



Erosion and Sediment Control Plan Roper Bar Mine Site

Western Desert Resources Ltd

Project No: GC120095

Project Name: WDRL Mine Site

Document No: GC1200095_ESCP-MS

Report Date: March 2012

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Document Control Record

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REVISION STATUS

Revision No.	Description of Revision	Date	Approved
0	First Issue	March 2012	 

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Executive Summary

VDM Consulting has been engaged by Western Desert Resources Limited (WDRL) to prepare an Erosion and Sediment Control Plan for the Roper Bar iron ore mine.

The ESCP details the following:

- Erosion and Sediment Control measures for the mine site and accommodation camp; and
- Maintenance and Monitoring Program.

Sediment and erosion control devices for the site have been developed in accordance with the IECA Best Practice Erosion and Sediment Control guidelines. The following sediment and erosion control devices and stormwater management controls will be implemented on the site:

- Diversion Drains;
- Catch Drains;
- Level Spreaders; and
- Sediment Basins.

Diversion drains will direct clean runoff around the site, while catch drains will direct contaminated runoff into sediment basins.

Sediment basins have been modelled a shaving a length to width ratio of 4:1 and sized in accordance with the IECA Best Practice Erosion and Sediment Control guidelines. Table E1 and Table E2 provide a summary of the annual sediment loss prediction and the sediment basin sizing configuration respectively.

Table E1 Annual Sediment Loss Prediction

Basin ID	Ac (ha)	Slope Grade	Intensity 6I2(mm/hr)	R	K	LS	C	P	A (t/ha/yr)	Yield (m ³ /yr)
1	56.32	1	16.1	13738	0.047	0.27	1	1.3	226.6	12764.1
2	119.81	1	16.1	13738	0.047	0.27	1	1.3	226.6	27153.2
3	10.1	1	16.1	13738	0.047	0.27	1	1.3	226.6	2289.0
4	10.1	1	16.1	13738	0.047	0.27	1	1.3	226.6	2289.0
5	33.03	1	16.1	13738	0.047	0.27	1	1.3	226.6	7485.8

Table E2 Sediment Basin Configuration

Basin ID	Catchment Size (ha)	Settling Zone Volume (m ³)	Storage Zone Volume (m ³)	Total Volume (m ³)	Length (m)	Width (m)	Settling Zone Depth (m)	Storage Zone Depth (m)	Total Depth (m)
1	56.32	12954	3886	16840	227	57	0.6	1.0	1.60
2	119.81	27556	8267	35823	321	80	0.6	1.0	1.60
3	10.1	2323	697	3020	109	27	0.6	1.0	1.60
4	10.1	2323	697	3020	109	27	0.6	1.0	1.60
5	33.03	7597	2279	9876	179	45	0.6	1.0	1.60

The implementation of these control measures will ensure the integrity of receiving water bodies will not be adversely impacted as a result of this construction.

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1 Introduction

VDM Consulting has been commissioned by Ecoz Pty Ltd on behalf of Western Desert Resources to prepare an Erosion and Sediment Control Plan (ESCP) for the proposed Roper Bar Mine Site. This report has been prepared to accompany an Environmental Impact Statement (EIS).

A comprehensive review of available Erosion and Sediment Control devices and Best Management Practices (BMP) was undertaken as part of this investigation. The following sections provide a summary of the mitigation measures required to meet best practice in accordance with the International Erosion Control Association Australasia Best Practice Erosion and Sediment Control Guidelines during the construction phases of the haul road.

This management plan is to be considered as part of an EIS process and provides conceptual design details. The level of detail provided within this report is not suitable for construction purposes, a Detailed Erosion and Sediment Control Plan outlining detailed designs will need to be completed in conjunction with detailed civil design documentation.

1.1 Background

Western Desert Resources Ltd (WDRL) operates the Roper Bar Mine camp located approximately 230 km east of Katherine, between the Towns River and Little Towns River approximately 30 km from the coast. This will be the future site of the proposed Roper Bar Mine. Material extracted from the Roper Bar Mine will be transported to Bing Bong Port some 165 km to the east via a new haul road.

Ecoz on behalf WDRL has engaged VDM Consulting to prepare a sediment and erosion control plan for the proposed Mine Site. This incorporates the processing plant, internal roads, accommodation camp, and airstrip.

Figure 1.1 shows the locations of the proposed mine site, haul road, and Bing Bong Port. Figures 1.2 shows a site plan of the Roper Bar Mine.

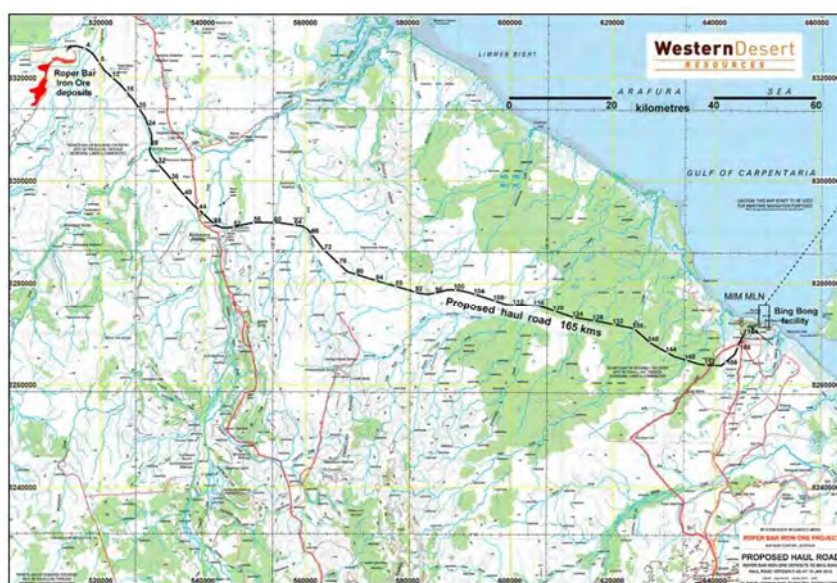
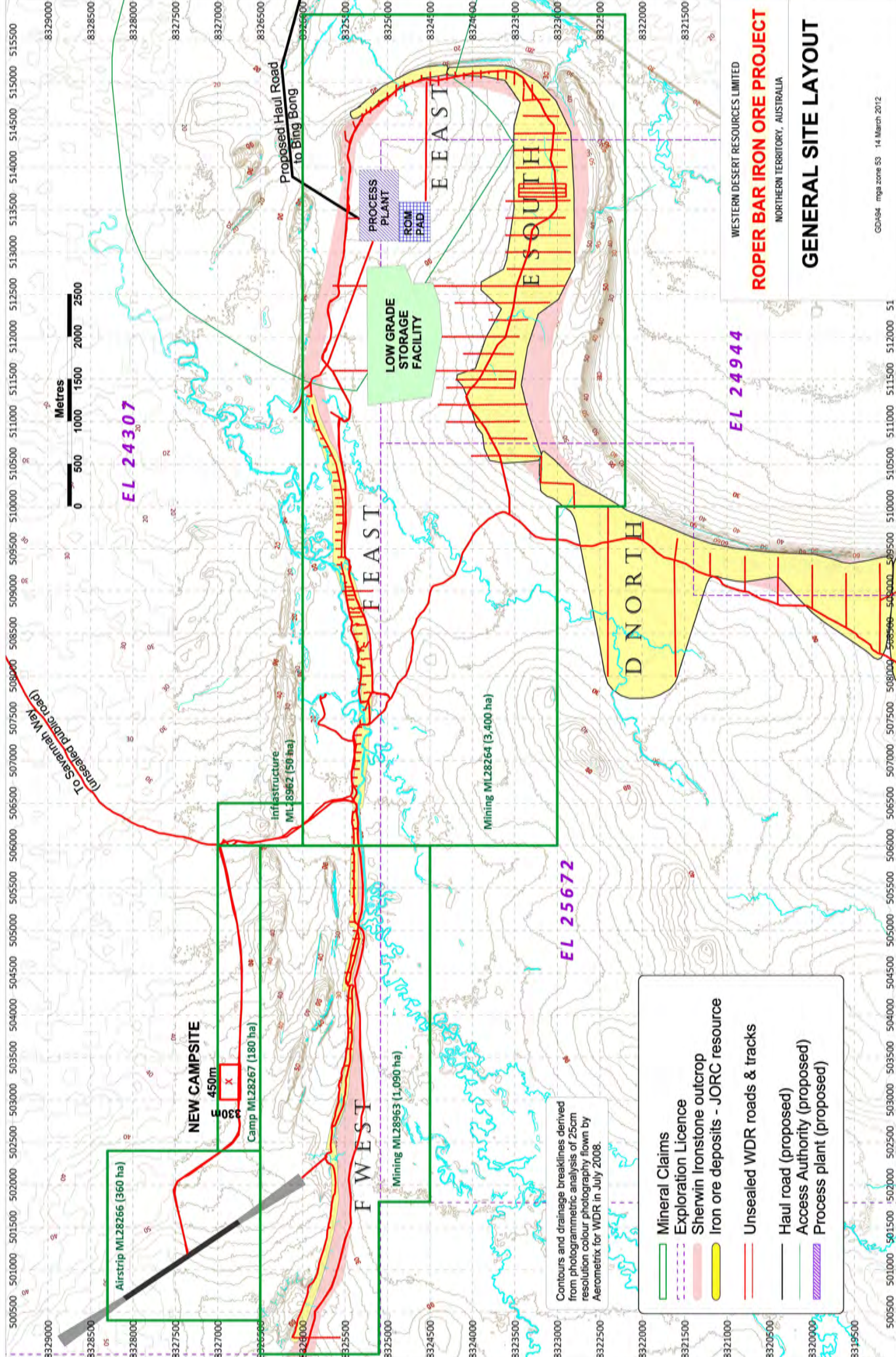


Figure 1.1 Proposed Roper Bar Mine and Haul Road Layout



WESTERN DESERT RESOURCES LIMITED

ROPER BAR IRON ORE PROJECT

NORTHERN TERRITORY, AUSTRALIA

GENERAL SITE LAYOUT

- Mineral Claims
- Exploration Licence
- Sherwin Ironstone outcrop
- Iron ore deposits - JORC resource
- Unsealed WDR roads & tracks
- Haul road (proposed)
- Access Authority (proposed)
- Process plant (proposed)

Contours and drainage breaklines derived from photogrammetric analysis of 25cm resolution colour photography flown by Aerometrix for WDR in July 2008.

NEW CAMPSITE
450m
Camp ML28267 (180 ha)

Airstrip ML28266 (360 ha)

Infrastructure ML18962 (50 ha)

Mining ML28963 (1,090 ha)

Mining ML28264 (3,400 ha)

EL 24307

EL 25672

EL 24944

Proposed Haul Road
to Bing Bong

PROCESS PLANT
ROM PAD

LOW GRADE
STORAGE FACILITY

F WEST

F EAST

D NORTH

E EAST

E SOUTH

To Savannah Way
(unsealed public road)

1.2 Scope

Specifically, this report details the following:

- Erosion and Sediment Control measures for the mine site; and
- Maintenance and Monitoring Program.

To minimise the impact of the proposed development on the external environment the proponent shall implement this ESCP. To avoid significant and/or sustained deterioration in downstream water quality this ESCP may be amended as required, in response to the Monitoring and Maintenance Program described herein.

1.3 Objectives

The objectives of this ESCP are to:

- Ensure stormwater is managed to protect downstream water quality;
- Reduce the potential for sedimentation (soil particles >1mm are retained onsite);
- Ensure adequate drainage and pollution control measures are implemented to manage runoff from disturbed areas of the site; and
- Prevent soil erosion on site.

1.4 Relevant Legislation and Guidelines

The following legislation and guidelines were used to prepare this ESCP:

- *Water Act (NT);*
- *Waste Management and Pollution Control Act (NT);*
- *Soil Conservation and Land Utilisation Act (NT);*
- *NRETAS Erosion and Sediment Control Plan Content (2006);*
- *Department of Health and Families guidelines for preventing mosquito breeding associated with construction practice near tidal areas in the NT (2005); and*
- *IEAust. Soil Erosion and Sediment Control Engineering Guidelines for Queensland Construction Sites (June, 1996).*

1.5 Performance Criteria

The following performance criteria in accordance with NRETAS requirements have been set for the Stockyard portion of the proposed development:

- Stable embankments and drainage channels;
- No obvious accumulation of sediment within natural watercourses or drainage lines outside of the construction area;
- No unnecessary disturbance of earth or vegetation outside areas to be cleared or disturbed;
- No new biting insect breeding habitats created and no increase in mosquito numbers;
- Soil particles >1 mm do not leave the site; and
- All batters or embankments to have slopes greater than 1:3.

2 Site Characteristics

2.1 Locality

The subject mine site is located approximately 230 km east of Katherine, between the Towns River and Little Towns River approximately 30 km from the coast. This mine site is to be connected to Bing Bong Port by a 165 km haul road which will be used for the transportation of extracted material. The Port currently serves the nearby Xtrata McArthur Creek Mine, and an additional loading facility will be constructed to serve the Roper Bar Mine. Access to the Port is via a sealed road to Borroloola some 55 km to the south.

2.2 Topography

Aerial LiDAR survey has been used as the basis for topographical information. This data has produced 0.5m contours in the location of the mine. The site is generally flat with an average elevation of approximately 3.0 m AHD. The site is bounded by ridges to the south and east and generally slopes toward the Little Towns River which runs from west to east between the mine site and the accommodation camp.

2.3 Disturbance

The site has had no previous works undertaken on it, and is therefore free from disturbance.

2.4 Soils and Land Units

Tenosols are the dominant soil type at the subject site. Kandosols will also be encountered on some parts of the site (Figure 2.1). The land units found on this site are shown below in Figure 2.3 and are described in Table 2.1.

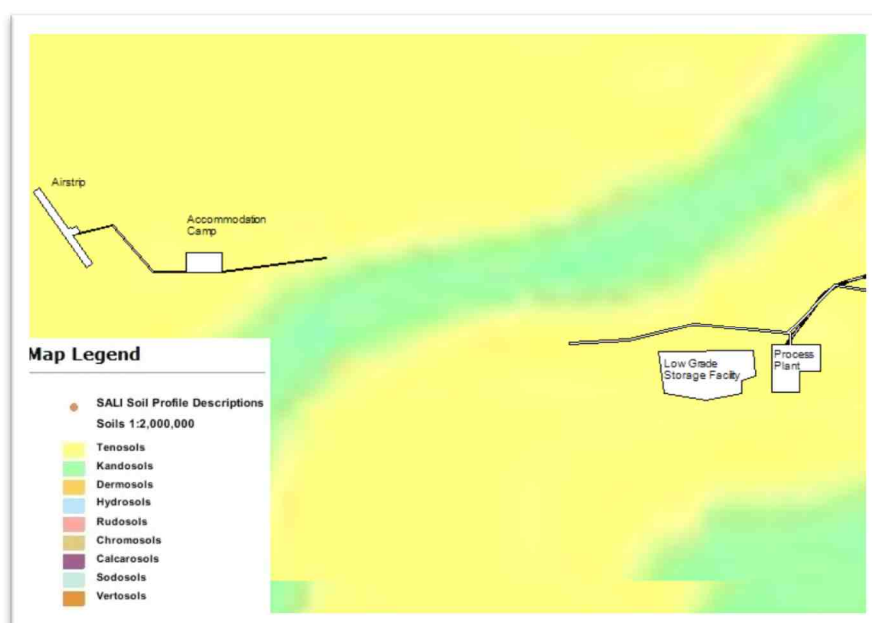


Figure 2.1 Soil Types

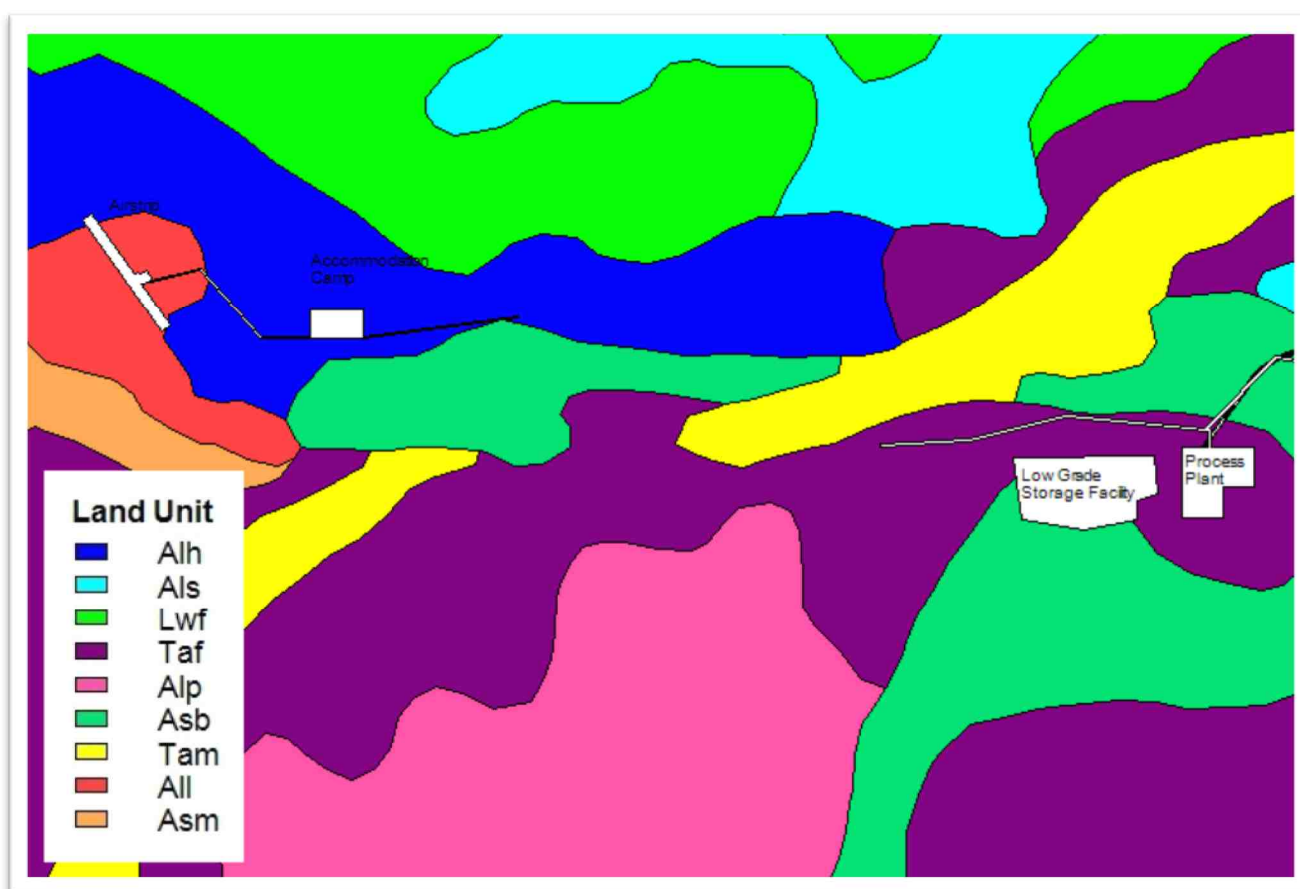


Figure 2.2 Land Units at the Proposed Development Site

Table 2.1 Land Unit Types on the Subject Site

Land Unit	Land Form	Soils	Vegetation
Asb	Rugged rocky plateaux and steep, linear ridges, on massive sandstones such as the Bukalara and Kombolgie Sandstones	Lithosols and shallow siliceous sands	Mid-high open woodland of <i>E. dichromophloia</i> with <i>E. miniata</i> , <i>E. tetradonta</i> and <i>E. leucophloia</i>
Taf	Broad sandy floodplains, terraces and lower colluvial slopes	Deep siliceous and earthy sands, sandy yellow earths and sandy solodic soils	Mid-high open woodland <i>E. tectifera</i> , <i>E. terminalis</i> and <i>Erythrophleum chlorostachys</i>
Als	Gently undulating to undulating rises with abundant, often linear rocky outcrops and shallow sandy soils	Lithosols, minor siliceous and earthy sands	Mid-high open woodland of <i>E. miniata</i> , <i>E. tetradonta</i> and <i>E. Jerruginea</i> with <i>E. dichromophloia</i> and <i>E. leucophloia</i>
Lwf	Level to very gently undulating plains on ferruginous material (laterite) that has been re-	Level to very gently undulating plains on ferruginous material (laterite) that has been re-	Tall open woodland of <i>E. tetradonta</i> with <i>Melaleuca viridiflora</i> , <i>Melaleuca nervosa</i> and <i>Callitris intratropica</i>

Land Unit	Land Form	Soils	Vegetation
	exposed from a sub marine position, with swales in a sub-coastal orientation	exposed from a sub marine position, with swales in a sub-coastal orientation	
Tam	Broad or narrow fluvial corridors conducting regional drainage across various land systems towards the coast	Grey and brown clays, red and yellow earths and siliceous sands	Mid-high open woodland of <i>C. terminalis</i> and <i>E. microtheca</i> with some <i>C. bella</i> and <i>C. polycarpa</i> ; tall fringing riparian vegetation often includes <i>Melaleuca</i> spp.
Alh	Gently undulating plains on sandstone with deep sandy soils and isolated swampy depressions	Siliceous sands and earthy sands	Tall open woodland of <i>E. tetradonta</i> and <i>E. miniata</i> ; <i>C. polycarpa</i> and <i>Melaleuca viridiflora</i> occur on wetter areas
All	Long, low, often terraced rises with linear outcrop on prominently bedded sandstones	Lithosols	Mid-high open woodland of <i>E. ferruginea</i> with some <i>Lysiphyllum cunninghamii</i>
Asm	Steep to gently slopes on the Munyi Member of the Abner Sandstones and the Sherwin Ironstone Member of the Maiwok Subgroup of Roper sediments	Lithosols	Mid-high open woodland of <i>E. leucophloia</i> with some <i>A. shirleyi</i>
Alp	Low hills, rises and undulating areas on reddish platy sandstones and siltstones, often micaceous, of the Crawford and Burrell Creek Formations and the Kyalla Member (Maiwok Subgroup) of Roper sediments	Lithosols, earthy sands and shallow red and brown earths	Mid -high open woodland of <i>E. leucophloia</i> , and <i>E. tectifera</i> with some <i>Melaleuca citrolens</i> and <i>E. pruinosa</i>

3 Erosion and Sediment Control

The purpose of this section is to provide a set of best practice site management procedures to control the severity and extent of soil erosion and pollutant transport during the construction phase of the proposed development.

Clearing of the site and the construction of erosion and sediment controls will comply with the NT Government Department of NRETAS's Erosion and Sediment Control Plan Content dated 2006. Due consideration should be given to stripped topsoil being retained and reused in drains, disturbed areas and rehabilitation of the site. The construction contractor will be responsible for the implementation, inspection, repair and modification of the controls.

The climate in the vicinity of the site is characterised by distinct wet and dry seasons. During the wet season from December to March access to the site may be limited by flooding and little if any construction work will be possible. Therefore it is anticipated and recommended that construction works be carried out during the dry season. This will significantly lower the risk of erosion and sediment transport as very little rain falls during this time period.

3.1 Principles of Erosion and Sediment Control

The principles of effective erosion and sediment control for the proposed clearing activity on site are based on the following:

- Appropriately integrate the development into the site;
- Integrate erosion and sediment control issues into site and construction planning;
- Develop effective and flexible erosion and sediment control (ESC) plans based on anticipated soil, weather and construction conditions;
- Minimise the extent and duration of soil disturbance;
- Control water movement through the site;
- Minimise soil erosion;
- Promptly stabilise disturbed areas;
- Maximise sediment retention on site;
- Maintain all ESC measures in proper working order at all times; and
- Monitor the site and adjust ESC practices to maintain the required performance standard.

3.1.1 Site Installation Sequence

The following sediment and erosion control devices and stormwater management controls will be implemented on the site;

- Tree Clearing – Clearing of vegetation as required will be undertaken where necessary;
- Diversion Drains – Used to divert clean water from upstream catchments around the site;
- Catch Drains – Used to transport contaminated runoff to sediment basins;
- Level Spreaders – Used to reduce velocities and return channelised flow to sheet flow; and
- Sediment Basins – Used to trap and retain sediment via settlement of suspended particles.

These controls have been developed in accordance with IECA Best Practice Erosion and Sediment Control guidelines and the location of these devices is presented in Appendix A.

3.2 Management of Erosion and Sediment Control

The following measures are to be implemented to maintain the current environmental values onsite.

Commitment:

- No deterioration in downstream water quality and no net increase in runoff quantity.

Issue:	Runoff - Stormwater Management - Contamination of Surface water - Erosion and Sedimentation.
Objectives:	• To ensure that there is no deterioration in stormwater quality or any reduction in the environmental values of the downstream receiving waters as a result of the proposed construction activities on the subject site; • To control stormwater runoff to minimise sediment loss from the site and pollution of natural waterways and drainage systems; • To comply with relevant governing statutory requirements; • To prevent soil erosion and contamination of the stormwater drainage system and waterways; • To prevent sediment from being deposited off site; and • Compliance with Environmental Protection Policies.
Management Procedure:	Pre-Construction (Sediment and Erosion Control): • Sediment erosion controls will be developed as construction progresses through each development stage; • Site personnel informed of the erosion and sediment controls; • Install vehicular shake down grids/rubble grids at designated construction exits to remove sediment from vehicles prior to exiting site. Any sediment dispersed onto roads shall be swept up immediately and placed in construction rubble waste bin. Construct exits in accordance with IEAust Guidelines at designated exits; • Minimise vegetation removal to areas designated for clearing. Clearly identify "No Go Areas" where vegetation is to be maintained. • Install diversion drains to direct clean stormwater away from disturbed areas; • Install mulch mounds to reduce runoff velocities and encourage sedimentation and filtration of eroded soils; and • Transportation of soil and other fill: Trucks shall have their loads secured and covered. Any spillage shall be collected and removed streets on a daily basis and placed in a construction rubble waste bin for removal. Construction (Mitigation of Water Quality): • Sediment fences to be erected at the base of all batters and soil stockpiles to prevent sediment laden stormwater migrating away from source; • Regular inspections as soon as practicable after storm events to check and maintain controls; • Inspection dates and actions taken to be recorded and available for review upon request;

	• Sediment to be removed from fences and basins when controls are 40% full and at the completion of construction. All material to be re-used or stored on-site in a controlled manner or taken off-site for re-use or disposal at a licensed waste disposal facility; • Monitoring of water quality to determine the effectiveness of the sediment and erosion control management practices; and • Progressive re-vegetation of filled and disturbed areas.
Performance Indicators:	• Visual evidence of deterioration of baseline water quality of downstream water courses directly attributable to the site; • Pollutant concentrations that exceed the water quality objectives (TSS 90th percentile all other analytes 80th percentile); • Visible erosion; and • Failure of control measures.
Responsibility:	Site Foreman and Environmental Management Officer.
Critical Dates:	Prior to commencement of work/construction safety induction (include training, awareness of commitments, directives, working hours and approval conditions for stormwater management, water quality and sediment and erosion control).
Monitoring:	Regular inspection as soon as practicable after storm events to check and maintain controls. Site visits from Environmental Management Officer during construction. Monitoring regime to be in accordance with the approved site Stormwater Management Plan. WQ monitoring by qualified personnel.
Reporting:	Report incidents to Site Foreman. Upon notification of Environmental Management Officer (EMO). EMO to certify compliance of measures by way of letter upon completion, and if necessary notify Project Manager of non-compliance. Site Manager (during construction) to report to relevant authority.
Corrective Action:	All corrective actions shall be agreed upon, dependent upon the severity of non-conformance and parameter concerned, between Construction Engineering, the Environmental Consultant and relevant authority. Remove sediment from fences when controls are 40% full and at completion of construction. Observations and monitoring data shall be used to guide implementation of additional measures, if and when required. The triggering of a performance indicator will require: • Locate source of water quality deterioration; • Prevent continuing deterioration by repairing existing measures, construct additional measures or modify procedures; • Review strategies/management plans in consultation with relevant authority; and • Repair existing controls, construct additional controls or modify procedures to prevent future deterioration in water quality.

3.3 Erosion and Sediment Controls

The following erosion and sediment controls have been developed and adopted for the proposed development.

3.3.1 Diversion Drains

The proposed diversion drains have been specified on the upstream side of all earthworks. This will ensure that clean runoff from upstream catchments will be directed around the works area, minimising the potential for sediment export. Calculations for the diversion drains is presented in Appendix D.

3.3.2 Level Spreaders

Level spreaders are constructed along the contour line and consist of a level entry that allows concentrated flow to spread over a nominated flow width before discharging as sheet flow down a stable slope.

3.3.3 Sediment Basins

Sediment basins are generally required where:

- Areas with exposed highly erodible soils;
- Areas with exposed slopes greater than 2%;
- Areas with exposed soils after 30 September or before May 1.

As construction may continue outside these dates, sediment basins will be required. Sediment basins have been sized to capture the Q10 runoff volume of the contributing catchments and allow for 3 months of sediment storage based on the Universal Soil Loss Equation. Table 3.1 and Table 3.2 provide a summary of the annual sediment loss prediction and the sediment basin sizing configuration respectively.

Table 3.1 Annual Sediment Loss Prediction

Basin ID	Ac (ha)	Slope Grade	Intensity 6l2(mm/hr)	R	K	LS	C	P	A (t/ha/yr)	Yield (m ³ /yr)
1	56.32	1	16.1	13738	0.047	0.27	1	1.3	226.6	12764.1
2	119.81	1	16.1	13738	0.047	0.27	1	1.3	226.6	27153.2
3	10.1	1	16.1	13738	0.047	0.27	1	1.3	226.6	2289.0
4	10.1	1	16.1	13738	0.047	0.27	1	1.3	226.6	2289.0
5	33.03	1	16.1	13738	0.047	0.27	1	1.3	226.6	7485.8

Table 3.2 Sediment Basin Configuration

Basin ID	Catchment Size (ha)	Settling Zone Volume (m ³)	Storage Zone Volume (m ³)	Total Volume (m ³)	Length (m)	Width (m)	Settling Zone Depth (m)	Storage Zone Depth (m)	Total Depth (m)
1	56.32	12954	3886	16840	227	57	0.6	1.0	1.60
2	119.81	27556	8267	35823	321	80	0.6	1.0	1.60
3	10.1	2323	697	3020	109	27	0.6	1.0	1.60
4	10.1	2323	697	3020	109	27	0.6	1.0	1.60
5	33.03	7597	2279	9876	179	45	0.6	1.0	1.60

The configuration of the sediment basin will have a minimum length to width ratio of 4:1. The minimum depth of the “settling zone” is 0.6 m. The side batters of the basins will be at a slope of 1:6.

Artificial flocculation will be applied on retained runoff to assist in the settling process. This will be completed via the application of Gypsum within 24 hours of the conclusion of each storm event and before any pumping out of the basin. Application of the Gypsum will occur by broadcasting it over the surface by hand, ensuring an even spread over the basin surface at a rate of 32 kg per 100 m³ of water.

3.4 Restricted Areas

All areas identified as being non-clearable areas should be flagged and/or marked on the ground so as to restrict movement of vehicles or persons to this area. All areas to be cleared should be provided to clearing contractors, downloaded onto GPS units prior to the commencement of any clearing activities.

3.5 Construction Phase Monitoring

Prior to construction onsite, it is recommended the contractor shall undertake a series of data collection exercises to define the existing stormwater quality. Samples will be analysed for total suspended solids (TSS), pH, dissolved oxygen (DO) and hydrocarbons with the results being used as water quality indicators for construction phase monitoring. Monitoring during the construction phase will be conducted to determine the impact of activities on the subject site only. Sampling by the proponent will be undertaken in accordance with procedures set out in the Environmental Protection Authority’s Water Quality Sampling Manual. A NATA registered laboratory will be used to perform the analysis of collected samples. Monitoring reports will be compiled upon request.

3.5.1 Investigation Indicators

The following indicators are used to identify if the objectives of the ESCP are being met:

- Visible evidence of deterioration of baseline water quality of downstream watercourses that is directly attributable to the site;
- Pollutant concentrations that exceed the water quality objectives (TSS 90th percentile all other analytes 80th percentile);
- Visible significant erosion; and/or
- Failure of control measures.

The triggering of an investigation indicator will require the following remedial actions:

- Locate source of water quality deterioration;
- Prevent continuing deterioration with temporary controls;
- Repair existing controls, construct additional controls or modify procedures to prevent future deterioration in water quality; and
- During the operational phase of the development, if there is a significant deterioration in water quality, the management plan and strategies will be reviewed.

3.6 Contingencies

During construction, the Contractor/Principal/Site Foreman shall allocate sufficient resources (personnel, plant, equipment and materials) to the site and store on-site, at suitable locations and at all times sufficient quantities of materials to immediately attend to any non-conformance.

Corrective actions may be agreed upon, dependent upon the severity of non-conformance and/or emergency and parameter involved, between the Principal, Construction Contractor, Environmental Consultant, and relevant Government Representatives.

3.7 Responsibilities

It should be noted that the basic responsibility for environmental protection rests with all employees and sub-contractors. Table 3.3 presents the specific responsibilities that pertain to this CMP.

Table 3.3 Party Responsibilities

Party	Primary Responsibility
Project Manager	• Overall implementation of the ESCP and management of environmental impacts and risks. • Responsible for reporting any incidents to relevant authorities if required. • Issue and distribution of ESCP. • Revision of the ESCP, as required, to reflect the <i>status quo</i>. • Revisions are to be made by replacing the entire document by consecutively numbered amendments. • Implementation, monitoring, reporting and corrective actions within the ESCP.
Construction Manager/Site Manager	• Implementation of strategies, requirements, procedures and measures to ensure that appropriate environmental protection is in place. • Induction, supervising and monitoring of the ESCP.

Party	Primary Responsibility
Safety Officer	- To attend construction at all times during working hours. - Site inspections (random, daily) to ensure adherence to the different plans and procedures. - Direct actions, as required, to protect the environment and to minimise and/or rectify any environmental concerns.
All other site personnel	Adherence to Site Safety Rules and ESCP.

3.7.1 Environmental Complaints and Incidents

The Site Manager shall investigate all environmental complaints. Where considered appropriate and/or required, the Site Manager shall notify the relevant statutory authority. Complaints received by external parties will also be subject to investigation by the Site Manager or EMO.

Should an environmental incident occur during the course of construction, the Landowner shall take prompt action to minimise any impact and, where necessary, seek the advice of the relevant authorities.

All complaints will be treated with respect. The Site Manager shall maintain a Complaints Register (refer Appendix B) and shall direct an appropriate course of action relating to the complaint. The Complaints Register will be included in any audit reports during construction and shall record the date, time and nature of any complaint, the name and contact details of the complainant, action taken, person responsible for action, and resolution of complaint. The Site Manager shall certify each entry on the record.

3.7.2 Environmental Notifications

In the event of a major incident/non-conformance that may cause or causes environmental harm, as soon as practicable after being made aware of the incident, the following people have a duty to notify the relevant authority of the incident:

- The person carrying on the activity;
- An employee or agent carrying on the activity;
- An employer carrying on the activity; and
- The occupier of the premises where the incident occurs.

Notification must be given as soon practicable after the person becomes aware of the incident.

The Site Manager shall furnish the following details:

- The time, date, nature, duration and location of the incident;
- The location of the place where non-conformance occurred;
- The nature of the non-conformance;
- The circumstances in which the incident occurred (including the cause of the incident, if known);
- The action taken or proposed to be taken to deal with the incident; and
- Other information prescribed by the regulations.

3.7.3 Awareness and Training

A copy of this document will be available from the following officers at the site:

- Site Manager; and
- Safety Officer.

Awareness and Training forms part of Safety Inductions conducted prior to site work. It is a requirement that no person shall undertake any site work unless properly inducted. As part of their site induction and training all personnel engaged in construction shall be made aware of the provisions of this document in order to promote a general awareness of the environment and to minimise any potential impact and/or disturbances to the environment. Evidence of environmental induction of personnel in this project shall be maintained on project records.

4 Conclusions

This study has reviewed the construction impact of the proposed construction on receiving waters. Based on this study the following erosion and sediment control measures have been developed:

- Diversion Drains;
- Catch Drains;
- Level Spreaders; and
- Sediment Basins.

Sediment basins have been sized to capture sediment carried by runoff from the contributing catchments and have been designed using the IECA Best Practice Erosion and Sediment Control guidelines with a minimum storage depth of 0.6 m.

In summary, the integrity of receiving water bodies will not be adversely impacted as a result of this construction provided the sediment control measures described herein are implemented.

Appendix A – Erosion and Sediment Control Plan and Details

ROPER BAR MINE TO BING BONG MINE

CONTRACT GC120095-EP02 EROSION AND SEDIMENT CONTROL



LOCALITY PLAN

SCHEDULE OF DRAWINGS	
Drawing No.	Drawing Title
GC120095-EP02-N000	COVER SHEET, SCHEDULE OF DRAWINGS
GC120095-EP02-N001	OVERALL LAYOUT PLAN
GC120095-EP02-N002	SEDIMENT AND EROSION CONTROL PLAN SHEET 1 OF 3
GC120095-EP02-N003	SEDIMENT AND EROSION CONTROL PLAN SHEET 2 OF 3
GC120095-EP02-N004	SEDIMENT AND EROSION CONTROL PLAN SHEET 3 OF 3
GC120095-EP02-N005	SEDIMENT CONTROL SECTIONS AND SCHEDULES
GC120095-EP02-N006	EROSION AND SEDIMENT DETAILS AND NOTES SHEET 1 OF 2
GC120095-EP02-N007	EROSION AND SEDIMENT DETAILS AND NOTES SHEET 2 OF 2

PREPARED FOR

WESTERN DESERT RESOURCES

PREPARED BY

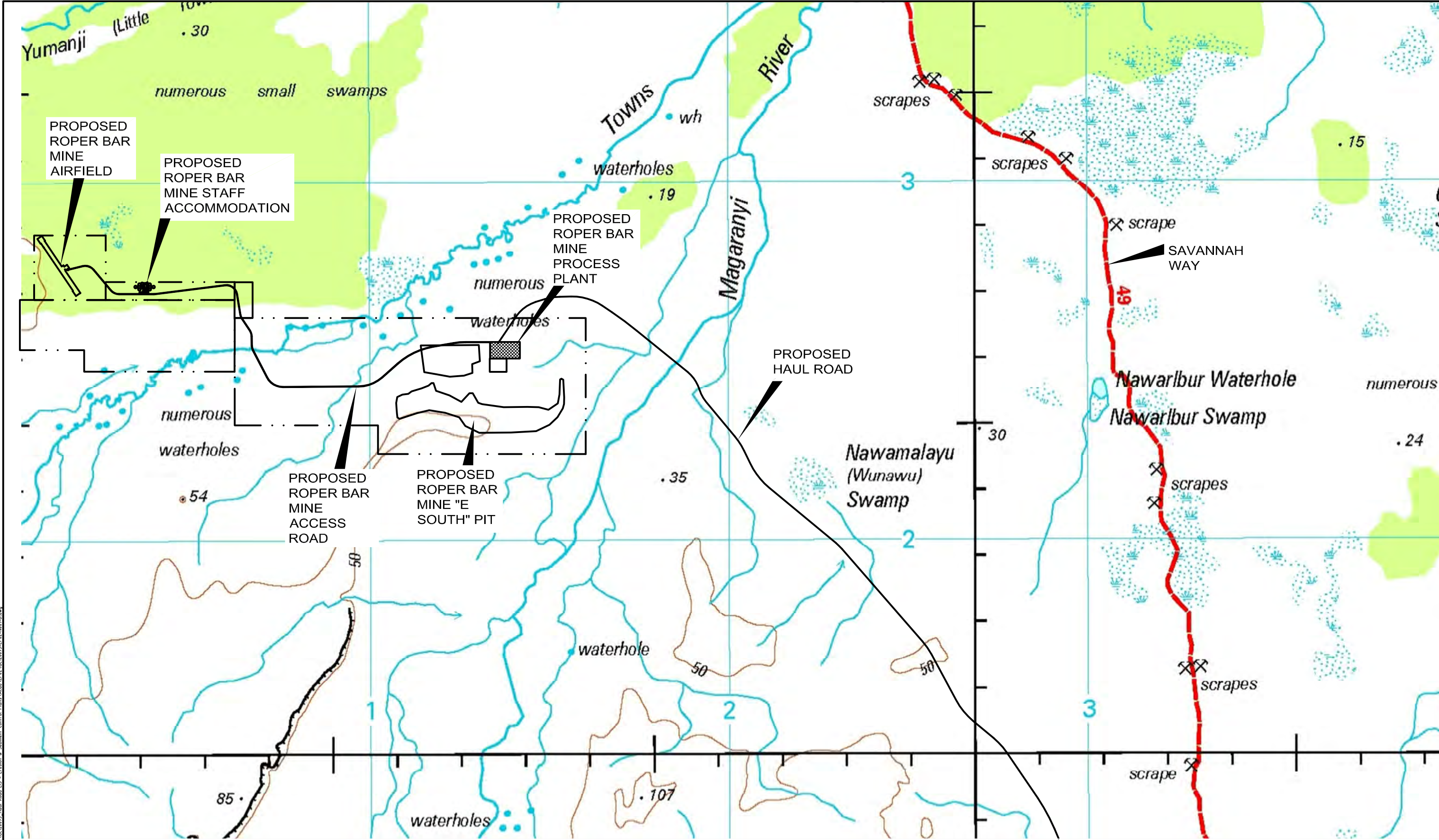


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Email: goldcoast@vdmgroup.com.au
VDM Engineering (Eastern Operations) Pty Ltd
ABN 91 087 601 296

DATE : 10-04-2012

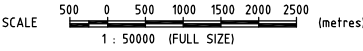
PROJECT No.:	DRAWING No.:	VERSION:
GC120095-EP02	N000	B

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DATUM
HORIZONTAL DATUM: MGA ZONE 53 (GDA94)
VERTICAL DATUM: AHD

OVERALL LAYOUT PLAN



ROPER BAR MINE TO BING BONG
HAUL ROAD
FOR
WESTERN DESERT RESOURCES

A	ORIGINAL ISSUE		22-03-12
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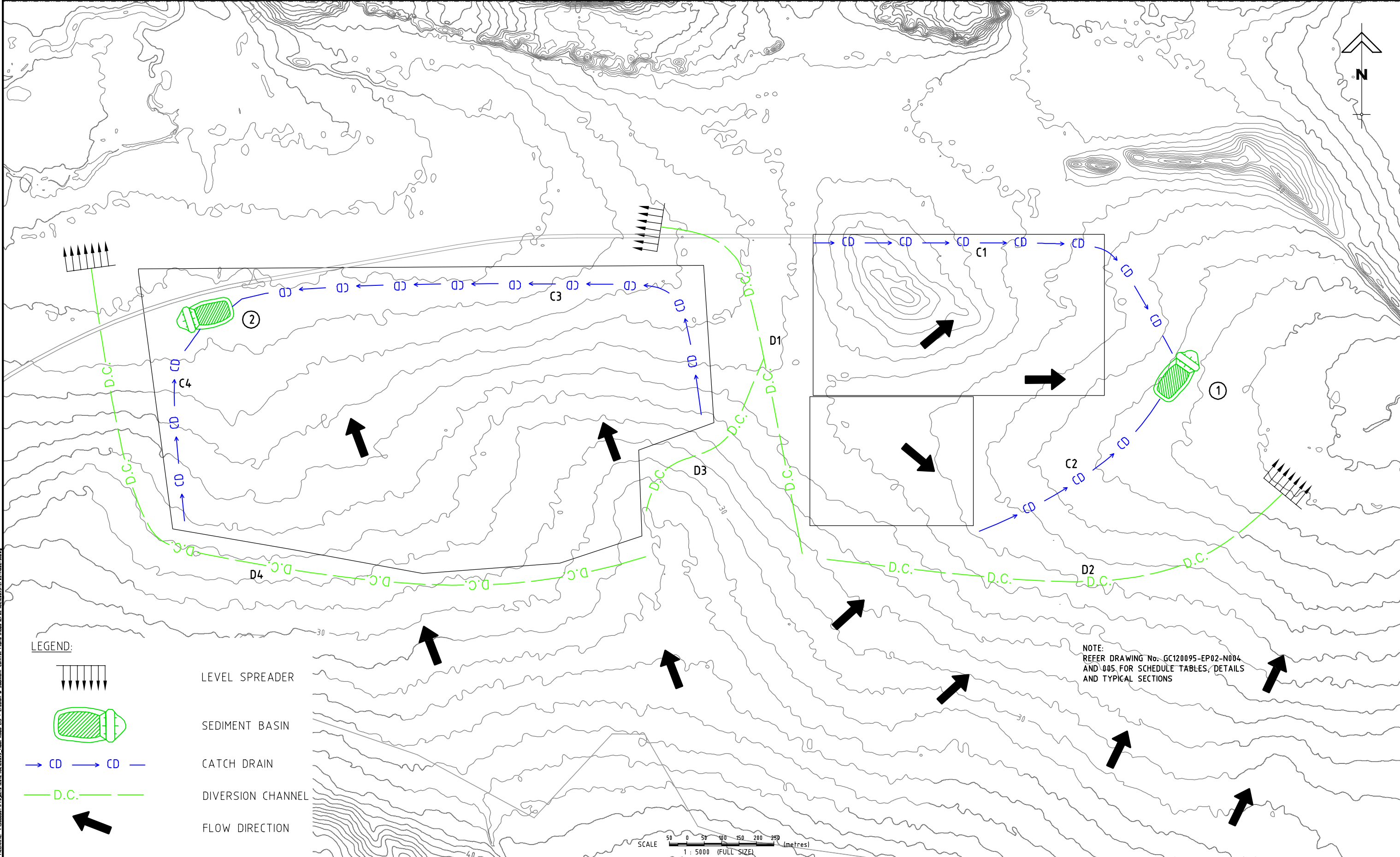
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PROJECT:
**EROSION AND
SEDIMENT CONTROL
for
PROPOSED MINE**

DRAWING TITLE :
OVERALL LAYOUT PLAN

DEVEL. APPLIC. No.:		DATE : 10-04-12	
PROJECT LEADER : BRAD COMLEY		DESIGNER : JOE McDONALD	
DRAFTSPERSON : ANNETTE LEGGE		CHECKED :	
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SCALE : AS SHOWN		FULL SIZE : A1	
PROJECT No.:		VERSION:	
GC120095-EP02		B	

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ROPER BAR MINE TO BING BONG
HAUL ROAD
FOR
WESTERN DESERT RESOURCES

B	LAYOUT AMENDED	10-04-12
A	ORIGINAL ISSUE	29-03-12

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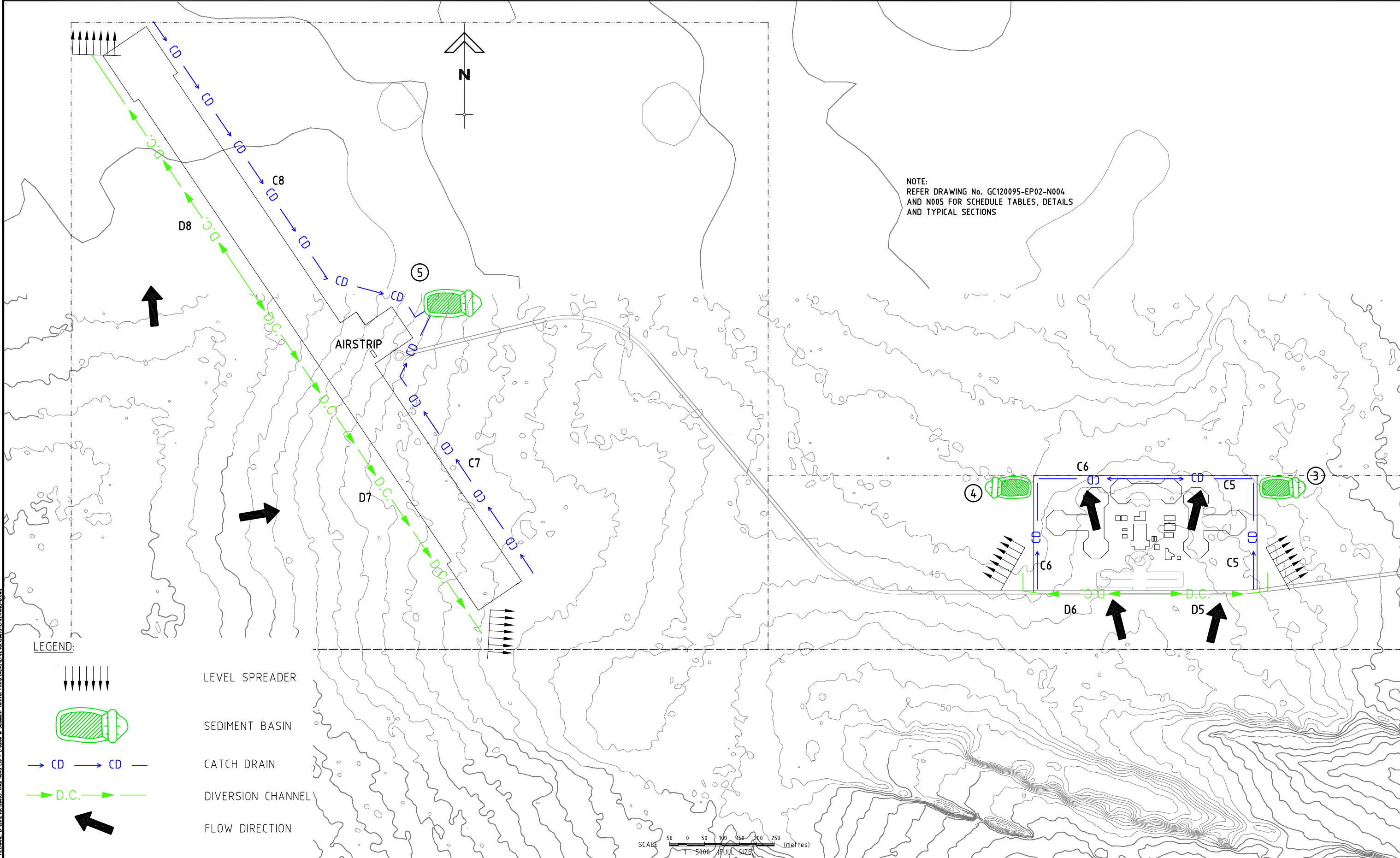
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PROJECT:
**EROSION AND
SEDIMENT CONTROL
for
PROPOSED MINE**

DRAWING TITLE:
**SEDIMENT AND EROSION
CONTROL PLAN
SHEET 1 OF 3**

DEVEL. APPLIC. No.:		DATE: 10-04-12
PROJECT LEADER: BRAD COMLEY	DESIGNER: JOE McDONALD	
DRAFTSPERSON: ANNETTE LEGGE	CHECKED:	
APPROVED FOR AND ON BEHALF OF VDM ENGINEERING (EASTERN OPERATIONS) PTY LTD ACN 087 601 296		
REQ No.:		
SCALE: AS SHOWN	DATUM: AHD	FULL SIZE: A1
PROJECT No.: GC120095 EP02	DRAWING No.: N1002	VERSION: D

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ROPER BAR MINE TO BING BONG
HAUL ROAD
FOR
WESTERN DESERT RESOURCES

VER.	DESCRIPTION	APPR.	DATE
B	LAYOUT AMENDED		10-04-12
A	ORIGINAL ISSUE		01-04-12

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PROJECT:
**EROSION AND
SEDIMENT CONTROL
for
PROPOSED MINE**

DRAWING TITLE:
**SEDIMENT AND EROSION
CONTROL PLAN
SHEET 2 OF 3**

DEVEL. APPLIC. No.:		DATE: 10-04-12
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RPEQ No.:		
SCALE: AS SHOWN	DATUM: AHD	FULL SIZE: A1
PROJECT No.: GC120095-EP02	DRAWING No.: N003	VERSION: B

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FILENAME: B:\2107\GC120095 Haul Road ES - Erosion & Sediment Control Plans\Road\EP02-GC120095-EP02-N004-A.dwg
PLOTED: 11 Apr 2012

ROPER BAR MINE TO BING BONG
HAUL ROAD
FOR
WESTERN DESERT RESOURCES

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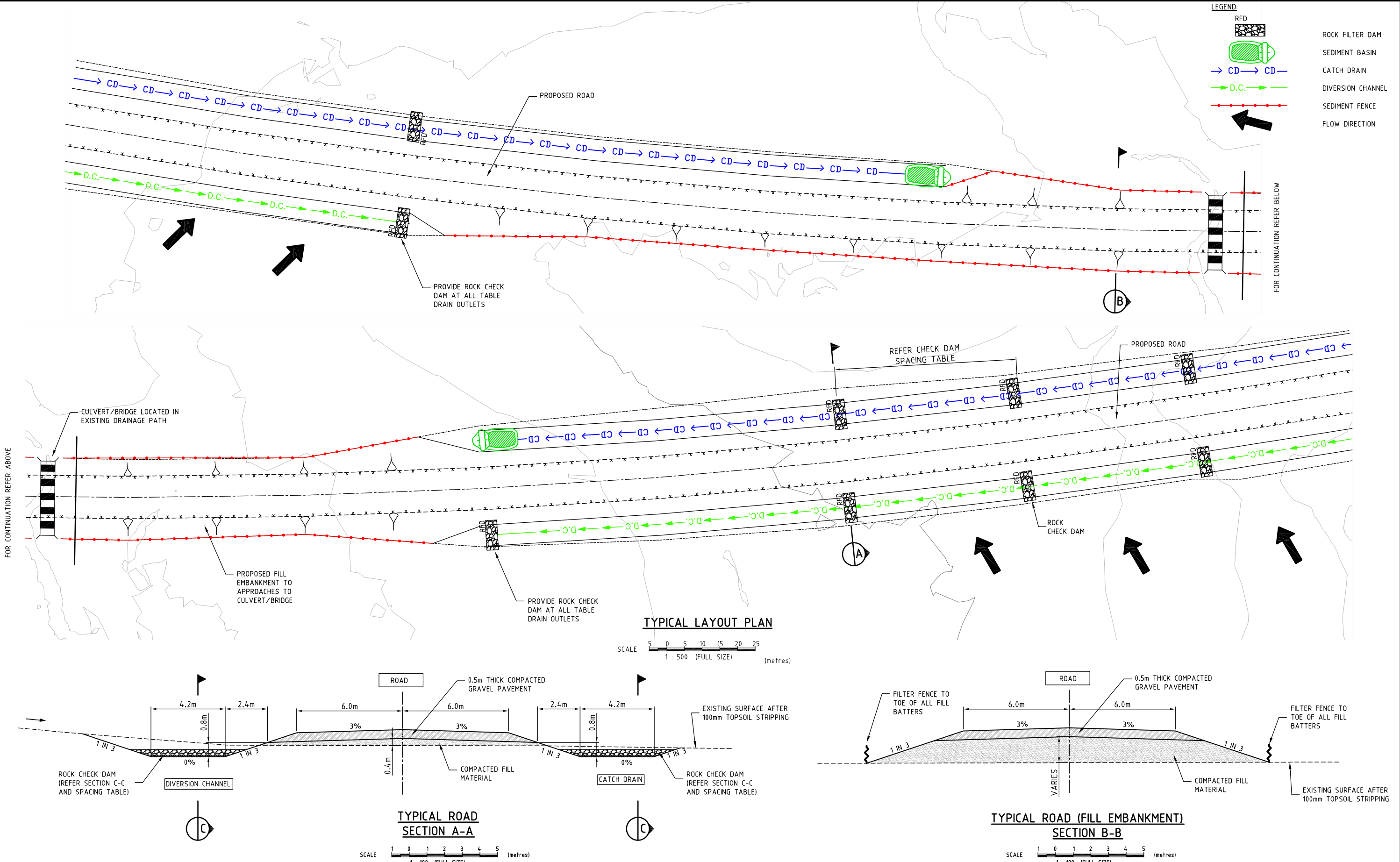
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PROJECT:
**EROSION AND
SEDIMENT CONTROL
for
PROPOSED MINE**

DRAWING TITLE:
**SEDIMENT AND
EROSION CONTROL PLAN
SHEET 3 OF 3**

DEVEL. APPLIC. No.:		DATE: 11-04-12
PROJECT LEADER: BRAD COMLEY		DESIGNER: JOE McDONALD
DRAFTSPERSON: ANNETTE LEGGE		CHECKED:
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SCALE: AS SHOWN	DATUM: AHD	FULL SIZE: A1
PROJECT No.: GC120095-EP02	DRAWING No.: N004	VERSION: A



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FILENAME: B:\2012\GC20095_Haul_Road_ES - Erosion & Sediment Control Plans\Task\EP02-GC20095-EP02-N005-B.dwg
PLOTTED: 11 Apr 2012

ROPER BAR MINE TO BING BONG
HAUL ROAD
FOR
WESTERN DESERT RESOURCES

B	SCHEDULES AND SECTIONS		
	AMENDED		10-04-12
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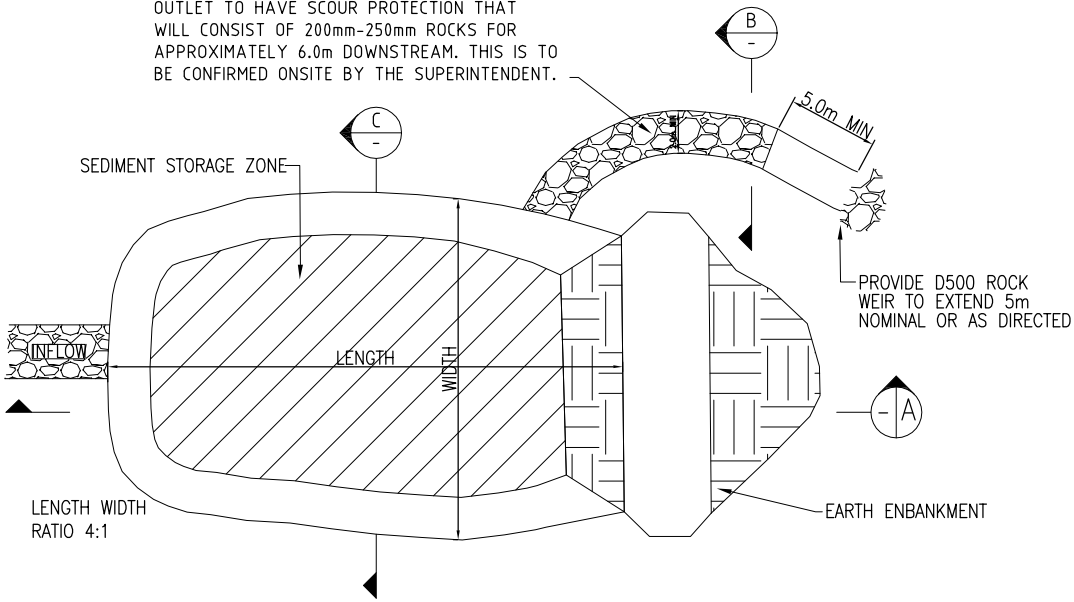
PROJECT:
**EROSION AND
SEDIMENT CONTROL
for
PROPOSED MINE**

DRAWING TITLE :
**SEDIMENT CONTROL
SECTIONS
AND SCHEDULES**

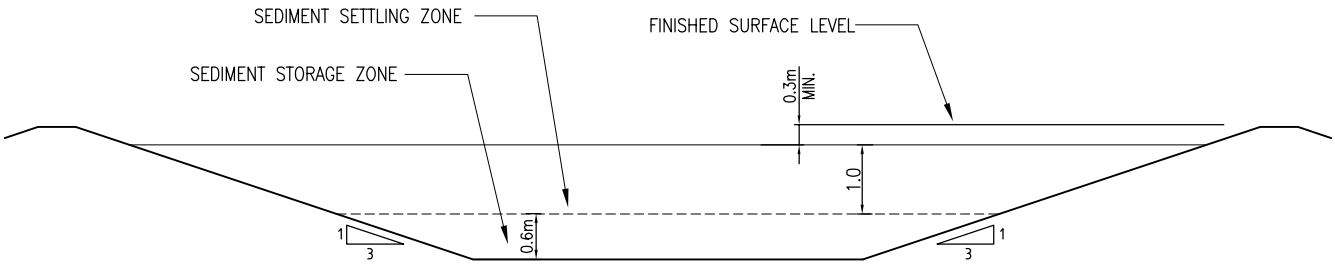
DEVEL. APPLIC. No.:		DATE : 11-04-12	
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DRAFTSPERSON : ANNETTE LEGGE		CHECKED :	
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RPEQ No. :			
SCALE : AS SHOWN		FULL SIZE : A1	
PROJECT No.:		VERSION:	
GC120095-EP02		B	

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NOTE:
EMERGENCY SPILL WAY ROCK LINED.
OUTLET TO HAVE SCOUR PROTECTION THAT
WILL CONSIST OF 200mm-250mm ROCKS FOR
APPROXIMATELY 6.0m DOWNSTREAM. THIS IS TO
BE CONFIRMED ONSITE BY THE SUPERINTENDENT.

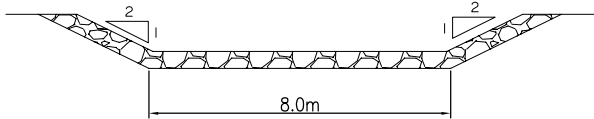


SEDIMENT BASIN DETAIL (TYPICAL)
N.T.S.



CROSS SECTION THROUGH SEDIMENT BASIN (TYPICAL)

N.T.S.
SECTION C



OUTLET WEIR SECTION (TYPICAL)
N.T.S.

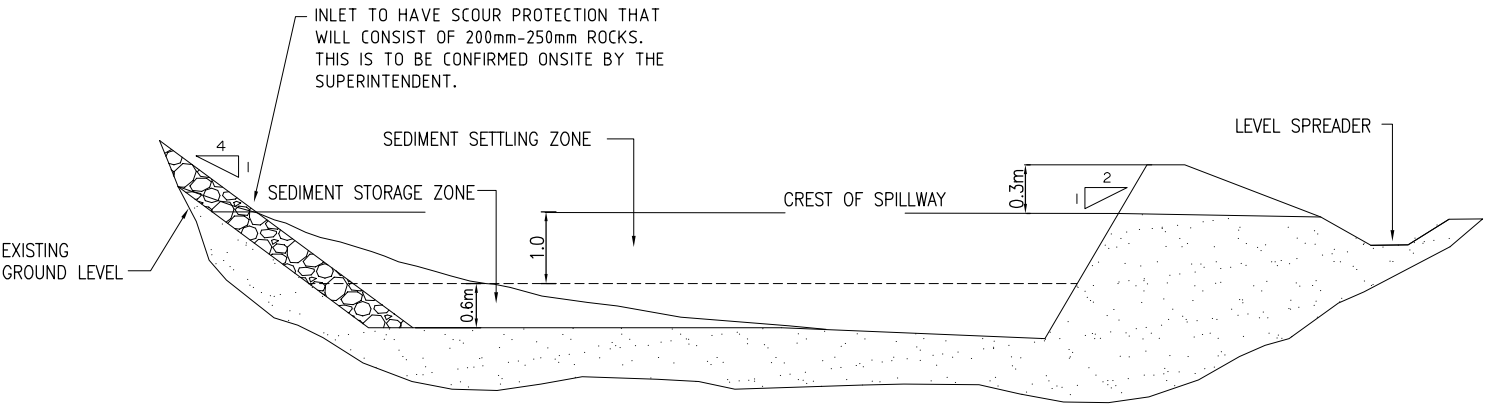
SECTION B

GENERAL NOTES:

EROSION AND SEDIMENT CONTROL DEVICES AND INFRASTRUCTURE TO BE INSTALLED PRIOR TO SITE DISTURBANCE. STRIP TOP SOIL ONLY FROM CONSTRUCTION AREAS AND STOCKPILE AT NOMINATED SITE. STRIPPED TOP SOIL MUST BE KEEP SEPARATE FROM OTHER SOIL/FILL. ALL SEDIMENT CONTROL STRUCTURES/TRAPS TO BE INSPECTED AFTER EACH RAINFALL EVENT FOR DAMAGE AND ALL TRAPPED SEDIMENT TO BE REMOVED TO A NOMINAL STOCKPILE. PRIOR TO ANY WORKS THE PROPOSED CLEARING AREA MUST BE FLAGGED ON THE GROUND AND INSPECTED TO CONFIRM ACCURACY PRIOR TO ANY WORKS COMMENCING. ALL AREAS TO BE CLEARED SHOULD BE PROVIDED TO CLEARING CONTRACTORS, DOWNLOADED ONTO CONTRACTORS GPS UNITS PRIOR TO ANY CLEARING ACTIVITIES COMMENCING. FLAGGING MUST BE MAINTAINED THROUGHOUT THE DEVELOPMENT PHASE TO RESTRICT ACCESS TO NO-GO AREAS. CONSTRUCTION COMPOUND MUST BE LOCATED IN THE APPROVED CLEARING AREA. ANY CHANGES TO THE EROSION AND SEDIMENT CONTROL PLAN SHALL BE SUBMITTED AND APPROVED BY NATURAL RESOURCE MANAGEMENT DIVISION, NRETAS PRIOR TO COMMENCEMENT.

ADDITIONAL EROSION CONTROLS MAY BE REQUIRED DURING CONSTRUCTION AS DETERMINED BY THE SUPERINTENDENT IN CONSULTATION WITH THE NATURAL RESOURCE MANAGEMENT DIVISION, NRETAS.

ALL EROSION AND SEDIMENT CONTROLS TO BE IMPLEMENTED TO THE SATISFACTION OF NRETAS.



CROSS SECTION THROUGH SEDIMENT BASIN SECTION (TYPICAL)

N.T.S.
SECTION A

ROPER BAR MINE TO BING BONG
HAUL ROAD
FOR
WESTERN DESERT RESOURCES

B	DRAWING RENUMBERED		10-04-12
A	ORIGINAL ISSUE		03-04-12
VER.	DESCRIPTION	APPR.	DATE

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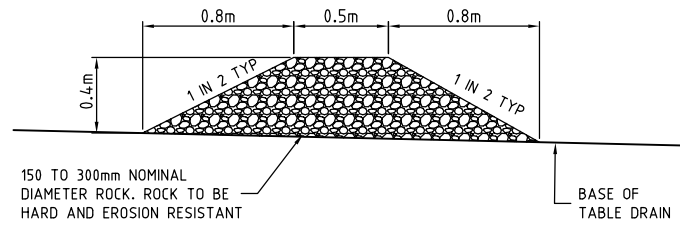
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PROJECT:
**EROSION AND
SEDIMENT CONTROL
for
PROPOSED MINE**

DRAWING TITLE:
**EROSION AND SEDIMENT
DETAILS AND NOTES
SHEET 1 OF 2**

DEVEL. APPLIC. No. :		DATE : 10-04-12	
PROJECT LEADER : BRAD COMLEY		DESIGNER : JOE McDONALD	
DRAFTSPERSON : ANNETTE LEGGE		CHECKED :	
APPROVED FOR AND ON BEHALF OF VDM ENGINEERING (EASTERN OPERATIONS) PTY LTD ACN 087 601 296			
RPEQ No. :			
SCALE : AS SHOWN	DATUM : AHD	FULL SIZE : A1	
PROJECT No.:	DRAWING No. :	VERSION:	
GC120095-EP02	N006	B	

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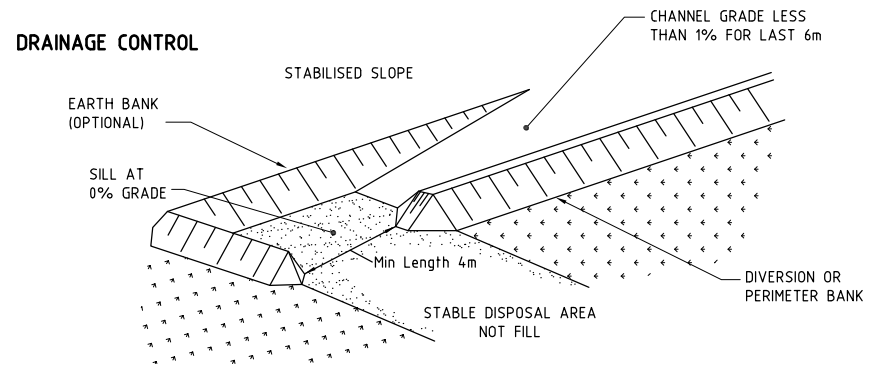


**CHECK DAM
SECTION C-C**

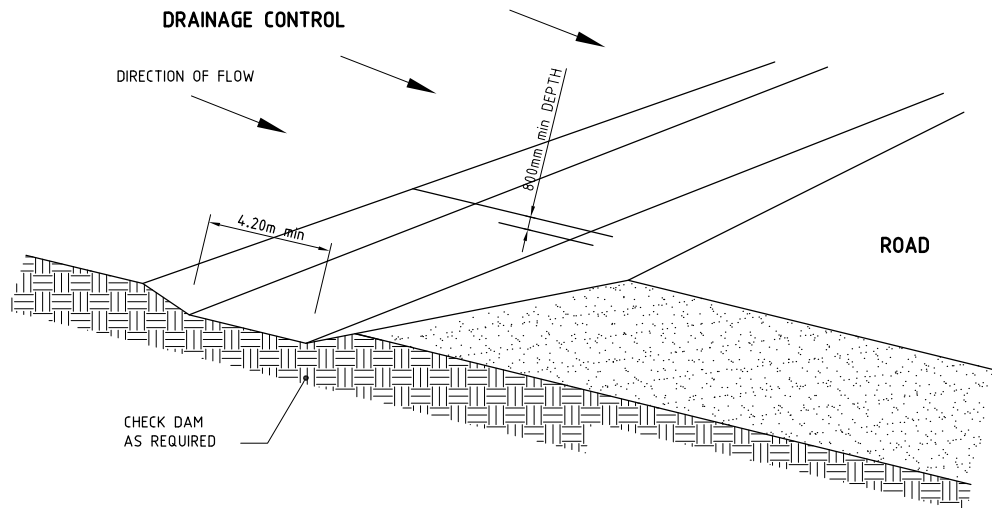
SCALE 0.2 0 0.2 0.4 0.6 0.8 1.0 (metres)
1 : 20 (FULL SIZE)

BED SLOPE OF TABLE DRAIN	SPACING OF ROCK CHECK DAM
0 TO 1%	NONE REQUIRED
1 TO 2%	200m
2 TO 3%	100m
OVER 3%	50m

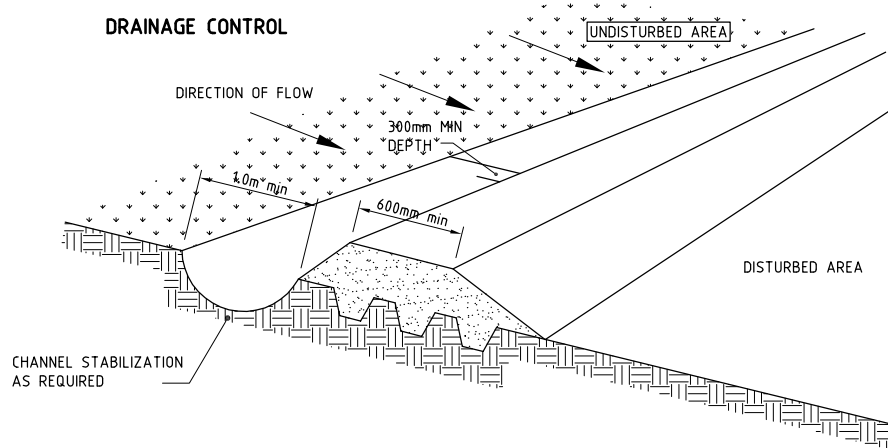
**CHECK DAM
SPACING TABLE**



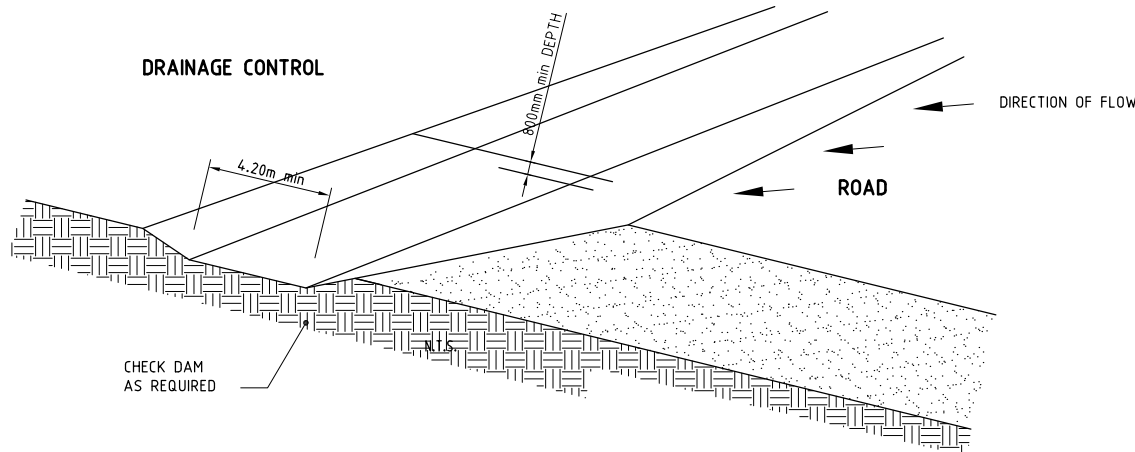
LEVEL SPREADER (TYPICAL)
N.T.S.



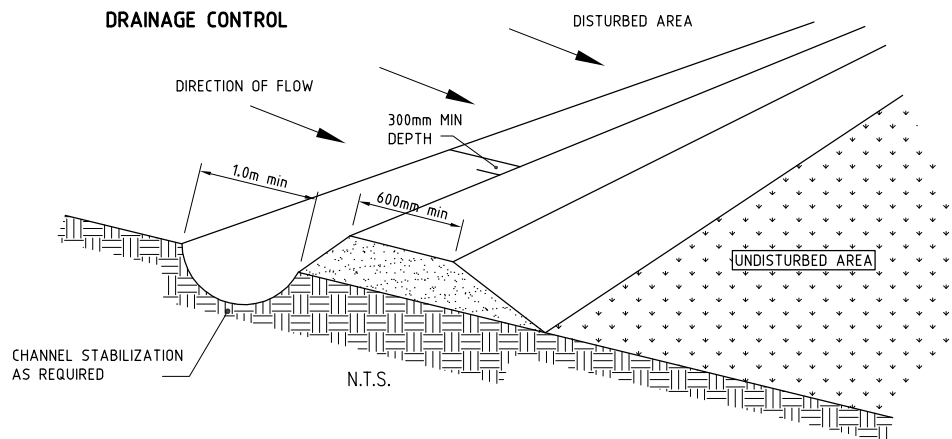
ROAD DIVERSION CHANNEL (TYPICAL)
N.T.S.



DIVERSION CHANNEL (TYPICAL)
N.T.S.



ROAD CATCH DRAIN (TYPICAL)



CATCH DRAIN (TYPICAL)

**ROPER BAR MINE TO BING BONG
HAUL ROAD**

FOR

WESTERN DESERT RESOURCES

A	ORIGINAL ISSUE		10-04-12
VER.	DESCRIPTION	APPR.	DATE

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PROJECT:

**EROSION AND
SEDIMENT CONTROL
for
PROPOSED MINE**

DRAWING TITLE :

**EROSION AND SEDIMENT
DETAILS AND NOTES
SHEET 2 OF 2**

DEVEL. APPLIC. No.:	DATE : 10-04-12
PROJECT LEADER : BRAD COMLEY	DESIGNER : JOE McDONALD
DRAFTSPERSON : ANNETTE LEGGE	CHECKED :
APPROVED FOR AND ON BEHALF OF VDM ENGINEERING (EASTERN OPERATIONS) PTY LTD	ACN 087 601 296
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PROJECT No.:	FULL SIZE : A1
GC120095-EP02	
DRAWING No.:	VERSION:
N007	A

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Appendix B – Complaints Register

Complaints Register

For the recording of any complaint pertaining to construction and the environment.

Date:	Time:
Name and Contact Details of Complainant:	
Details of Complaint:	
Action Taken:	
Responsible Person:	
Resolution/Notes:	
Site Manager:	Date:
Date:	Time:
Name and Contact Details of Complainant:	
Details of Complaint:	
Action Taken:	
Responsible Person:	
Resolution/Notes:	
Site Manager:	Date:
Date:	Time:
Name and Contact Details of Complainant:	
Details of Complaint:	
Action Taken:	
Responsible Person:	
Resolution/Notes:	
Site Manager:	Date:

Appendix C – Incident/Non-Conformance Notification Form

Incident/Non-Conformance Notification Form

Name of Designated Contact:	
Telephone Number:	
Location of the Incident:	
Date and Time of Incident:	
Cause of the Incident:	
Environmental Harm: (Caused/threatened/suspected)	
Details of Actions: (to prevent further incidents and/or recurrence)	
Mitigation: (actions to mitigate any environmental harm)	
Site Manager:	Date

Appendix D – Drain Calculations

	Cat_ID	Area (ha)	Fall (m)	Length (m)	Slope (%)	Manning s n	T of C (mins)	Intensity (mm/hr)	C factor	Flow (m ³ /s)	Drain ID	Length (m)	Fall (m)	Slope (m/m)	Base Width (m)	Depth (m)	Flow Area (m ²)	Wetted Perimeter	Hydraulic Radius	Velocity (m/s)	Capacity (m ³ /s)	Capacity OK?	Channel Type
Diversion Drains	D1	16.22	8	950	0.842	0.035	22.6	129	0.7	4.09	D1	840	4.5	0.005	5.0	0.500	3.250	6.580	0.494	1.31	4.25	OK	A
	D2	123	34	2050	1.659	0.035	19.8	135	0.7	32.43	D2	965	7.5	0.008	10.0	1.000	13.000	13.160	0.988	2.50	32.48	OK	B
	D3	9.67	8	660	1.212	0.035	21.0	133	0.7	2.51	D3	600	7.0	0.012	2.0	0.500	1.750	3.580	0.489	1.92	3.35	OK	C
	D4	276	36	2550	1.412	0.035	20.4	135	0.7	72.77	D4	2050	12.0	0.006	13.0	1.500	26.250	17.740	1.480	2.84	74.51	OK	D
	D5	5.53	4	380	1.053	0.035	21.6	133	0.7	1.44	D5	370	4.0	0.011	2.0	0.500	1.750	3.580	0.489	1.84	3.23	OK	C
	D6	5.61	4	390	1.026	0.035	21.8	133	0.7	1.46	D6	370	4.0	0.011	2.0	0.500	1.750	3.580	0.489	1.84	3.23	OK	C
	D7	29.2	7	1130	0.619	0.035	24.1	126	0.7	7.19	D7	940	4.0	0.004	5.0	0.700	4.970	7.212	0.689	1.45	7.23	OK	F
	D8	21.6	6	890	0.674	0.035	23.7	127	0.7	5.36	D8	720	3.0	0.004	5.0	0.700	4.970	7.212	0.689	1.44	7.15	OK	F
Catch Drains	C1	14.79	10	960	1.042	0.035	21.7	133	0.7	3.84	C1	945	7.0	0.007	5.0	0.500	3.250	6.580	0.494	1.54	4.99	OK	A
	C2	41.53	5	1050	0.476	0.035	25.4	123	0.7	9.98	C2	630	3.0	0.005	5.0	1.000	8.000	8.160	0.980	1.95	15.57	OK	E
	C3	100.5	10	1950	0.513	0.035	25.0	124	0.7	24.34	C3	1850	9.0	0.005	10.0	1.000	13.000	13.160	0.988	1.98	25.70	OK	B
	C4	19.31	5	660	0.758	0.035	23.1	128	0.7	4.83	C4	650	4.5	0.007	5.0	0.500	3.250	6.580	0.494	1.49	4.83	OK	A
	C5	5.05	4	320	1.250	0.035	20.9	133	0.7	1.31	C5	310	4.0	0.013	2.0	0.500	1.750	3.580	0.489	2.01	3.52	OK	C
	C6	5.05	4	320	1.250	0.035	20.9	133	0.7	1.31	C6	310	4.0	0.013	2.0	0.500	1.750	3.580	0.489	2.01	3.52	OK	C
	C7	14.64	2	720	0.278	0.035	28.2	118	0.7	3.37	C7	710	3.0	0.004	5.0	0.500	3.250	6.580	0.494	1.16	3.77	OK	A
	C8	18.39	2	1120	0.179	0.035	30.9	114	0.7	4.09	C8	1070	2.0	0.002	5.0	0.700	4.970	7.212	0.689	0.96	4.79	OK	F