Erosion and Sediment Control Plan
Bing Bong Haul Road

Western Desert Resources Ltd

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Executive Summary

VDM Consulting has been engaged by Ecoz Pty Ltd on behalf of Western Desert Resources Limited (WDRL) to prepare an Erosion and Sediment Control Plan (ESCP) for a proposed haul road as part of the Roper Bar iron ore mine.

The ESCP details the following:

- Erosion and Sediment Control measures for the haul road; and
- Maintenance and Monitoring Program.

Sediment and erosion control devices for the haul road 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 Channel;
- Catch Drains;
- Silt Fences;
- Check Dams;
- Level Spreaders;
- Sediment Basins; and
- Floating Booms.

Diversion bunds will direct clean runoff around the construction site, incorporating check dams to limit erosion within the drain itself. Catch drains will capture contaminated runoff from the construction site and direct it toward sediment basins. Floating booms will ensure that contaminated water generated by creek crossing construction works will be contained. Sediment Basins located every 500 m will treat contaminated runoff prior to discharge. The treatment measures listed above have been sized to cater for a 1 in 10 year storm event.

The erosion and sediment control drawings provided in Appendix A show the location and details of the proposed sediment and erosion control devices.

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.

Contents

1 Introduction 6

1.1 Background 6

1.2 Scope 7

1.3 Objectives 7

1.4 Relevant Legislation and Guidelines 7

1.5 Performance Criteria 7

2 Site Characteristics 8

2.1 Locality 8

2.2 Topography 8

2.3 Disturbance 8

2.4 Soils and Land Units 8

3 Erosion and Sediment Control 12

3.1 Principles of Erosion and Sediment Control 12

3.2 Management of Erosion and Sediment Control 13

3.3 Erosion and Sediment Controls 15

3.4 Restricted Areas 17

3.5 Construction Phase Monitoring 17

3.6 Contingencies 18

3.7 Responsibilities 18

3.8 Awareness and Training 20

4 Conclusions 21

Tables

Table 2.1 Land Unit Types on the Subject Site 10
Table 3.1 Check Dam Spacing 16
Table 3.2 Annual Sediment Loss Prediction 16
Table 3.3 Sediment Basin Configuration 17
Table 3.4 Party Responsibilities 18

Figures

Figure 1.1 Proposed Roper Bar Mine and Haul Road Layout 6
Figure 2.1 Soil Types 9
Figure 2.2 Land Units at the Proposed Development Site 9

Appendices

Appendix A – Erosion and Sediment Control Plan and Details 22
Appendix B – Complaints Register 23
Appendix C – Incident/Non-Conformance Notification Form 25

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 haul road between the mine site at Roper Bar and Bing Bong Port in the Gulf of Carpentaria. 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 Australiasia 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. 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 of WDRL has engaged VDM Consulting to prepare a sediment and erosion control plan for the haul road which links the proposed mine and the existing Bing Bong Port. This haul road will be used to transport bulk iron ore prior to loading onto barges at Bing Bong Port.

As part of the construction strategy for the haul road, the project has been split into 4 packages. The erosion and sediment control philosophy remains constant across all packages. Figure 1.1 shows the locations of the proposed mine site, haul road, and Bing Bong Port.

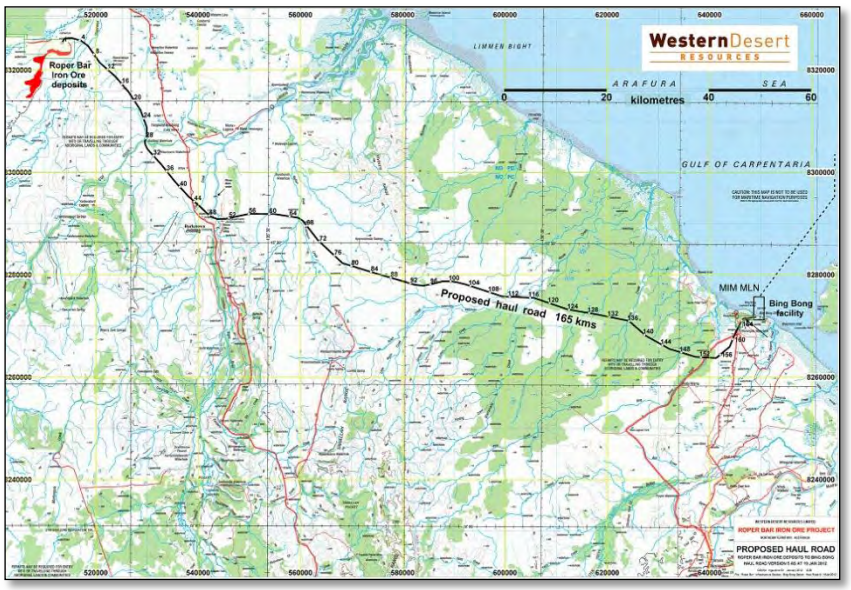

Figure 1.1 Proposed Roper Bar Mine and Haul Road Layout

1.2 Scope

Specifically, this report details the following:

- Erosion and Sediment Control measures for the proposed haul road; 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 haul road portion of the proposed development:

- Stable embankments and drainage channels;
- No obvious accumulation of sediment within natural watercourses 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 0.5 m contours along the length of the haul road. The haul road alignment traverses many small and large waterway crossings, and traverses a variety of topographical features from low lying wetland areas to rock rises. Appendix A includes catchment plans for the length of the haul road, which also incorporates topographical information.

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 along the length of the haul road. There are also small sections of Kandosols and Vertosols (Figure 2.1). The land units found along the haul road alignment are shown below in Figure 2.2 and are described in Table 2.1.

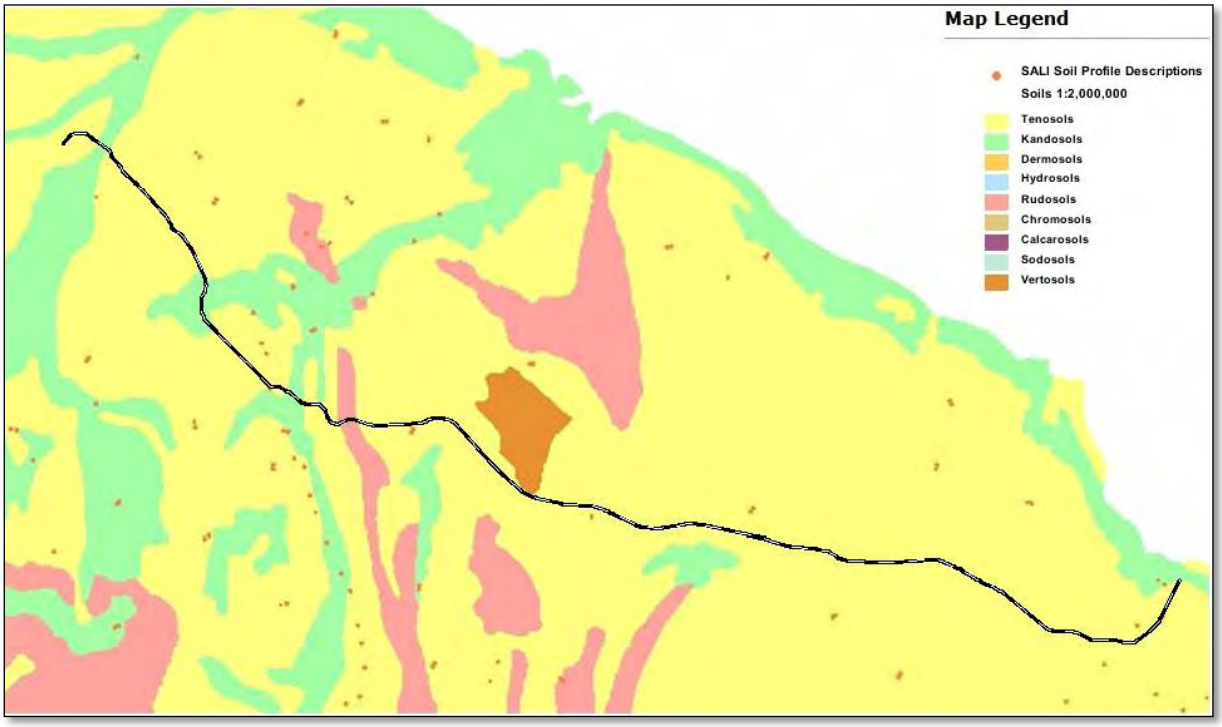

Figure 2.1 Soil Types

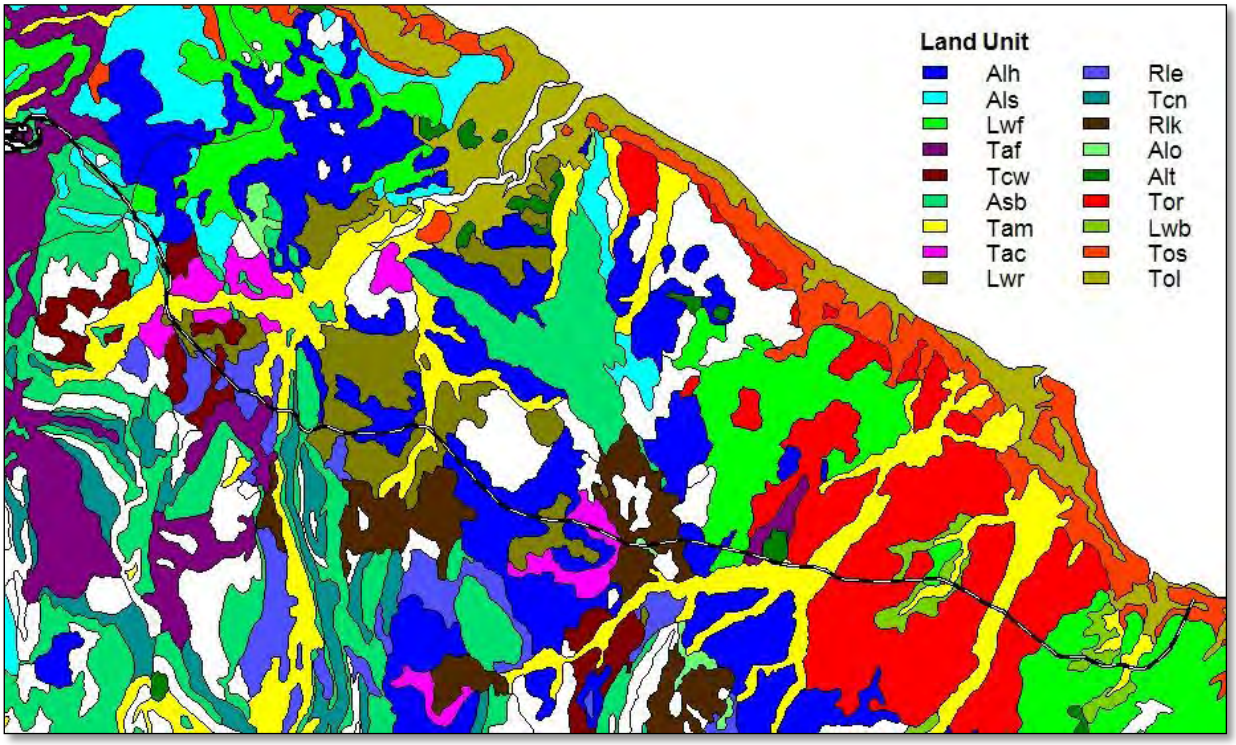

Figure 2.2 Land Units at the Proposed Development Site

Table 2.1 Land Unit Types on the Subject Site

Land Unit	Land Form	Soils	Vegetation
Tos	Coastal sand sheets, dunes and cheniers with minor intervening tidal flats	Siliceous sands and yellow podsolic soils	Tall grassland of Chrysopogon elongatus with some Melaleuca viridiflora, Melaleuca nervosa, Pandanus spiralis and C. bella
Tol	Flat to gently undulating upland surface	Shallow, gravelly yellow massive earths, minor lateritic lithosols	Eucalyptus miniata, E. Tetrodonta Sorghum spp.
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 E. dichromophloia with E. miniata, E. tetrodonta and E. leucophloia
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 E. tectifica, E. terminalis and Erythrophleum chlorostachys
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 E. miniata, E. tetrodonta and E. Jerruginea with E. dichromophloia and E. leucophloia
Lwf	Level to very gently undulating plains on ferruginous material (laterite) that has been re-exposed from a sub marine position, with swales in a sub-coastal orientation	Level to very gently undulating plains on ferruginous material (laterite) that has been re-exposed from a sub marine position, with swales in a sub-coastal orientation	Tall open woodland of E. tetrodonta with Melaleuca viridiflora, Melaleuca nervosa and Callitris intratropica
Tcw	Gently undulating plains and pediplains on transported material or argillaceous sediments	Yellow podsolics and solodic soils	Mid-high woodland of Melaleuca citrolens
Tac	Level to gently undulating plains on unconsolidated transported materials, rarely sedentary	Grey and brown clays, minor black earths	Tall open grassland of Chrysopogon fallax and Eulalia aurea with some E. microtheca and E. pruinosa; mid-high open woodland of E. microtheca with some Excoecaria parvifolia and C. bella
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 C. terminalis and E. microtheca with some C. bella and C. polycarpa; tall fringing riparian vegetation often includes Melaleuca spp.
Lwr	Gently undulating plains and rises on ferruginised, mainly arenaceous	Lateritic podsolics and lithosols	Tall open woodland of E. tetrodonta with C. dichromophloia, C. ferruginea, E. miniata and E. phoenicea

Land Unit	Land Form	Soils	Vegetation
	sediments		
Rle	Tall open woodland of E. tetrodonta with C. dichromophloia, C. ferruginea, E. miniata and E. phoenicea	Lithosols and shallow yellow earths	Mid-high open woodland of C. latifolia with some E. tectifica, C. terminalis and Erythrophleum chlorostachys
Tcn	Pediments, and side slopes of broad valleys on detritus and argillaceous sediments	Pediments, and side slopes of broad valleys on detritus and argillaceous sediments	Mid-high open woodland E. tectifica, C. terminalis and Erythrophleum chlorostachys with some Bauhinia cunninghamii and Melaleuca citrolens
Alh	Gently undulating plains on sandstone with deep sandy soils and isolated swampy depressions	Siliceous sands and earthy sands	Tall open woodland of E. tetrodonta and E. miniata; C. polycarpa and Melaleuca viridiflora occur on wetter areas
Rlk	Tall open woodland of E. tetrodonta and E. miniata; C. polycarpa and Melaleuca viridiflora occur on wetter areas	Tall open woodland of E. tetrodonta and E. miniata; C. polycarpa and Melaleuca viridiflora occur on wetter areas	Mid-high open woodland of E. tectifica, C. terminalis and Erythrophleum chlorostachys with Melaleuca viridiflora, Pandanus spiralis and C. polycarpa on low lying areas
Alo	Very rocky gently undulating rises on massive sandstones	Lithosols	Mid-high open woodland of C. dichromophloia
Alt	Undulating rises to low hills with some rocky outcrops on sandstone	Lithosols and siliceous sands	Mid-high open woodland of E. phoenicea with C. polycarpa on lower slopes
Tor	Almost level plains on old sea-floor deposits with regular dune-swale systems, or isolated sand dunes, in sub-coastal orientation	Earthy sands and yellow podsolic soils	Tall open woodland of E. tetrodonta with Melaleuca viridiflora and Asteromyrtus symphyocarpa on low lying areas
Lwb	Incised, undulating rises flanking streams	Ferruginous lithosols and earthy sands	Mid-high open woodland of E. tetrodonta with Callitris intratropica

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 haul road.

Clearing of the site and the construction of erosion and sediment controls is to 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 specified erosion and sediment 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 work will be possible. Therefore it is anticipated and recommended that 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 road alignment into the local topography and soil distribution;
- 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 will be undertaken where necessary and is to be restricted to identified areas only;
- Diversion Channels– Used to divert clean water from upstream catchments around the site, and convey flow within disturbed areas to sediment basins;
- Catch Drains – Used on the downstream side of the construction to capture contaminated runoff;
- Silt Fences – Used to intercept runoff from disturbed areas and aims to temporarily pond up-slope water allowing settlement.
- Check Dams – Used to reduce velocities within open drains. This will protect the open drain itself from erosion.;

- Level Spreaders – Used to reduce velocities and return channelised flow to sheet flow;
- Sediment Basins – Used to trap and retain sediment via settlement of suspended particles;
- Floating Booms – Used to sediment export from constructions within waterways.

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 channels 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. Details of these devices are contained within the drawings in Appendix A.

3.3.1 Diversion Channels

Diversion channels are to be constructed on the upstream side of the haul road to direct clean runoff around the construction works area. This will minimise the volume of water which will require treatment. The capacity of the diversion channels has been calculated using Manning's equation for a minimum bed slope of 1 in 1,000 and a roughness of 0.035. The catchment runoff draining into the diversion channels has been based on a typical two (2) hour duration storm with a 1 in 10 year rainfall intensity of 47 mm/hr and a runoff coefficient of 0.30 (in accordance with the WDRL hydrology report). The maximum catchment area draining into each diversion channel along the length of the haul road is 256 ha. This equates to a 1 in 10 year peak flow of 10.0 m^3/s. The proposed diversion channels will therefore have a maximum flow depth of 1.41 m, resulting in a 2 m wide inundation of the road shoulder.

3.3.2 Catch Drains

Catch Drains will be utilised on the downstream side of the road construction to capture contaminated water running off the construction area. These drains will direct runoff into the sediment basins where it will be treated prior to release. Check dams will be installed within the catch drains to create sediment basins. Catch drains have been sized to capture the 1 in 10 year storm event.

3.3.3 Check Dams

Check Dams will be utilised within the proposed diversion channels on the upstream side of the proposed works and within the proposed catch drains on the downstream site of the haul road. These devices will be used to reduce the velocities within the Diversion channels and prevent scouring. On the downstream side of the haul road within the Catch Drains the proposed Check Dams will create opportunities for runoff to pond, promoting settlement of sediments. In effect the Check Dams will be used to created small sediment basins.

Check Dams are to be composed of 200 mm rock spalls with a height of 400 mm. Longitudinal spacing of the check dams within the drains will be as per Table 3.1 below.

Table 3.1 Check Dam Spacing

Longitudinal Slope	Check Dam Spacing	Length of Road
0 – 1 %	Not Required	116.0 km
1 – 2 %	200 m	31.5 km
2 – 3 %	100 m	10.0 km
> 3 %	50 m	8.5 km

3.3.4 Sediment Fences

Given the maintenance involved with Sediment Fences and the isolated nature of the site the use of Sediment Fences has been minimised. These control measures will be used at the base of exposed batters where obvious risk of sediment export is evident.

3.3.5 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.

3.3.6 Sediment Basins

Sediment basins are generally required where:

- Areas with exposed highly erodible soils;
- Areas with exposed slopes greater than 2%; and
- 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 are to be installed on the downstream side of the road at maximum 500 m spacings. The catchment for each basin will therefore be the width of half of the road plus the width of the catch drain multiplied by 500 m (7,500 m^2 total for each basin). 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 3.2 Annual Sediment Loss Prediction

Basin ID	Ac (ha)	Slope Grade	Intensity $^{6}I_{2}$(mm/hr)	R	K	LS	C	P	A (t/ha/yr)	Yield (m^3/yr)
Typical	0.75	1	16.1	13738	0.047	0.24	1	1.3	201.5	116

Table 3.3 Sediment Basin Configuration

Catchment	Area (ha)	Settling Zone Volume (m^3)	Storage Zone Volume (m^3)	Surface Area (m^2)	Length (m)	Width (m)	Total Depth (m)	Total Volume (m^3)
500 m length	0.75	168	51	450	45	10	0.75	219

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 m^3 of water.

3.3.7 Floating Booms

Floating Booms are used to contain sediment and construction debris when work is being carried out within a natural watercourse. The booms are to be placed within the watercourse on the downstream side of the construction works prior to commencement of any construction.

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. This will comprise the collection of water samples after the following rainfall events:

- Three storm events of greater than 25 mm; and
- Three smaller rainfall events.

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 anolytes 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 3.4 presents the specific responsibilities that pertain to this CMP.

Table 3.4 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 *status quo*. • 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.

3.8 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 Channels;
- Catch Drains;
- Silt Fences;
- Check Dams;
- Level Spreaders;
- Sediment Basins; and
- Floating Booms.

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 HAUL ROAD

CONTRACT GC120095-EP01

EROSION AND SEDIMENT CONTROL

LOCALITY PLAN

SCHEDULE OF DRAWINGS	
Drawing No.	Drawing Title
GC120095-EP01-N000	COVER SHEET, SCHEDULE OF DRAWINGS
GC120095-EP01-N001	OVERALL LAYOUT PLAN
GC120095-EP01-N002	CATCHMENT PLAN HAUL ROAD PACKAGE No. 1
GC120095-EP01-N003	CATCHMENT PLAN HAUL ROAD PACKAGE No. 2
GC120095-EP01-N004	CATCHMENT PLAN HAUL ROAD PACKAGE No.3
GC120095-EP01-N005	CATCHMENT PLAN HAUL ROAD PACKAGE No.4
GC120095-EP01-N006	SEDIMENT AND EROSION CONTROL PLAN
GC120095-EP01-N007	SEDIMENT AND EROSION CONTROL TYPICAL DETAILS

PREPARED FOR

WESTERN DESERT RESOURCES

PREPARED BY

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ABN 91 087 601 296

DATE : 03-03-2012

PROJECT No.:	DRAWING No. :	VERSION:
GC120095-EP01	N000	A

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

OVERALL LAYOUT PLAN

SCALE 2000 0 2000 4000 6000 8000 10000 (metres)
1 : 200,000 (FULL SIZE)

ROPER BAR MINE TO BING BONG HAUL ROAD

FOR

WESTERN DESERT RESOURCES

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		22-03-12

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ABN 91 087 601 296

PROJECT:
EROSION AND SEDIMENT CONTROL for PROPOSED HAUL ROAD

DRAWING TITLE :
OVERALL LAYOUT PLAN

DEVEL. APPLIC. No. :		DATE : 22-03-12
PROJECT LEADER : BRAD COMLEY	DESIGNER : PAUL COUCHMAN	
DRAFTSPERSON : PAUL COUCHMAN	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.: GC120095-EP01	DRAWING No. : N001	VERSION: A

FILENAME: R:\3127\GC120095_Haul Road EIS_ Erosion & Sediment Control Plans\Acad\EP01\GC120095-EP01-N001-A.dwg
PLOTTED: 23 Apr 2012

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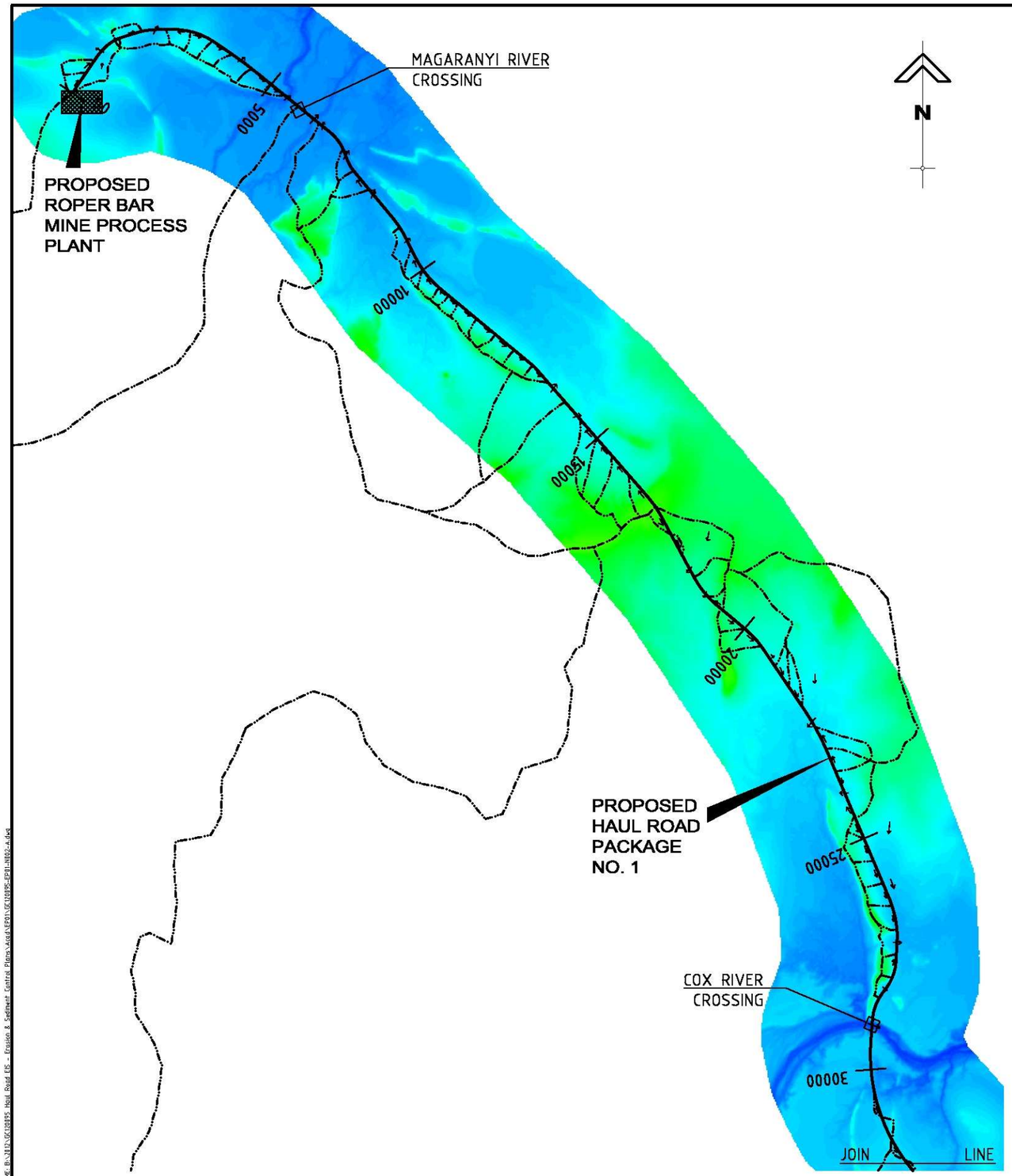
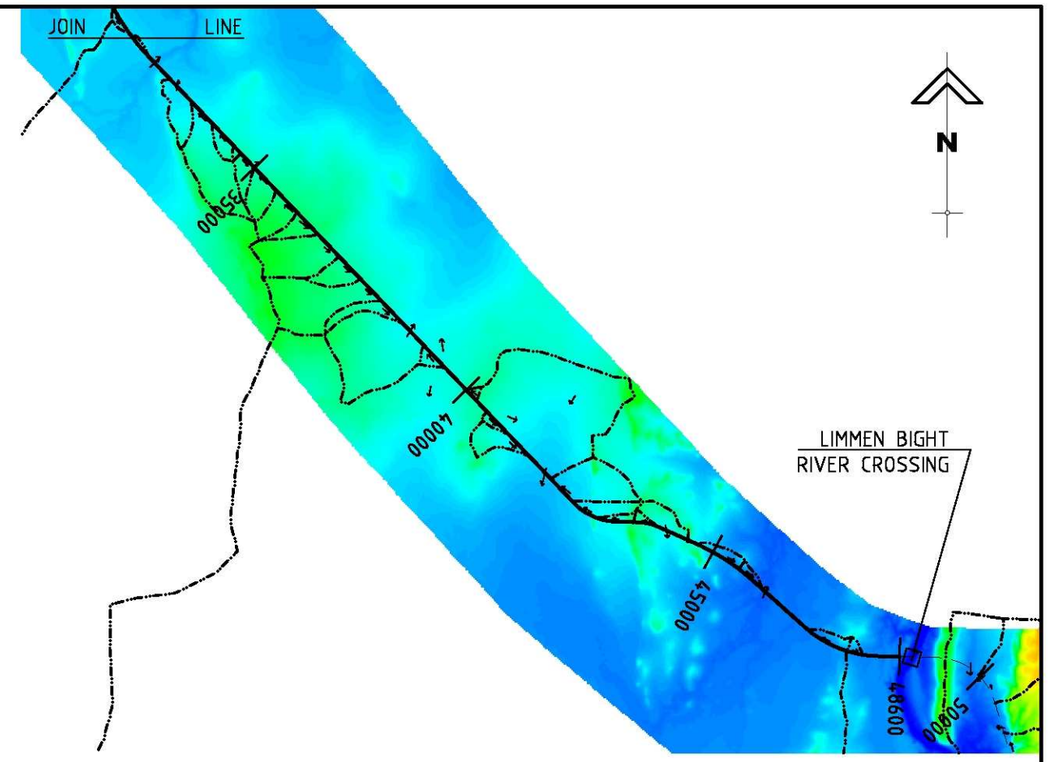


PLAN



PLAN

CONTOUR LEGEND

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RL4m TO 5m	RL54m TO 55m
RL5m TO 6m	RL55m TO 56m
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RL47m TO 48m	RL97m TO 98m
RL48m TO 49m	RL98m TO 99m
RL49m TO 50m	RL99m TO 100m

LEGEND

CATCHMENT BOUNDARY

DIRECTION OF FLOW

SCALE 500 0 500 1000 1500 2000 2500 (metres)

1 : 50000 (FULL SIZE)

ROPER BAR MINE TO BING BONG HAUL ROAD

FOR

WESTERN DESERT RESOURCES

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03-04-12

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VDM Engineering (Eastern Operations) Pty Ltd
ABN 91 087 601 296

PROJECT:
EROSION AND SEDIMENT CONTROL for PROPOSED HAUL ROAD

DRAWING TITLE:
CATCHMENT PLAN

HAUL ROAD PACKAGE NO.1

DEVEL. APPLIC. No. :		DATE : 03-04-12
PROJECT LEADER : BRAD COMLEY	DESIGNER : PAUL COUCHMAN	
DRAFTSPERSON : PAUL COUCHMAN	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.: GC120095-EP01	DRAWING No. : N002	VERSION: A

FILENAME: B:\2011\GC120095 Haul Road EIS - Erosion & Sediment Control Plans\Acad\EP01\GC120095-EP01-N002-A.dwg
PLOTTED: 4 apr 2012

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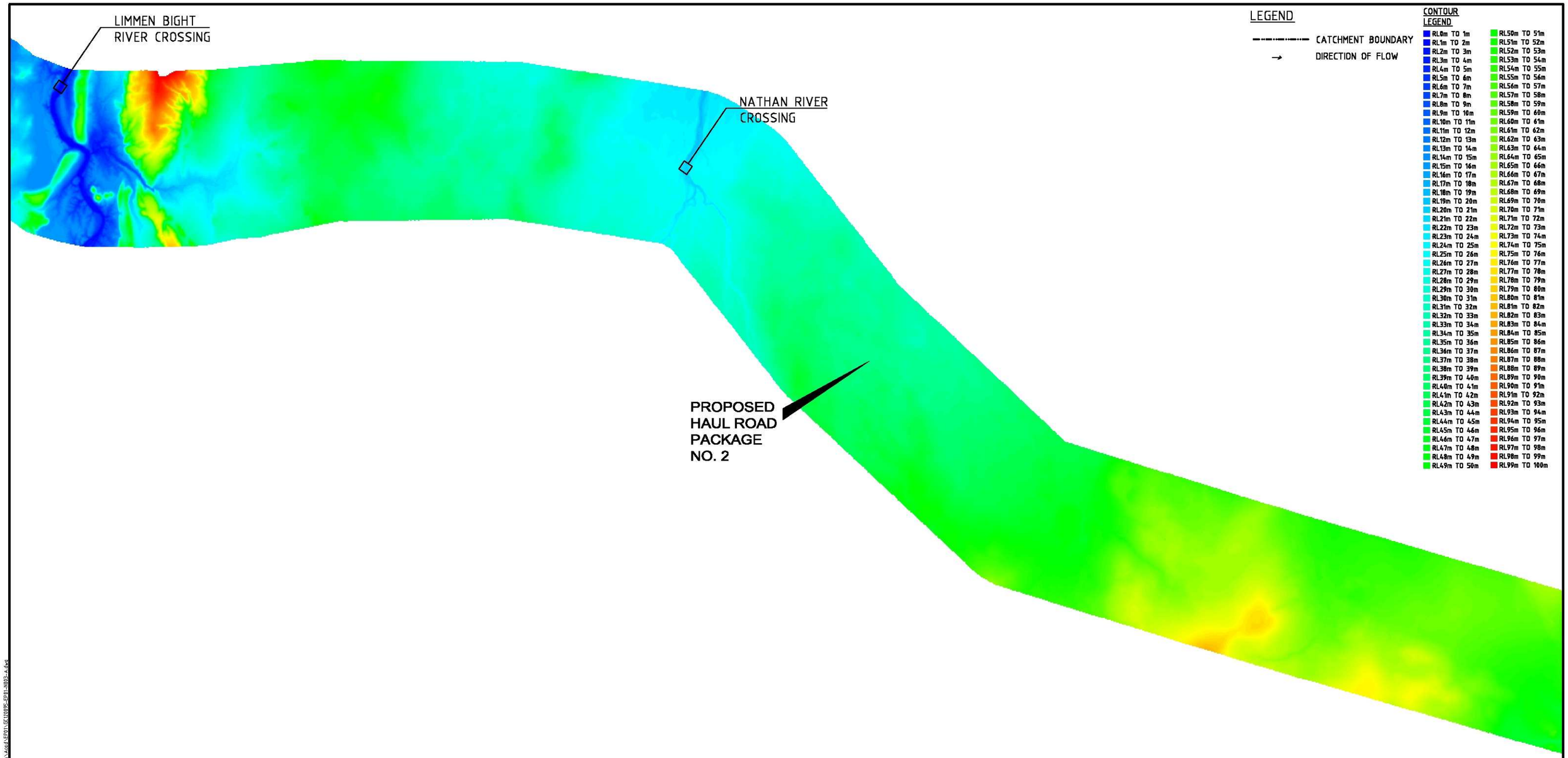

LEGEND

CATCHMENT BOUNDARY

DIRECTION OF FLOW

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RL2m TO 3m
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RL5m TO 6m
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RL97m TO 98m
RL98m TO 99m
RL99m TO 100m

PLAN

SCALE 500 0 500 1000 1500 2000 2500 (metres)
1 : 50000 (FULL SIZE)

ROPER BAR MINE TO BING BONG HAUL ROAD

FOR

WESTERN DESERT RESOURCES

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03-04-12

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PROJECT:
EROSION AND SEDIMENT CONTROL for PROPOSED HAUL ROAD

DRAWING TITLE:
CATCHMENT PLAN

HAUL ROAD PACKAGE NO.2

DEVEL. APPLIC. No. :		DATE : 03-04-12
PROJECT LEADER : BRAD COMLEY	DESIGNER : PAUL COUCHMAN	
DRAFTSPERSON : PAUL COUCHMAN	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.: GC120095-EP01	DRAWING No. : N003	VERSION: A

FILENAME: R:\1212\GC120095 Haul Road EIS - Erosion & Sediment Control Plans\Acad\EP01\GC120095-EP01-N003-A.dwg
PLOTTED: Fri Apr 2012

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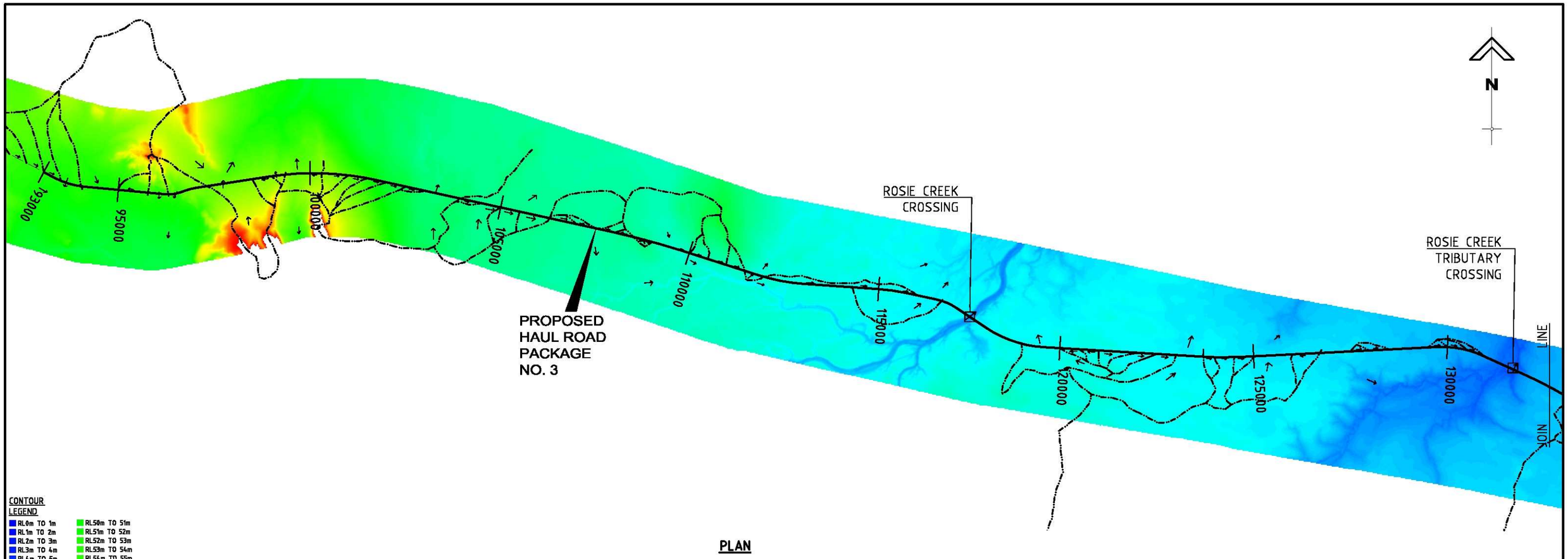
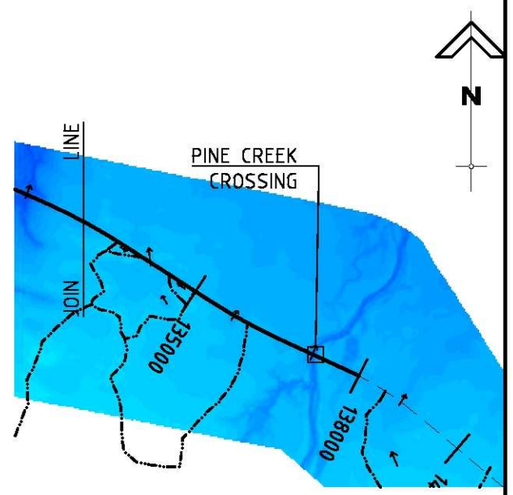


PLAN



PLAN

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RL48m TO 49m	RL98m TO 99m
RL49m TO 50m	RL99m TO 100m

LEGEND

CATCHMENT BOUNDARY

DIRECTION OF FLOW

SCALE 500 0 500 1000 1500 2000 2500 (metres)
1 : 50000 (FULL SIZE)

ROPER BAR MINE TO BING BONG HAUL ROAD

FOR

WESTERN DESERT RESOURCES

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03-04-12

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VDM Engineering (Eastern Operations) Pty Ltd
ABN 91 087 601 296

PROJECT:
EROSION AND SEDIMENT CONTROL for PROPOSED HAUL ROAD

DRAWING TITLE:
CATCHMENT PLAN

HAUL ROAD PACKAGE NO.3

DEVEL. APPLIC. No. :		DATE : 03-04-12
PROJECT LEADER : BRAD COMLEY	DESIGNER : PAUL COUCHMAN	
DRAFTSPERSON : PAUL COUCHMAN	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.: GC120095-EP01	DRAWING No. : N004	VERSION: A

FILENAME: B:\2011\GC120095 Haul Road EIS - Erosion & Sediment Control Plans\Acad\EP01\GC120095-EP01-N004-A.dwg
PLOTTED: 5 Apr 2012

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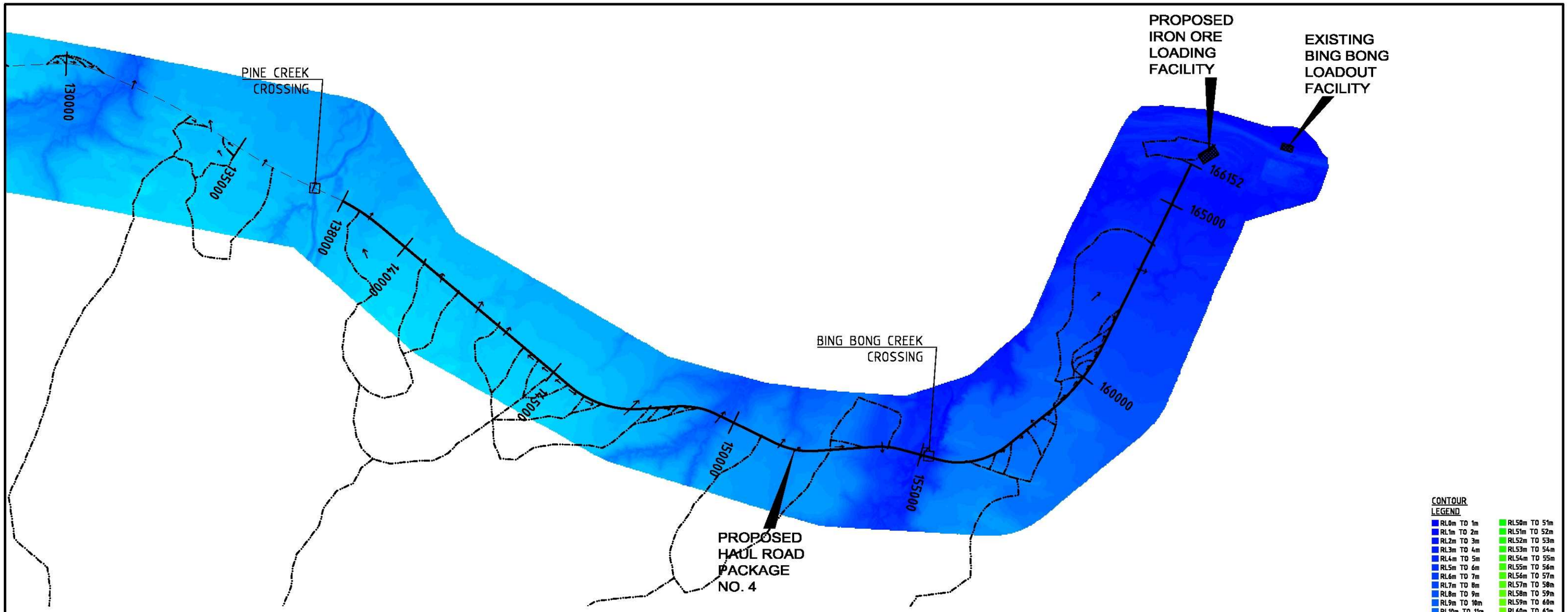

PLAN

CONTOUR LEGEND

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RL49m TO 50m	RL99m TO 100m

LEGEND

CATCHMENT BOUNDARY

DIRECTION OF FLOW

SCALE 500 0 500 1000 1500 2000 2500 (metres)
1 : 50000 (FULL SIZE)

ROPER BAR MINE TO BING BONG HAUL ROAD

FOR

WESTERN DESERT RESOURCES

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03-04-12

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VDM Engineering (Eastern Operations) Pty Ltd
ABN 91 087 601 296

PROJECT:
EROSION AND SEDIMENT CONTROL for PROPOSED HAUL ROAD

DRAWING TITLE:
CATCHMENT PLAN

HAUL ROAD PACKAGE NO.4

DEVEL. APPLIC. No. :	DATE : 03-04-12
PROJECT LEADER : BRAD COMLEY	DESIGNER : PAUL COUCHMAN
DRAFTSPERSON : PAUL COUCHMAN	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.: GC120095-EP01	DRAWING No. : N005 / VERSION: A

FILENAME: B:\2010\GC120095 Haul Road EIS - Erosion & Sediment Control Plans\Acad\EP01\GC120095-EP01-N005-A.dwg
PLOTTED: 5 Apr 2012

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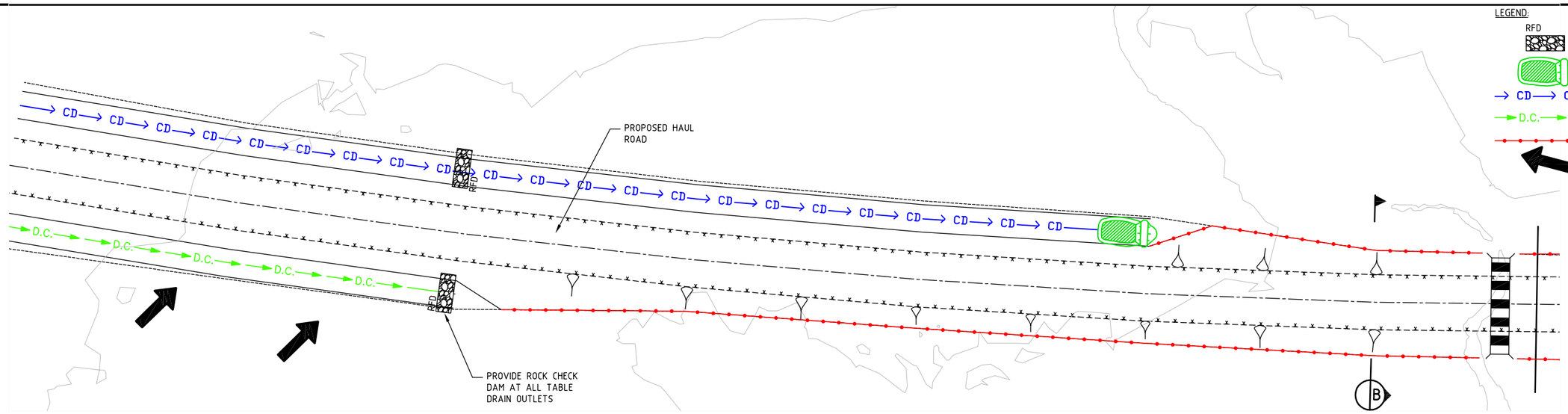
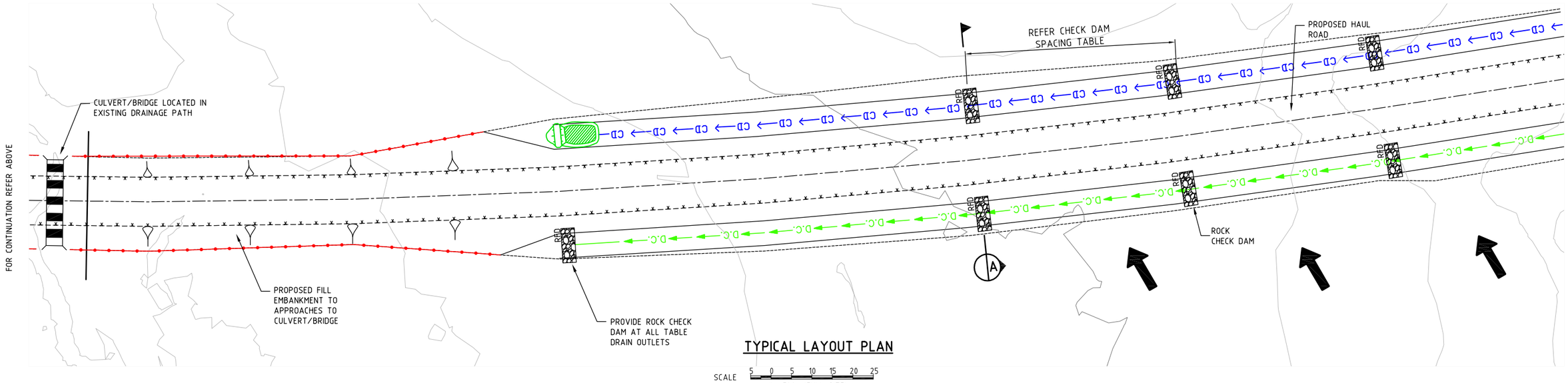
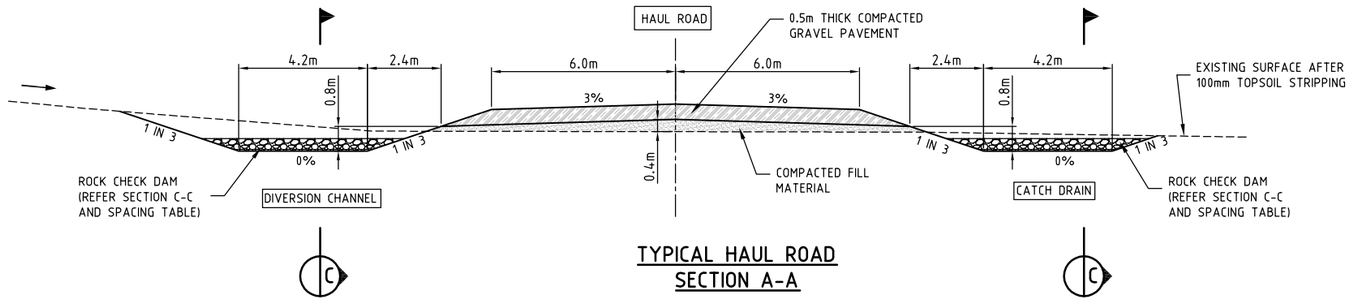




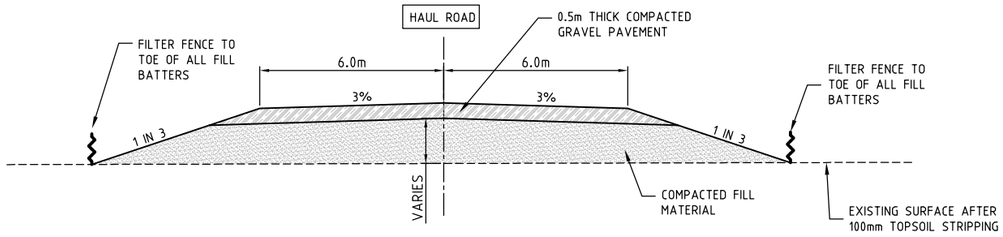
TYPICAL LAYOUT PLAN

SCALE 5 0 5 10 15 20 25 (metres)
1 : 500 (FULL SIZE)



TYPICAL HAUL ROAD SECTION A-A

SCALE 1 0 1 2 3 4 5 (metres)
1 : 100 (FULL SIZE)



TYPICAL HAUL ROAD (FILL EMBANKMENT) SECTION B-B

SCALE 1 0 1 2 3 4 5 (metres)
1 : 100 (FULL SIZE)

FILENAME: B:\2012\GC120095_Haul Road EIS - Erosion & Sediment Control Plans\Acad\EP01\GC120095-EP01-N006-A.dwg

PLOTTED: 04 Apr 2012

ROPER BAR MINE TO BING BONG HAUL ROAD

FOR

WESTERN DESERT RESOURCES

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03-04-12

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

PROJECT:

EROSION AND SEDIMENT CONTROL for PROPOSED HAUL ROAD

DRAWING TITLE:

SEDIMENT AND EROSION CONTROL PLAN

DEVEL. APPLIC. No.:		DATE: 03-04-12
PROJECT LEADER: BRAD COMLEY	DESIGNER: PAUL COUCHMAN	
DRAFTSPERSON: PAUL COUCHMAN	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.: GC120095-EP01	DRAWING No.: N006	VERSION: A

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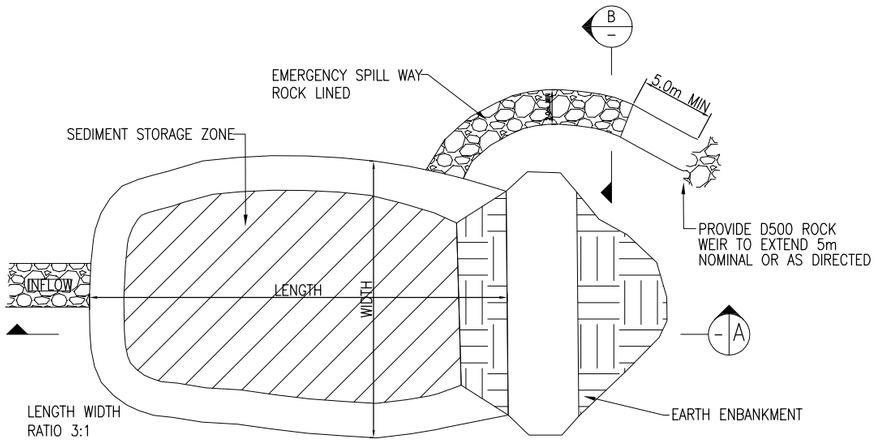
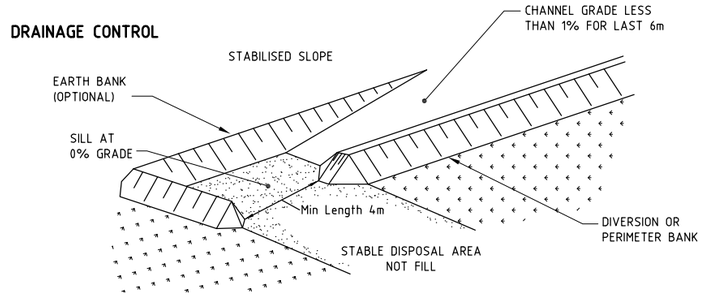


SEDIMENT BASIN DETAIL (TYPICAL)

N.T.S.



LEVEL SPREADER (TYPICAL)

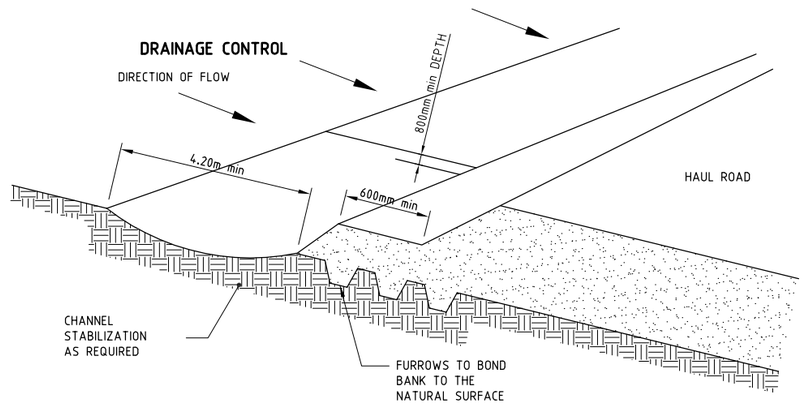
N.T.S.

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.

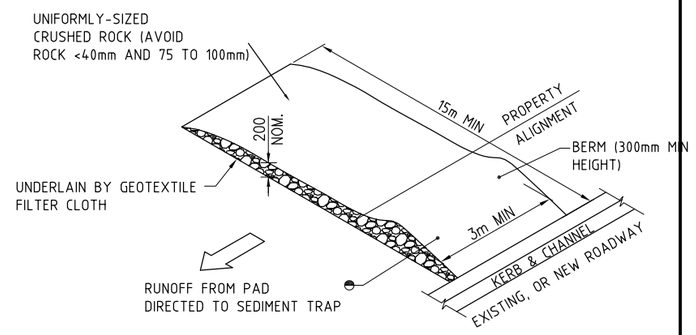
ADDITIONAL EROSION CONTROLS MAY BE REQUIRED DURING CONSTRUCTION AS DETERMINED BY THE SUPERINTENDENT IN CONSULTATION WITH THE NATURAL RESOURCE MANAGEMENT DIVISION, NRETAS.

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



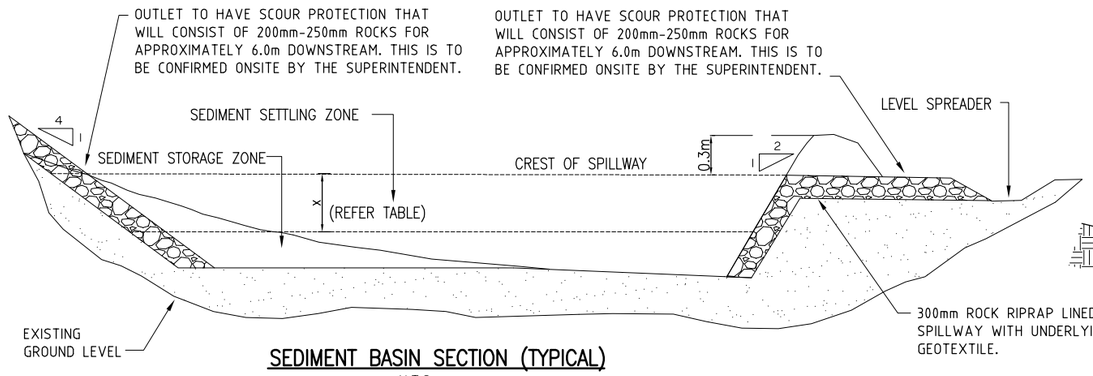
DIVERSION CHANNEL (TYPICAL)

N.T.S.



ROCK CONSTRUCTION EXIT

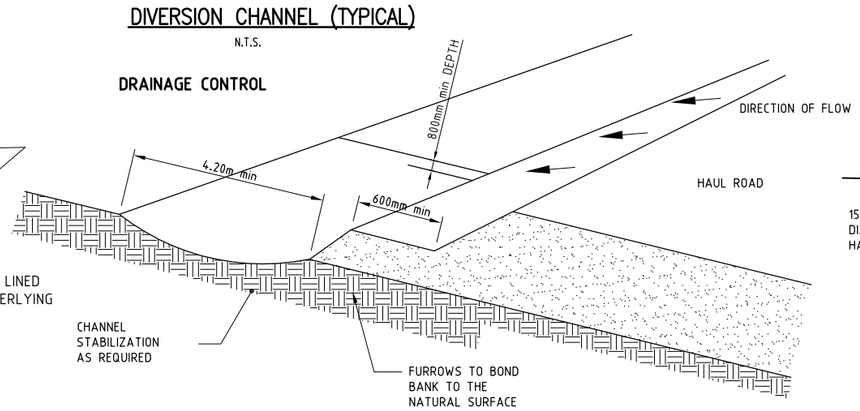
N.T.S.



SEDIMENT BASIN SECTION (TYPICAL)

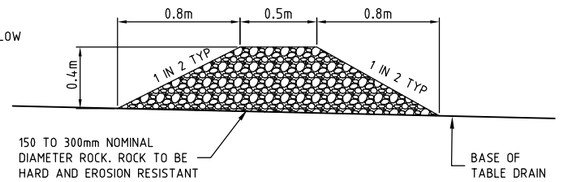
N.T.S.

SECTION A

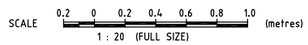


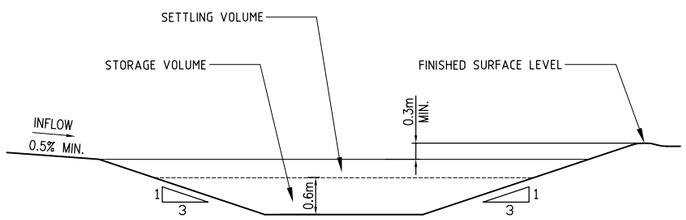
CATCH DRAIN (TYPICAL)

N.T.S.



CHECK DAM SECTION C-C





CROSS SECTION THROUGH SEDIMENT BASIN A (TYPICAL)

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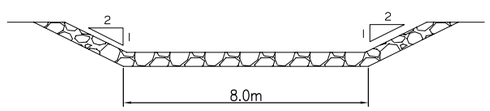
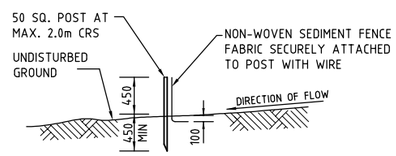


OUTLET WEIR SECTION (TYPICAL)

N.T.S.

SECTION C



SEDIMENT FENCE

NOT TO SCALE

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

ROPER BAR MINE TO BING BONG HAUL ROAD

FOR

WESTERN DESERT RESOURCES

VER.	DESCRIPTION	APPR.	DATE
A	ORIGINAL ISSUE		03-04-12

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ABN 91 087 601 296

PROJECT:
EROSION AND SEDIMENT CONTROL for PROPOSED HAUL ROAD

DRAWING TITLE:
SEDIMENT AND EROSION CONTROL TYPICAL DETAILS

DEVEL. APPLIC. No. :		DATE : 03-04-12
PROJECT LEADER : BRAD COMLEY	DESIGNER : PAUL COUCHMAN	
DRAFTSPERSON : PAUL COUCHMAN	CHECKED :	
APPROVED FOR AND ON BEHALF OF VDM ENGINEERING (EASTERN OPERATIONS) PTY LTD ACN 087 601 296		
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SCALE : AS SHOWN	DATUM : AHD	FULL SIZE : A1
PROJECT No.: GC120095-EP01	DRAWING No. : N007	VERSION: A

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PLOTTED: 04 Apr 2012

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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**