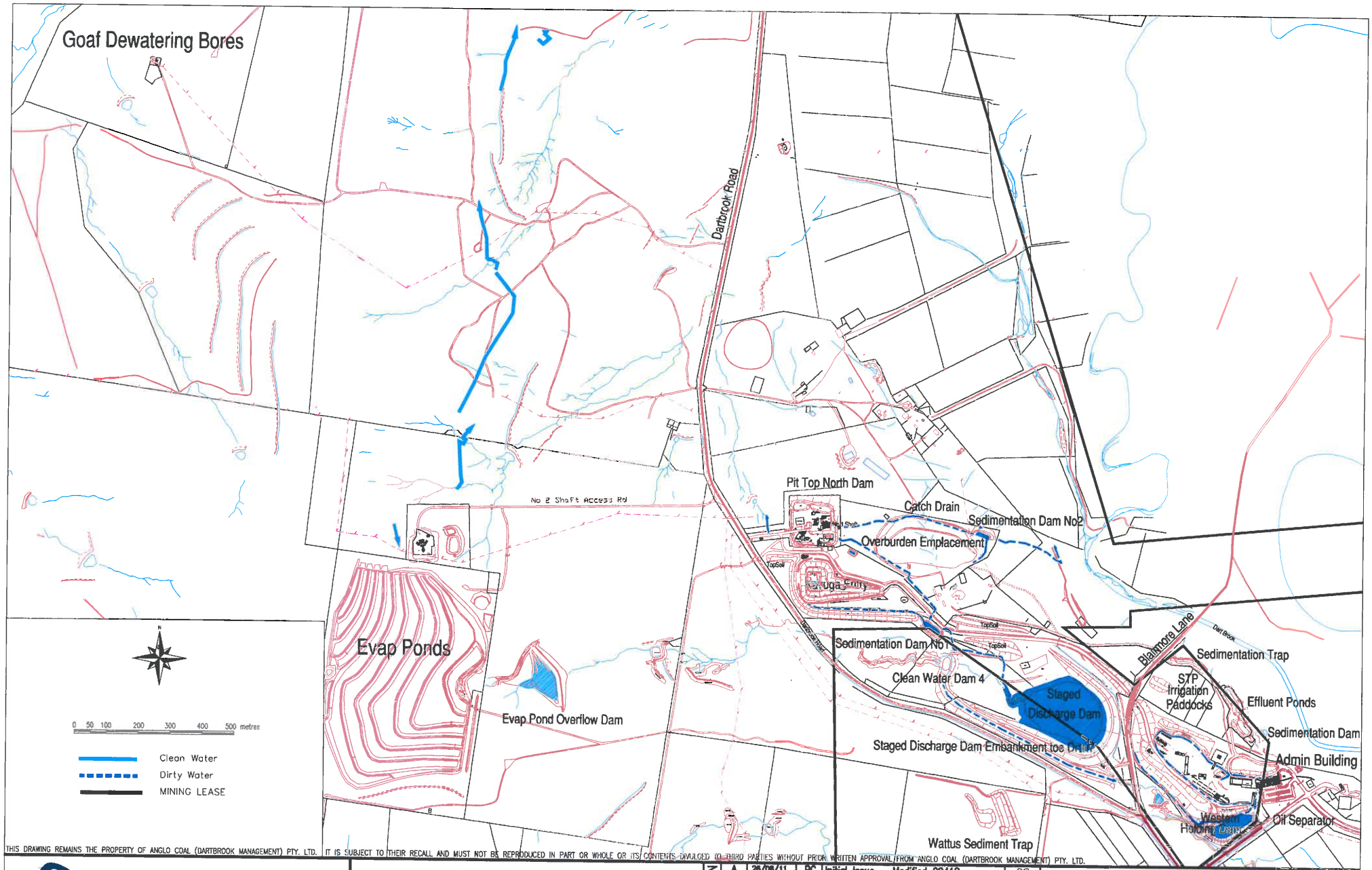

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REVISION					
REV.	DATE	BY	DESCRIPTION		CHK.
A	26/08/11	PC	Initial Issue – Modified 29418		DS
B	05/07/13	PC	Modified to Figure 2 from 1		DS
C	19/12/13	PC	Goaf Drainage Pipe Capture Added		DS

DRAWN	DATE	CHECKED	APPROVED
PC	26/08/11		

Dartbrook Mine
Drainage Management Plan - West Site
FIGURE 2

SCALE		DRG.	REV.
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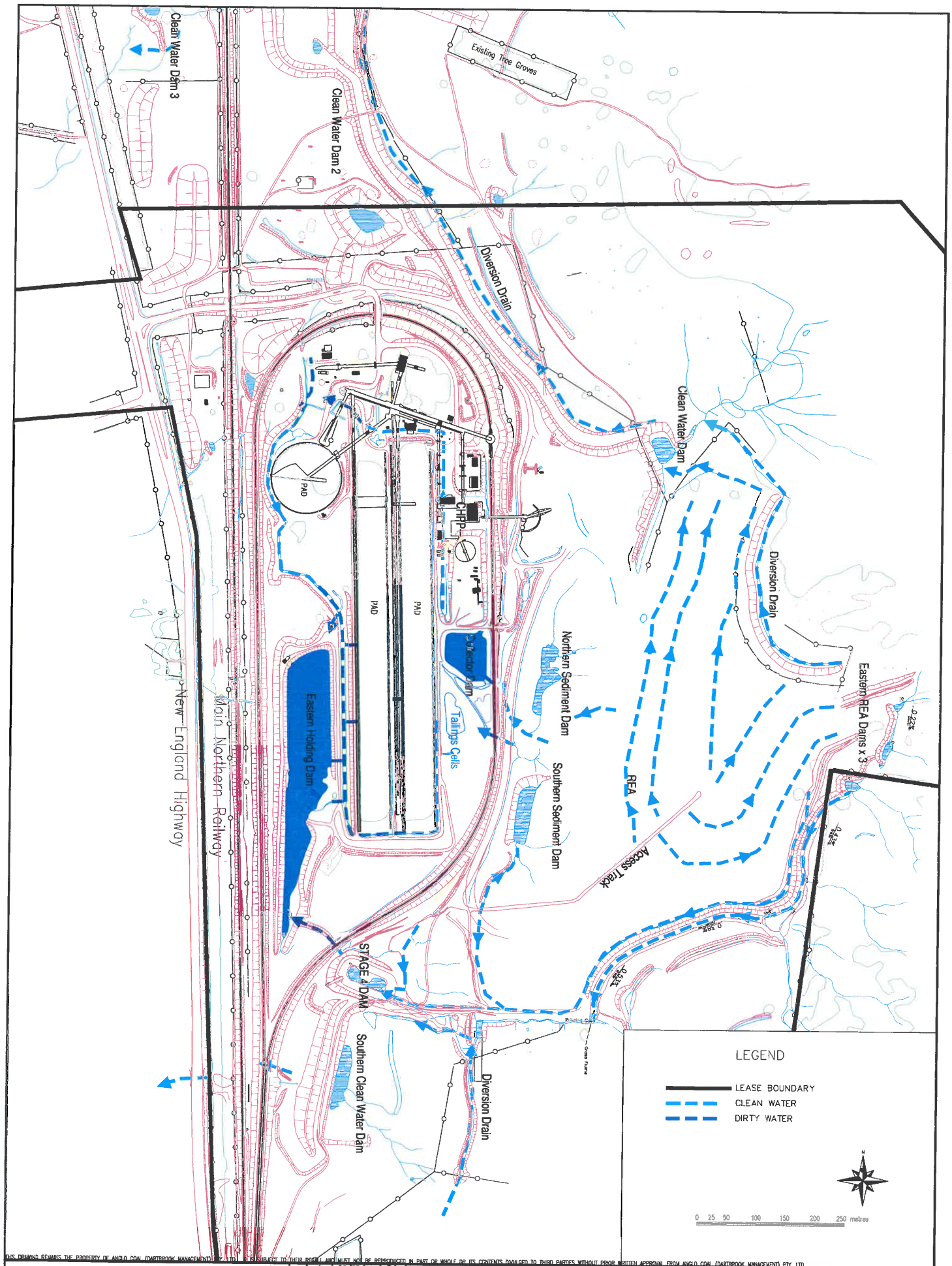

AngloAmerican

REVISION					
REV.	DATE	BY	DESCRIPTION		CHK.
A	26/08/11	PC	Initial Issue Modified 23346 AEMR Plan		DS
B	05/07/13	PC	Dam Names Added		DS
C	19/12/13	PC	Drainage Adjusted		DS

DRAWN	DATE	CHECKED	APPROVED
PC	26/08/11		

Dartbrook Mine
Drainage Management Plan - East Site
FIGURE 3

SCALE		DRG.	REV.
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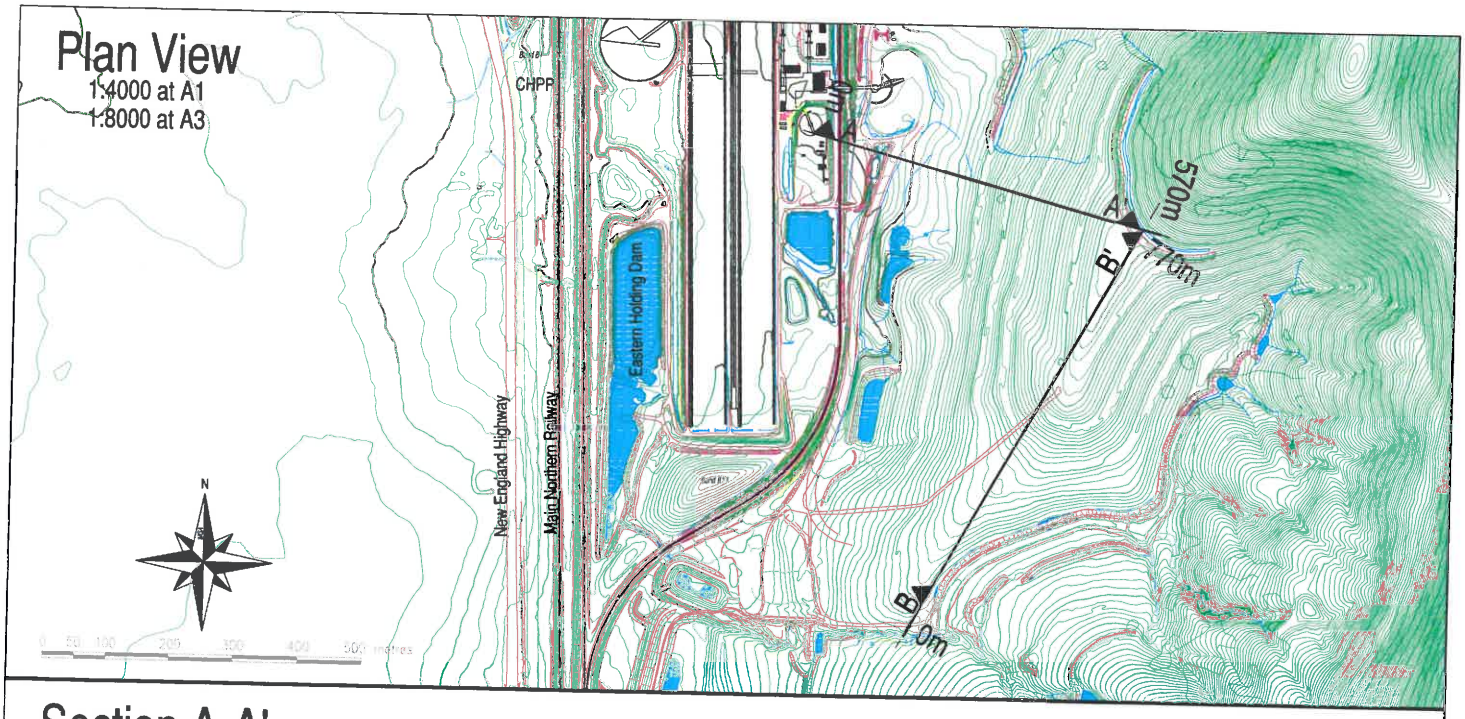
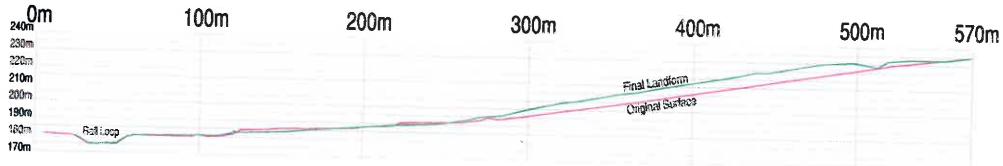
Plan View

1:4000 at A1
1:8000 at A3



Section A-A'

1:1500 at A1
1:3000 at A3



Section B-B'

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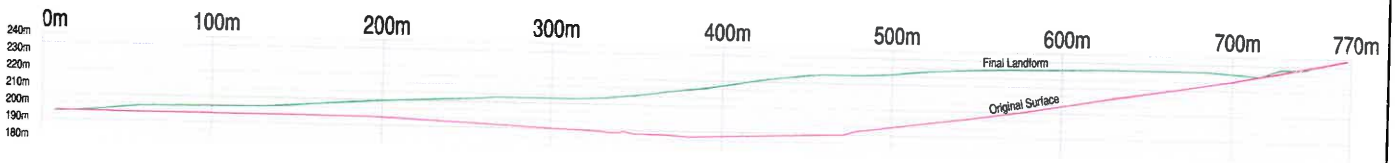

Final Landform as per current MOP proposal, original surface is taken from pre reject implacement flight contours.

Mine Surveyors Certification of Accuracy Date

REVISIONS	REV.	DATE	BY	DESCRIPTION	CHK.
	A	12/12/08	PC	Initial Issue	PB
	B	07/03/11	PC	AngloAmerican Logo Added	DS

DRAWN	PC	12/06/08
CHECKED	FB	12/06/08
DATUM	A.H.D.	
PROJECTION	MGA(56)	

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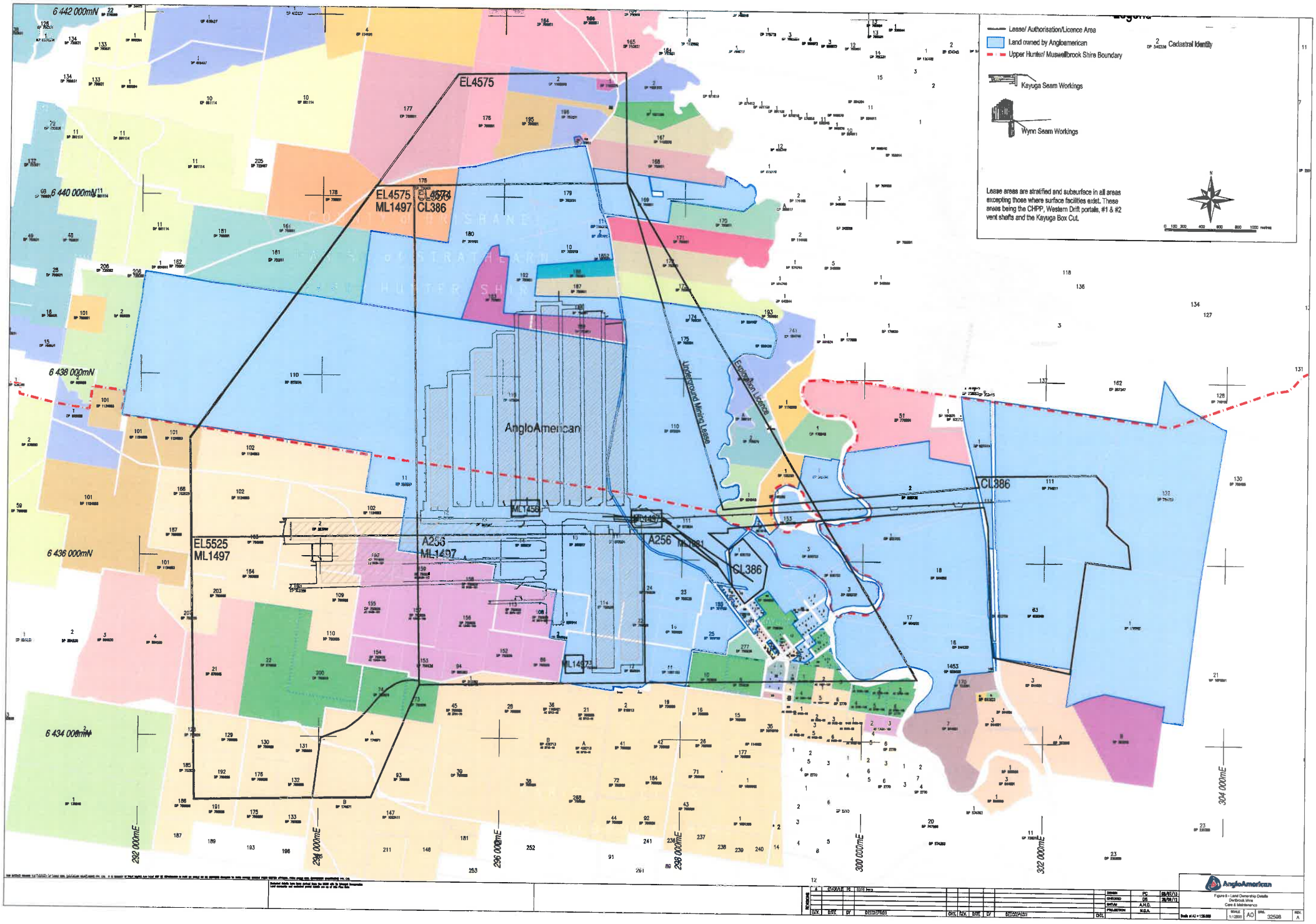
Section Through Dartbrook Reject Emplacement Area
Original & Final Landform
Section Plan 1

SCALE	SIZE	DRG.	REV.
as Shown	A1	32457	B


Lease/ Authorisation/Licence Area
Land owned by Angloamerican
Upper Hunter/ Muswellbrook Shire Boundary
Cadastral Identity
Kayuga Seam Workings
Wynn Seam Workings
Lease areas are stratified and subsurface in all areas excepting those where surface facilities exist. These areas being the CHPP, Western Drift portals, #1 & #2 vent shafts and the Kayuga Box Cut.
EL4575
EL4575 EL4574
ML1497 CL386
AngloAmerican
Underground Mining Lease
Exploration Licence
CL386
MLT456
ML1497
A256
ML1691
EL5525
ML1497
ML1497
6 442 000mN
6 440 000mN
6 438 000mN
6 436 000mN
6 434 000mN
292 000mE
294 000mE
296 000mE
298 000mE
300 000mE
302 000mE
304 000mE

APPENDICES

APPENDIX A
AAMC Erosion and Sediment Control Standard

CATCH DRAIN

OVERVIEW

CATCH DRAINS (ALSO KNOWN AS FLOW DIVERSION BANKS / CONTOUR BANKS) ARE USED TO:

- DIVERT FLOW AROUND DISTURBED AREAS, STOCKPILES AND CUT BATTERS.
- SHORTEN THE FLOW PATH DOWN LONG, STEEP SLOPES.
- CONVEY CONTAMINATED RUNOFF TO SEDIMENT TRAPS.

GEOMETRY

A. DO NOT EXCEED 2H:1V SIDE SLOPES.
B. DRAINS SHOULD BE AT LEAST 0.3M DEEP AND 1.0M WIDE BASE.
C. SUITABLE CHANNEL GRADIENT IS TYPICALLY AROUND 0.5%, HOWEVER:
   i. GRADIENT SHOULD BE MINIMISED AS MUCH AS POSSIBLE.
   ii. DO NOT EXCEED 0.4% FOR OPEN-EARTH CHANNELS.
   iii. GRADIENT SHOULD NOT EXCEED 1% FOR UNSTABLE SOILS
   iv. STABLE SOILS MAY HAVE GRADIENTS UP TO 2%.

D. PARABOLIC / U-SHAPED SECTIONS ARE PREFERRED WHERE SIDE SLOPES EXCEED 6H:1V

CAPACITY

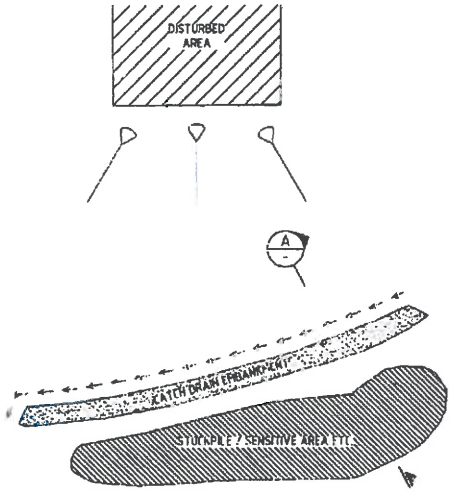
A. ADOPT A MINIMUM FREEBOARD OF 0.15M.
B. DRAINS ARE TO BE DESIGNED TO CONVEY THE 10 YEAR ARI RAINFALL EVENT

GENERAL DESIGN CONSIDERATIONS

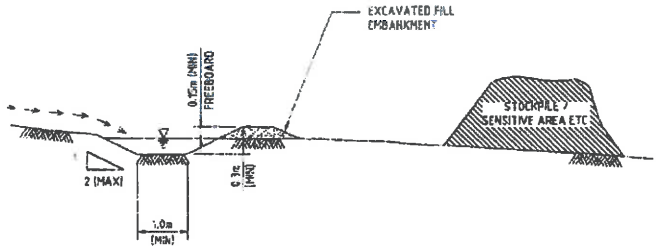
A. CATCH DRAINS ARE GENERALLY REQUIRED FOR CATCHMENT AREAS EXCEEDING 1500M², BUT SHOULD ALSO BE CONSIDERED FOR USE IN SMALLER CATCHMENTS DUE TO ENVIRONMENTAL AND DRAINAGE BENEFITS.
B. DIVERSION DRAINS SHOULD BE PROVIDED AROUND STOCKPILES WHERE AVERAGE MONTHLY RAINFALL EXCEEDS 45MM.
C. ENSURE THAT CATCH DRAIN OUTLETS:
   i. ARE UNOBSTRUCTED.
   ii. ADHERE TO LAWFUL POINTS OF DISCHARGE.
   iii. DO NOT DISCHARGE TO FILL SLOPES.
   iv. ARE STABILISED WHERE NECESSARY (E.G. TURF, ROCK LINED, CHUTE ETC.).
   v. INCORPORATE ENERGY DISSIPATERS OR LEVEL SPREADERS TO CONVERT CONCENTRATED FLOW INTO SHEET FLOW, IF DISCHARGING DOWN AN EVEN SLOPE.

D. ENSURE CATCH DRAIN EMBANKMENTS ARE STABILISED, SO AS NOT TO CREATE A NEW EROSION OR SEDIMENTATION HAZARD. IN PARTICULAR:
   i. PROVIDE EROSION CONTROL ON EMBANKMENTS AS NECESSARY, SUCH AS MULCHING, ROCK LINING ETC.

E. DO NOT INCORPORATE MULTIPLE CATCH DRAINS. INSTEAD INCREASE CAPACITY OF SINGLE CATCH DRAIN AS REQUIRED.



PLAN
SCALE: N.T.S



SECTION A
SCALE: N.T.S

CONSTRUCTION

A. DRAINS SHALL BE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS AND DESIGN DETAILS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERINTENDANT OR CONTRACT HOLDER.
B. COMPLETE CONSTRUCTION OF DOWNSTREAM SEDIMENT TRAP(S) (WHERE NECESSARY), BEFORE COMMENCING CONSTRUCTION OF THE CATCH DRAIN(S).
C. CONSIDER THE FOLLOWING WHEN NO PLANS ARE PROVIDED:
   i. CATCH DRAINS WHERE SEDIMENT-LADEN RUNOFF IS EXPECTED SHOULD BE DIRECTED TOWARDS DOWNSTREAM SEDIMENT TRAP(S) WHERE POSSIBLE
   ii. CLEAN WATER CATCH DRAINS SHOULD BE DIVERTED AROUND DOWNSTREAM SEDIMENT TRAP(S)
   iii. ALLOW SUFFICIENT SPACE FOR CONSTRUCTION AND MAINTENANCE PURPOSES ENSURE ACCESS IS AVAILABLE FOR PERSONNEL AND EQUIPMENT DURING CONSTRUCTION, WITH A MINIMUM 3M PROVIDED FOR SMALL MAINTENANCE VEHICLES.

D. CONSTRUCT THE CATCH DRAIN(S) ENSURING A MINIMUM DEPTH OF 0.3M, AND SIDE SLOPES NO GREATER THAN 2H:1V (REFER TO PREVIOUS SECTIONS FOR DETAILED DESIGN CONSIDERATIONS).
E. REMOVE AND APPROPRIATELY DISPOSE OF ALL STUMPS, TREES, SILT, OBSTRUCTIONS AND OTHER WASTE MATERIAL WHICH MAY INTERFERE WITH THE PROPER FUNCTION OF THE DRAIN.
F. APPLY EROSION PROTECTION AS NECESSARY, OR IF MAXIMUM RECOMMENDED GRADE IS EXCEEDED (REFER GEOMETRY SECTION)
G. ENSURE DISCHARGE IS NOT RECEIVED BY AN UNSTABLE FILL SLOPE.
H. DO NOT COMMENCE CLEARING OF UPSTREAM AREAS BEFORE THE CATCH DRAIN AND DOWNSTREAM SEDIMENT TRAPPING DEVICES ARE IN PLACE.
I. SALVAGE ALL TOPSOIL REMOVED DURING CONSTRUCTION, AND STOCKPILE IN APPROVED LOCATION.

MAINTENANCE

THE FOLLOWING SITE INSPECTION ON THE CATCH DRAINS SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGE:

A. PRIOR TO 1ST NOVEMBER EACH YEAR.
B. AFTER EACH SIGNIFICANT RAINFALL EVENT

SOME SPECIFIC MAINTENANCE GUIDELINES ARE AS FOLLOWS:

- REMOVE ACCUMULATED SEDIMENTS TO MAINTAIN THE CATCH DRAIN CAPACITY.
- DISPOSE OF SEDIMENT, OR MIX WITH DRY SOIL FROM THE SITE, BEING CAREFUL NOT TO CREATE A NEW EROSION OR SEDIMENT HAZARD.
- CHECK THAT CATCH DRAIN(S) ARE DIRECTING FLOWS AS DESIRED DURING RAINFALL EVENTS, AND MODIFY AS NECESSARY.
- REPAIR ANY SIGNIFICANT EROSION OR DAMAGE TO THE BANK OF THE CATCH DRAIN, WHICH MAY IMPACT THE FUNCTION OF THE CATCH DRAIN.

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRAWN	CHECK	DESIGN	VERIFY
C	NOV 2010	FINAL	RNG	EB	DDJ	APE

NCSI accredited Quality System to ISO 9001

SCALES: A1 ORIGINAL

PB PARSONS BRINCKERHOFF

CLIENT: ANGLO AMERICAN

PROJECT: EROSION AND SEDIMENTATION CONTROL GUIDELINES
EROSION AND SEDIMENT CONTROL DATA SHEET
CATCH DRAIN

PROJECT No.	DISCIPLINE	NUMBER	REV.
2148810A	ESC	0001	C

2148810A_ESC_0001

Plotted By: geffreys Plot Date: 02/11/10 10:19 Last File: \\Ausbne\PROJ\AA\Anglo_American_Metal_Coal\2148810A_PREPARATION_OF_GENERIC_WATER\05_WorkPapers\Erosion Sediment Control Guideline\2148810A_ESC_0001.dwg

2148810A_ESC_0002

CHECK DAMS

OVERVIEW

CHECK DAMS ARE SIMILAR TO SEDIMENT TRAPS (SEE 'SEDIMENT TRAPS' FACT SHEET) BUT ARE TYPICALLY SMALLER, AND ARE USED TO

- CONTROL FLOW VELOCITY (WHERE CHANNEL SLOPE >2%, CONSIDER USING ROCK LINING)
- TRAP SMALL QUANTITIES OF COARSE SEDIMENT.
- SPAN BETWEEN EXISTING EMBANKMENTS OF WIDE, SHALLOW, POORLY DEFINED WATER COURSES.
- PREVENT MINOR GULLY EROSION, PARTICULARLY IN NEW CHANNELS WHERE VEGETATION OR OTHER EROSION PROTECTION MEASURES ARE NOT YET IN PLACE.

CHECK DAMS ARE TYPICALLY CONSTRUCTED WITH TILT-BUCKET EXCAVATOR, OR BACKHOE.

GEOMETRY

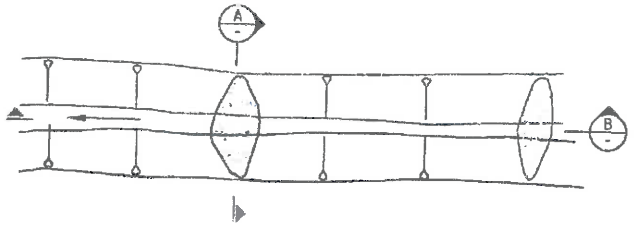
A. LIMIT HEIGHT FROM CHANNEL INVERT TO 0.5M (TYPICALLY APPROX. 0.3M).
B. ENSURE CREST INVERT IS APPROX. HALF THE HEIGHT OF THE OUTER EDGES.
C. GENERALLY SUITABLE FOR CHANNELS < 1 IN 10 (FOR STEEPER GRADES, CONSIDER USING ROCK LINING IN CONJUNCTION WITH CHECK DAMS).
D. BANK SLOPE SHOULD NOT EXCEED 2H:1V.
E. EMBED ROCKS 0.5M INTO THE CHANNEL.

MATERIALS

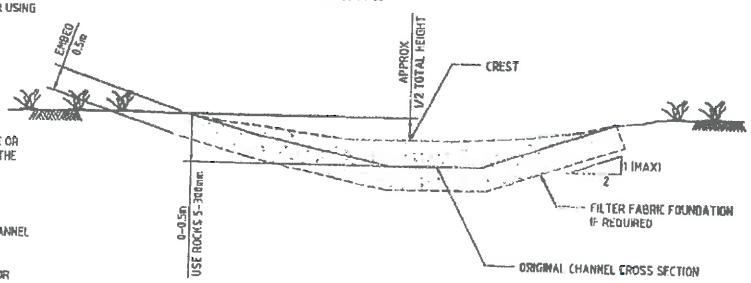
A. DO NOT USE STRAW BALES.
B. USE VARIETY OF ROCKS 5 - 300MM, ENSURING GOOD SIZE DISTRIBUTION.
C WEATHER RESISTENT AND COMPETANT MATERIAL MUST BE USED (IE. SANDSTONE OR BASALT ETC.). MATERIAL THAT IS EASILY WEATHERED OR COULD CONTAMINATE THE DOWNSTREAM ENVIRONMENT SHOULD NOT BE USED.

GENERAL DESIGN CONSIDERATIONS

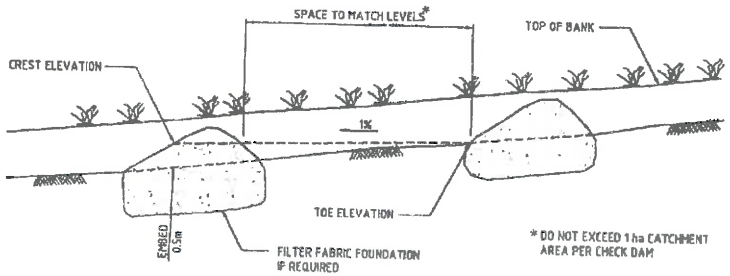
A. CREST HEIGHT MAY BE CONTROLLED BY EMBEDDING THE CHECK DAM INTO THE CHANNEL BED.
B SUITABLE FOR CONCENTRATED FLOWS ONLY.
C CONSIDERING ADOPTING ROCK LINING IF CHECK DAMS ARE TOO CLOSELY SPACED, OR CHANNEL SLOPE IS TOO STEEP.
D. UPSTREAM CATCHMENT GENERALLY SHOULD NOT EXCEED 1.0 HA.
E. WHERE MULTIPLE CHECK DAMS ARE REQUIRED, LOCATE DOWNSTREAM CHECK DAM(S) SO THAT THE CREST ELEVATION IS LEVEL WITH THE TOE ELEVATION OF THE UPSTREAM DAM (REFER SECTION B).
F ENSURE CHECK DAM IS CLEARLY VISIBLE (E.G. USING MARKER POSTS) TO PREVENT DAMAGE TO GRASS CUTTING EQUIPMENT.
G. DESIGN SO AS TO PREVENT FLOWS FROM UNDERMINING OR SIDE CUTTING THE STRUCTURE.
H. WHERE EROSION CONTROL IS REQUIRED IMMEDIATELY DOWNSTREAM OF THE CHECK DAM, PROTECTION SHOULD BE EXTENDED AT LEAST 2X DAM HEIGHT. PROTECTION MAY CONSIST OF:
   I. ROCK APRON EXTENDED FROM THE TOE OF THE DOWNSTREAM EMBANKMENT, PARTICULARLY IF ENERGY DISSIPATION IS REQUIRED.
   II. EROSION CONTROL MAT OR SUITABLE GEOTEXTILE FILTER CLOTH, ANCHORED BENEATH THE CHECK DAM.



PLAN
SCALE: N.T.S



SECTION A
SCALE : N.T.S



* DO NOT EXCEED 1 ha CATCHMENT AREA PER CHECK DAM

SECTION B
SCALE : N.T.S

CONSTRUCTION

A. CHECK DAMS SHALL BE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS AND DESIGN DETAILS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERINTENDANT OR CONTRACT HOLDER.
B. TYPICALLY CONSTRUCT USING TILT-BUCKET EXCAVATOR, OR BACKHOE.
C. LAY FILTER FABRIC FOUNDATION IF NECESSARY, EXTENDING DOWNSTREAM OF THE CHECK DAM IF EROSION CONTROL IS REQUIRED.
D. BUILD CHECK DAM WITH SUITABLE ROCK MATERIAL, ENSURING THE LOWEST (MIDDLE) ELEVATION REMAINS AT LEAST 150MM BELOW THE EXISTING BANK LEVELS.
E. EXTEND EMBANKMENT TOWARDS THE EXISTING BANKS, TO AN ELEVATION AT LEAST 150MM ABOVE THE CREST LEVEL.
F WHERE MULTIPLE CHECK DAMS ARE TO BE CONSTRUCTED, LOCATE DOWNSTREAM CHECK DAM(S) SO THAT THE CREST ELEVATION IS LEVEL WITH THE TOE ELEVATION OF THE UPSTREAM DAM.
G PROVICE EROSION PROTECTION DOWNSTREAM OF THE CHECK DAM(S) AS NECESSARY, PARTICULARLY FOR THE LAST CHECK DAM IN A SERIES

MAINTENANCE

THE FOLLOWING SITE INSPECTION ON THE CHECK DAM(S) SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGE:

A. PRIOR TO 1ST NOVEMBER EACH YEAR.
B. AFTER EACH SIGNIFICANT RAINFALL EVENT.

SOME SPECIFIC MAINTENANCE GUIDELINES ARE AS FOLLOWS:

- REPAIR ANY DAMAGE IMMEDIATELY, AND REASSESS THE SPACING BETWEEN MULTIPLE CHECK DAMS AND THE NEED FOR ADDITIONAL EROSION PROTECTION IN THE CHANNEL.
- ENSURE RUNOFF IS FLOWING THROUGH OR OVER THE CHECK DAM EMBANKMENT (NOT AROUND), AND RESHAPE THE SPILLWAY AS NECESSARY
- ENSURE DOWNSTREAM STRUCTURES SUCH AS CULVERT INLETS ARE NOT BLOCKED BY DISPLACED CHECK DAM MATERIALS.
- CHECK ROCKS HAVE NOT BEEN DISPLACED DOWNSTREAM.
- IMPROVE ROCK SIZE DISTRIBUTION IF THE ACCUMULATION OF SEDIMENTS IS NOT SATISFACTORY.

REV	DATE	DESCRIPTION	APD	DRAWN	CHECK	DESIGN	VERIFY
C	NOV 2010	FINAL	EB	DDJ			APB

SCALES

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CLIENT
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PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

PROJECT
EROSION AND SEDIMENTATION CONTROL GUIDELINES
EROSION AND SEDIMENT CONTROL DATA SHEET
CHECK DAMS

PROJECT No.	DISCIPLINE	NUMBER	REV.
2148810A	- ESC -	0002	C

Plotted By: geffreye Plot Date: 02/11/10 - 15:33 Cad File: \\AUBNE\Proj\A\Anglo_American_Metal_Coal\2148810A_PREPARATION_OF_GENERIC_WATER\05_Work\Reports\Erosion Sedimentation Control Guidelines\2148810A_ESC_0002.dwg

Unless otherwise specified, dimensions are in millimetres. Size of original drawing is A1 (594mm x 841mm). Reduced drawings will not be to scale.

2148810A_ESC_0003

ENERGY DISSIPATORS

OVERVIEW

ENERGY DISSIPATORS ARE PERMANENT STRUCTURES PLACED AT STORMWATER DISCHARGE OUTLETS SUCH AS CULVERTS, BATTER CHUTES OR DROP PIPES. ENERGY DISSIPATORS ARE DESIGNED TO

- REDUCE FLOW VELOCITIES.
- MINIMISE DOWNSTREAM SOIL EROSION, WHERE STANDARD OUTLET STRUCTURES ARE NOT SUFFICIENT

ENERGY DISSIPATORS ARE GENERALLY CONSIDERED ONLY WHERE OTHER OPTIONS ARE NOT AVAILABLE, AS THEY:

- TEND TO BE EXPENSIVE IN TERMS OF CAPITAL AND MAINTENANCE COSTS
- CAN FORM A HAZARD TO WILDLIFE AND /OR THE PUBLIC

ENERGY DISSIPATOR TYPES

ENERGY DISSIPATORS MAY BE BROADLY CATEGORISED INTO FOUR TYPES INCLUDING:

i. BED FRICTION DISSIPATORS
ii. PLUNGE POOLS.
iii. IMPACT STRUCTURES.
iv. HYDRAULIC JUMP DISSIPATORS

BED FRICTION DISSIPATORS AND PLUNGE POOLS ARE PREFERABLE, AND ARE THE FOCUS OF THIS FACT SHEET. IMPACT STRUCTURES AND HYDRAULIC JUMP DISSIPATORS MAY BE ADOPTED WITH FORMAL DESIGN IF REQUIRED

GENERAL DESIGN CONSIDERATIONS

A ENERGY DISSIPATORS ARE GENERALLY WHERE CONCENTRATED FLOW DISCHARGE IS LIKELY TO CAUSE EROSION.
B. BED FRICTION DISSIPATORS.

- SUITABLE FOR SHALLOWER SLOPES.

C PLUNGE POOLS

- SUITABLE FOR STEEPER SLOPES.
- IF DESILTING IS LIKELY TO BE REQUIRED, CONSIDER KEEPING THE BASE FREE OF ROCK-LINING

D. CONSIDER WHETHER CONTROL OF BED OR BANK EROSION IS A PRIORITY IN DESIGNING THE ENERGY DISSIPATOR
E RESTRICT ALL UPSTREAM ENTRY POINTS WHERE A POTENTIALLY HAZARDOUS ENERGY DISSIPATOR IS TO BE LOCATED AT A DOWNSTREAM OUTLET
F. ENSURE SUFFICIENT MAINTENANCE ACCESS IS PROVIDED

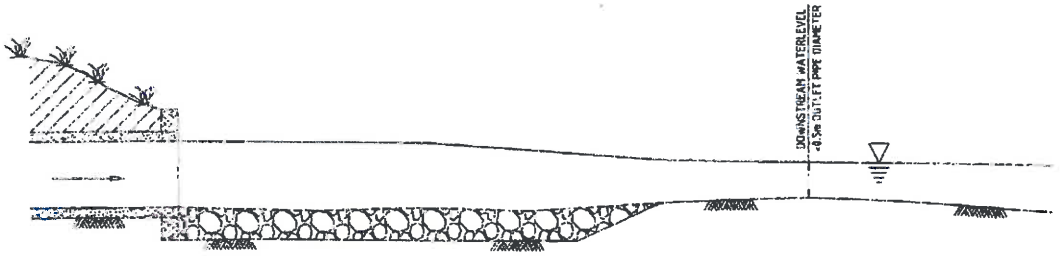
CONSTRUCTION

ENERGY DISSIPATORS SHALL BE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS AND DESIGN DETAILS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERINTENDANT OR CONTRACT HOLDER.

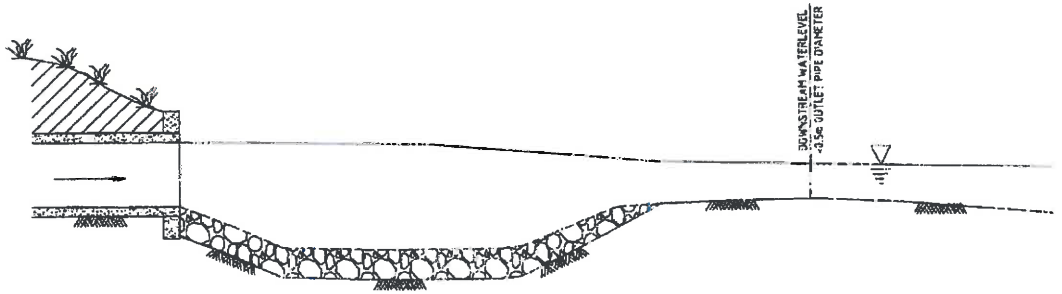
MAINTENANCE

THE FOLLOWING SITE INSPECTION ON THE ENERGY DISSIPATOR(S) SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGE:

A. PRIOR TO 1ST NOVEMBER EACH YEAR
B. AFTER EACH SIGNIFICANT RAINFALL EVENT



BED FRICTION DISSIPATOR (EXAMPLE)
SCALE: N.T.S



PLUNGE POOL (EXAMPLE)
SCALE: N.T.S

PRELIMINARY ISSUE
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REV	DATE	DESCRIPTION	DRAWN	CHECK	DESIGN	VERIFY	APC
C	NOV 2010	FINAL	RRB	EB	ODJ		

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CLIENT: ANGLO AMERICAN

PROJECT: EROSION AND SEDIMENTATION CONTROL GUIDELINES
EROSION AND SEDIMENT CONTROL DATA SHEET
ENERGY DISSIPATORS

PROJECT No	DISCIPLINE	NUMBER	REV.
2148810A	ESC	0003	C

Plotted By: gaffneya Plot Date: 02/11/10 - 10:31 Cad File: \\AUBNEPprojects\Anglo_American_Metal_Coal\2148810A_PREPARATION_OF_GENERIC_WATERMS_whPersons\Erosion Sediment and Control Guidelines\2148810A_ESC_0003.dwg

100mm AT FULL SIZE

2148810A_ESC_0004

EROSION CONTROL BLANKETS

OVERVIEW

EROSION CONTROL BLANKETS ARE SHEETS OF PERVIOUS / IMPERVIOUS FABRIC USED TO PROVIDE EROSION CONTROL ON BATTER SLOPES. EROSION CONTROL BLANKETS MAY BE USED FOR:

- SHORT TERM PROTECTION FROM RAINDROP IMPACT EROSION.
- AREAS SUBJECT TO SHEET FLOW ONLY.
- EXPOSED EARTH ON BATTER SLOPES.
- NEWLY SEEDED GRASS CHANNELS.

GENERAL DESIGN CONSIDERATIONS

REFER TO MANUFACTURER'S SPECIFICATIONS FOR DETAILED CONSIDERATIONS. IN GENERAL HOWEVER:

i. IMPERVIOUS FABRIC EROSION CONTROL BLANKETS SHOULD BE USED FOR HIGHLY DISPERSIVE SOILS.
ii PERVIOUS FABRIC ALLOWS FOR PLANT GROWTH.
iii. BIODEGRADABLE FABRICS TEND TO HAVE A LOWER TOLERANCE OF FLOW VELOCITIES AND SHORTER LIFE SPAN. HOWEVER, THESE ARE PREFERRED TO NON-BIODEGRADABLE FABRICS WHICH CAN LEAD TO ENVIRONMENTAL PROBLEMS.
iv. EROSION CONTROL BLANKETS ARE SUITABLE FOR ALL SLOPES.

SOURCE: HTTP://WWW.THEWATERSHED.ORG

CONSTRUCTION

A. EROSION CONTROL BLANKETS SHALL BE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS AND DESIGN DETAILS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERINTENDANT OR CONTRACT HOLDER
B. REFER TO SPECIFIC INSTALLATION GUIDELINES PROVIDED WITH THE CHOSEN PRODUCT GENERALLY HOWEVER, THE FOLLOWING SHOULD BE UNDERTAKEN:

i. REMOVE IRREGULARITIES IN THE SOIL SURFACE.
ii. IF SEEDING, PREPARE 75MM TOPSOIL AND GRADE TO CREATE A SMOOTH SURFACE FREE FROM TRACKS OR FOOTPRINTS.
iii. FERTILISE, SEED AND WATER. RAKE TO REMOVE TRACKS OR FOOTPRINTS.
iv. ROLL OUT THE EROSION CONTROL BLANKET(S) FROM DOWNSTREAM TO UPSTREAM, IN THE DIRECTION OF FLOW.
v. AVOID STRETCHING THE MESH, AND ENSURE GOOD CONTACT BETWEEN THE SOIL SURFACE AND THE EROSION CONTROL BLANKET(S).
vi OVERLAP SIDES OF ADJOINING EROSION CONTROL BLANKETS BY 100MM. OVERLAP ENDS BY 300MM (WITH THE UPSTREAM BLANKET OVERLAPPING THE DOWNSTREAM BLANKET).
vii. SECURELY ANCHOR THE OUTER EDGES OF THE EROSION CONTROL BLANKET(S) IN TRENCHES 300MM DEEP, STAPLED WITHIN THE TRENCH USING WIRE STAPLES (8-12 GAUGE, 100MM WIDE, 150MM LENGTH) AT 200-250MM INTERVALS. THIS SHOULD ALSO BE APPLIED TO OVERLAPPING ENDS IN HIGH VELOCITY AREAS, FOR THE BOTTOM SHEET ONLY
viii. STAPLE EXPOSED AREAS OF THE EROSION CONTROL BLANKET(S) TO THE SOIL SURFACE AT 1M CENTRES TO AVOID UNDERMINING, UPLIFTING AND EROSION.
ix ROLL WITH A LIGHTWEIGHT 60-90 KG/M LENGTH ROLLER IF DESIRED, AND WATER

MAINTENANCE

THE FOLLOWING SITE INSPECTION ON THE EROSION CONTROL BLANKET(S) SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGE:

A. PRIOR TO 1ST NOVEMBER EACH YEAR
B. AFTER EACH SIGNIFICANT RAINFALL EVENT.

SOME SPECIFIC MAINTENANCE GUIDELINES ARE AS FOLLOWS:

- CHECK FOR DAMAGE (E.G. FROM FALLEN BRANCHES / ROCKS), AND REPAIR DAMAGED SECTIONS AS NECESSARY
- CHECK FOR FLOWS UNDERMINING THE EROSION CONTROL BLANKET(S). REPAIR OVERLAP AREAS, AND ANCHOR THE LOWER BLANKET IN A TRENCH IF NECESSARY (SEE 'CONSTRUCTION"). REBURY BLANKET EDGES AS REQUIRED.
- ENSURE THE EROSION CONTROL BLANKET(S) ARE PROPERLY MAINTAINED UNTIL REPLACED BY PERMANENT CONTROL MEASURES.
- CHECK FOR PIPING OR RODENT BURROWING HOLES UNDERNEATH THE BLANKETS.

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

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C	NOV 2010	FINAL	MRD	EB	ODI	APS

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CLIENT
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PROJECT
EROSION AND SEDIMENTATION CONTROL GUIDELINES
EROSION AND SEDIMENT CONTROL DATA SHEET
EROSION CONTROL BLANKETS

PROJECT No.	DISCIPLINE	NUMBER	REV.
2148810A	ESC	0004	C

Plotted By: gaffneya Plot Date: 02/12/10 - 11:02 Cad File: \\AUNHCF\proj\A\Anglo_American_Metal_Coal\2148810A_PREPARATION_OF_GENERIC_WATER\IS_WrkPapers\Erosion Sedimentation Control Guidelin\2148810A_ESC_0004.dwg

100mm AT FULL SIZE

2148810A_ESC_0005

GEOBINDERS

OVERVIEW

GEOBINDERS (ALSO KNOWN AS 'CHEMICAL STABILISERS') ARE A TYPE OF SOIL BINDER WHICH PROVIDE A 'THIN CRUST' ON EXPOSED SOIL SURFACES. GEOBINDERS HAVE A LIMITED LIFE SPAN AND ARE USED TO TEMPORARILY:

- PROTECT AGAINST RAINDROP IMPACT EROSION
- TACK ORGANIC MULCHES
- SUPPRESS DUST

SOME GEOBINDERS CAN REDUCE INFILTRATION OF RUNOFF.

GENERAL DESIGN CONSIDERATIONS

A. ENSURE GEOBINDER SELECTED DOES NOT CONTAIN HAZARDOUS CHEMICALS (SUCH AS BITUMEN PRODUCTS) WHERE RUNOFF INTO SENSITIVE AREAS IS POSSIBLE.

CONSTRUCTION

A. GEOBINDERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS AND DESIGN DETAILS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERINTENDANT OR CONTRACT HOLDER.
B. CONSULT SPECIFIC APPLICATION GUIDELINES FOR THE SELECTED GEOBINDER PRODUCT USED.
C. PROVIDE LIGHT PROTECTIVE FENCING IF REQUIRED TO PROTECT FROM VEHICLE DAMAGE.

MAINTENANCE

THE FOLLOWING SITE INSPECTION ON THE GEOBINDER(S) SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGE.

A. PRIOR TO 1ST NOVEMBER EACH YEAR
B. AFTER EACH SIGNIFICANT RAINFALL EVENT

SOME SPECIFIC MAINTENANCE GUIDELINES ARE AS FOLLOWS.

- WHERE REVEGETATION IS NOT POSSIBLE, MAINTAIN THE INTEGRITY OF THE SURFACE BY REGULAR RE-APPLICATION OF THE GEOBINDER PRODUCT TO REPAIR DISTURBANCES

SOURCE: HTTP://WWW.GYPSUMSOLUTIONS.COM

PRELIMINARY ISSUE
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C	NOV 2010	FINAL	RBB	EB	GD	APS

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Email brisbane@pb.com.au

CLIENT: ANGLO AMERICAN

PROJECT: EROSION AND SEDIMENTATION CONTROL GUIDELINES
EROSION AND SEDIMENT CONTROL DATA SHEET
GEOBINDER

PROJECT No. 2148810A - DISCIPLINE ESC - DRAWING No. 0005 - REV C

Plotted By: gaffneyo Plot Date: 03/11/10 - 11:36 File: \\AUBNE1\proj\AA\Anglo_American_Metal_Lnd\2148810A_PREPARATION_OF_GENERIC_MATERIALS_V\All Issues\Erosion Sediment Control Guidelin\2148810A_ESC_0005.dwg

100mm At FULL SIZE

GEOCELLULAR CONTAINMENT SYSTEM

OVERVIEW

GEOCELLULAR CONTAINMENT SYSTEMS ARE A 3-DIMENSIONAL HDPE HONEYCOMB MESH. ORIGINALLY DEVELOPED TO FACILITATE TANKS TRAVELLING OVER SAND DUNES, GEOCELLULAR CONTAINMENT SYSTEMS ARE USED IN EROSION CONTROL TO:

- REDUCE EROSION.
- STABILISE BANKS, PARTICULARLY WHERE ROCKS ARE NOT AVAILABLE TO PROVIDE ROCK PROTECTION.

GENERAL DESIGN CONSIDERATIONS

A. TYPICALL USED ON EARTHEN EMBANKMENTS WHICH HAVE A SLOPE OF AT LEAST 1 IN 4 OR WHERE EARTHEN EMBANKMENT MATERIALS NEED ASSISTANCE TO STABILISE, WHICH IS NOT AVAILABLE NATURALLY.

B. REFER TO MANUFACTURER'S GUIDELINES FOR DETAILED CONSIDERATIONS. IN GENERAL HOWEVER:

i. WATER-LOGGING MAY RESULT WHEN PLACED OVER POOR DRAINAGE SOILS.
ii. CONCENTRATED FLOWS MAY TEND TO LIFT THE MESH DUE TO THE STRUCTURAL 'MEMORY' OF HDPE, OR WHERE PEGGING IS INSUFFICIENT.

CONSTRUCTION

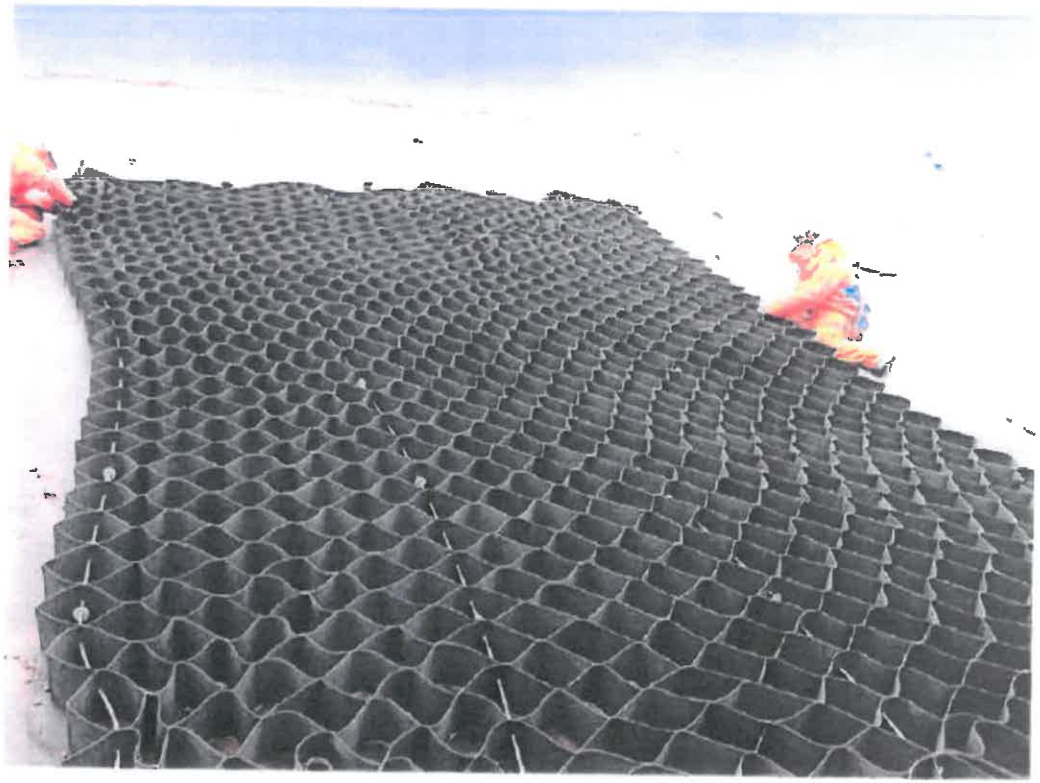
A. GEOCELLULAR CONTAINMENT SYSTEMS SHALL BE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS AND DESIGN DETAILS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERINTENDANT OR CONTRACT HOLDER
B. REFER TO SPECIFIC INSTALLATION GUIDELINES PROVIDED WITH THE CHOSEN PRODUCT.

MAINTENANCE

THE FOLLOWING SITE INSPECTION ON THE GEOCELLULAR CONTAINMENT SYSTEM(S) SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGE:

A. PRIOR TO 1ST NOVEMBER EACH YEAR.
B. AFTER EACH SIGNIFICANT RAINFALL EVENT.

REFER TO MANUFACTURER'S GUIDELINES FOR SPECIFIC MAINTENANCE REQUIREMENTS.



SOURCE: HTTP://TERRAM.COM

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150mm AT FULL SIZE

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C	NOV 2010	FINAL	RRG	EB	DDJ	APS

SCALES

A1 ORIGINAL

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ANGLO AMERICAN

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

PROJECT
EROSION AND SEDIMENTATION CONTROL GUIDELINES

EROSION AND SEDIMENT CONTROL DATA SHEET
GEOCELLULAR CONTAINMENT SYSTEMS

PROJECT No.	DISCIPLINE	NUMBER	REV.
2148810A	ESC	0006	C

Plotted By: gaffneya Plot Date: 03/11/10 - 15:49 Cad File: \\AUBNET\proj\AA\Anglo_American_Metal_Coal\2148810A_PREPARATION_OF_GENERIC_WATERMS_WebPages\Erosion Sediment after Control Guides\2148810A_ESC_0006.dwg

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MULCHING

OVERVIEW

MULCHING AS USED IN REVEGETATION IS NOT PRESENTED IN THIS FACT SHEET INSTEAD THE FOCUS IS ON ROCK / GRAVEL MULCHING ONLY WHICH IS USED TO:

- PROVIDE AN ALTERNATIVE TO VEGETATION IN ARID AREAS.
- STABILISE TRAFFICABLE AREAS, STEEP BATTERS SUBJECT TO CONCENTRATED FLOWS, OR PERMANENTLY SHADED AREAS (E.G. UNDER BRIDGES).
- CONTROL EROSION PRIOR TO SUFFICIENT ESTABLISHMENT OF VEGETATION, EVEN FOR STEEP OR IRREGULAR TERRAIN.
- REDUCE EROSION CAUSED BY RAINDROP IMPACT.
- REDUCE TURBIDITY OF RUNOFF.
- REDUCE RUNOFF VOLUME AND VELOCITY.
- INCREASE INFILTRATION.
- RETAIN SOIL MOISTURE AND CONTROL SOIL TEMPERATURE.

MATERIALS

WEATHER RESISTENT AND COMPENTANT MATERIALS MUST BE USED (IE. SANDSTONE / BASALTS ETC). MATERIAL THAT IS EASILY WEATHERED OR COULD CONTAMINATE THE DOWNSTREAM ENVIRONMENT SHOULD NOT BE USED

CONSTRUCTION

A. MULCHING SHALL BE UNDERTAKEN IN ACCORDANCE WITH APPROVED PLANS AND DESIGN DETAILS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERINTENDANT OR CONTRACT HOLDER

B. REMOVE DEBRIS THAT MAY REDUCE CONTACT OF MULCH WITH THE SOIL, OR HINDER MAINTENANCE (E.G. STUMPS, ROOTS OR ROCKS)

C. COVER AT LEAST 80-100% OF SOIL SURFACE.

D. APPLY EVENLY AT A THICKNESS NO GREATER THAN 50MM. FOR WEED CONTROL, APPLY AT 75-100MM

E. ON STEEP SLOPES OR IN CRITICAL AREAS INCORPORATE MECHANICAL ANCHORING, SURFACE NETTING, CHEMICAL TACKIFIER OR CRIMPING TO PROTECT AGAINST WIND / WATER

MAINTENANCE

THE FOLLOWING SITE INSPECTION ON THE SOIL SURFACE MULCHING & ROCK MULCHING SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGE:

A. PRIOR TO 1ST NOVEMBER EACH YEAR.

B. AFTER EACH SIGNIFICANT RAINFALL EVENT.

ADOPT AN ALTERNATE SOIL EROSION CONTROL MEASURE SHOULD MULCHING BE INEFFECTIVE.

PRELIMINARY ISSUE
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D	NOV 2010	FINAL	KAG	EB	BDJ	APS

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CLIENT

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PROJECT
EROSION AND SEDIMENTATION CONTROL GUIDELINES

EROSION AND SEDIMENT CONTROL DATA SHEET
MULCHING

PROJECT No.	DISCIPLINE	NUMBER	REV.
2148810A	ESC	0007	C

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ROCK LINING

OVERVIEW

ROCK LININGS SHOULD BE USED TO:

- PROTECT AREAS OF CONCENTRATED OVERLAND FLOW FROM EROSION, SUCH AS CHANNELS, DROP CHUTES, SPILLWAYS AND OUTLETS
- PROTECT CHANNELS WITH SLOPES >2%, OR WHERE CHECK DAMS WOULD BE TOO CLOSELY SPACED TOGETHER.

ROCK LININGS MAY INVOLVE:

- PLACING ROCKS OVER GEOTEXTILES OR A ROCK FILTER LAYER
- FILLING VOIDS WITH SOIL AND VEGETATION
- PROVIDING A MINIMUM ROCK LAYER THICKNESS AT 3X THE ROCK DIAMETER.

A FILTER LAYER IS ALSO REQUIRED, SUCH AS GEOFABRIC OF GRADED FILTER LAYER.

GEOMETRY

A. THICKNESS OF THE ROCK LINING(S) SHOULD BE A MINIMUM OF:

   i. 3X THE ROCK DIAMETER
   ii. 1.5X THE ROCK DIAMETER, WHERE ROCKS ARE PLACED OVER GEOTEXTILES OR A ROCK FILTER LAYER, OR IF VOIDS ARE FILLED WITH SOIL AND VEGETATION.

B. EDGES SHOULD BE FLUSH WITH THE SURROUNDING GROUND SURFACE SO AS NOT TO IMPEDE RUNOFF. FOR CHANNELS, THIS MAY INVOLVE OVER-EXCAVATING TO ACCOMMODATE THE ROCK LINING.

C. ROCK LININGS ARE NOT SUITABLE FOR SLOPES >1V:2H.

ROCK SELECTION

A. UNDERSIZED ROCKS MAY TEND TO WASH DOWNSTREAM IN LARGE FLOW EVENTS, CAUSING FURTHER EROSION. ROUNDED ROCKS ARE NOT AS STABLE AS CRUSHED ROCKS. GRADED ROCKS ARE MORE STABLE IN COMPARISON TO UNIFORM ROCK SIZE.

B. DETERMINE ROCK SIZE BASED ON CHANNEL VELOCITY OR BOUNDARY SHEER STRESS (MINIMUM 200mm SIZE).

C. NO ROCK SHOULD EXCEED 1.5x THE SIZE SELECTED.

D. INCREASE ROCK SIZE ON THE OUTSIDE OF BENDS, OR ON STEEPER SECTIONS.

E. IN SELECTING ROCK TYPE, ENSURE:

   i. ADEQUATE DURABILITY AND WEATHER RESISTANCE.
   ii. ROCKS WILL NOT CAUSE PH PROBLEMS, PARTICULARLY IN LOW FLOWS.
   iii. LENGTH OF INDIVIDUAL ROCKS DOES NOT EXCEED 3X THICKNESS.
   iv. AT LEAST 25% OF ROCKS ARE < 50MM, AND 25% ARE >100MM.
   v. NOT CONTAINING MATERIALS WHICH MAY LEACH AND/OR OXIDISE AND CAUSE ENVIRONMENTAL ISSUES.

GENERAL DESIGN CONSIDERATIONS

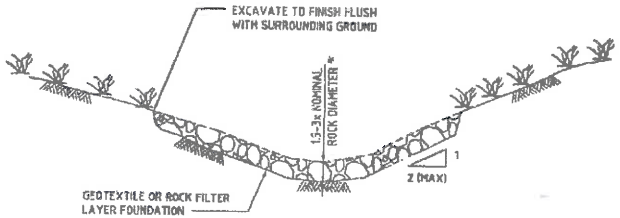
A. ROCK LININGS MAY NOT BE APPROPRIATE WHERE REGULAR DE-SILTING IS REQUIRED.

B. EDGES OF THE ROCK PROTECTION ARE PARTICULARLY VULNERABLE TO EROSION AND UNDERMINING, AND SHOULD BE PAID PARTICULAR ATTENTION. SELECTING LARGER ROCKS AND INCREASING LINING THICKNESS MAY BE CONSIDERED.

C. FILLING THE VOIDS IN BETWEEN THE ROCKS WITH SOIL AND VEGETATING IT WILL INCREASE THE STABILITY OF THE LINING.

D. EXTEND GEOFABRIC / LINING INTO ALL FLOW INLET POINTS (E.G. CONTOUR BANKS).

E. PLACE ENERGY DISSIPATORS / SEDIMENT CONTROL MEASURES DOWNSTREAM AS NECESSARY.



* REFER FACT SHEET NOTES FOR DETAILS

SECTIONS
SCALE: N.T.S

CONSTRUCTION

A. ROCK LININGS SHALL BE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS AND DESIGN DETAILS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERINTENDANT OR CONTRACT HOLDER.

B. MINIMISE WATER POLLUTION AND EROSION AS FAR AS PRACTICABLE THROUGHOUT CONSTRUCTION.

C. ENSURE RUNOFF IS DIRECTED ONTO THE AREA FOR ROCK LINING.

D. REMOVE IRREGULARITIES IN THE SOIL SURFACE. FOR PROPOSED CHANNELS, REMOVE LOOSE ROCKS, TREES, STUMPS, AND ROOTS IN THE AREA

E. EXCAVATE PROPOSED CHANNELS TO LINER FOUNDATIONS AS INDICATED ON RELEVANT PLANS, ENSURING THAT:

   i. OVER-EXCAVATED AREAS ARE EITHER BACKFILLED WITH MOIST SOIL AND COMPACTED TO THE DENSITY OF THE SURROUNDING SOIL, OR ALTERNATIVELY THE LINER IS THICKENED IN IMMEDIATE AREAS
   ii. EXCAVATION ACCOMMODATES THE ROCK LINING, TO RESULT IN ROCK LINING EDGES BEING FLUSH WITH THE SURROUNDING GROUND SURFACE.

F. FOR SYNTHETIC FILTER FABRIC UNDERLAY:

   i. ONCE THE FOUNDATION IS PREPARED, IMMEDIATELY APPLY THE SPECIFIED FILTER FABRIC SUCH AS GEOFABRIC.
   ii. OVERLAP SIDES OF ADJOINING FILTER FABRIC SECTIONS BY 300MM, AND APPLY ANCHOR PINS AT 1M INTERVALS.
   iii. BURY UPSTREAM ENDS OF THE FILTER FABRIC IN TRENCHES 300MM DEEP, AND ALSO DOWNSTREAM ENDS IF REQUIRED.
   iv. COVER ANY AREAS DAMAGED DURING INSTALLATION WITH AN EXTRA FILTER FABRIC SHEET, EXTENDING AT LEAST 300MM BEYOND THE DAMAGED AREA

G. COMMENCE INSTALLATION OF ROCK LINING IMMEDIATELY AFTER INSTALLING THE FILTER BLANKET / UNDERLAY. IN PLACING ROCKS, ENSURE:

   i. ROCK PLACEMENT DOES NOT DAMAGE THE FILTER BLANKET / UNDERLAY. A 100MM LAYER OF SAND OR FINE GRAVEL ON TOP OF THE FILTER MAY BE REQUIRED
   ii. LAYER IS DENSE AND WELL GRADED, WITH VOIDS MINIMISED.
   iii. SELECTIVE LOADING AND CONTROLLED DUMPING HAS BEEN UNDERTAKEN TO ACHIEVE THE DESIRED DISTRIBUTION OF ROCKS.
   iv. ROCKS ARE NOT PLACED USING METHODS WHICH SEGREGATE ROCK SIZES SUCH AS CHUTES.
   v. AN EVEN DISTRIBUTION OF ROCK SIZES IS ACHIEVED, WITH NO APPARENT PROTRUSIONS. FINISHED GRADE SHOULD BE FLUSH WITH THE SURROUNDING AREA.
   vi. IF VELOCITY IS HIGH (SUCH AS IN CHUTES), CEMENT OR CONCRETE GROUTING IS APPLIED AS REQUIRED

MAINTENANCE

THE FOLLOWING SITE INSPECTION ON THE ROCK LINING(S) SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGE:

A. PRIOR TO 1ST NOVEMBER EACH YEAR.

B. AFTER EACH SIGNIFICANT RAINFALL EVENT.

SOME SPECIFIC MAINTENANCE GUIDELINES ARE AS FOLLOWS:

- IMMEDIATELY REPAIR ANY SCOUR OR ROCK DISLODGMENT, PARTICULARLY AT INLETS AND OUTLETS.
- CHECK THE STABILITY OF THE ROCK LINING CAREFULLY, AND REPAIR ANY
  - SCOUR HOLES
  - BANK FAILURES
  - RILL EROSION ON ROCK FILL EDGES
  - PIPING
- REMOVE / SLASH WEEDS AS REQUIRED.

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

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PROJECT
EROSION AND SEDIMENTATION CONTROL GUIDELINES
EROSION AND SEDIMENT CONTROL DATA SHEET
ROCK LINING

PROJECT NO.	DISCIPLINE	NUMBER	REV.
2148810A	ESC	0008	C

Plotted By: gerfreya Plot Date: 02/11/10 - 14:19 Cad File: \\BNEMEP\proj\A\Anglo_American_Metal_Coal\2148810A_PREPARATION_OF_GENERIC_WATERMS_WorkPapers\Erosion Sediment Control Guidelines\2148810A_ESC_0008.dwg

100mm AT FULL SIZE

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ROCK MATTRESS

OVERVIEW

ROCK MATTRESSES (SUCH AS GABIONS) ARE ESSENTIALLY ROCKS CONTAINED WITHIN GALVANISED OR PVC COATED WIRE CAGES, AND ARE AVAILABLE IN A VARIETY OF SHAPES AND SIZES. ROCK MATTRESSES ARE USED TO

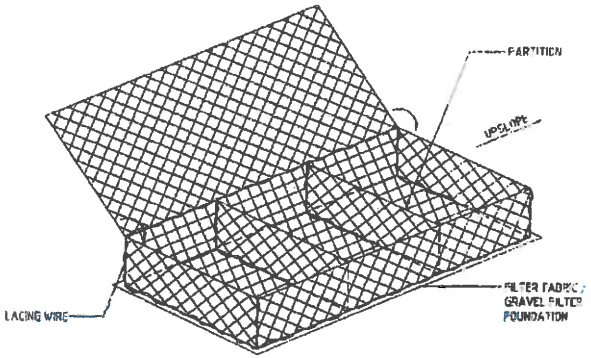
- PROTECT CHANNELS, CHUTES AND SPILLWAYS.
- PROVIDE ENERGY DISSIPATION DOWNSTREAM OF CHECK DAMS

ROCK SELECTION

A 80% OF ROCKS SHOULD BE GREATER THAN 100mm
B. ALL ROCKS SHOULD BE AT LEAST 1/3 OF WIRE CAGE HEIGHT, AND NO GREATER THAN 2/3 OF CAGE HEIGHT
C ADEQUATE DURABILITY AND WEATHER RESISTANCE
D. NOT CONTAINING MATERIALS WHICH MAY LEACH AND / OR OXIDISE AND CAUSE CONTAMINATION / ENVIRONMENTAL ISSUES

GENERAL DESIGN CONSIDERATIONS

A. ROCK MATTRESSES MAY NOT BE APPROPRIATE WHERE REGULAR DE-SILTING IS REQUIRED.
B. SERVICE LIFE OF THE WIRE MAY BE REDUCED BY ACCUMULATED SEDIMENT
C WIRE BREAKAGE CAN OCCUR THROUGH TURBULENT MOVEMENT OF THE BED LOAD
D. EDGES OF THE ROCK MATTRESSES ARE PARTICULARLY VULNERABLE TO EROSION AND UNDERMINING, AND SHOULD BE PAID PARTILULAR ATTENTION
E CONSTRUCTION IS RELATIVELY LABOUR INTENSIVE
F REQUIRES FILTER FABRIC OR GRAVEL FILTER FOUNDATION



ROCK MATTRESS - TO BE FILLED WITH ROCKS AND LID SECURED
SCALE: N.T.S

CONSTRUCTION

A ROCK MATTRESSES SHALL BE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS AND DESIGN DETAILS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERINTENDANT OR CONTRACT HOLDER
B REFER TO SPECIFIC INSTALLATION GUIDELINES PROVIDED WITH THE CHOSEN PRODUCT IF UNAVAILABLE TAKE THE FOLLOWING GENERAL STEPS.

i. FLATTEN WIRE CAGE ON HARD SURFACE, STAMPING OUT CREASES.
ii. STAMP EDGE CREASES INTO INTERNAL PARTITIONS
iii. STAND INTERNAL PARTITIONS UPRIGHT, ENSURING CORRECT HEIGHT IS ACHIEVED
iv. FOLD UP ALL EXTERNAL SIDES, AND HOLD IN PLACE TEMPORARILY WITH WIRE.
v. ONCE SATISFIED WITH CONFIGURATION, APPLY PERMANENT LACING TO SIDES AND CORNERS.
vi. PLACE FILTER FABRIC / GRAVEL FILTER FOUNDATION AS REQUIRED. INSTALL WIRE CAGE IN PLACE ENSURING FOUNDATION IS NOT DAMAGED (BEND ALL WIRE ENDS UP BEFOREHAND), AND INTERNAL PARTITIONS ARE ALIGNED ALONG THE SLOPE
vii WIRE ADDITIONAL WIRE CAGES TOGETHER

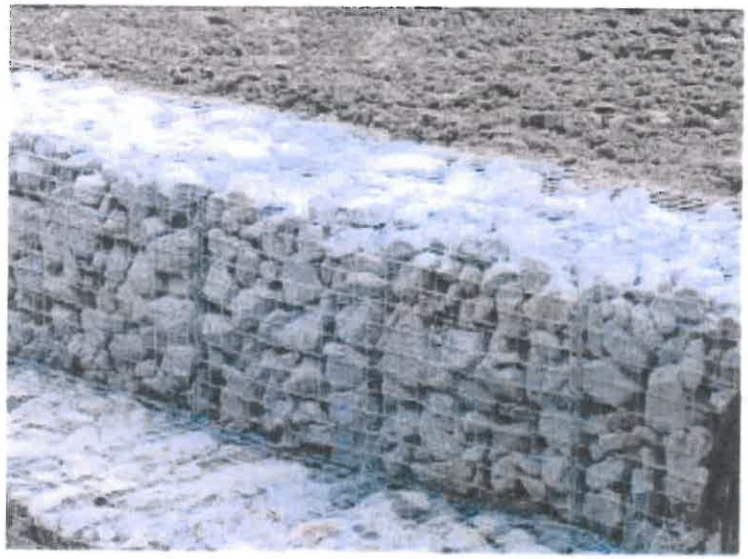
FILL WITH ROCK MATERIAL (SEE ROCK SELECTION SECTION), WORKING UP THE SLOPE. SLIGHTLY OVERFILL TO ALLOW FOR SETTLEMENT, AND SECURE WIRE LIDS.

MAINTENANCE

THE FOLLOWING SITE INSPECTION ON THE ROCK MATTRESSES SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGE:

A PRIOR TO 1ST NOVEMBER EACH YEAR
B AFTER EACH SIGNIFICANT RAINFALL EVENT

FOR MORE SPECIFIC MAINTENANCE ADVICE REFER TO MANUFACTURER'S GUIDELINES.



SOURCE: HTTP://WWW.RIVERDALE.COM

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A1 ORIGINAL

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PROJECT: EROSION AND SEDIMENTATION CONTROL GUIDELINES
EROSION AND SEDIMENT CONTROL DATA SHEET
ROCK MATTRESS

PROJECT No.	DISCIPLINE	NUMBER	REV.
2148810A	ESC	0009	C

Plotted By: gaffneyo Plot Date: 02/11/10 - 14:48 Cad File: \\AUBNE\proj\AV\Anglo_American_Metal_Coal\2148810A_PREPARATION_OF_GENERIC_WATER\05_WIP\Papers\Erosion Sediment Control Guidelines\2148810A_ESC_0009.dgn

100mm AT FULL SIZE

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SEALING OR HARD SURFACES

OVERVIEW

SEALING OR HARD SURFACES ARE AN IMPERVIOUS LINING (GENERALLY CONCRETE), AND ARE USED TO

- PROVIDE PERMANENT EROSION PROTECTION OF CHANNELS IN HIGH VELOCITY AREAS
- CONTAIN DISPERSIVE SOILS

GENERAL DESIGN CONSIDERATIONS

A. WHERE SEDIMENT LADEN RUNOFF IS EXPECTED:
   i. ENSURE MINIMUM GRADE OF 2% TO PROMOTE SELF-CLEANING VELOCITIES, OR
   ii. PROVIDE UPSTREAM SEDIMENT CONTROL AS REQUIRED.

B. CAN BE AESTHETICALLY UNDESIRABLE COMPARED WITH VEGETATION, MAY GIVE THE APPEARANCE OF A DRAIN RATHER THAN A CREEK OR STREAM
C. EDGES SHOULD BE FLUSH WITH THE SURROUNDING GROUND SURFACE SO AS NOT TO IMPEDE RUNOFF, OR CAUSE EROSION PROBLEMS AT THE INTERFACE.
D. CUT-OFF TRENCHES SHOULD BE IMPLEMENTED TO AVOID SEEPING UNDER THE HARD SURFACE.
E. DIFFERENTIAL SETTLEMENT SHOULD BE CONSIDERED WHERE SOIL FOUNDATION IS NON-INSITU OR IN SOFT FOUNDATION.
F. HARD SURFACES TEND TO INCREASE FLOW VELOCITIES.
G. AN ENERGY DISSIPATER WILL BE REQUIRED AT THE CHANNEL OUTLET.

CONSTRUCTION

A. HARD SURFACES SHALL BE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS AND DESIGN DETAILS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERINTENDANT OR CONTRACT HOLDER.

MAINTENANCE

THE FOLLOWING SITE INSPECTION ON THE HARD SURFACE(S) SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGE:

A. PRIOR TO 1ST NOVEMBER EACH YEAR.
B. AFTER EACH SIGNIFICANT RAINFALL EVENT.

SOME SPECIFIC MAINTENANCE GUIDELINES ARE AS FOLLOWS:

- ENSURE ACCUMULATION OF SEDIMENT IS NOT EXCESSIVE.
- CHECK FOR EROSION, UNDERMINING OR DIFFERENTIAL SETTLEMENT ISSUES AT THE INTERFACE BETWEEN THE HARD SURFACE(S) AND THE EXISTING GROUND
- HARD SURFACES ARE A PERMANENT MEASURE AND MAINTENANCE REQUIREMENTS ARE GENERALLY MINIMAL.

SOURCE: HTTP://WWW.ENERGYINTLPOWER.COM

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C	NOV 2010	FINAL	RRD	EB	WDJ	APS

SCALES

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PRELIMINARY ISSUE
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PROJECT
EROSION AND SEDIMENTATION CONTROL GUIDELINES

EROSION AND SEDIMENT CONTROL DATA SHEET
SEALING OR HARD SURFACE

PROJECT No.	DISCIPLINE	NUMBER	REV.
2148810A	- ESC -	0010	C

Plotted By: geffreys Plot Date: 09/11/10 - 16:55 Cad File: \\AUBNE1\proj\A\Anglo_American_Metal_Coal\2148810A_PREPARATION_OF_GENERIC_WATER\05_Wrk\Papers\Erosion Sediment and Dust Control Guidelines\2148810A_ESC_0010.dwg

100mm AT FULL SIZE

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SEDIMENT FENCES

OVERVIEW

SEDIMENT FENCES CONSIST OF A WIRE AND PICKET FENCE SUPPORTING SPECIAL SEDIMENT FENCE FABRIC. SEDIMENT FENCES ARE CONSTRUCTED ALONG THE CONTOURS AT REGULAR INTERVALS (DEPENDING ON THE SLOPE) AND ARE USED TO:

- INTERCEPT SHEET FLOW FROM GENERATED FROM STOCKPILES, UNSEALED ROADS OR EXPOSED AREAS
- TRAP COARSE SEDIMENTS FROM SHEET FLOW
- REDUCE SHEET FLOW VELOCITY
- LIMIT RUTTING CAUSED BY CONCENTRATED FLOW

SEDIMENT FENCES ARE SUITABLE DURING CONSTRUCTION ONLY, AND ARE NOT TO BE USED AS A LONG TERM SEDIMENT CONTROL MEASURE

LOCATION

A. ALIGN FENCES CAREFULLY SO AS NOT TO RECEIVE OR GENERATE CONCENTRATED FLOW.
B. LOCATE ON RELATIVELY FLAT AREA TO FACILITATE PONDING AND SETTLEMENT.
C. ALLOW SUFFICIENT SPACE BETWEEN THE FENCE AND THE DISTURBED AREA, FOR:
   i. MAINTENANCE ACCESS
   ii. CONSTRUCTION ACTIVITIES.
   iii. GRADING / FILLING

MATERIALS

A. ENSURE MINIMUM LIFE SPAN OF 6 MONTHS
B. SUITABLY STRONG, PERVIOUS SYNTHETIC FABRIC MATERIALS INCLUDE:
   i. POLYPROPYLENE
   ii. POLYETHYLENE YARN
   iii. POLYESTER
   iv. NYLON

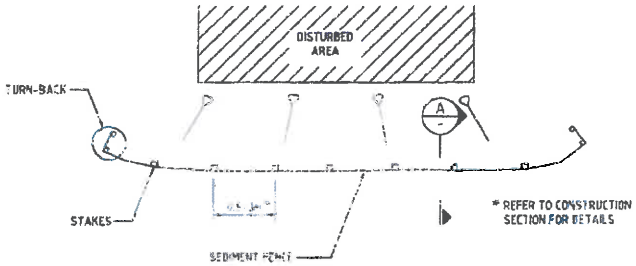
C. ADOPT SQUARE HARDWOOD STAKES AT LEAST 1500mm LENGTH, OR STEEL STAR PICKETS (1.5kg/m MINIMUM). DO NOT ATTACH TO TREES

FOR FABRIC REINFORCEMENT USE 14 GAUGE WIRE MESH, WITH OPENINGS NO GREATER THAN 200mm

GENERAL DESIGN CONSIDERATIONS

A. SEDIMENT FENCES ARE GENERALLY NOT EFFECTIVE IN REDUCING TURBIDITY OR TRAPPING FINE SEDIMENTS (PARTICULARLY IF REGULAR MAINTENANCE INCLUDING DESILTING IS NOT CARRIED OUT), EXCEPT IN LOW FLOW EVENTS
B. NOT SUITABLE FOR HIGH FLOWS OR CONCENTRATED FLOWS
C. SEDIMENT FENCES SHOULD BE 450mm - 700mm HIGH, WITH A FURTHER 200mm OF FABRIC (MINIMUM) BURIED AND COMPACTED INTO A TRENCH ON THE UPSTREAM SIDE
D. WHILE STRAW BALES MAY BE ADDED TO THE DOWNSTREAM SIDE FOR ADDITIONAL SUPPORT, THIS MAY INTRODUCE UNWANTED SEEDS / WEEDS AND SHOULD NOT BE USED IN SENSITIVE AREAS.
E. PROVIDE REGULAR 'TURN-BACKS' (I.E. END SECTION OF THE SEDIMENT FENCE ALIGNS BACK UPSLOPE):
   i. WHERE SEDIMENT FENCES ARE USED TO CONTROL RUTTING, TO AVOID CONCENTRATION OF FLOWS
   ii. ON THE ENDS OF SEDIMENT FENCES

CREATE SPILL THROUGH WEIRS TO ALLEVIATE HYDRAULIC PRESSURE AS NECESSARY, TO PREVENT FENCE FAILURE



PLAN
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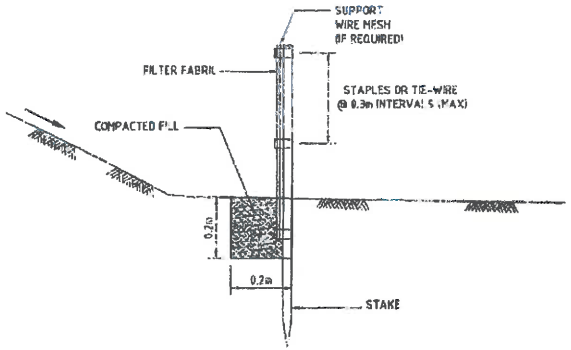

SECTION A
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SOURCE: HTTP://WWW.IECA.ORG

CONSTRUCTION

A. SEDIMENT FENCES SHALL BE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERVISOR OR SITE ENGINEER
B. EXCAVATE A TRENCH ON THE UPSTREAM SIDE OF THE SEDIMENT FENCE ALIGNMENT, 200mm WIDE x 200mm DEEP. HEAP EXCAVATED FILL ON THE UPSTREAM SIDE OF THE TRENCH

   NOTE: DO NOT EXCAVATE A TRENCH IF ALIGNED ALONG THE EDGE OF EXISTING TREES (TO AVOID DISTURBING ROOT ZONES). INSTEAD, BURY FABRIC UNDER A LAYER OF AGGREGATE

C. SECURE STAKES ALONG THE BACK EDGE OF THE TRENCH BASE, AT INTERVALS NOT EXCEEDING:
   i. 3m (WITH WIRE MESH REINFORCEMENT)
   ii. 2m (WITHOUT WIRE MESH REINFORCEMENT).
   iii. 0.5m (WHERE MINOR CONCENTRATED FLOWS ARE EXPECTED)

D. IF USING WIRE MESH REINFORCEMENT, SECURE THE WIRE MESH TO THE UPSTREAM SIDE OF THE FENCE, EXTENDING INTO THE TRENCH AT LEAST 200mm.
E. FIX THE FILTER FABRIC TO THE STAKES FROM A CONTINUOUS ROLL, AVOIDING JOINS WHEREVER POSSIBLE. EXTEND INTO THE TRENCH AT LEAST 200MM. FIX TO EACH STAKE AT INTERVALS NOT EXCEEDING 300mm, USING 25mm STAPLES OR TIE-WIRE.
F. WHERE JOINS ARE NECESSARY, CONSTRUCT AS FOLLOWS
   i. ATTACH EACH END TO INDIVIDUAL STAKES.
   ii. HOLD STAKES TOGETHER, AND ROTATE 180 DEGREES
   iii. DRIVE COMBINED STAKES INTO THE GROUND.

G. TO CONSTRUCT A SPILL-THROUGH OUTLET WEIR:
   i. PROTECT THE GROUND DOWNSTREAM OF THE OUTLET USING FILTER FABRIC, CHUTE OR SPLASH PAD. IF USING FILTER FABRIC, PLACE THE INITIAL 150mm IN THE TRENCH, SECURING THE DOWNSTREAM SECTION WITH STAKES ALONG THE EDGES
   ii. AT THE DESIRED WEIR LEVEL, ATTACH A STEEL / HARDWOOD HORIZONTAL SUPPORT BETWEEN STAKES.

H. BACKFILL THE TRENCH AND COMPACT TO ANCHOR THE FENCE

MAINTENANCE

SITE INSPECTION ON THE SEDIMENT FENCE(S) SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGE PRIOR TO COMMENCING EACH SHIFT

SOME SPECIFIC MAINTENANCE GUIDELINES ARE AS FOLLOWS:

- CHECK FOR DAMAGE TO THE SEDIMENT FENCE DURING CONSTRUCTION (I.E. FROM FALLEN TREES, MACHINERY OR FILL MATERIAL). REPAIR AS NECESSARY.
- ENSURE RUNOFF IS NOT FLOWING UNDER OR OVER THE FENCE DURING RAINFALL EVENTS. IF FLOWING UNDER, SECURE IN TRENCH AS DETAILED IN 'CONSTRUCTION' SECTION. IF FLOWING OVER, CONSIDER IMPLEMENTING OUTLET WEIR STRUCTURES AT THESE LOCATIONS
- AMEND SAGS IN THE FENCE BY ADDING MORE STAKES AS NECESSARY
- REMOVE SEDIMENT WHEN ACCUMULATED TO THE LESSER OF HALF WAY UP THE FENCE, OR 300mm HEIGHT
- DISPOSE OF SEDIMENT. BEING CAREFUL NOT TO CREATE A NEW EROSION OR SEDIMENT HAZARD.
- LIFE SPAN OF SEDIMENT FENCES IS APPROXIMATELY 6 MONTHS, OR VARIABLE DEPENDING ON SITE CONDITIONS

PRELIMINARY ISSUE
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ANGLO AMERICAN

PROJECT
EROSION AND SEDIMENTATION CONTROL GUIDELINES
EROSION AND SEDIMENT CONTROL DATA SHEET
SEDEMENT FENCES

PROJECT No.	DISCIPLINE	NUMBER	REV
2148810A	ESC	0011	C

Plotted By: gwilmore Plot Date: 07/11/10 - 15:01 Last File: \\AUBNE1\proj\NA\Anglo_American_Metal_Centre\148810A_PREPARATION_OF_GENERIC_WATER\05_Wrk\Papers\Erosion and Sediment Control Guidelines\2148810A_ESC_0011.dwg

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SURFACE ROUGHENING

OVERVIEW

SURFACE ROUGHENING IS A SHORT TERM MEASURE WHICH REQUIRES REGULAR REPETITION, AND IS USED TO:

- REDUCE RUNOFF VOLUME AND VELOCITY ON SLOPES.
- INCREASE INFILTRATION.
- INCREASE SEDIMENT RETENTION.
- REDUCE WIND EROSION.

SURFACE ROUGHENING IS NOT EFFECTIVE AGAINST CONCENTRATED RUNOFF OR IN MAJOR STORM EVENTS. SURFACE ROUGHENING TECHNIQUES INCLUDE:

- ROUGHENING.
- GROOVING (OR CONTOUR FURROWING).
- STEP GRADING.

SURFACE ROUGHENING CAN BE ACHIEVED USING AN EXCAVATOR'S TOOTHED BUCKET, A SCARIFIER, A CHISEL PLOUGH, A RIPPER OR SIMPLY A DOZER'S TRACK MARKS.

CONSTRUCTION

A. SURFACE ROUGHENING SHALL BE UNDERTAKEN IN ACCORDANCE WITH APPROVED PLANS AND DESIGN DETAILS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERINTENDANT OR CONTRACT HOLDER.
B. APPLY LIME OR GYPSUM TO DISPERSIVE SOILS BEFORE UNDERTAKING SURFACE ROUGHENING. FAILING TO DO SO MAY INCREASE SOIL EROSION RATHER THAN REDUCE IT.
C. FILL / CONTOUR ANY EXISTING GULLIES OR RUTS BEFORE UNDERTAKING SURFACE ROUGHENING.
D. IN THE CASE OF SURFACE ROUGHENING BEING UNDERTAKEN WHERE THE LOCATION AND DETAILS ARE NOT SHOWN IN THE DRAWINGS, THE FOLLOWING SHALL BE NOTED:

SURFACE ROUGHENING TECHNIQUE	COMMENTS
ROUGHENING	A. APPLY ACROSS THE SLOPE. IF USING TRACKED MACHINERY, OPERATE UP THE SLOPE TO ACHIEVE HORIZONTAL TRACK IMPRINTS. B. FOR CONTOUR RIPPING TECHNIQUE, RIPPED LINES SHOULD BE SPACED 1- 10m APART. C. THE FINAL SLOPE FACE SHOULD NOT BE BACK-BLADED OR SCRAPED.
GROOVING (I.E. CONTOUR FURROWING)	A. APPLY ACROSS THE SLOPE. B. CUT GROOVES 25 – 300mm DEEP, AT 0.25 – 10m INTERVALS (INCREASE DEPTH AND FREQUENCY WITH INCREASING SLOPE).
STEP GRADING	A. APPLY ACROSS THE SLOPE. B. ENSURE HORIZONTAL > VERTICAL CUT DISTANCE. C. VERTICAL CUT DEPTH SHOULD NOT EXCEED 600mm IN SOFT SOIL, OR 1800mm IN ROCKY SOIL. D. SLIGHTLY GRADE THE HORIZONTAL CUT TOWARDS THE VERTICAL FACE.

MAINTENANCE

THE FOLLOWING SITE INSPECTION ON THE SURFACE ROUGHENING SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGED

A. PRIOR TO 1ST NOVEMBER EACH YEAR
B AFTER EACH SIGNIFICANT RAINFALL EVENT

SURFACE ROUGHENING IS A SHORT TERM MEASURE ONLY, AND SHOULD BE REAPPLIED BEFORE THE WET SEASON (I.E. 1ST NOVEMBER) EACH YEAR AS NECESSARY.

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SIGNED

DATE

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CLIENT: ANGLO AMERICAN

PRELIMINARY ISSUE
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PROJECT: EROSION AND SEDIMENTATION CONTROL GUIDELINES

EROSION AND SEDIMENT CONTROL DATA SHEET
SURFACE ROUGHENING

PROJECT No.	DISCIPLINE	NUMBER	REV.
2148810A	– ESC –	0012	C

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VEGETATIVE BUFFERS

OVERVIEW

VEGETATIVE BUFFERS ARE CORRIDORS OF VEGETATION, AND ARE USED TO REDUCE FLOW VELOCITIES AND INCREASE SEDIMENT DEPOSITION (COARSE SEDIMENTS ONLY)

GENERAL DESIGN CONSIDERATIONS

A. LOCATE STRATEGICALLY TO INTERCEPT OVERLAND SHEET FLOWS (PARTICULARLY THOSE GENERATED FROM STOCKPILES / ACCESS ROADS ETC.) BEFORE REACHING BUSHLAND, DRAINAGE CHANNELS, WATERCOURSES OR OTHER SENSITIVE AREAS
B. ALIGN THE VEGETATIVE 'CORRIDOR' ALONG THE CONTOURS, OR AROUND IMPERVIOUS AREAS DISCHARGING TO INTO DRAINAGE SYSTEMS.
C. SUITABLE FOR FLAT AREAS OR NATURAL SLOPES (1-3%), DOWNSTREAM OF REHABILITATED SPOIL AREAS, PERMANENT INFRASTRUCTURE OR EROSION SOURCES
D EFFECTIVENESS OF THE VEGETATIVE BUFFER WILL INCREASE WITH WIDTH, WHICH SHOULD BE A MINIMUM OF 6m, OR 1.5x THE WIDTH OF THE UPSLOPE DISTURBANCE
E. LOCATE AT LEAST 50m FROM TOE OF THE SLOPE.
F. USE EXISTING NATURAL VEGETATION WHERE POSSIBLE
G. WHERE GRASS SEEDING IS ADOPTED, USE STOLONIFEROUS TYPE GRASSES (I.E. SPREAD VIA HORIZONTAL SHOOTS OR 'RUNNERS')

CONSTRUCTION

A. VEGETATIVE BUFFERS SHALL BE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS AND DESIGN DETAILS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERINTENDANT OR CONTRACT HOLDER.
B FOR INSTALLATION OF TURF IN AREAS OF HIGH OVERLAND FLOW VELOCITY (I.E. STEEPER SLOPES), LAY TURF OVER GEOFABRIC ENFORCEMENT AND/OR STAPLE TURF TO THE SURFACE
C. CONSTRUCT BARRIERS AROUND THE VEGETATIVE BUFFER(S) TO PREVENT VEHICLE ACCESS AND ASSOCIATED DAMAGE.

MAINTENANCE

THE FOLLOWING SITE INSPECTION ON THE VEGETATIVE BUFFER(S) SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGE:

A. PRIOR TO 1ST NOVEMBER EACH YEAR.
B. AFTER EACH SIGNIFICANT RAINFALL EVENT

SOME SPECIFIC MAINTENANCE GUIDELINES ARE AS FOLLOWS

- GRAZING NEEDS TO BE MANAGED TO ENSURE A MINIMUM GRASS HEIGHT OF 50mm IS MAINTAINED.
- ENSURE VISIBLE SEDIMENTS ARE BEING TRAPPED IN THE FIRST QUARTER OF THE WIDTH OF THE VEGETATIVE BUFFER(S), PARTICULARLY WHERE PROTECTING SENSITIVE DOWNSTREAM ENVIRONMENTS. INCREASE WIDTH OF VEGETATIVE BUFFER(S) AS NECESSARY
- CONTROL WEED GROWTH WITHIN THE VEGETATIVE BUFFER(S), AND ENSURE AT LEAST 75% GROUND COVER IS MAINTAINED WITHIN THE CORRIDOR
- ENSURE VEGETATIVE BUFFER(S) CONVEY OVERLAND SHEET FLOW ONLY (i.e. NOT CONCENTRATED FLOWS) FOR THE DURATION OF THEIR USE. IF THIS CANNOT BE ACHIEVED, CONSIDER ALTERNATIVE OR ADDITIONAL SEDIMENT CONTROL MEASURES
- WHERE EXCESSIVE SEDIMENTATION IS RESULTING IN CONCENTRATED FLOWS, REMOVE AS NECESSARY AND INVESTIGATE SOURCES
- IMMEDIATELY REPAIR ANY DAMAGE TO BARRIERS AROUND THE VEGETATIVE BARRIER(S).
- VEGETATIVE BUFFER(S) SHOULD BE RETAINED PERMANENTLY WHERE POSSIBLE.

PRELIMINARY ISSUE
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PROJECT: EROSION AND SEDIMENTATION CONTROL GUIDELINES
EROSION AND SEDIMENT CONTROL DATA SHEET
VEGETATIVE BUFFERS

PROJECT No.	DISCIPLINE	NUMBER	REV.
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SEDIMENT TRAPS

OVERVIEW

SEDIMENT TRAPS ARE ALSO KNOWN AS 'ROCK FILTER DAMS', AS THEY CONSIST OF A ROCK EMBANKMENT AND SPILLWAY SPANNING BETWEEN EXISTING EMBANKMENTS. SEDIMENT TRAPS ARE SIMILAR TO CHECK DAMS (SEE 'CHECK DAMS' FACT SHEET), ALTHOUGH SOMEWHAT LARGER. SEDIMENT TRAPS ARE GENERALLY USED TO:

- INTERCEPT CONCENTRATED FLOW
- CAPTURE SEDIMENT ON SMALLER FLOW PATHS, AS AN ALTERNATIVE TO LARGER SEDIMENTATION PONDS.
- FORM AN OUTLET STRUCTURE FOR SEDIMENT BASINS, AS A CHEAPER ALTERNATIVE TO USING A PIPED OUTLET SYSTEM.
- CONTROL FLOW VELOCITY (I.E. AS A LARGE FORM OF CHECK DAM)

GEOMETRY

A EMBANKMENT:
- i. UPSTREAM SLOPE 2H:1V MAXIMUM.
- ii. DOWNSTREAM SLOPE 3H:1V MAXIMUM.
- iii. TOP WIDTH 1.5M MINIMUM.
- iv. HEIGHT AT CENTRELINE 1.5M MAXIMUM.

B SPILLWAY:
- i. GRADE TO OUTLET 3H:1V MAXIMUM
- ii. LENGTH SHOULD EXCEED EMBANKMENT HEIGHT.
- iii. SIDE SLOPES 2H:1V MAXIMUM.
- iv. ROCK-LINED CHUTE 300MM MINIMUM DEPTH.
- v. ROCK LINING THICKNESS, THE LARGER OF 500MM OR 2X NOMINAL ROCK SIZE

MATERIALS

A. EMBANKMENT:
- i. ADOPT A NOMINAL DIAMETER (D50) BETWEEN 225–350M.
- ii. ENSURE ROCKS ARE HARD, EROSION RESISTANT AND WELL GRADED.
- iii. NOT CONTAINING ANY MATERIALS WHICH MAY LEACH AND / OR OXIDISE AND CAUSE CONTAMINATION / ENVIRONMENTAL ISSUES.

B. FOR SPILLWAY ROCK SELECTION REFER TO APPROVED DESIGN PLAN

GENERAL DESIGN CONSIDERATIONS

A. SEDIMENT TRAPS ARE GENERALLY NOT EFFECTIVE IN REDUCING TURBIDITY OR TRAPPING FINE SEDIMENTS, EXCEPT IN LOW FLOW EVENTS

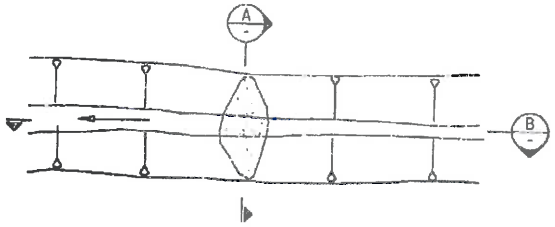
B THE ENTIRE FOUNDATION AND EARTH ABUTMENTS MUST BE COVERED WITH FILTER FABRIC TO AVOID 'PIPING', ENSURING A MINIMUM OVERLAP OF 600MM.

C. ENSURE MAINTENANCE ACCESS IS PROVIDED.

D. SAFETY:
- i. PROVIDE FENCES / WARNING SIGNS TO PREVENT PUBLIC ACCESS WHERE APPROPRIATE.
- ii. AVOID STEEP SIDE SLOPES.

E. FLOWS:
- i FULL VOLUME SHOULD TAKE AT LEAST 8HRS TO DISCHARGE
- ii. SPILLWAY DESIGN DISCHARGE CAPACITY TYPICALLY 2 YEAR ARI.
- iii. EMERGENCY BYPASS FLOWS SHOULD BE DIRECTED TO STABLE, NATURAL AREAS, ENSURING DAMAGE TO EMBANKMENTS IS AVOIDED.

F. EXTEND A FLAT ROCK APRON FROM THE TOE OF THE DAM TO PREVENT EROSION (AT LEAST 500MM THICK).



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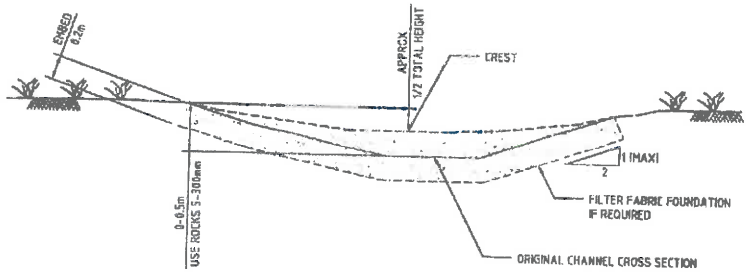

SECTION A
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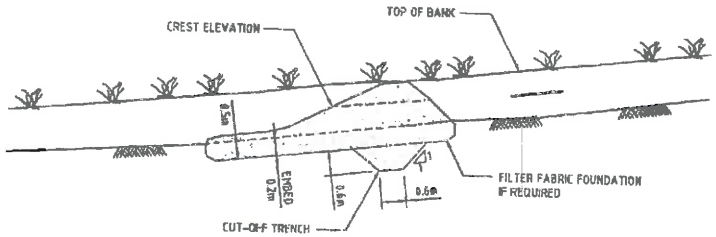

SECTION B
SCALE: N.T.S

CONSTRUCTION

A SEDIMENT TRAPS SHALL BE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS AND DESIGN DETAILS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERINTENDANT OR CONTRACT HOLDER.

B IF CONSTRUCTING USING SMALL ROCKS IN A GRASSED CHANNEL, EMBED AT LEAST 200MM TO PREVENT UNDERMINING

C. REMOVE WOODY VEGETATION AND ORGANIC MATTER.

D. EXCAVATE A CUT-OFF TRENCH SPANNING THE FULL EXTENT OF THE EARTH ABUTMENTS, WITH 1H:1V SIDE SLOPES AND MINIMUM 600MM DEPTH AND BASE WIDTH.

E. APPLY EXTRA-STRENGTH FILTER FABRIC TO COVER THE FOUNDATION AREA OF THE SEDIMENT TRAP, INCLUDING ABUTMENTS AND DOWNSTREAM APRON. ENSURE A MINIMUM OVERLAP OF 600MM BETWEEN SHEETS.

F. ALLOW FOR SETTLEMENT IN EARTH EMBANKMENTS WITH 150MM OVERFILL.

G. CONSTRUCT ROCK EMBANKMENT AND SPILLWAY IN ACCORDANCE WITH GUIDELINES PROVIDED (SEE 'GEOMETRY' SECTION).

H APPLY A 300MM ROCK/AGGREGATE FILTER ON THE UPSTREAM SLOPE OF THE EMBANKMENT (IN PLACE OF GEOFABRIC).

I CREATE THE REQUIRED VOLUME BY EXCAVATING THE STORAGE PIT, ENSURING IT IS FREE-DRAINING WHERE POSSIBLE. MINIMISE SIDE SLOPES FOR SAFETY, AND DO NOT EXCEED 2H:1V.

J. PROVIDE A MARKER TO INDICATE WHEN SEDIMENTATION REACHES 10% OF THE ORIGINAL STORAGE VOLUME.

K. ENSURE RUNOFF FROM THE DISTURBED AREA UPSTREAM IS DIRECTED INTO THE SEDIMENT TRAP

MAINTENANCE

THE FOLLOWING SITE INSPECTION ON THE CHECK DAM(S) SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGE:

A. PRIOR TO 1ST NOVEMBER EACH YEAR.
B. AFTER EACH SIGNIFICANT RAINFALL EVENT.

SOME SPECIFIC MAINTENANCE GUIDELINES ARE AS FOLLOWS.

- CAREFULLY INSPECT THE SIDES OF THE EMBANKMENT FOR EROSION, PIPING OR UNDERMINING, AND REFILL / COMPACT AS NECESSARY
- CHECK PERMEABILITY THROUGH THE ROCK/AGGEREGATE FILTER IS ACCEPTABLE; REPLACE THE FILTER IS NECESSARY.
- CHECK DOWNSTREAM FOR EXCESSIVE SEDIMENTATION OR EROSION.
- IF PERMEABILITY IS TOO HIGH, A MEMBRANE FABRIC MAY BE ADDED TO THE FILTER
- MONITOR SETTLEMENT OF THE EMBANKMENT, AND ENSURE THE REQUIRED SPILLWAY DEPTH BELOW THE EMBANKMENT IS MAINTAINED.
- IMMEDIATELY REPLACE ANY ROCKS DISPLACED FROM THE SPILLWAY.
- REMOVE SEDIMENT WHEN SEDIMENT VOLUME REACHES APPROXIMATELY 10% OF ORIGINAL SEDIMENT STORAGE VOLUME (I.E. UP TO THE MARKER PROVIDED), AND REPLACE ANY CONTAMINATED AGGREGATE IN THE FACING.
- DISPOSE OF SEDIMENT, BEING CAREFUL NOT TO CREATE A NEW EROSION OR SEDIMENT HAZARD.
- IMPROVE ROCK SIZE DISTRIBUTION IF THE ACCUMULATION OF SEDIMENTS IS NOT SATISFACTORY

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C	NOV 2010	FINAL	RAD	EB	BDJ	APB

SCALES
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PRELIMINARY ISSUE
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PROJECT
EROSION AND SEDIMENTATION CONTROL GUIDELINES
EROSION AND SEDIMENT CONTROL DATA SHEET
SEDIMENT TRAP

PROJECT No.	DISCIPLINE	NUMBER	REV.
2148810A	ESC	0014	C

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SEDIMENT BASIN

OVERVIEW

SEDIMENT BASINS ARE TEMPORARY OR PERMANENT STRUCTURES USED TO CAPTURE ERODED OR DISTURBED SOIL THAT IS WASHED OFF DURING RAIN EVENTS AND PROTECT THE WATER QUALITY OF DOWNSTREAM RIVERS OR WATER BODIES. THE SEDIMENT-LADEN SOIL SETTLES IN THE POND BEFORE THE RUNOFF IS DISCHARGED. SEDIMENT BASINS ARE TYPICALLY LARGE AND ARE USUALLY LOCATED AT THE DOWNSTREAM END OF THE SITE. THEY ARE OFTEN USED IN CONJUNCTION WITH EROSION CONTROLS AND SEDIMENT TRAPS. SEDIMENT BASINS ARE GENERALLY USED TO

- INTERCEPT CONCENTRATED FLOW
- CAPTURE SEDIMENT ON LARGER FLOW PATHS, AS AN ALTERNATIVE TO SMALLER SEDIMENT TRAPS.
- FACILITATE THE SETTLING OUT OF SEDIMENTS BEFORE DISCHARGING OFFSITE
- PROTECT DOWNSTREAM AREAS SUCH AS WATERWAYS, BUSHLAND AND DRAINAGE NETWORKS FROM SEDIMENT-LADEN RUNOFF.

FORMAL DESIGN IS REQUIRED FOR SEDIMENT BASINS WITH CONSIDERATION OF CATCHMENT HYDROLOGY, SEDIMENT TRANSPORT RATE AND THE SEDIMENT TRAPPING EFFICIENCY REQUIRED. MAIN ELEMENTS OF A SEDIMENT BASIN INCLUDE

- EXCAVATED PIT
- CONTROLLED FLOW ENTRY POINTS
- HIGH FLOW EMBANKMENT / OUTLET / SPILLWAY

GEOMETRY

A EMBANKMENT:
- i. HEIGHT 3.0M MAXIMUM
- ii. TOP WIDTH 2.5M MINIMUM
- iii. BATTER SLOPES 3H:1V MAXIMUM

B. BASIN VOLUME:
- i. BASIN VOLUME (ML) IS 31% OF UPSTREAM CATCHMENT (HA) AND FACTORED FOR UP-SLOPE LAND USE. THIS IS BASED ON THE 80TH PERCENTILE EVENT (1 YEAR ARI 5 DAY DURATION)

C LAND USE ALLOWANCE:
- i. COAL STOCKPILE: BASIN VOLUME INCREASES BY A FACTOR OF 1.5
- ii. RESHAPED SPOIL: BASIN VOLUME INCREASES BY A FACTOR OF 1.3
- iii. REVEGETATED SPOIL: BASIN VOLUME INCREASES BY A FACTOR OF 1.0

D SPILLWAYS:
- i. PROVIDE AT LEAST 0.75M FREEBOARD TO THE SPILLWAY
- ii. DO NOT LOCATE ON FILL WHERE POSSIBLE
- iii. DESIGN TO ENSURE STRUCTURAL INTEGRITY DURING A 20 YEAR ARI EVENT

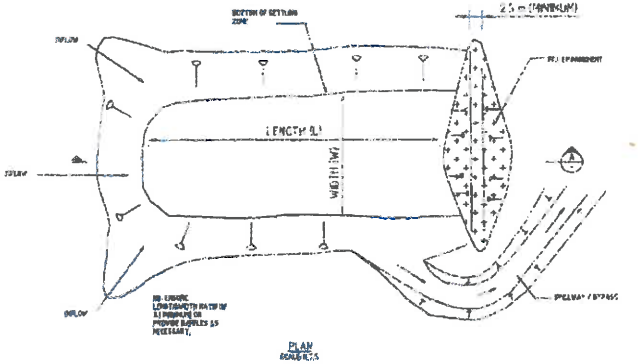
GENERAL DESIGN CONSIDERATIONS

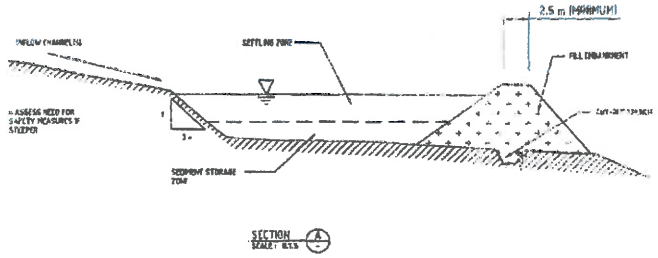
A TYPICALLY ADOPTED FOR CATCHMENT > 1HA
B. ENSURE SEDIMENT BASIN INFLOWS AND OUTFLOWS ARE CONTROLLED IN A WAY SO AS TO LIMIT SOIL EROSION
C CHEMICAL DOSING OF CAPTURED RUNOFF IS REQUIRED FOR EFFECTIVE REMOVAL OF FINE SILTS AND CLAYS
D. FOR SAFETY ISSUES:
- i. AVOID SMOOTH, STEEP INTERNAL SLOPES
- ii. IF INTERNAL SLOPES EXCEED 3H:1V PROVIDE A 2M WIDE TURF STRIP UP THE BANK TO FACILITATE EXIT DURING WET WEATHER
- iii. SEDIMENT BASINS SHOULD BE FENCED WHERE DEPTHS EXCEED 300 MM
- iv. PROVIDE WARNING SIGNS

E SEDIMENT BASINS ARE NOT AN ALTERNATIVE TO PROVIDING ADEQUATE EROSION CONTROL OR ON-SITE DRAINAGE
F AT SUCH A TIME THAT SEDIMENT-LADEN RUNOFF FROM EXPOSED SOIL IS NO LONGER AN ISSUE, SEDIMENT BASINS MAY BE CONVERTED INTO PERMANENT WETLANDS FOR STORMWATER TREATMENT
G SEDIMENT BASINS ARE TO BE USED IN CONJUNCTION WITH UP-SLOPE AND DOWN-SLOPE TREATMENT MEASURES. FOR EXAMPLE, EROSION CONTROL MEASURE ON THE UP-SLOPE AND ROCK PROTECTIONS ON THE DOWN-SLOPE.

TREATMENT PERFORMANCE

SEEK SPECIFIC PERFORMANCE CRITERIA FOR THE MINE. IF WATER QUALITY IS NOT ACHIEVED, CHEMICALLY TREAT PONDED WATER WITH GYPSUM OR SIMILAR FLOCCULANT TO FACILITATE THE SETTLING OF SEDIMENTS





CONSTRUCTION

A SEDIMENT BASINS SHALL BE CONSTRUCTED IN ACCORDANCE WITH APPROVED PLANS AND DESIGN DETAILS. ANY DISCREPANCIES / ISSUES WITH THE PLANS, CONSTRUCTION OR MATERIALS SHALL BE REFERRED TO THE SUPERINTENDENT OF CONTRACT HOLDER
B. EXCAVATE CUT-OFF TRENCH
- i. 1H:1V SIDE SLOPES
- ii. 600MM DEPTH AND BASE WIDTH (MINIMUM)
- iii. SPAN FOR THE FULL EXTENT OF THE EARTH EMBANKMENTS, AND INTO BOTH ABUTMENTS
- iv. REMOVE ANY ACCUMULATED WATER WITHIN THE TRENCH

C. CONSTRUCT EMBANKMENT
- i. USE APPROVED FILL ONLY (REFER PLANS)
- ii. APPLY AND COMPACT FILL IN CONTINUOUS 150-200MM LAYERS, COVERING ENTIRE FILL AREA
- iii. EXCEED REQUIRED ELEVATION BY 10% TO ALLOW FOR SETTLING OF THE EMBANKMENT

D. CLEARLY INDICATED THE MAXIMUM SEDIMENT ACCUMULATION DEPTH (I.E. BEFORE REMOVAL IS REQUIRED) USING MARKERS / POSTS SET TO MATCH THE ELEVATION OF THE SEDIMENT STORAGE VOLUME.

MAINTENANCE

THE FOLLOWING SITE INSPECTION ON SEDIMENT BASINS SHALL BE CARRIED OUT FOR MONITORING AND MAINTENANCE OF EROSION AND DAMAGE

A. PRIOR TO 1ST NOVEMBER EACH YEAR
B AFTER EACH SIGNIFICANT RAINFALL EVENT

SOME SPECIFIC MAINTENANCE GUIDELINES ARE AS FOLLOWS

- CAREFULLY INSPECT THE SIDES OF THE EMBANKMENT FOR EROSION, PIPING OR UNDERMINING, AND REPAIR / COMPACT AS NECESSARY
- CHECK DOWNSTREAM FOR EXCESSIVE SEDIMENTATION OR EROSION
- MONITOR SETTLEMENT OF THE EMBANKMENT, AND ENSURE THE REQUIRED DEPTH BELOW THE EMBANKMENT IS MAINTAINED.
- REMOVE SEDIMENT WHEN SEDIMENT VOLUME REACHES APPROXIMATELY 10% OF ORIGINAL SEDIMENT STORAGE VOLUME (I.E. UP TO THE MARKER PROVIDED), AND REPLACE ANY CONTAMINATED AGGREGATE IN THE FACING
- DISPOSE OF SEDIMENT. BEING CAREFUL NOT TO CREATE A NEW EROSION OR SEDIMENT HAZARD.
- ENSURE SPILLWAYS ARE FREE FROM EROSION AND DEBRIS OR OBSTRUCTIONS
- TREES / SUCKERS GROWING ON THE EMBANKMENTS MUST BE REMOVED.

PRELIMINARY ISSUE
NOT FOR CONSTRUCTION

REV	DATE	DESCRIPTION	DRAWN	CHECK	DESIGN	VERIFY
C	NOV 2010	FINAL	KRE	EB	BDJ	APS

SCALES

A1 ORIGINAL
DO NOT SCALE THIS DRAWING - USE FIGURED DIMENSIONS ONLY. VERIFY ALL DIMENSIONS ON SITE
APPROVED FOR AND ON BEHALF OF PARSONS BRINCKERHOFF AUSTRALIA PTY LIMITED
SIGNED
DATE

PB PARSONS BRINCKERHOFF
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CLIENT
ANGLO AMERICAN

PROJECT
EROSION AND SEDIMENTATION CONTROL GUIDELINES
EROSION AND SEDIMENT CONTROL DATA SHEET
SEDIMENT BASIN

PROJECT No.	DISCIPLINE	NUMBER	REV.
2148810A	ESC	0015	C

Plotted By: gaffneya Plot Date: 02/11/10 - 15:15 Cad File: \\AUBNE\proj\AV\Anglo_American_Metal_Coal\2148810A_PREPARATION_OF_GENERIC_MATERIALS_MitigationMeasures\Sediment Control Guidelines\2148810A_ESC_0015.dwg

Upon A1 Full Size 100mm at

APPENDIX B
AAMC Maintenance checklist templates

SCHEDULE OF SITE VISITS (minimum requirement)													
Purpose of visit	Frequency	J	F	M	A	M	J	J	A	S	O	N	D
Routine inspection	Annually		✓								✓		
Routine maintenance	Annually										✓		
Annual Inspection and maintenance	Annually										✓		

The above schedule is a guide only. It is recommended that at least 2 inspections occur through the year: One prior to the onset of the wet season (November) and th other throughout the wet season (February). Routine maintenance may be scheduled based on the outcome of routine inspection or it may be required after a heavy storm.

INSPECTION		
1.0	**Routine Inspection**	
1.1	Purpose	Routine inspection should be carried out on a regular basis and following a heavy storm event. The purpose of the inspection is to check that all ESC measures are not damaged and in working order. Additionally, the inspection should identify if any of the following have occurred: ▪ erosion around the structures (e.g. bypass flows) ▪ sediment accumulation outside sediment control measure ▪ damage to ESC structures ▪ movement of rock ▪ additional areas where ESC should be implemented
1.2	Scope	Routine inspection should involve visually checking the control structures (including inlets and outlets where necessary) and erosion control treatments for any debris, damage or vandalism to the structures and surrounding areas.
1.3	Forms	Any damage or problems should be noted on the applicable AAMC Maintenance Form and entered into the maintenance system. Note that the damage or problem needs to be fixed and returned to working order. AAMC procedures should be adopted to determine appropriate work flow procedures in undertaking work to fix any issues.
ROUTINE MAINTENANCE		
2.0	**Purpose**	
2.1	Purpose	The purpose of the routine maintenance is to identify and repair any significant damage to the ESC measures.
3.0	**Drainage control structures**	

3.1	Purpose	If at the time of routine inspection, vegetation or debris is blocking the inlet structures, this material will need to be removed. Structures to be inspected for structural integrity and to ensure there has been no damage that would affect hydraulic performance.
3.2	Access	Access to various drainage control structures should be via designated tracks.
3.3	Warning	Do not access control structures (e.g. catch drains) during wet weather. Maintenance should only be taken when there is no or minimal flow across / through the structure.
4.0	**Erosion control structures**	
4.1	Purpose	Purpose of routine maintenance is to assess whether there is any damage to the erosion control measure (e.g. loose rock, rock which has been removed / washed away etc) which may render the treatment dysfunctional and allow for erosion and scour to occur and bypass the treatment (ineffective treatment).
4.2	Access	Vehicular access to erosion control measures is to be via designated tracks only.
4.3	Warning	Do not access the erosion control measure during wet weather. Maintenance should only be undertaken when there is no or minimal flow.
5.0	**Sediment control structures**	
5.1	Purpose	Routine inspection should be carried out at least once a year. The purpose of the inspection is to determine when de-silting of the sediment control structure pond is required.
5.2	Scope	Routine inspection of the sediment control structure involves assessing any visible damage to the structure (including erosion). Sediment clean out is required when the structure is deemed ineffective.
5.3	Access	Vehicular access to the sediment control structures is via designated tracks.
5.4	Warning	Do not enter the sediment control structures during wet weather or when there is flow entering the structure.
5.5	Sediment depth and quality	The depth of sediment needs to be determined before any cleanout. Refer to AAMC procedures beforehand to comply with SHE requirements. Generally, before any de-silting is undertaken, trapped sediments should be analysed for heavy metal content. DERM criteria exist for the disposal of contaminated materials, these must be adhered to. The inlet zone has been designed not to trap smaller particles, which can also be polluted. However, over time these may accumulate and progressively contaminate the sediments in the sediment pond.
5.6	Is clean-out required?	Cleanout should be scheduled to occur during winter to minimise the volume of water to be removed from the ponds and the need to divert large inflows.
6.0	**Forms**	
6.1	Forms	Any damage or problems should be noted on the applicable AAMC Maintenance Form and entered into the maintenance system. Note that the damage or problem needs to be fixed and returned to working order. AAMC procedures should be adopted to determine appropriate work flow procedures in undertaking work to fix any issues.

APPENDIX C
Dartbrook ESCP Audit Protocol

APPENDIX C

DARTBROOK MINE EROSION AND SEDIMENT CONTROL PLAN AUDIT PROTOCOL

BACKGROUND

Dartbrook site has not been operational since January 2007. Consequently there has been no significant ground disturbance or the need for the construction of erosion and sediment controls (ESC) since then, whilst under the Care and Maintenance Strategy (C&M). The exception to this was to repair a major wash out in the Rejects Emplacement Area following the heavy rainfall of June 2007 and the construction of dam on a gully head in the Casey property. Consequently the site is generally well vegetated and stable.

During operations before C&M all areas were treated for ESC such as:

- Previously disturbed and current infrastructure areas have banks diverting clean water around them.
- Rehabilitated areas have had banks constructed through them to reduce the overland flow and safely dispose of the runoff water.
- Banks constructed below infrastructure and disturbed areas capture runoff and direct it into sediment control dams prior to flowing off site.

AUDIT of DARTBROOK's ESCP

Consequently general areas covered in the scope of this audit of Dartbrook's structures against the Met Coal Standard are:

- The competency of the existing ESC structures
- The appropriateness of the existing structures
- Management processes regarding the current ESC plan. (Including inspections and maintenance.)

The Met Coal Standard requires:

1. Diversion drains / Catch drains which separate the water running off from the clean and the disturbed / industrial catchments.

   Construction -
   - Batters = 1V:2H max slope
   - Base = 1.0 m min width
   - Depth = 0.3 m min
   - Freeboard = 0.15 m min
   - Gradient = 0.5% bare earth
     = 2% stable and vegetated
   - Designed to convey a 10 year ARI rainfall event. Outlets are designed and constructed to be stable.

Maintenance –

- Inspected annually or following a significant rainfall event.
- Maintain design capacity.
- Repair when and where needed.

2. Sediment Basins by definition have been constructed to capture sediment and allow treated water to flow out. Sediment traps are generally constructed of rock and capture sediment while allowing the water to flow through.

Construction –

- Embankment height = 3 m max
- Crest width = 2 m min
- Batter slopes = 1V:3H max
- Freeboard = 0.75 m to spill
- Fence where depth > 300mm
- Install warning signs
- Designed to contain 31% of the catchment runoff from a 1 year ARI 5 day duration storm. Capable of handling a 20 year ARI event.

Maintenance –

- Ensure operating at 90% of design capacity or remove sediment
- Maintain spillway capacity.
- Remove unwanted vegetation. Stable entry / exit.

SPECIFIC STRUCTURES AT DARTBROOK

The relevant structures and their specifications are detailed on the following pages. Alongside each identified structure is provision to rate their performance against the standard and make appropriate comments.

APPENDIX C

DARTBROOK MINE EROSION AND SEDIMENT CONTROL PLAN AUDIT PROTOCOL

ESCP STRUCTURES

Dam	Catchment Area (ha)	Full Storage Volume (1000m3/ ML)	Design Capacity ML	Current Capacity ML	Crest - -width - height (m)	Freeboard (m)	Walls / batters (m)	Outlet / Inlet (m)	Inspections	Comments - problems, maintenance, actions
East site										
Clean Water Dam1	31.29	10.0	10	9.5	4	1.2	3:1			
Clean Water Dam 2	2	10.0	10	10	4	1	2.5:1			
Clean Water Dam 3	60.79	30.0	<0.5	<0.5						Small farm dam recently modified as part of the rifle range facility
Clean Water Diversion Bank	60	N/A								Routing runoff away from infrastructure
Collector Dam	23.4	10.0			Excavation					Isolated for washery slimes disposal
Northern Sediment (REA) Dam	4.44	2.3	1	1	4	1	3:1			Small sediment trap
Hardstand Dam	21.72	4.0	4	4	N/A					Excavation only. Used as a disposal cell for washery
Eastern Sediment (REA) Dam	7.93	10.3	2	2	4	1.2	3:1			Formerly a farm dam
Southern Sediment (REA) Dam	10.61	8.0	8	7	4	1.2	2.5:1			Main sediment collecting dam in the centre of the reject disposal area.
Southern (Clean water) Dam also Diversion.	97.56	<1	100	<1						Detention with pipe draining to <1ML
Eastern Holding Dam	31.18	88.0	88	80	5	1.2	2.5:1			Generally kept at 50%. Requires 33% in reserve to ensure zero overflow.
Stage 4 REA Dam	8.18	7.9	.	nil	5	1.2	3:1			Has valve (currently faulty & closed) to flow to EHD
South East REA Diversion Dams A B C	12.06 3.30 9.9	1 0.3 0.5	3.7 1.0 3.1			1 1 1				Catchment to the southeast of the REA
REA Clean Water Diversion Bank		N/A								
Southern (REA) Diversion Flow line		N/A								Requires maintenance prior to re-enterant point
Northern Storage detention Structure	72	100	100	<1						Has 500mm pipe drainage system to Detention Storage Structure.

APPENDIX C

DARTBROOK MINE EROSION AND SEDIMENT CONTROL PLAN AUDIT PROTOCOL

Dam	Catchment Area (ha)	Full Storage Volume (1000m3/ ML)	Design Capacity	Current Capacity	Crest - -width - height	Freeboard	Walls / batters	Outlet / Inlet	Inspections	Comments - problems, maintenance, actions
West site										
Pit Top Dam North	3.23	3.0	1.0	3	4	1	2.5:1			Has pump out facility
Sediment Dam 2 drains		N/A								
Sediment Dam 2		0.4	0.5	0.4	4	1	2.5:1			
Sediment Dam 1	2.53	1.0	0.8	1	4	1	2.5:1			
Sediment Dam 1 Catch Drain	4.89	N/A								
Sediment Dam 3	2.52	0.4	0.8							
Sediment Trap		0.6	0.8	0.6	3	1	2.5:1			Part of rural contour bank sysyem
Clean Water Dam 4	64	3.4	19.8		4	1.5	3:1			Diverts from SDD
Stage Discharge Dam	17.14	492	8	430	5	1	3:1			
SDD Overflow & Toe Drain		N/A	X/S							
Western Holding Dam	10.28	15.4	15	15	5	1	2.5:1			Managed at 50% to avoid overflows. O/L restricted by poly pipes.
Overflow Dam	100	60.0	60	50	4	1.2	3:1			Requires work to stabilise the O/L
Overflow Dam Diversion bank		N/A								
Evaporation Ponds	27	132.0	180	130	4	1	2:1			Pump in system. Leave bottom bay unused
Evaporation Ponds diversion drain		N/A								
No2 Shaft sediment dam	2	1.0	1	1	4	1	2.5/1			
West Surface facilities drains		N/A								
Pleuger secondary containment drain		N/A								

APPENDIX C

DARTBROOK MINE EROSION AND SEDIMENT CONTROL PLAN AUDIT PROTOCOL

MANAGEMENT ISSUES

- Inspection Regime = annual
- Training / Awareness – issues covered at Induction
- Reporting protocol – report monthly and in the AEMR
- Safety Issues – require buoyancy vests, plus an Observer

Inspection requirement	Last Inspection		

APPENDIX C

DARTBROOK MINE EROSION AND SEDIMENT CONTROL PLAN AUDIT PROTOCOL