



# **GRANTS LITHIUM PROJECT**

## **Environmental Impact Statement**

### **Appendix F**

## **Erosion and Sedimentation Control Plan**

Prepared by EcOz  
October 2018



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## **Environmental Impact Statement**

# **Erosion and Sediment Control Plan**



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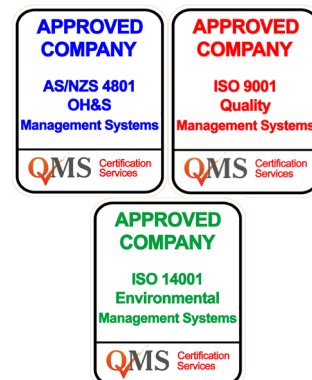
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# ABBREVIATIONS AND DEFINITIONS

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|                |                                                                                                             |
|----------------|-------------------------------------------------------------------------------------------------------------|
| <b>ARI</b>     | annual recurrence interval                                                                                  |
| <b>BoM</b>     | Bureau of Meteorology                                                                                       |
| <b>DMS</b>     | dense medium separation                                                                                     |
| <b>DPIR</b>    | Department of Primary Industry and Resources (Northern Territory)                                           |
| <b>EIS</b>     | Environmental Impact Statement                                                                              |
| <b>ESCP</b>    | Erosion and Sediment Control Plan                                                                           |
| <b>MCP</b>     | Mine Closure Plan                                                                                           |
| <b>ML</b>      | megalitre (10 <sup>6</sup> litres)                                                                          |
| <b>ML</b>      | Mineral Lease (granted)                                                                                     |
| <b>MMP</b>     | Mining Management Plan                                                                                      |
| <b>Mt</b>      | million tonnes                                                                                              |
| <b>NOI</b>     | Notice of Intent                                                                                            |
| <b>NT</b>      | Northern Territory                                                                                          |
| <b>NT EPA</b>  | Northern Territory Environment Protection Authority                                                         |
| <b>Project</b> | Core Exploration Limited's Grants Lithium Project                                                           |
| <b>TDS</b>     | total dissolved solids                                                                                      |
| <b>TSS</b>     | total suspended solids                                                                                      |
| <b>ToR</b>     | <i>Terms of Reference for the Preparation of and Environmental Impact Statement, Grants Lithium Project</i> |
| <b>TSF</b>     | tailings storage facility                                                                                   |
| <b>RoM</b>     | Run of Mine pad                                                                                             |
| <b>WMP</b>     | Water Management Plan                                                                                       |
| <b>WRD</b>     | waste rock dump                                                                                             |

# 1 INTRODUCTION

---

Core Exploration Limited (Core) propose to develop the Grants Lithium Project (the project) open-cut mine located within ML31726, approximately 24 km south of Darwin and 22 km northwest of Berry Springs (Figure 1-1). The targeted ore is a near-vertical pegmatite intrusion, rich in the lithium-bearing mineral spodumene. The ore body will be mined via an open pit using drill and blast methods, and processed on site (crushing, screening and water-based dense medium separation [DMS]) to produce a concentrate for transport via road to Darwin Port for export. Waste rock from the pit will be placed in an onsite waste rock dump (WRD), and waste from processing will be placed in a tailings storage facility (TSF) contained within the WRD. Mine life is expected to be two to three years. Figure 1-2 shows the general mine site layout.

## 1.1 EIS Terms of Reference requirements

The project triggered assessment by Environmental Impact Statement (EIS) under the NT *Environmental Assessment Act*. Information required in the EIS is outlined in “*Terms of Reference (ToR) for the Preparation of an Environmental Impact Statement*” (NT EPA 2018). The ToR (Section 4.2.1.4) require that an ESCP be prepared by a Certified Practitioner in Erosion and Sediment Control (CPESC).

## 1.2 ESCP scope and purpose

This ESCP has been prepared by a CPESC. The scope of the ESCP incorporates the following elements that address the EIS ToR and are in accordance with accepted best practice erosion and sediment control:

- Identification of areas vulnerable to erosion, and receiving waters.
- Details of measures to be implemented to effectively manage erosion, and potential sediment mobilisation associated with the project activities.

The purpose of this ESCP is to:

- Ensure stormwater is managed to protect downstream water quality.
- Prevent erosion and potential sedimentation associated with site activities.
- Provide general drainage, erosion and sediment control practices for the project.
- Provide an erosion assessment by a CPESC.

This ESCP has been prepared to provide a best-practice framework for implementation of effective erosion and sediment control over the life of mine. ESC recommendations and designs provided are consistent with the International Erosion Control Association. *Best Practice Erosion and Sediment Control* (IECA 2008). This plan will be used to inform preparation of Progressive ESCP's that provide detailed site-specific controls relevant to the current operational phase and level of erosion risk (i.e. wet/dry season).

The ESCP links closely with the Water Management Plan prepared for the EIS. The water quality monitoring program detailed in the plan will assess the adequacy of ESC measures in terms of protecting downstream water quality. The Water Management Plan details performance indicators and triggers for review of the ESCP requirements.

Both the ESCP and Water Management Plan submitted with the EIS, are documents that will be updated as the project progresses through more detailed design. Future revisions of both plans will be submitted with the Mining Management Plan (MMP) issued for authorisation under the *Mining Management Act*. The documents will continue to be revised throughout the life of mine as management practices are adapted to the current project stage and to address emerging issues/risks.



**Figure 1-1. Map of project locality**



**Figure 1-2. Map of project site layout**

## 2 PROJECT DETAILS

Major project components are shown in Figure 1-1 and include:

- Open pit and associated heavy vehicle access ramps and haul roads
- WRD and TSF for storage of geochemically benign waste rock and tailings.
- Bund created from topsoil removed from the mine's footprint placed around the WRD to prevent overland flows into the WRD and mine site during rainfall and run-off events
- Bund around northern and eastern sides of the mine site, and drains within the mine site, to capture stormwater incident on the mine site and direct it into sediment basins. Bund will be constructed from low permeability clay material excavated from the pit, topsoiled and vegetated.
- Crushing and screening plant, DMS processing plant and associated reject stockpile area, tailings pipelines, and concentrated product stockpile for loading into road trains and transport to Darwin Port
- Run of Mine (RoM) stockpile pad for receiving unprocessed ore for feeding the processing plants
- Raw water dam (RWD) for supplying operational, short-term water supply for ore processing, dust suppression and office facilities.
- Mine water dams (MWD1 and MWD2) for storage and reuse of water dewatered from the open pit and TSF decant water (process water).
- Heavy vehicle workshop, wash-down area and refuelling station
- Offices and associated light vehicle car park and wash-down

The open pit will be worked over a period of 25 months, followed by mine rehabilitation and closure as outlined in Table 2-1.

**Table 2-1. Mining schedule**

| Year/Month | Months 1-7                                                                                                          | Months 8-25                                                                                                     | Months 26-30                                                                               | Months 31 onward                                                                                                         |
|------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Phase      | Pre-strip & construction                                                                                            | Operation                                                                                                       | Rehabilitation & Closure                                                                   | Post-closure                                                                                                             |
| Activities | Removal of oxide waste and oxidised pegmatite waste. Construction of site infrastructure and processing facilities. | Mining of the pegmatite ore body and adjacent 'fresh' waste, and processing/transport of product to Darwin Port | Rehabilitation and mine closure activities undertaken in accordance with Mine Closure Plan | On-going monitoring of the mine site until rehabilitation completion criteria are achieved and the site is relinquished. |

The topsoil and inundation bunds surrounding the project area are designed to prevent surface water run-off from up-gradient running onto the site; minimising the volume of water coming into contact with mining operations.

Rainfall and run-off captured within the topsoil and inundation bunds will be directed into a drainage network that flows to sediment basins (Figure 1-2). This ESCP details the requirements of measures implemented across the site to minimise erosion and sedimentation associated with run-off from the WRD, access/haul roads, RoM pad and other stockpile areas.

## 3 CURRENT CONDITIONS

### 3.1 Rainfall and evaporation

The project is in the wet-dry tropics. The wet season is typically November to April, and the dry season May to October. Typically, January and February are the wettest months with monthly average rainfall totals between 335 and 448 mm. June, July and August are the driest months when usually no rain falls. Average annual rainfall for these sites ranges between 1622 mm (Darwin River Dam) and 1827 mm (Territory Wildlife Park).

Mean monthly pan evaporation data available for Darwin Airport BoM station (No. 14015) shows maximum evaporation occurs in October, and minimum in February (Figure 3-1; pan evaporation data from World Meteorological Organisation <http://data.un.org/>). Average annual pan evaporation is 2688 mm, which exceeds average annual rainfall by at least 860 mm. Average monthly rainfall significantly exceeds evaporation during the wet season months December to March, whereas average monthly evaporation significantly exceeds rainfall during the late wet season, throughout the dry season and early wet season (April to November).

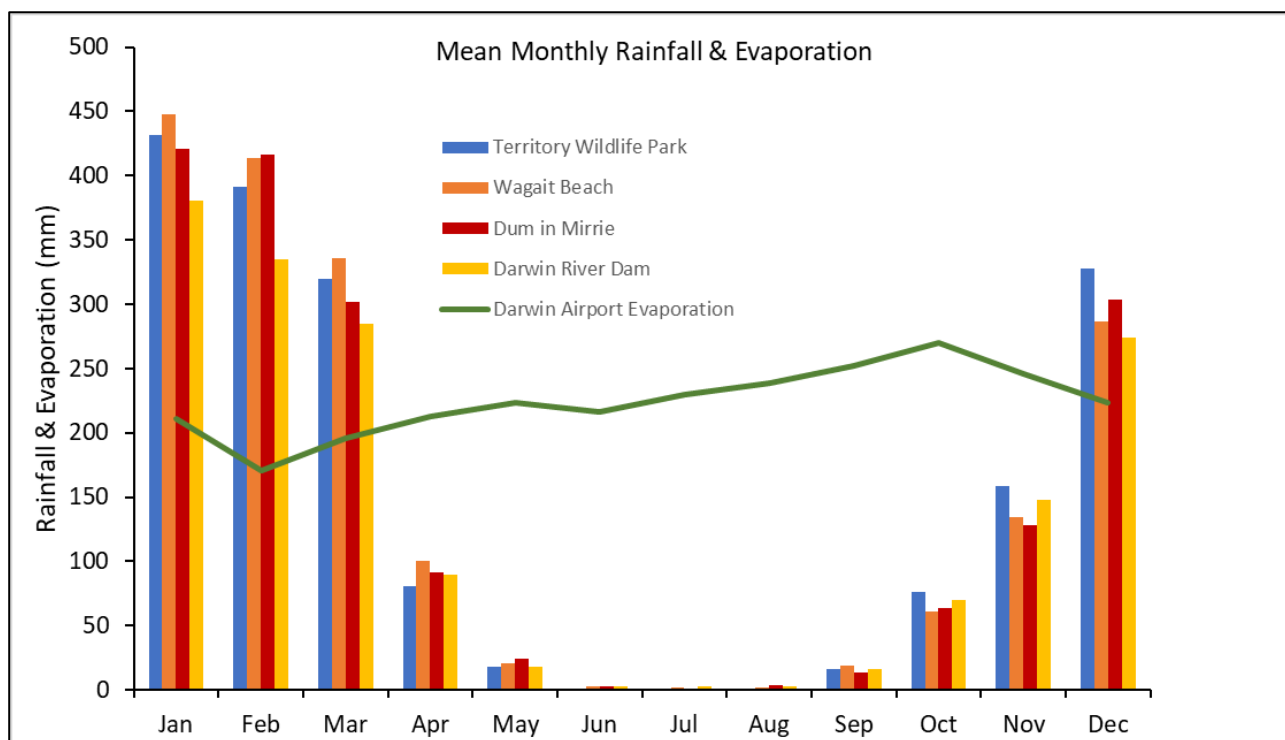


Figure 3-1. Mean monthly rainfall and pan evaporation for closest BoM sites with reliable data

### 3.2 Topography and drainage

The project area is situated on plains and rises intersected by drainage systems and alluvial plains. The land is generally flat; slopes in the area are less than 5 %.

The Darwin Harbour / Bynoe Harbour catchment boundary cuts across the south-west corner of ML31726 (Figure 3-2). A majority of the lease, and all proposed mining infrastructure lies north of this catchment boundary, where surface water drains north into the West Arm of Darwin Harbour estuary. The small drainage lines starting in the south-west corner of ML31726 flow south-west into a tidal inlet of Bynoe Harbour. These drainages are outside of the project disturbance footprint.

The existing Observation Hill Dam, proposed to supply a portion of mining water requirements, lies within the Bynoe Harbour catchment (Figure 3-2).

There are no permanent watercourses within ML31726, and all drainage lines are relatively small and cease to flow early in the dry season. The ephemeral watercourses which drain the areas around the proposed mine footprint, flow north, crossing under the Cox Peninsula Road at two points (culverts), meeting around 1 km north of the mine (Figure 3-2). A further 1 km downstream, the watercourse flows into a mangrove-lined tidal inlet of Darwin Harbour, West Arm.

**Figure 3-2. Map of project area surface water catchments**

### 3.3 Soils and land units

Landform class, land units and associated landform and soil descriptions for the project area, are described within Table 3-1.

**Table 3-1. Land units and soils within the mineral lease boundary**

| Landform Class  | Land Unit | Landform                                                                                  | Soil description                                                                                                                                                                                                                    |
|-----------------|-----------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rises           | 2a1       | Low rises and associated upper slopes.<br>Gradient 0.5-4 %.<br>Extensive surface gravels. | Rudosols.<br>Gravelly lithosols, usually shallow with some moderately deep occurrences.<br>Loamy sand or sandy loam surface to sandy clay loam subsoil.<br>20-40 % gravels in surface, 30-60 % gravels in subsoil.<br>Well drained. |
| Plains          | 6b        | Broad drainage floors and creek margins.<br>Gradient < 1.5 %.                             | Hydrosols<br>Shallow to moderately deep siliceous and earthy sands, minor sandy massive earths.<br>Coarse textured sands to sandy loams.<br>0-10 % gravel in surface, 5-40 % gravel in subsoil.<br>Well drained.                    |
| Alluvial plains | 5a        | Narrow alluvial plains within upland terrain.<br>Gradient < 1.0 %.                        | Hydrosols.<br>Hardsetting apedal mottled yellow duplex soils.<br>Fine sandy loam or loam overlaying light clay to medium clay subsoil.<br>Minor subsoil ferruginous gravels.<br>Imperfectly drained.                                |

The majority of the disturbance area comprises rudisol soils associated with land unit 2a1, with small areas of hydrosols associated with land units 6b (drainage systems) and 5a (alluvial plains) (Figure 3-3).

Land unit mapping shows the project area has a Nil (Class 1) risk of Acid Sulfate Soils which correlates with the Land Systems of the Northern Part of the Northern Territory which shows there is no potential acid sulfate soils within the project area.

### 3.4 Soil characteristics

Soil sampling was undertaken across the project area (Figure 3-3), with subsequent laboratory analysis of a range of physical and chemical characteristics. A summary of the key characteristics relating to potential for soil erosion are provided within Table 3-2. Full results of soil analysis are provided within the document '*Soil and Waste Characterisation Grants Lithium Project*' (EcOz 2018b).

Soil texture is the principal component affecting soil erodibility (structure, organic matter and permeability also contribute). This is discussed further in Section 4.1.2.

The Emerson Class is determined from the Emerson Aggregate Test, and eight-class classification describing the behaviour of air-dried aggregates when placed in distilled water. Specifically, it describes whether the soil aggregates slake or disperse. Soil erodibility factors are required to be adjusted upwards for Emerson Class 1 and 2 soils (not observed from those samples analysed).

**Table 3-2. Soil sample characteristics**

| Sample ID | Unit | Depth (m)  | Horizon | Texture         | Emerson Class | Particle Size |                |                 |               |
|-----------|------|------------|---------|-----------------|---------------|---------------|----------------|-----------------|---------------|
|           |      |            |         |                 |               | Clay (<2 µm)  | Silt (2-60 µm) | Sand (0.06-2mm) | Gravel (>2mm) |
| GPSS01    | 2a1  | 0-0.1      | A1      | Gravelly Sand   | 8             | 11            | 10             | 30              | 49            |
|           |      | 0.1-0.26   | B1      | Sandy Clay Loam | 4             | 15            | 17             | 40              | 28            |
|           |      | 0.26+      | B2      | Gravelly Sand   | 8             | 17            | 12             | 31              | 40            |
| GPSS02    | 2a1  | 0-0.22     | A1      | Loamy Sand      | 4             | 10            | 8              | 34              | 48            |
| GPSS03    | 2a1  | 0-0.19     | A1      | Loamy Sand      | 4             | 10            | 10             | 47              | 33            |
|           |      | 0.19-0.31+ | B2      | Sandy Clay Loam | 4             | 8             | 13             | 49              | 30            |
| GPSS04    | 2a1  | 0-0.06     | A1      | Gravelly Sand   | 8             | 8             | 5              | 27              | 60            |
|           |      | 0.19-0.3+  | B2      | Loamy Sand      | 4             | 10            | 9              | 42              | 39            |
| GPSS05    | 2a1  | 0-0.25     | A1      | Loamy Sand      | 4             | 10            | 14             | 73              | 3             |
|           |      | 0.25-0.37  | B1      | Gravelly Sand   | 8             | 10            | 13             | 46              | 31            |
| GPSS06    | 2a1  | 0-0.14     | A1      | Gravelly Sand   | 8             | 13            | 14             | 27              | 46            |
|           |      | 0.14-0.31+ | B2      | Sandy Clay Loam | 4             | 13            | 14             | 41              | 32            |
| GPSS07    | 2a1  | 0-0.17     | A1      | Sandy Clay Loam | 4             | 11            | 19             | 61              | 9             |
|           |      | 0.17-0.41+ | B2      | Sandy Loam      | 4             | 13            | 15             | 62              | 10            |
| GPSS08    | 2a1  | 0-0.11     | A1      | Sandy Clay      | 4             | 13            | 16             | 62              | 9             |
|           |      | 0.11-0.51+ | B2      | Sandy Clay Loam | 4             | 16            | 13             | 65              | 6             |
| GPSS09    | 2a1  | 0-0.21     | A1      | Gravelly Sand   | 8             | 9             | 8              | 43              | 40            |
|           |      | 0.21-0.41+ | B2      | Gravelly Sand   | 8             | 16            | 16             | 46              | 22            |
| GPSS10    | 2a1  | 0-0.1      | A1      | Sandy Clay      | 4             | 14            | 11             | 27              | 48            |
|           |      | 0.1-0.4+   | B2      | Gravelly Sand   | 8             | 15            | 13             | 31              | 41            |
| GPSS12    | 6b   | 0-0.3      | A1      | Sandy Loam      | 4             | 13            | 25             | 62              | <1            |
|           |      | 0.3-0.5+   | A2      | Sandy Loam      | 4             | 16            | 25             | 56              | 3             |
| GPSS13    | 5a   | 0-0.1      | A1      | Sandy Loam      | 4             | 10            | 28             | 62              | <1            |
|           |      | 0.1-0.3    | A2      | Sandy Loam      | 3             | 11            | 24             | 47              | 18            |
| GPSS14    | 6b   | 0-0.25     | A1      | Sandy Loam      | 4             | 15            | 23             | 62              | <1            |
|           |      | 0.3-0.49+  | B2      | Sandy Clay Loam | 4             | 20            | 16             | 64              | <1            |
| GPSS15    | 6b   | 0.1-0.19   | A1      | Sandy Clay Loam | 4             | 17            | 20             | 63              | <1            |
|           |      | 0.19-0.43  | A2      | Sandy Clay Loam | 4             | 22            | 18             | 59              | 1             |
| GPSS16    | 6b   | 0-0.08     | A1      | Sandy Loam      | 4             | 22            | 16             | 58              | 4             |
|           |      | 0.18-0.46+ | B2      | Sandy Clay Loam | 4             | 24            | 17             | 55              | 4             |
| GPSS17    | 6b   | 0-0.1      | A1      | Sandy Clay      | 4             | 22            | 25             | 53              | <1            |
|           |      | 0.1-0.2    | A2      | Sandy Clay      | 4             | 20            | 28             | 52              | <1            |
|           |      | 0.2-0.49+  | B2      | Sandy Clay      | 4             | 23            | 20             | 56              | 1             |
| GPSSD1    | 2a1  | 0-0.17     | A1      | Sandy Loam      | 4             | 7             | 6              | 33              | 54            |
|           |      | 0.29-0.37+ | B2      | Sandy Loam      | 3             | 8             | 5              | 36              | 51            |
| GPSS04    | 2a1  | 0.06-0.1   | A2      | Gravelly Sand   | 8             | 8             | 7              | 37              | 48            |
|           |      | 0.1-0.19   | B1      | Loamy Sand      | 4             | 8             | 9              | 41              | 42            |



**Figure 3-3. Location of soil sample sites and land units with the mineral lease**

## 4 EROSION HAZARD AND RISK

Inputs and equations used to assess erosion hazard and risk for the project area are detailed in the sections below.

### 4.1 Erosion hazard

Erosion hazard within individual project sub-catchments is assessed using the Revised Universal Soil Loss Equation – RUSLE (IECA 2008). This is commonly used to predict the long term, average, annual soil loss from sheet and rill erosion under specified management conditions. The RUSLE is represented by the following equation:

$$A = R * K * L * S * P * C, \text{ where:}$$

| Factor | Description                        | Value    | Comment                                                                                          |
|--------|------------------------------------|----------|--------------------------------------------------------------------------------------------------|
| A      | estimated soil loss (tonnes/ha/yr) | variable | As calculated per catchment                                                                      |
| R      | rainfall erosivity factor          | 11 994   | Adopted from Darwin Harbour Advisory Committee Research Group for Darwin airport (Section 4.1.1) |
| K      | soil erodibility factor            | 0.043    | 0.043 adopted – worst case scenario (Section 4.1.2)                                              |
| LS     | slope length/gradient factor       | variable | Based on catchment characteristics. (Section 4.1.3)                                              |
| P      | erosion control practice factor    | 1.3      | Construction phase condition (Section 4.1.5)                                                     |
| C      | ground cover and management factor | variable | Based on proposed surface cover. (Section 0)                                                     |

#### 4.1.1 Rainfall erosivity (R-factor)

The rainfall erosivity factor (R-factor) is a measure of the ability of rainfall to cause erosion. It is a product of two components: total energy (E) and maximum 30-minute intensity for each storm (Landcom 2004). The R-factor is an input component in measuring estimated soil loss using the RUSLE calculation. The adopted annual R factor for the project is 11,994; provided by the Darwin Harbour Advisory Committee Research Group to better reflect the rainfall erosivity of the NT.

#### 4.1.2 Erodibility (K-factor)

The K-factor is a numerical representation of the ability of soils to resist the erosive energy of rain (IECA 2008). Soil texture is the principle component affecting K, but soil structure, organic matter and profile permeability also contribute. In the absence of site specific soils information, a K-factor of 0.043 has been adopted for all areas impacted by construction and operation stages of the project. This represents the highest observed soil erodibility, based on texture (sandy clay loam), recorded from soil samples (Table 3-2).

#### 4.1.3 Slope (LS-factor)

The LS-factor describes the combined effect of slope length and slope gradient on soil loss. The project area is characterised by slopes from 0.5 – 4 % (Table 3-1). This represents the topography at the commencement of project construction, with ongoing earthworks during construction and operation to significantly affect both slope gradient and slope length. For processing areas, haul roads, ROM and associated ancillary areas, slopes will reduce, or remain similar to the natural landform (ie. < 4 %). Side-slopes of the WRD will be >10 %.

#### 4.1.4 Cover and management factor (C-factor)

The cover and management factor is a measure of the level of soil surface protection provided by various groundcovers. It includes proportion of vegetation, rock, hardstand, paving, soil binders, matting and associated non-erodible material. The C-factor for the project will vary depending on stabilisation and management of surfaces exposed by construction and operation. C-factors for various surface are summarised in Table 4-1.

**Table 4-1. Adopted C-factors**

| Surface type                                                  | % cover | C-factor     |
|---------------------------------------------------------------|---------|--------------|
| Concrete, bitumen                                             | 100     | 0            |
| Vegetation (highly variable)                                  | 25 - 80 | 0.37 – 0.025 |
| Soil stabiliser (eg. Vital Bon-Matt HR or Bon-Matt RDS (S72)) | 80      | 0.025        |
| Rock                                                          | 80-100  | 0.025 - 0    |
| Competent gravel/soil (eg. haul roads/pads)                   | 20      | 0.44         |
| Bare soil, erosive surface                                    | 0 - 20  | 1 - 0.44     |

#### 4.1.5 Erosion control practice factor (P-factor)

The P-factor measures the combined effect of all support practices and management variables. It also represents structural methods for controlling erosion (IECA 2008). The nominated P-factor for all areas without permanent stable groundcover is 1.3 (based on the default construction phase condition).

#### 4.1.6 Estimated soil loss

Potential soil loss calculations and associated erosion hazard for defined project areas are provided within Table 4-2. Nominated project components reflect the proposed site layout. The mine pit will be fully internally drained, as will the TSF, with any sediment being contained within these structures. Soil loss calculations exclude mine water storage dams, which will also be self-contained.

**Table 4-2. Soil loss and erosion hazard**

| Parameter                                      | Project component                   |           |                            |                |                 |                       |                               |                        |
|------------------------------------------------|-------------------------------------|-----------|----------------------------|----------------|-----------------|-----------------------|-------------------------------|------------------------|
|                                                | Roads                               | Pads      | Perimeter bunds            | Storm-water    | WRD             | TSF                   | Mine Pit                      | Pipeline corridor      |
| <b>Characteristics</b>                         | Compacted, competent gravel surface |           | Stabilised with vegetation | Lined channels | Waste Rock Dump | Tailings Storage      | Internally drained excavation | Narrow easement        |
| <b>Undisturbed (ha)</b>                        | 0                                   | 0         | 0                          | 0              | 0               | 0                     | 0                             | 0                      |
| <b>Disturbed (ha)</b>                          | 8.7                                 | 9.8       | 23                         | 5.4            | 54.5            | 14.3                  | 13.1                          | 6                      |
| <b>Total catchment area (ha)</b>               | 8.7                                 | 9.8       | 23                         | 5.4            | 54.5            | 14.3                  | 13.1                          | 6                      |
| <b>Rainfall erosivity (R)</b>                  | 11994                               | 11994     | 11994                      | 11994          | 11994           | 11994                 | 11994                         | 11994                  |
| <b>Soil erodibility (K)</b>                    | 0.043                               | 0.043     | 0.043                      | 0.043          | 0.043           | 0.043                 | 0.043                         | 0.043                  |
| <b>Slope length (L)</b>                        | 10                                  | 80        | 10                         | 150            | 300             | 300                   | 300                           | 50                     |
| <b>Slope gradient (S)</b>                      | 33                                  | 2         | 25                         | 2              | 4               | 1                     | 4                             | 4                      |
| <b>Length/gradient (LS)</b>                    | 2.41                                | 0.41      | 1.88                       | 0.52           | 1.82            | 0.27                  | 1.82                          | 0.71                   |
| <b>Erosion control practice (P)</b>            | 1.3                                 | 1.3       | 1.3                        | 1.3            | 1.3             | 1.3                   | 1.3                           | 1.3                    |
| <b>Ground cover in disturbed catchment (%)</b> | 75                                  | 25        | 95                         | 75             | 50              | 0                     | 0                             | 50                     |
| <b>Ground cover in disturbed catchment (C)</b> | 0.04                                | 0.37      | 0.005                      | 0.04           | 0.44            | 1                     | 1                             | 0.145                  |
| <b>Treatment</b>                               | Soil binder                         | Hardstand | Hydro-mulch                | Soil binder    | High rock %     | Runoff self-contained | Runoff self-contained         | Mulch berm, vegetation |
| <b>Potential Soil Loss</b>                     |                                     |           |                            |                |                 |                       |                               |                        |
| <b>Soil Loss (t/ha/yr)</b>                     | 65                                  | 102       | 4                          | 14             | 496             | 930                   | 1220                          | 64                     |
| <b>Soil Loss (m<sup>3</sup>/ha/yr)</b>         | 50                                  | 78        | 3                          | 11             | 381             | 1861                  | 939                           | 49                     |
| <b>Soil Loss Class</b>                         | 1                                   | 1         | 1                          | 1              | 4               | 6                     | 6                             | 1                      |
| <b>Erosion Hazard</b>                          | Very low                            | Very low  | Very low                   | Very low       | Moderate        | Very high             | Very high                     | Very low               |

## 4.2 Erosion risk

Erosion risk refers to the evaluation of the “risk” of soil erosion when consideration is given to both the degree of erosion and the likelihood of the erosion occurring (IECA 2008). In the absence of a site specific risk assessment procedure, erosion risk rating is determined from the 2 year ARI monthly rainfall erosivity factor for Darwin Airport (Table 4-3), as provided by the Darwin Harbour Advisory Committee Research Group.

Erosion risk ratings range from high to extreme for the wet season (Dec – Mar), with dry season risk moderate to very low (Apr – Nov).

**Table 4-3. Monthly erosion risk rating for Darwin**

| Month                     | Jan     | Feb  | Mar  | Apr  | May      | Jun | Jul | Aug | Sep | Oct  | Nov | Dec     |
|---------------------------|---------|------|------|------|----------|-----|-----|-----|-----|------|-----|---------|
| <b>Rainfall erosivity</b> | 3572    | 2781 | 2124 | 514  | 0        | 0   | 0   | 0   | 0   | 322  | 906 | 1775    |
| <b>Rating</b>             | Extreme |      |      | High | Very Low |     |     |     |     | High |     | Extreme |

## 4.3 Erosion and sediment control requirements

Recommended erosion and sediment control measures are based upon the relationship between erosion hazard (as determined from Table 4-2) and erosion risk (Table 4-3). The Darwin climate, with a reliable and prolonged dry season (May to September), provides a low risk of erosion from rainfall throughout these months, although wind erosion potential (dust) is significant.

It is essential that erosion and sediment control measures are fully implemented prior to the 1<sup>st</sup> October, in preparation for the wet season, and corresponding high to extreme erosion risk from October to April. Table 4-4 summarises erosion and sediment control requirements for all stages of project construction and operation across a full calendar year. Typical measures to be implemented during the project are discussed in Section 5 below, with specific design, timing and location to be provided within Progressive ESCPs and associated engineering drawings.

**Table 4-4. Erosion risk and ESC requirements during construction**

| Erosion Risk Rating | Rainfall erosivity (monthly) | Period                  | Erosion & Sediment Control Requirements                                                                                                                                                                                                                                                                                                                 |
|---------------------|------------------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Very low            | 0 to 60                      | May – Sept (Dry Season) | <ul style="list-style-type: none"> <li>• ESCs not required for activities which do not disturb groundcover.</li> <li>• Unfinished earthworks are suitably stabilised if rainfall is reasonably possible.</li> <li>• Sediment control to be installed around areas of erosion risk prior to 1<sup>st</sup> October (wet season commencement).</li> </ul> |
| High                | 285+ to 1500                 | Oct, Nov, Apr,          | <ul style="list-style-type: none"> <li>• Areas of erosion risk protected within 10 days' completion (or cessation) of earthworks or inactivity <sup>[1]</sup></li> <li>• Sediment control fully installed &amp; maintained</li> </ul>                                                                                                                   |

| Erosion Risk Rating | Rainfall erosivity (monthly)                                                                                                                                                                                                                                        | Period    | Erosion & Sediment Control Requirements                                                                                                                              |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Extreme             | > 1500                                                                                                                                                                                                                                                              | Dec - Mar | Areas of erosion risk protected within 5 days' completion (or cessation) of earthworks or inactivity <sup>[1]</sup><br>Sediment control fully installed & maintained |
| Notes:              | <sup>[1]</sup> Areas of erosion risk may be protected using the following types of cover: hardstand, soil binder (eg. polymer), placement of mats, blankets (eg. geotextile, jute) or vegetative cover (min 75% for all areas, with min 90% for drainage channels). |           |                                                                                                                                                                      |

## 5 EROSION AND SEDIMENT CONTROL MEASURES

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Erosion and sediment control measures required during construction and operation have been derived based on the site erosion hazard and risk. Conceptual details of the controls are provided in the sections below based on the current level of design detail. The process for development of progressive ESCPs that will provide further detail on site-specific controls is also described.

### 5.1 Progressive ESCPs

As construction and operation activities advance, specific up-to-date details on the location and installation of ESC measures will be provided within Progressive ESCPs. Typically, this will include the following construction stages/situations where erosion risk rating is assessed as high to extreme (i.e. October – April):

- Where a new stage of construction/operation works are commenced and/or controls require alteration due to change in work practices (e.g. clear & grub, topsoil strip, bulk earthworks, final stabilisation).
- Controls require alteration due to change in seasonal conditions (e.g. dry season vs wet season).
- Installation of road, drainage and waterway crossings.
- A change in the project design occurs that potentially impacts on ESC requirements.
- The desired outcome (e.g. protection of receiving environments) is not being achieved. This will be indicated through the water quality monitoring program detailed in the Water Management Plan.

Where required, Progressive ESCPs will be developed with site personnel, when specific site conditions can be assessed and appropriate control measures determined. All Progressive ESCP's are to be consistent with this Primary ESCP, with specific measures in accordance with IECA guidelines, project approvals and associated documentation.

### 5.2 Drainage control

Drainage controls include measures for the diversion of 'clean' stormwater runoff around and through the site; and the diversion of 'dirty' site stormwater runoff to enable treatment of sediment prior to release offsite, as defined below:

***Clean water:***

Water that either enters site from an external source and has not been further contaminated by sediment within site; or water that has originated from the site and is of such quality that it does not need to be treated in order to achieve the required water quality standard (IECA 2008). Site clean water constitutes surface runoff from areas of non-erodible cover, including vegetation, hardstand, soil binder, mats or blankets (e.g. geotextile).

***Dirty water:***

Water not defined as clean, thereby requiring treatment with appropriate controls prior to release from site (IECA 2008).

Temporary drainage controls installed as part of construction will enable management of stormwater within work areas. Drainage controls will perform the following functions:

- Enable diversion of 'clean' up-slope run-on water either around or through the site at non-scouring velocities.
- Enable collection of 'dirty' runoff generated within construction areas and the delivery of this water to an appropriate sediment control measure.
- Minimise the risk of soil erosion caused by site-generated flows within the project, through the use of 'intermediate' flow treatment and release points.
- Control of the flow velocity, volume and location of water passing through the project at drainage line and waterway crossings.

Controls proposed for the mine site include:

- Inundation bund – to prevent ingress of upslope clean water into the project area, and direct site water to sediment basins
- Topsoil bund - to prevent ingress of upslope clean water into the project area, direct site water to sediment basins, and contain WRD runoff.
- Catch drains – for collection and diversion of sheet flow across a slope or around soil disturbances.
- Diversion channel – for diversion of large concentrated flows.
- Flow diversion bank – flow diversion at base of fill slopes; cross drainage on unsealed roads.
- Chutes – discharge of concentrated flows down steep slopes.
- Rock Check Dams – velocity control device within concentrated flow channels. Also used as sediment control.
- Culverts.

Controls proposed for the pipeline corridor include:

- Placement of topsoil diversion banks along the corridor perimeter to enable diversion of external runoff (via identified flow paths).
- Incorporation of protected flow paths across the corridor, located at existing watercourse crossings or intermediate release points.
- Installation of velocity control devices (eg. rock check dams) within concentrated flow channels.
- Construction of flow control berms (cross banks) across the corridor to:
  - capture and divert site water from within the corridor segment to discharge points.
  - reduce slope length within the corridor.

Typical designs are provided within Appendix B and applicable engineering plans.

## 5.3 Erosion control

Prevention of erosion is the primary approach for the prevention of adverse impacts associated with sedimentation. Construction and operation activities are to be undertaken so as to reduce the duration of soil exposure to erosive forces (wind and water), either by holding the soil in place or by shielding it. Measures to be used include a variety of construction practices, structural controls and vegetative measures aimed at managing runoff at a non-erosive velocity, and the protection of disturbed soil surfaces.

The specific measure(s) implemented will be based on seasonal erosion risk and construction considerations. Measures will be documented in the most current Progressive ESCP and based upon IECA guidelines. Proposed controls are listed below:

- Undertaking initial construction in the dry season months as far as schedule allows.
- Minimise disturbance to existing vegetation as far as practical within the project area. Land clearing will be undertaken in accordance with a Vegetation Clearing Procedure, which includes procedures and methods for minimising levels of soil disturbance and impacts to natural drainage pathways.
- Promptly stabilising exposed areas once construction phase has been completed (e.g. protecting topsoil and inundation bunds).
- Protection of soil surface (temporary and permanent) including placement of hardstand surfaces, use of soil binder, vegetation establishment (including mulch), and protection with mats & blankets (e.g. jute, geotextile) where practical.
- Application of dust suppression by wetting of exposed surfaces (water truck), application of soil binder, and/or application of soil cover.

## 5.4 Sediment control standards

Effective erosion and sediment hazard reduction is best achieved by undertaking initial construction activities during the dry season months (April – October) wherever possible (e.g. roads, bunds, environmental dams). The current project schedule has construction commencing in June 2018.

Sediment control standards are described below and are based upon the soil loss calculations relevant to the site (Table 4-2). Typical designs are provided within Appendix B, with more detailed designs to be provided as engineering drawings and applicable site-specific Progressive ESCPs.

### 5.4.1 Type 1 Sediment control standard

Based on the scale of the project and calculated potential soil loss (Table 4-2), the Type 1 sediment control standard applies.

A Type 1 sediment control is typically the minimum requirement for catchment areas  $> 2,500 \text{ m}^2$  where soil loss  $> 150 \text{ t/ha/yr}$ . A Type 1 sediment control standard is provided by purpose built sediment basins, designed to collect and settle sediment-laden water. They perform two main functions:

- Rapid settlement of coarse grained particles (e.g. sand and coarse silt) during all storm events that flow through the basin
- Settlement of fine-grained particles that are allowed to pass through the basin under controlled conditions.

This enables sediment basins to reduce turbidity levels of construction runoff water, thereby reducing potential for ecological harm.

The waste rock dump is expected to be the major source of sediment, although it is anticipated to contain a large proportion of low erodibility material (i.e. rock). Furthermore, the WRD will contain the TSF which will be internally draining with reuse of water in mine operations. Sediment basin design is discussed below in Section 6.

### 5.4.2 Type 2 sediment control standard

Type 2 and Type 3 sediment controls may be implemented in addition to sediment basins to provide supplementary controls throughout the project area. Specific requirements are to be documented within Progressive ESCPs and engineering plans, taking into account timing (i.e. season) and practicality of control measures.

A Type 2 sediment control is the minimum requirement for catchment areas  $> 2,500 \text{ m}^2$  where soil loss is 75-150 t/ha/yr. A Type 2 sediment control will demonstrate the following characteristics:

- Under typical flow conditions (discharge and suspended sediment concentration), is capable of capturing and holding at least 90 % of material  $> 0.14 \text{ mm}$ .
- Sufficient sediment retention capacity to capture and hold one month's sediment loss from the catchment.
- Designed to maintain its hydraulic and structural integrity under normal site conditions.

Type 2 controls include:

- Rock Filter Dam (RFD) - RFDs are structures formed by the incorporation of geotextile (e.g. A19 bidum®) and a coarse rock filter (40-75 mm nominal diameter).
- Filter Bag/Tube - Filter tubes are geotextile bags through which site runoff is directed to enable filtering and treatment of sediment.
- Coir logs - Coir logs are biodegradable tubes filled with densely packed coconut fibre wrapped in coir netting. They can be used as flow diversion berms or to provide sediment control by providing temporary ponding and filtering of site runoff.
- Mulch berms - Berms of coarse mulch located along the contour. Often incorporate a rock filter dam discharge point.

### 5.4.3 Type 3 Sediment Control standard

A Type 3 sediment control is the minimum requirement where calculated soil loss is  $< 75 \text{ t/ha/yr}$ . A Type 3 sediment trap will demonstrate the following characteristics:

- Under typical flow conditions (discharge and suspended sediment concentration), is capable of capturing and holding at least 90 % of material  $> 0.42 \text{ mm}$ .
- Sufficient sediment retention capacity to capture and hold one month's sediment loss from the catchment
- Designed to maintain its hydraulic and structural integrity under normal site conditions.

Type 3 controls include:

- Rock berms - clean rock may be placed as a perimeter berm to filter sheet flow runoff from site (typical size 75-150 mm).
- Sediment fence - sediment fence may be used in locations where placement of rock berms is not practical (due to access, materials and equipment constraints).

### 5.4.4 Supplementary sediment control

Supplementary sediment controls are not considered effective to meet the Type 3 classification in isolation, but will form an important component of the erosion and sediment control system when implemented as supplementary controls. The following supplementary controls will be implemented where relevant to the project phase and site conditions:

- Grass filter strips
- Check dams
- Construction exits.

In addition to adopting measures as per IECA Standard Drawings, variations to these may be implemented where it can be demonstrated that they are equally as effective and meet the intent of IECA standards.

## 6 SEDIMENT BASIN DESIGN

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Two sediment basins will be constructed on site. Runoff captured within these basins will be re-used within the project area wherever practical (dust suppression, processing etc.), with excess treated runoff to be discharged to the receiving environment. Sediment basin capacity for the project has been developed consistent with IECA guidelines (IECA 2008).

The layout of the mine site includes topsoil and inundation bunds to separate external clean runoff from internal site runoff, forming a clear delineation between project site water and external runoff. Within the bunded project area, runoff within the mine pit 'footprint' will drain internally and be managed via the pit dewatering process (and is therefore excluded from sediment basin calculations). This will involve pumping the water to mine water dam 1, for reuse in the processing circuit and/or for dust suppression. During the peak of the wet season (November to March), water in mine water dam 1 will be treated and discharged to the environment under a Waste Discharge Licence issued under the *Waste Management Pollution Control Act*. Discharge requirements, management and monitoring are addressed in the Water Management Plan.

Sediment basins proposed for the mine site are initially designed as Type D basins, which assume dispersive soils requiring the use of flocculating agent to settle. This is a conservative approach, representing the worst case scenario. With the recent finalisation of *Appendix B – Sediment Basin Design and Operation* (IECA 2008), basin design will be revised prior to implementation of mine development to ensure the most efficient basin configuration is adopted. Final basin location will be subject to final site layout; however, the following criteria is to be met:

- Located to maximise collection of sediment-laden runoff generated within the site
- Not located within waterway of drainage channel
- Located above the 1 in 5 year ARI
- Have suitable access for maintenance
- Placed in close proximity to site perimeter for ease of dewatering.

### 6.1 Basin capacity

Sediment basin capacity is based on the following design parameters:

- 5 day, 85<sup>th</sup> %ile rainfall amount for Darwin; 46.2 mm (Table B6, IECA 2008).
- Project catchment areas and potential soil loss (Table 4-2).
- Project area runoff coefficients for 100 mm rainfall event:
  - 1 for heavily impacted areas (haul roads, pads, high traffic, compacted)
  - 0.75 for vegetated or less compacted (Table B7 IECA 2008).

Calculations are provided within Table 6-1. The total required capacity is to be provided by the two sediment basins, with relative proportional volumes to be determined upon final site layout and contributing catchment areas.

**Table 6-1. Calculation of sediment basin capacity**

|                                                                  | Project components (excluding mine pit 'footprint')     |              |                 |       |             |      |
|------------------------------------------------------------------|---------------------------------------------------------|--------------|-----------------|-------|-------------|------|
|                                                                  | Access Roads                                            | Working Pads | Perimeter bunds | WRD   | Storm-water | Misc |
| <b>Sediment Storage Zone</b>                                     |                                                         |              |                 |       |             |      |
| Soil loss (t/ha/yr)                                              | 65                                                      | 102          | 4               | 496   | 14          | 31   |
| Soil loss (m <sup>3</sup> /ha/yr)                                | 50                                                      | 78           | 3               | 381   | 11          | 23   |
| Annual soil loss (m <sup>3</sup> /yr)                            | 433                                                     | 767          | 36              | 19519 | 58          | 282  |
| Sediment storage zone (assume desilt 2 times per year)           | 216                                                     | 383          | 18              | 9760  | 29          | 141  |
| <b>Settling Zone</b>                                             |                                                         |              |                 |       |             |      |
| Soil Hydrologic Group                                            | C                                                       | C            | C               | C     | C           | C    |
| Volumetric runoff coefficient                                    | 1                                                       | 1            | 0.75            | 0.75  | 0.75        | 1    |
| Settling Zone Volume                                             | 3280                                                    | 4528         | 4158            | 17741 | 1871        | 5544 |
| <b>Sediment Basin Capacity</b>                                   |                                                         |              |                 |       |             |      |
| Sediment storage volume m <sup>3</sup>                           | 216                                                     | 383          | 18              | 9760  | 29          | 141  |
| Settling zone volume m <sup>3</sup>                              | 4019                                                    | 4528         | 4158            | 17741 | 1871        | 5544 |
| Sediment basin volume requirement (m <sup>3</sup> per work area) | 4235                                                    | 4911         | 4176            | 27501 | 1900        | 5685 |
| <b>Total sediment basin requirement</b>                          | <b>48408 m<sup>3</sup></b><br>(sediment basins 1 and 2) |              |                 |       |             |      |

## 6.2 Basin construction

Basin construction is to incorporate the following elements:

- Earth embankments to be certified as structurally sound by geotechnical engineer/specialist.
- Stable inflow system (eg. rock chute).
- Minimum 3:1 length to width ratio (may require internal baffles).
- Primary outlet (eg. siphon, perforated riser) for controlled release.
- Emergency spillway (minimum design storm 1 in 50 year ARI).
- Marker to identify the sediment storage zone depth.

## 6.3 Basin management

Sediment basins are to be managed as follows:

- Discharged within 5 days of cessation of rainfall (min 25 mm).
- Prior to discharge, water quality to meet project discharge criteria specified in site Water Management Plan (flocculant or coagulant may be required).
- Designed to ensure easy and safe access to dose retained water with flocculants as required.
- Marker peg to be installed to indicate sediment storage capacity.
- Removal of sediment where sediment storage capacity exceeds 50% and disposal/management of sediment so as not to create an erosion or pollution hazard.

## 6.4 Coagulants & Ameliorants

Flocculation of basins will be required where the contained water does not meet discharge criteria standard within five days of cessation of rainfall. The application of a coagulant is to occur within 12 hours of the receipt of runoff producing rainfall. Typically, gypsum (calcium sulfate) is used for this purpose. This requires application across the sediment basin surface (spray or hand cast) at a rate of 32 kg per 100 m<sup>3</sup> of water volume.

There are also a range of anionic polymers which may provide a more effective flocculation option. These are also well suited to flow-activated dosing systems, reducing labour associated with flocculation. Choice of flocculant and dosing methods will be managed adaptively based on monitoring of sediment basin performance over the first wet season of operations.

## 6.5 Site stabilisation (post-mining)

Following the completion of construction and operational activities, long-term protection of the site from erosion will be provided by the final rehabilitated landform. The project Mine Closure Plan (submitted as Appendix D of the EIS) provides details of the site closure objectives, closure criteria for each landform, a works program and monitoring methods. The closure objective for the site is a “stable non-polluting landform which supports self-sustaining native vegetation comprising local species.”

In relation to erosion and sediment control, the following practices will assist in achieving site stabilisation and long-term protection for downstream environments:

- Topsoil is managed to ensure preservation of its long term value.
- Selected plant species for revegetation are appropriate for site conditions and endemic to local vegetation communities.
- Erosion and sediment controls are to remain in place until minimum 75 % self-sustaining groundcover (or equivalent) is achieved for disturbed areas, with minimum of 90 % for drainage features.

Site-specific controls will be provided in a closure ESCP, which will be prepared by a CPESC based on the as constructed site and the proposed rehabilitation program. The closure ESCP will be submitted with the final revision of the MMP prior to commencement of closure works.

The Mine Closure Plan (Section 10.3) details an erosion monitoring program. Erosion monitoring will be undertaken until completion criteria relating to percent groundcover are met (i.e. permanent stabilisation is achieved). In the event that erosion issues are identified, a CPESC will advise on appropriate contingency measures.

## 7 SPECIFIC AREAS AND ACTIVITIES

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Best-practice erosion and sediment control guidance for specific areas and activities associated with the project area provided below. This guidance will be incorporated into project designs and engineering drawings, management procedures and future Progressive ESCP's.

### 7.1 Access and haul roads

Access to the project is to be via a new construction access road from Cox Peninsula Road. Construction of the project access road is to incorporate a sealed surface and drainage infrastructure as per relevant engineering plans. Project haul roads and LV access roads are to be constructed in accordance with relevant engineering plans, incorporating the following:

- Graded to a crown, or with cross-fall drainage.
- Capped with competent gravel layer.
- Runoff to be directed to sediment control measures.
- LV access road batters not exceeding 25 % slope (1:4 batter), stabilised with soil binder or similar cover.
- Haul roads to incorporate safety perimeter bund, protected with soil binder.

### 7.2 Vegetation clearing

Clearing activities associated with the project are to be undertaken consistent with the Vegetation Clearing Procedure (submitted as Appendix S of the EIS), along with the following control measures:

- Vegetation clearing shall be kept to the minimum amount necessary.
- Protected vegetation and significant areas of vegetation are to be retained, and clearly identified prior to the commencement of clearing.
- Approved areas for native vegetation clearing to be clearly marked.
- Disturbance to natural watercourses and associated riparian zones must be limited to the minimum practicable.

### 7.3 Stockpiles and inundation bunds

Earthworks are to incorporate the stripping and preservation of topsoil for reuse (wherever practical). The depth of topsoil stripping is dependent upon soil type; however, ideally the top 100 mm is to be retained separately from other material (contains most of the biological activity and nutrients required for successful rehabilitation). Topsoil is to be stored primarily within the topsoil bund, along the western perimeter of site (Figure 1-2).

The inundation bund will be constructed from compacted clay fill material, rehabilitated with 150 mm topsoil cover. Topsoil, inundation bunds and other stockpile areas are to be managed so as not to cause environmental harm as a result of sedimentation by adoption of the following:

- Stockpiles are not to be located within protected areas of vegetation, driplines of trees, or within 10 m of retained trees, drainage lines, flood zones or any area otherwise likely to be inundated with water.

- Avoid placement of stockpiles within 50 m of any drains, drainage lines or other waterways. Where not practicable, specific erosion and sedimentation controls to be implemented.
- Topsoil bund to be < 1.5 m in height as far as practical (to enhance preservation of biological activity).
- Spoil stockpiles are to be protected upslope by earth diversion banks to divert run-on water, and downslope by an appropriate Type 2/3 sediment control measure (eg. mulch berm, rock berm).
- Long term (> 10 days) stockpiles, batters and other erosion sensitive areas shall be adequately stabilised through velocity reduction, covering, grassing, vegetation, soil binding, water diversion or other as appropriate.
- Inundation and topsoil bunds are to be protected by:
  - Light ripping of subgrade (to 150 mm)
  - Placement of 150 mm topsoil capping layer
  - Amelioration of topsoil layer for plant growth
  - Light ripping of final topsoil layer
  - Application of hydromulch at 4 t/ha complete with 40 kg/ha grass seed
  - Placement and pinning of jute matting over hydromulched surface on external batter.

## 7.4 Watercourse crossings

Watercourse crossings on the site access road and along the water pipeline route are to be constructed in accordance with relevant engineering plans, incorporating the following:

- Temporary stockpiling of soil, equipment and materials within watercourses, or on adjacent banks and floodplains, is to be avoided (unless integral to drainage control requirements).
- Crossings should be constructed at right angles in locations where the stream is straight.
- Site runoff from exposed surfaces is to be prevented from directly entering watercourses.
- Where culvert pipes are to be utilised, the following guidelines are to be considered:
  - The long-term stability of the bed and bank of the waterway are not compromised.
  - Culverts are to have sufficient capacity to ensure minimal disturbance to stream flow for the design discharge.
  - Culvert cells are aligned with the channel.
  - Culvert cells extend well beyond the fill embankment.
  - Rock (or similar) is to be used to protect fill abutments.
  - Energy dissipation is provided downstream of culvert.

Additional contingencies are required in the event of wet conditions, which will include diversion of flows around active work areas, protection of disturbed areas, and restricting vehicular access as far as practicable.

## 7.5 Processing and ancillary areas

Processing areas include crushing circuits, ROM pads and stockpiles, DMS plant and product stockpile areas. Ancillary areas include temporary infrastructure required to support the construction and operations program. These include site offices, workshops, go-lines, crib facilities and lay-down areas. These areas are to be constructed as per relevant engineering plans, incorporating the following:

- Constructed as hardstand surfaces with low erodibility.
- Site runoff directed to stormwater drains and sediment dams.

- Application of soil binder for dust suppression and erosion control.

## 7.6 Waste rock dump

Over the mine's life, an estimated total 178 Mt of waste rock, i.e. weathered, transitional and fresh Burrell Creek Formation host rock, will be excavated in order to access the ore body. Waste rock from the pit will be placed in an onsite waste rock dump (WRD), and waste from processing will be placed in a tailings storage facility (TSF) contained within the WRD. The proposed area of the WRD is 54.5 ha.

The TSF, located within the WRD, will comprise cells that progressively receive tailings from ore processing. A sump within the TSF will collect water (decant and incident rainfall) for return and reuse in ore processing.

The WRD will be contained along the western and southern perimeter by the topsoil bund, with the northern and eastern perimeters formed by diversion channels (designed to minimum 1 in 5 year ARI). This will result in diversion of excess WRD runoff to sediment basins (1 and 2) for containment and treatment prior to reuse or discharge. The minimisation of sediment delivered to the sediment basins from the WRD will be achieved through:

- Incorporation of TSF to maximise water reuse within the WRD.
- Incorporation of flow diversion banks along the toe of WRD batters to enable diversion of runoff to rock check dam discharge points, prior to entering the Sediment Dam drainage network.
- Implementation of contour banks to reduce slope length and promote infiltration.
- Application of soil binders to batters for dust suppression and erosion control.
- Composition of the WRD will include a significant proportion of low erodibility material (i.e. rock), reducing sediment generation.

## 7.7 Water supply pipeline

A water pipeline will be installed to transport operational water from the Observation Hill Dam (OHD) to the mine site. The pipeline corridor will be 10 m wide along a 6 km route, and will include an unsealed access track, which will be used for inspection and maintenance.

Pipeline construction is likely to intercept overland flows from up-slope catchments in the event of rainfall, although in most cases, this will be sheet flow with low erosive potential. Preparation of the pipeline corridor will involve mulching of vegetation and placement of a mulch berm along the downslope perimeter of the corridor. Topsoil will be stripped and placed to the upslope side of the corridor (to control run-on water and for later use in re-instatement activities). A trench will be dug to approximately 500 mm depth, the pipe laid and the trench backfilled. Windrows of vegetation/soil will be re-spread across the corridor to encourage groundcover re-establishment.

Construction of the pipeline will incorporate IECA recommended strategies to manage ESC within the corridor (as outlined in *Best Practice Erosion and Sediment Control - Appendix P: Land-based Pipeline Construction*), including:

- Minimise forward clearing.
- Maximise the retention of soil surface cover (as far as can be practically achieved given the narrow corridor).
- Control water movement through the corridor.
- Divert clean run-on water away from soil disturbances (if practical), or ensure this water passes through the corridor in a controlled manner.

- Strip topsoil to preserve the seed bank (where practical).
- Stockpile topsoil and subsoils (trench spoil) separately.
- Amelioration of problematic trench soils (where identified during site investigations and construction works).
- Placement of subsoil layers back into the trench in the same order as excavated (especially where dispersive and/or saline soils are present).
- Suitably compact, and where necessary, gypsum treat trench spoil to minimise the risk of tunnel erosion.
- Inspect and maintain control measures in proper working order.
- Progressively rehabilitate the pipeline corridor to minimise the extent and duration of soil disturbance.

## 8 MANAGEMENT AND IMPLEMENTATION

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This plan provides a framework and guidance for managing erosion and sediment issues and risks over the life of mine. The sections below document details relevant to implementation of this conceptual ESCP and Progressive ESCP's.

### 8.1 Responsibilities

Roles and responsibilities for implementation of environmental plans and requirements for the project will be detailed within the MMP submitted for authorisation under the *Mining Management Act*. Future revisions of this ESCP and progressive ESCP's will be submitted as sub-plans to the MMP. Generally, the site HSE Manager will have overarching responsibility for ensuring ESCP's are current and for monitoring implementation and effectiveness of the site specific controls.

Site supervisors and specific staff will have responsibility for installing and maintaining erosion and sediment controls. Designated staff will also have responsibility for ensuring the effective operation of the sediment dams, including monitoring of water quality to ensure discharge criteria are achieved.

Contractors undertaking the site clearing will be responsible for undertaken the works in accordance with the Vegetation Clearing Procedure in order to minimise erosion risk.

### 8.2 Training and awareness

All project staff and contractors shall be required to undertake an environmental awareness induction prior to commencement of works on the project. The environmental awareness induction is to be targeted to educate staff and contractors on the project environmental objectives and their individual responsibilities for environmental management. This training is to include ESC requirements, with additional specific training of relevant personnel who have a primary role in supervising, installing and maintaining erosion and sediment control measures.

### 8.3 ESC installation and maintenance

The installation and maintenance of all ESC measures is to be overseen by a suitably qualified person. Installation is to be consistent with the ESCP and associated progressive ESCPs.

All required temporary erosion and sediment control measures must be fully operational and maintained in proper working order until permanent stabilisation is achieved. If ESCs are observed to have reduced capacity, damage or insufficient effectiveness, they are to be repaired, improved or substituted as follows:

- Identified soil erosion areas are to be resolved as soon as possible, with additional control measures implemented to prevent recurrence.
- Settled sediment must be removed as soon as reasonable and practicable from any sediment basin if:
  - It is anticipated that the next storm is likely to cause sediment to settle above the sediment basin's sediment storage zone; or
  - The elevation of settled sediment is above the top of the basin's sediment storage zone.
- All sediment control devices (other than sediment basins) must be de-silted and made fully operational as soon as reasonable and practicable after runoff-producing rainfall, or if the sediment retention capacity of the device falls below 75% of the design retention capacity (IECA 2008).

- Sediment removed from areas of deposition is to be incorporated within subsoil stockpile areas and/or buried on-site.

Spare materials including geo-fabric, sediment fence material, mulch and rock are to be stored on-site to enable repairs to be conducted within a short timeframe.

## 8.4 Monitoring & reporting

ESC measures are to be inspected at least weekly during operation; within 24 hrs of expected rainfall; and as soon as reasonably practical after receiving significant rainfall events (i.e. >10 mm in 24 hr period). Visual assessment will be carried out of surface water runoff structures, drainage structures and erosion control structures to ensure they are operating efficiently. An inspection checklist is provided within Appendix C.

Environmental objectives and targets for erosion and sediment control are to be documented in the site EMP. Where monitoring identifies that environmental objectives and targets for erosion and sediment control are not being achieved, corrective actions will be enacted. Where significant erosion and/or major exceedances of water quality triggers are recorded, a CPESC will be engaged to advise on suitable controls.

## 8.5 Updates and variations

ESCPs are dynamic documents, typically requiring updating as construction and operational stages progress and site characteristics alter. Any alterations to the implementation of erosion and sediment controls within specific areas will be recorded and outlined in progressive ESCPs. This may include the following scenarios:

- Controls require alteration due to change in work practices or new stage of works is commenced.
- Controls require alteration due to change in seasonal conditions (e.g. dry season vs wet season).
- Changes occur in slope gradients and drainage paths, with their exact form unpredictable before works start.
- A change in the project design occurs that potentially impacts on ESC requirements.
- The desired outcome (e.g. protection of receiving environments) is not being achieved.

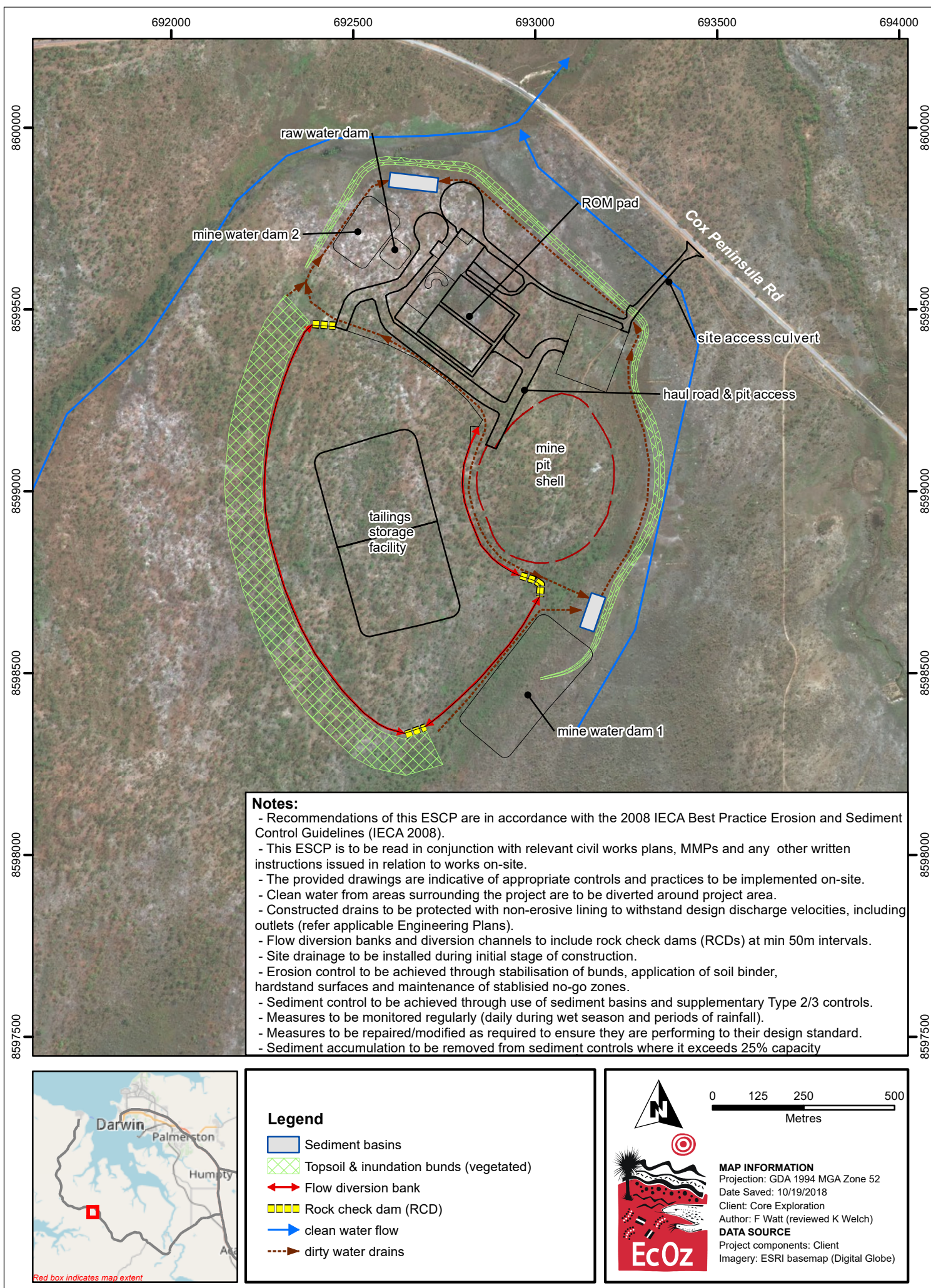
Progressive ESCP's will be submitted with revisions of the MMP for approval by DPIR in accordance with the *Mining Management Act*.

## 9 REFERENCES

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## APPENDIX A SITE LAYOUT



Path: Z:\01 EcOz\_Documents\04 EcOz Vantage GIS\IEZ18086 - Grants Project - EIS\01 Project Files\ESCP\ESCP site layout.mxd

## Appendix A. ESCP site layout

## APPENDIX B TYPICAL ESC DESIGNS

## Rock Check Dam (RCD) & Lined Chute

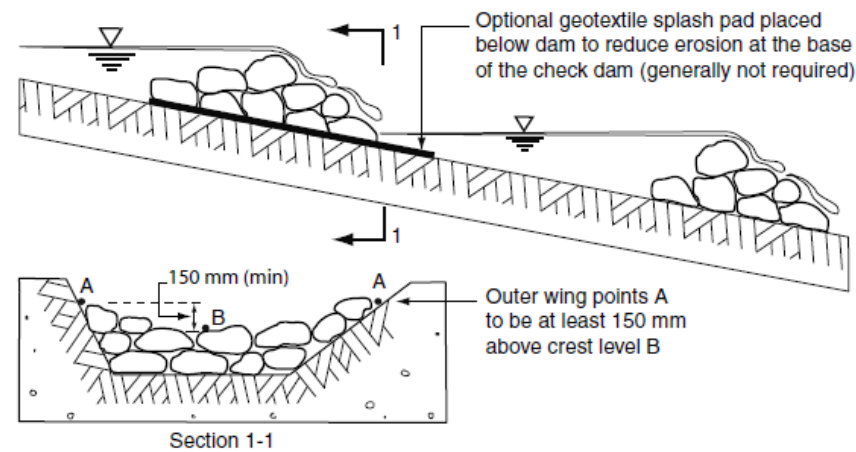
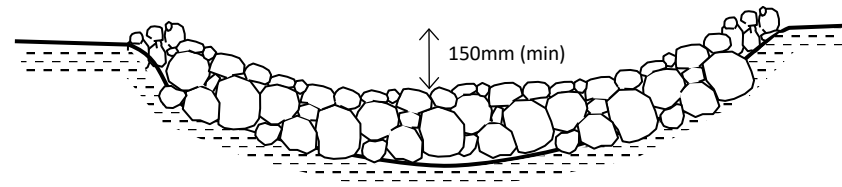


**Fig A1.** Rock check dams (Catchments & Creeks 2009, RCD-01)



### Notes:

- Rock to be clean (zero fines), sized 150-300mm (approx.)
- RCD to be extended up the channel bank to prevent outflanking
- RCD to be constructed with 150mm invert
- RCD may be installed as outlet incorporated within mulch berm (MB) and/or earth berm (EB).
- RCD to be covered with geotextile where indicated

**Fig A2.** Rock check dam – typical design

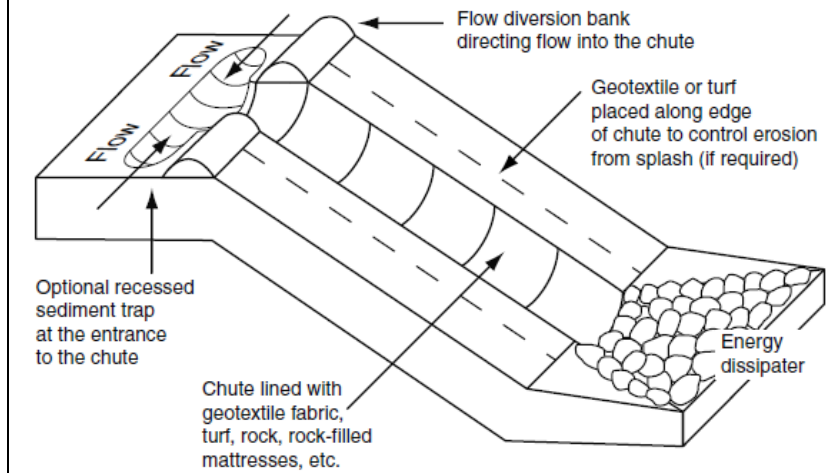


**Fig B1.** Lined chute (Catchments & Creeks 2009, CH-01)

## Diversion Banks (DB) & Earth Berm (EB)

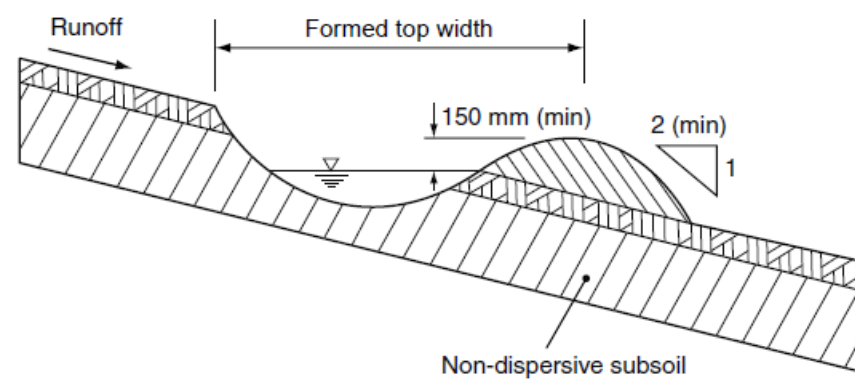


**Fig C1.** Parabolic catch drain (Catchments & Creeks 2009, CD-01)

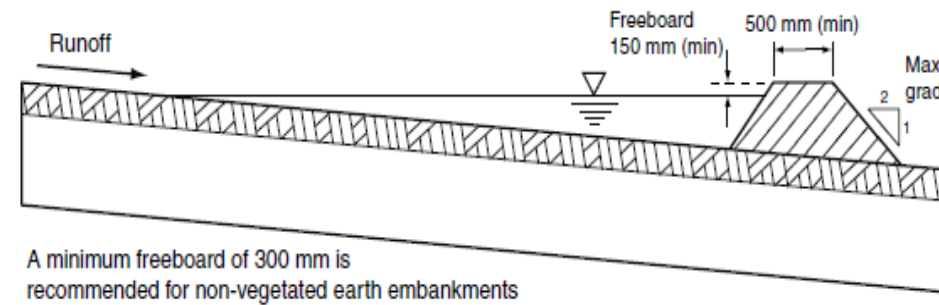


**Fig C2.** Flow diversion bank (Catchments & Creeks 2009, DB-01)

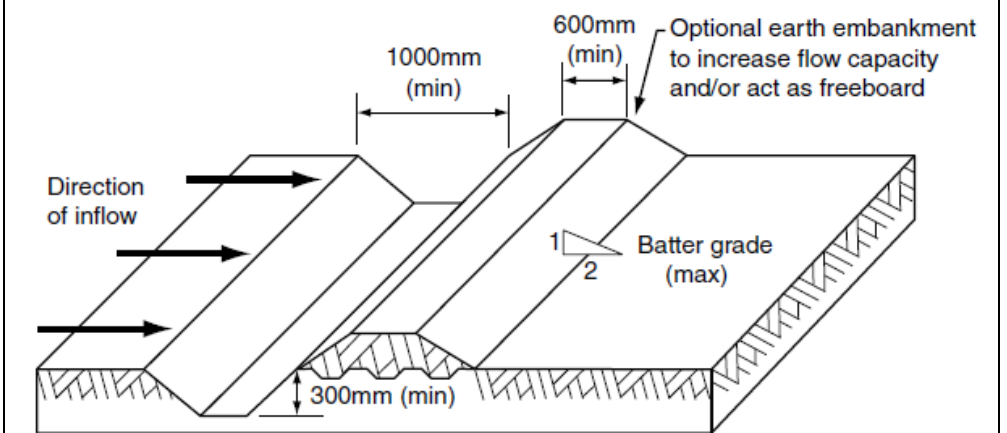


**Fig C3.** Diversion channel (Catchments & Creeks 2009, DC-01)

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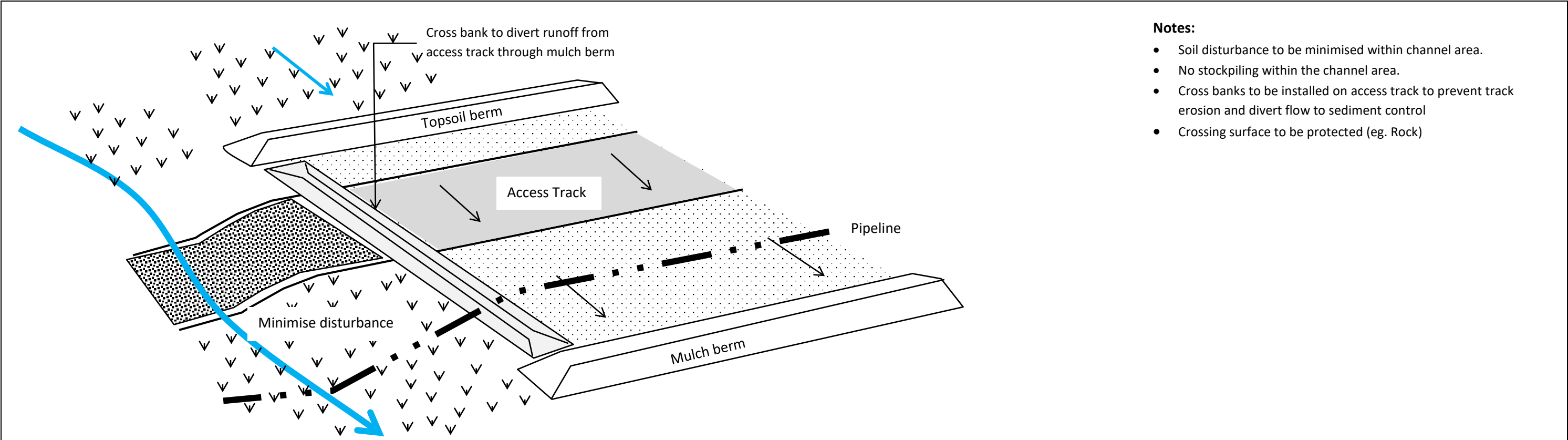


**Grants Lithium Project - ESCP**  
**Typical ESC Designs**

Drawing: EZ18086-171153-001

REVISION:1

Pipeline corridor



- Notes:**
- Soil disturbance to be minimised within channel area.
  - No stockpiling within the channel area.
  - Cross banks to be installed on access track to prevent track erosion and divert flow to sediment control
  - Crossing surface to be protected (eg. Rock)

Fig D1. Typical pipeline corridor at watercourse crossing

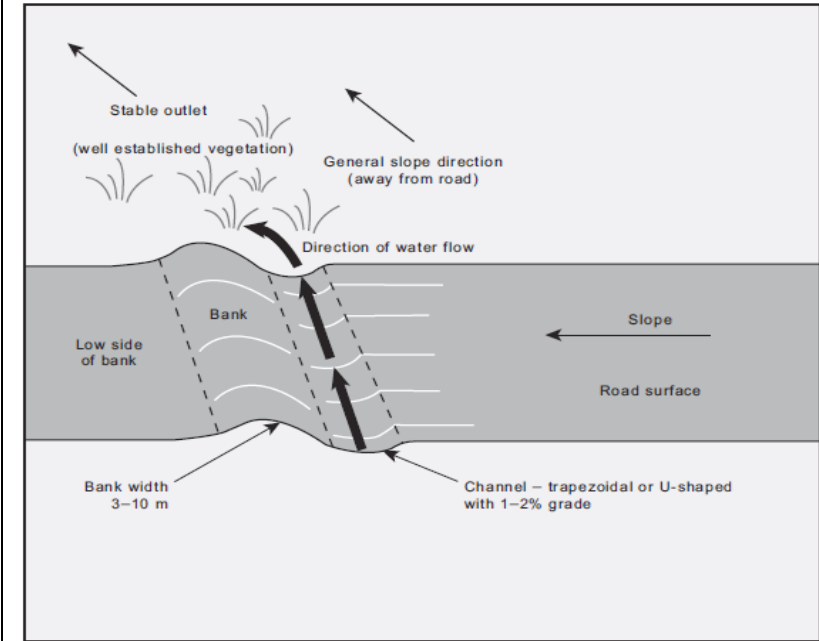


Figure E1. Typical Cross Bank Construction (DECC 2007)

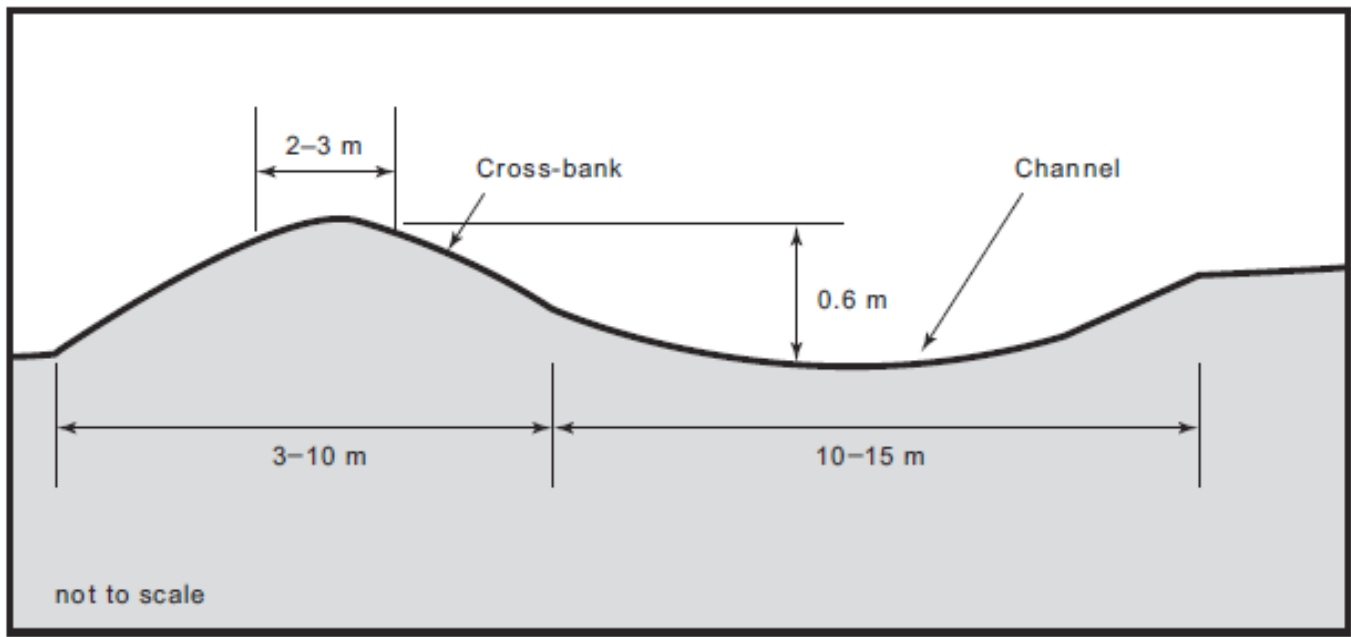
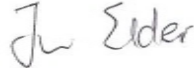


Figure E2. Typical Cross Bank – Cross Section (DECC 2007)

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|----------|----------|-------|----------|----------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|------------------------------------------------------|--|
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## Sediment Basin

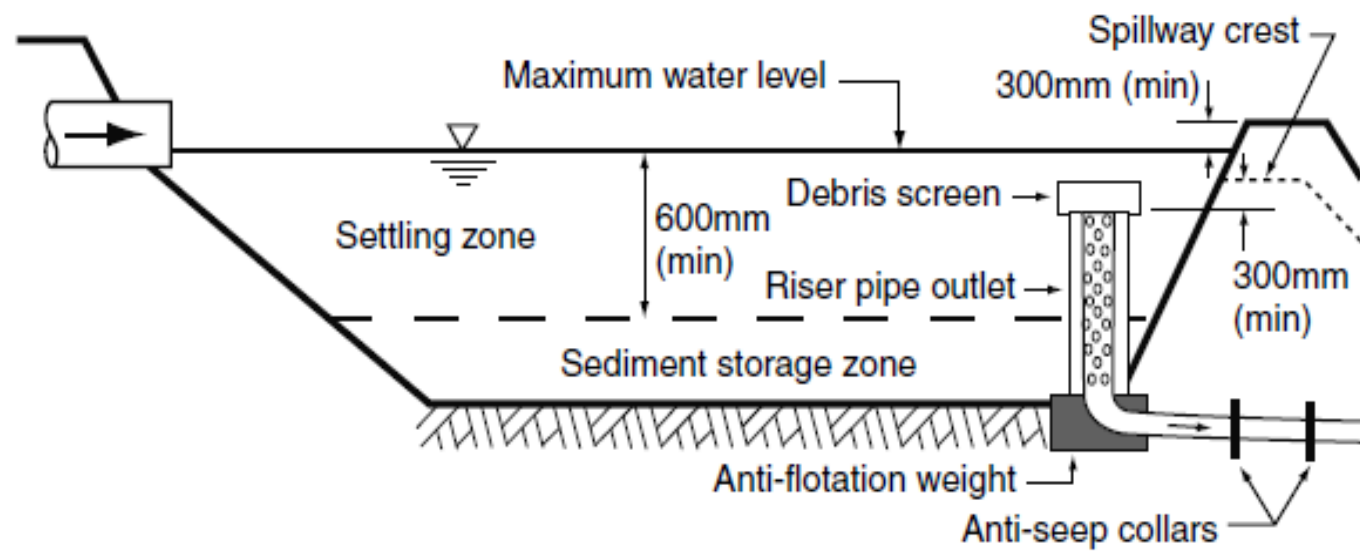


Fig F1. Sediment basin – section view (Catchments & Creeks 2010, SB-01)

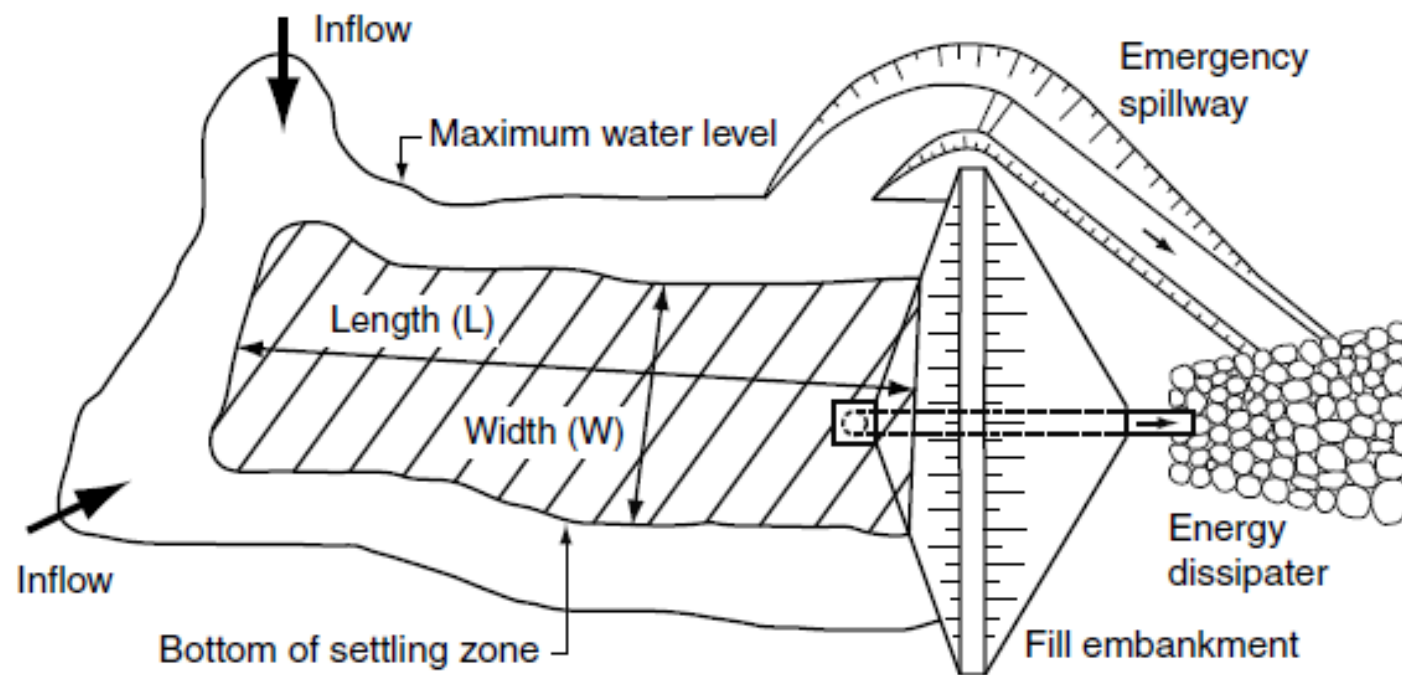


Fig F2. Sediment basin – plan view (Catchments & Creeks 2010, SB-01)

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**MATERIALS**

EARTH FILL: CLEAN SOIL WITH EMERSON CLASS 2(1), 3, 4, OR 5, AND FREE OF ROOTS, WOODY VEGETATION, ROCKS AND OTHER UNSUITABLE MATERIAL. SOIL WITH EMERSON CLASS 4 AND 5 MAY NOT BE SUITABLE DEPENDING ON PARTICLE SIZE DISTRIBUTION AND DEGREE OF DISPERSION. CLASS 2(1) SHOULD ONLY BE USED UPON RECOMMENDATION FROM GEOTECHNICAL SPECIALIST. THIS SPECIFICATION MAYBE REPLACED BY AN EQUIVALENT STANDARD BASED ON THE EXCHANGEABLE SODIUM PERCENTAGE.

RISER PIPE: MINIMUM 250mm DIAMETER.

SPILLWAY ROCK: HARD, ANGULAR, DURABLE, WEATHER RESISTANT AND EVENLY GRADED ROCK WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL (d50) ROCK SIZE. LARGE ROCK SHOULD DOMINATE, WITH SUFFICIENT SMALL ROCK TO FILL THE VOIDS BETWEEN THE LARGER ROCK. THE DIAMETER OF THE LARGEST ROCK SIZE SHOULD BE NO LARGER THAN 1.5 TIMES THE NOMINAL ROCK SIZE. THE SPECIFIC GRAVITY SHOULD BE AT LEAST 2.5.

GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH, MINIMUM 'BIDIM' A24 OR EQUIVALENT.

**CONSTRUCTION**

1. NOTWITHSTANDING ANY DESCRIPTION CONTAINED WITHIN THE APPROVED PLANS OR SPECIFICATIONS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR SATISFYING THEMSELVES AS TO THE NATURE AND EXTENT OF THE SPECIFIED WORKS AND THE PHYSICAL AND LEGAL CONDITIONS UNDER WHICH THE WORKS WILL BE CARRIED OUT. THIS SHALL INCLUDE MEANS OF ACCESS, EXTENT OF CLEARING, NATURE OF MATERIAL TO BE EXCAVATED, TYPE AND SIZE OF MECHANICAL PLANT REQUIRED, LOCATION AND SUITABILITY OF WATER SUPPLY FOR CONSTRUCTION AND TESTING PURPOSES, AND ANY OTHER LIKE MATTERS AFFECTING THE CONSTRUCTION OF THE WORKS.

2. REFER TO APPROVED PLANS FOR LOCATION, DIMENSIONS, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

3. BEFORE STARTING ANY CLEARING OR CONSTRUCTION, ENSURE ALL THE NECESSARY MATERIALS AND COMPONENTS ARE ON THE SITE TO AVOID DELAYS IN COMPLETING THE POND ONCE WORKS BEGIN.

4. INSTALL REQUIRED SHORT-TERM SEDIMENT CONTROL MEASURES DOWNSTREAM OF THE PROPOSED EARTHWORKS TO CONTROL SEDIMENT RUNOFF DURING CONSTRUCTION OF THE BASIN.

5. THE AREA TO BE COVERED BY THE EMBANKMENT, BORROW PITS AND INCIDENTAL WORKS, TOGETHER WITH AN AREA EXTENDING BEYOND THE LIMITS OF EACH FOR A DISTANCE NOT EXCEEDING FIVE (5) METRES ALL AROUND MUST BE CLEARED OF ALL TREES, SCRUB, STUMPS, ROOTS, DEAD TIMBER AND RUBBISH AND DISPOSED OF IN A SUITABLE MANNER. DELAY CLEARING THE MAIN POND AREA UNTIL THE EMBANKMENT IS COMPLETE.

6. ENSURE ALL HOLES MADE BY GRUBBING WITHIN THE EMBANKMENT FOOTPRINT ARE FILLED WITH SOUND MATERIAL, ADEQUATELY COMPACTED, AND FINISHED FLUSH WITH THE NATURAL SURFACE.  
CUT-OFF TRENCH:

7. BEFORE CONSTRUCTION OF THE CUT-OFF TRENCH OR ANY ANCILLARY WORKS WITHIN THE EMBANKMENT FOOTPRINT, ALL GRASS GROWTH AND TOPSOIL MUST BE REMOVED FROM THE AREA TO BE OCCUPIED BY THE EMBANKMENT AND MUST BE DEPOSITED CLEAR OF THIS AREA AND RESERVED FOR TOPDRESSING THE COMPLETING THE EMBANKMENT.

8. EXCAVATE A CUT-OFF TRENCH ALONG THE CENTRE LINE OF THE EARTH FILL EMBANKMENT. CUT THE TRENCH TO STABLE

SOIL MATERIAL, BUT IN NO CASE MAKE IT LESS THAN 600mm DEEP. THE CUT-OFF TRENCH MUST EXTEND INTO BOTH ABUTMENTS TO AT LEAST THE ELEVATION OF THE RISER PIPE CREST. MAKE THE MINIMUM BOTTOM WIDTH WIDE ENOUGH TO PERMIT OPERATION OF EXCAVATION AND COMPACTION EQUIPMENT, BUT IN NO CASE LESS THAN 600mm. MAKE THE SIDE SLOPES OF THE TRENCH NO STEEPER THAN 1:1 (H:V).

9. ENSURE ALL WATER, LOOSE SOIL, AND ROCK ARE REMOVED FROM THE TRENCH BEFORE BACKFILLING COMMENCES. THE CUT-OFF TRENCH MUST BE BACKFILLED WITH SELECTED EARTH-FILL OF THE TYPE SPECIFIED FOR THE EMBANKMENT, AND THIS SOIL MUST HAVE A MOISTURE CONTENT AND DEGREE OF COMPACTION THE SAME AS THAT SPECIFIED FOR THE SELECTED CORE ZONE.

10. MATERIAL EXCAVATED FROM THE CUT-OFF TRENCH MAY BE USED IN CONSTRUCTION OF THE EMBANKMENT PROVIDED IT IS SUITABLE AND IT IS PLACED IN THE CORRECT ZONE ACCORDING TO ITS CLASSIFICATION.

**EMBANKMENT:**

11. SCARIFY AREAS ON WHICH FILL IS TO BE PLACED BEFORE PLACING THE FILL.

12. ENSURE ALL FILL MATERIAL USED TO FORM THE EMBANKMENT MEETS THE SPECIFICATIONS CERTIFIED BY A SOIL SCIENTIST OR GEOTECHNICAL SPECIALIST.

13. THE FILL MATERIAL MUST CONTAIN SUFFICIENT MOISTURE SO IT CAN BE FORMED BY HAND INTO A BALL WITHOUT CRUMBLING. IF WATER CAN BE SQUEEZED OUT OF THE BALL, IT IS TOO WET FOR PROPER COMPACTION. PLACE FILL MATERIAL IN 150 TO 250mm CONTINUOUS LAYERS OVER THE ENTIRE LENGTH OF THE FILL AREA AND THEN COMPACT BEFORE PLACEMENT OF FURTHER FILL.

14. PLACE RISER PIPE OUTLET SYSTEM, IF SPECIFIED, IN APPROPRIATE SEQUENCE WITH THE EMBANKMENT FILLING. REFER TO SEPARATE INSTALLATION SPECIFICATIONS.

15. UNLESS OTHERWISE SPECIFIED ON THE APPROVED PLANS, COMPACT THE SOIL AT ABOUT 1% TO 2% WET OF OPTIMUM AND TO 95% MODIFIED OR 100% STANDARD COMPACTION.

16. WHERE BOTH DISPERSIVE AND NON-DISPERSIVE CLASSIFIED EARTH-FILL MATERIALS ARE AVAILABLE, NON-DISPERSIVE EARTH-FILL MUST BE USED IN THE CORE ZONE. THE REMAINING CLASSIFIED EARTH-FILL MATERIALS MUST ONLY BE USED AS DIRECTED BY [INSERT TITLE].

17. WHERE SPECIFIED, CONSTRUCT THE EMBANKMENT TO AN ELEVATION 10% HIGHER THAN THE DESIGN HEIGHT TO ALLOW FOR SETTLING; OTHERWISE FINISHED DIMENSIONS OF THE EMBANKMENT AFTER SPREADING OF TOPSOIL MUST CONFORM TO THE DRAWING WITH A TOLERANCE OF 75mm FROM THE SPECIFIED DIMENSIONS.

18. ENSURE DEBRIS AND OTHER UNSUITABLE BUILDING WASTE IS NOT PLACED WITHIN THE EARTH EMBANKMENT.

19. AFTER COMPLETION OF THE EMBANKMENT ALL LOOSE UNCOMPACTED EARTH-FILL MATERIAL ON THE UPSTREAM AND DOWNSTREAM BATTER MUST BE REMOVED PRIOR TO SPREADING OF TOPSOIL.

20. TOPSOIL AND REVEGETATE/STABILISED ALL EXPOSED EARTH AS DIRECTED WITHIN THE APPROVED PLANS.

(continued on SB-06)

Drawn:

GMW

Date:

Feb-10

Sediment Basins

SB-05

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**SPILLWAY CONSTRUCTION:**

21. THE SPILLWAY MUST BE EXCAVATED AS SHOWN ON THE PLANS, AND THE EXCAVATED MATERIAL IF CLASSIFIED AS SUITABLE, MUST BE USED IN THE EMBANKMENT, AND IF NOT SUITABLE IT MUST BE DISPOSED OF INTO SPOIL HEAPS.

22. ENSURE EXCAVATED DIMENSIONS ALLOW ADEQUATE BOXING-OUT SUCH THAT THE SPECIFIED ELEVATIONS, GRADES, CHUTE WIDTH, AND ENTRANCE AND EXIT SLOPES FOR THE EMERGENCY SPILLWAY WILL BE ACHIEVED AFTER PLACEMENT OF THE ROCK OR OTHER SCOUR PROTECTION MEASURES AS SPECIFIED IN THE PLANS.

23. PLACE SPECIFIED SCOUR PROTECTION MEASURES ON THE EMERGENCY SPILLWAY. ENSURE THE FINISHED GRADE BLENDS WITH THE SURROUNDING AREA TO ALLOW A SMOOTH FLOW TRANSITION FROM SPILLWAY TO DOWNSTREAM CHANNEL.

24. IF A SYNTHETIC FILTER FABRIC UNDERLAY IS SPECIFIED, PLACE THE FILTER FABRIC DIRECTLY ON THE PREPARED FOUNDATION. IF MORE THAN ONE SHEET OF FILTER FABRIC IS REQUIRED, OVERLAP THE EDGES BY AT LEAST 300mm AND PLACE ANCHOR PINS AT MINIMUM 1m SPACING ALONG THE OVERLAP. BURY THE UPSTREAM END OF THE FABRIC A MINIMUM 300mm BELOW GROUND AND WHERE NECESSARY, BURY THE LOWER END OF THE FABRIC OR OVERLAP A MINIMUM 300mm OVER THE NEXT DOWNSTREAM SECTION AS REQUIRED. ENSURE THE FILTER FABRIC EXTENDS AT LEAST 1000mm UPSTREAM OF THE SPILLWAY CREST.

25. TAKE CARE NOT TO DAMAGE THE FABRIC DURING OR AFTER PLACEMENT. IF DAMAGE OCCURS, REMOVE THE ROCK AND REPAIR THE SHEET BY ADDING ANOTHER LAYER OF FABRIC WITH A MINIMUM OVERLAP OF 300mm AROUND THE DAMAGED AREA. IF EXTENSIVE DAMAGE IS SUSPECTED, REMOVE AND REPLACE THE ENTIRE SHEET.

26. WHERE LARGE ROCK IS USED, OR MACHINE PLACEMENT IS DIFFICULT, A MINIMUM 100mm LAYER OF FINE GRAVEL,

AGGREGATE, OR SAND MAY BE NEEDED TO PROTECT THE FABRIC.

27. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER FABRIC. PLACE ROCK SO THAT IT FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS. THE DESIRED DISTRIBUTION OF ROCK THROUGHOUT THE MASS MAY BE OBTAINED BY SELECTIVE LOADING AT THE QUARRY AND CONTROLLED DUMPING DURING FINAL PLACEMENT.

28. THE FINISHED SLOPE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF ROCK SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE ROCK SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.

29. ENSURE THAT THE FINAL ARRANGEMENT OF THE SPILLWAY CREST WILL NOT PROMOTE EXCESSIVE FLOW THROUGH THE ROCK SUCH THAT THE WATER CAN BE RETAINED WITHIN THE SETTLING BASIN AN ELEVATION NO LESS THAN 50mm ABOVE OR BELOW THE NOMINATED SPILLWAY CREST ELEVATION. ESTABLISHMENT OF SETTLING POND:

30. THE AREA TO BE COVERED BY THE STORED WATER OUTSIDE THE LIMITS OF THE BORROW PITS MUST BE CLEARED OF ALL SCRUB AND RUBBISH. TREES MUST BE CUT DOWN STUMP HIGH AND REMOVED FROM THE IMMEDIATE VICINITY OF THE WORK.

31. ESTABLISH ALL REQUIRED INFLOW CHUTES AND INLET BAFFLES, IF SPECIFIED, TO ENABLE WATER TO DISCHARGE INTO THE BASIN IN A MANNER THAT WILL NOT CAUSE SOIL EROSION OR THE RE-SUSPENSION OF SETTLED SEDIMENT.

32. INSTALL A SEDIMENT STORAGE LEVEL MARKER POST WITH A CROSS MEMBER SET JUST BELOW THE TOP OF THE SEDIMENT STORAGE ZONE (AS SPECIFIED ON THE

APPROVED PLANS). USE AT LEAST A 75mm WIDE POST FIRMLY SET INTO THE BASIN FLOOR.

33. IF SPECIFIED, INSTALL INTERNAL SETTLING POND BAFFLES. ENSURE THE CREST OF THESE BAFFLES IS SET LEVEL WITH, OR JUST BELOW, THE ELEVATION OF THE EMERGENCY SPILLWAY CREST.

34. INSTALL ALL APPROPRIATE MEASURES TO MINIMISE SAFETY RISK TO ON-SITE PERSONNEL AND THE PUBLIC CAUSED BY THE PRESENCE OF THE SETTLING POND. AVOID STEEP, SMOOTH INTERNAL SLOPES. APPROPRIATELY FENCE THE SETTLING POND AND POST WARNING SIGNS IF UNSUPERVISED PUBLIC ACCESS IS LIKELY OR THERE IS CONSIDERED TO BE AN UNACCEPTABLE RISK TO THE PUBLIC.

**MAINTENANCE OF SEDIMENT BASIN**

1. INSPECT THE SEDIMENT BASIN DURING THE FOLLOWING PERIODS:

(i) DURING CONSTRUCTION TO DETERMINE WHETHER MACHINERY, FALLING TREES, OR CONSTRUCTION ACTIVITY HAS DAMAGED ANY COMPONENTS OF THE SEDIMENT BASIN. IF DAMAGE HAS OCCURRED, REPAIR IT.

(ii) AFTER EACH RUNOFF EVENT. INSPECT THE EROSION DAMAGE AT FLOW ENTRY AND EXIT POINTS. IF DAMAGE HAS OCCURRED, MAKE THE NECESSARY REPAIRS.

(iii) AT LEAST WEEKLY DURING THE NOMINATED WET SEASON (IF ANY) OTHERWISE AT LEAST FORTNIGHTLY.

(iv) PRIOR TO, AND IMMEDIATELY AFTER, PERIODS OF 'STOP WORK' OR SITE SHUTDOWN.

2. CLEAN OUT ACCUMULATED SEDIMENT WHEN IT REACHES THE MARKER BOARD/POST, AND RESTORE THE ORIGINAL STORAGE VOLUME. PLACE SEDIMENT IN A DISPOSAL AREA OR, IF APPROPRIATE, MIX WITH DRY SOIL ON THE SITE.

3. DO NOT DISPOSE OF SEDIMENT IN A MANNER THAT WILL CREATE AN EROSION OR POLLUTION HAZARD.

4. CHECK ALL VISIBLE PIPE CONNECTIONS FOR LEAKS, AND REPAIR AS NECESSARY.

5. CHECK ALL EMBANKMENTS FOR EXCESSIVE SETTLEMENT, SLUMPING OF THE SLOPES OR PIPING BETWEEN THE CONDUIT AND THE EMBANKMENT; MAKE ALL NECESSARY REPAIRS.

6. REMOVE ALL TRASH AND OTHER DEBRIS FROM THE BASIN AND RISER.

7. SUBMERGED INFLOW PIPES MUST BE INSPECTED AND DE-SILTED (AS REQUIRED) AFTER EACH INFLOW EVENT.

**REMOVAL OF SEDIMENT BASIN**

1. WHEN GRADING AND CONSTRUCTION IN THE DRAINAGE AREA ABOVE A TEMPORARY SEDIMENT BASIN IS COMPLETED AND THE DISTURBED AREAS ARE ADEQUATELY STABILISED, THE BASIN MUST BE REMOVED OR OTHERWISE INCORPORATED INTO THE PERMANENT STORMWATER DRAINAGE SYSTEM. IN EITHER CASE, SEDIMENT SHOULD BE CLEARED AND PROPERLY DISPOSED OF AND THE BASIN AREA STABILISED.

2. BEFORE STARTING ANY MAINTENANCE WORK ON THE BASIN OR SPILLWAY, INSTALL ALL NECESSARY SHORT-TERM SEDIMENT CONTROL MEASURES DOWNSTREAM OF THE SEDIMENT BASIN.

3. ALL WATER AND SEDIMENT MUST BE REMOVED FROM THE BASIN PRIOR TO THE DAM'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

4. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT, AND STABILISE AND/OR REVEGETATE AS REQUIRED TO ESTABLISH A STABLE LAND SURFACE.

Drawn:

GMW

Date:

Feb-10

Sediment Basins

SB-06

| Revision | Date     | Drawn | Approved | Description    |
|----------|----------|-------|----------|----------------|
| 1        | 22/10/18 | TE    | KW       | Sent to client |
|          |          |       |          |                |
|          |          |       |          |                |



Tim Elder #4399



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PREPARED FOR:



CORE  
EXPLORATION LTD

Grants Lithium Project - ESCP  
Typical ESC Designs

Drawing: EZ18086-171153-001

REVISION:1



**APPENDIX C SITE INSPECTION REPORT TEMPLATE**

## Erosion & Sediment Control Checklist

|                                                                                |                          |                                                                                                                                                                                            |                 |
|--------------------------------------------------------------------------------|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>Conducted by:</b> _____ <b>Date:</b> _____                                  |                          | <b>Priority:</b> 1. Stop work                      4. Fix within 24hrs<br>2. Fix immediately                5. Fix within 48hrs<br>3. Fix within 12 hrs                6. Fix within 72hrs |                 |
| <b>Location / Area:</b> _____ <b>Supervisor:</b> _____                         |                          |                                                                                                                                                                                            |                 |
| <b>ITEM</b>                                                                    | <b>STATUS<br/>Y/N/NA</b> | <b>COMMENTS</b>                                                                                                                                                                            | <b>PRIORITY</b> |
| <b>Summary</b>                                                                 |                          |                                                                                                                                                                                            |                 |
| Work footprint minimum extent necessary                                        |                          |                                                                                                                                                                                            |                 |
| Erosion and sediment controls installed consistent with ESCP                   |                          |                                                                                                                                                                                            |                 |
| Erosion and sediment controls functional and effective                         |                          |                                                                                                                                                                                            |                 |
| Clean and dirty water adequately separated                                     |                          |                                                                                                                                                                                            |                 |
| Site being progressively stabilised                                            |                          |                                                                                                                                                                                            |                 |
| No evidence of off-site sediment, scouring, erosion or pollution               |                          |                                                                                                                                                                                            |                 |
| <b>Planning &amp; Site Establishment</b>                                       |                          |                                                                                                                                                                                            |                 |
| ESCP is current and applicable to stage of works                               |                          |                                                                                                                                                                                            |                 |
| Foremen/Supervisors are aware of ESCP requirements                             |                          |                                                                                                                                                                                            |                 |
| Workforce deemed competent in ESC installation (VOC)                           |                          |                                                                                                                                                                                            |                 |
| ESC locations marked out prior to installation                                 |                          |                                                                                                                                                                                            |                 |
| ESCs installed outside of 20yr ARI flood level                                 |                          |                                                                                                                                                                                            |                 |
| ESCs installed and functional prior to commencement of bulk earthworks         |                          |                                                                                                                                                                                            |                 |
| Work areas and no-go zones cleared delineated                                  |                          |                                                                                                                                                                                            |                 |
| ESCP requirements clearly communicated to the workforce (eg. Toolbox)          |                          |                                                                                                                                                                                            |                 |
| <b>Erosion Control</b>                                                         |                          |                                                                                                                                                                                            |                 |
| Clearing/disturbance minimum extent necessary for construction                 |                          |                                                                                                                                                                                            |                 |
| High traffic areas, laydowns, ancillary areas protected with hardstand surface |                          |                                                                                                                                                                                            |                 |
| Temporary erosion control materials on hand in case of emergencies             |                          |                                                                                                                                                                                            |                 |

| ITEM                                                                 | STATUS<br>Y/N/NA | COMMENTS | PRIORITY |
|----------------------------------------------------------------------|------------------|----------|----------|
| <b>Site access</b>                                                   |                  |          |          |
| Site access & egress points stabilised                               |                  |          |          |
| Exit points free of sediment/mud tracking                            |                  |          |          |
| Construction access able to utilise existing tracks                  |                  |          |          |
| Site access tracks stabilised to prevent erosion                     |                  |          |          |
| Watercourse crossings installed as per approved design               |                  |          |          |
| <b>Revegetation</b>                                                  |                  |          |          |
| Soil surface sufficiently prepared & roughened prior to seeding      |                  |          |          |
| Date of seed application                      How was it applied     |                  |          |          |
| Species                                              Rate            |                  |          |          |
| Fertiliser Type                                      Fertiliser Rate |                  |          |          |
| Assessed % Groundcover                                               |                  |          |          |
| <b>Hydromulch</b>                                                    |                  |          |          |
| Mulch cover > 80% of the bare ground                                 |                  |          |          |
| Mulch secured against wind/rain                                      |                  |          |          |
| How long is material expected to control erosion                     |                  |          |          |
| <b>Soil binder</b>                                                   |                  |          |          |
| Type of material used                                                |                  |          |          |
| Application density                                                  |                  |          |          |
| Date of application                                                  |                  |          |          |
| Expected lifespan (provide > 80% cover)                              |                  |          |          |
| Surface currently stable                                             |                  |          |          |
| <b>Dust</b>                                                          |                  |          |          |
| Dust suppression being carried out                                   |                  |          |          |
| Appropriate traffic controls in place (eg. speed, restricted)        |                  |          |          |

| ITEM                                                                        | STATUS<br>Y/N/NA | COMMENTS | PRIORITY |
|-----------------------------------------------------------------------------|------------------|----------|----------|
| <b>Drainage Control</b>                                                     |                  |          |          |
| <b>Diversion drains/structures - clean water</b>                            |                  |          |          |
| Clean water diverted around work area                                       |                  |          |          |
| Sediment control structure designed to include clean water                  |                  |          |          |
| Clean water diversion protected against erosion                             |                  |          |          |
| Clean water diversion constructed to control and divert design flows        |                  |          |          |
| Clean water diversion includes stable outlet                                |                  |          |          |
| Clean water diversion stable and functional                                 |                  |          |          |
| <b>Diversion drains/structures - dirty water (sediment laden diversion)</b> |                  |          |          |
| Dirty water directed to sediment control device                             |                  |          |          |
| Dirty water diversion constructed to control and divert design flows        |                  |          |          |
| Dirty water diversion protected against erosion (>5% grade)                 |                  |          |          |
| Dirty water diversion includes sumps or check dams                          |                  |          |          |
| Dirty water diversion includes stable outlet                                |                  |          |          |
| Dirty water diversion stable and functional                                 |                  |          |          |
| <b>Drop structures/inlets &amp; flumes</b>                                  |                  |          |          |
| Designed and implemented as per ESCP                                        |                  |          |          |
| Structure includes stabilised apron (1m) inlet & cut-off trench             |                  |          |          |
| Structure includes stabilised dissipation area                              |                  |          |          |
| Correct sized rock being used (no significant movement)                     |                  |          |          |
| Water flows down centre of structure (no outflanking)                       |                  |          |          |
| Drop structure stable & functional                                          |                  |          |          |
| <b>Crossings</b>                                                            |                  |          |          |
| Watercourse crossings installed as per the ESCP                             |                  |          |          |
| Crossings stable & functional                                               |                  |          |          |

| ITEM                                                        | STATUS<br>Y/N/NA | COMMENTS | PRIORITY |
|-------------------------------------------------------------|------------------|----------|----------|
| <b>Check Dams</b>                                           |                  |          |          |
| Correct sized rock being used (no significant movement)     |                  |          |          |
| Water flow over the middle instead of around the edges      |                  |          |          |
| Sediment accumulation < 25% of check dam capacity           |                  |          |          |
| Accumulated sediment disposed of in designated area         |                  |          |          |
| <b>Cut-off (Contour) Drains - dirty water</b>               |                  |          |          |
| Installed and functional (short-term temp structures)       |                  |          |          |
| Graded < 2% (unless lined)                                  |                  |          |          |
| Min size: 500mm depth; 250mm compacted bank                 |                  |          |          |
| U-shaped or parabolic or trapezoidal profile (not V-shaped) |                  |          |          |
| Catchment area < 0.5ha                                      |                  |          |          |
| Discharge to sediment control via stable outlet             |                  |          |          |
| <b>Sediment Control</b>                                     |                  |          |          |
| <b>Sediment Basins</b>                                      |                  |          |          |
| Sediment basins installed and functional as per design:     |                  |          |          |
| primary spillway installed and functional                   |                  |          |          |
| emergency spillway sized for 50yr ARI storm event           |                  |          |          |
| inlet protection (chute)                                    |                  |          |          |
| 3:1 length/width ratio                                      |                  |          |          |
| sediment storage zone market installed                      |                  |          |          |
| internal baffles                                            |                  |          |          |
| chemical treatment systems                                  |                  |          |          |
| As-built surveys completed                                  |                  |          |          |
| Desilting required (sediment capacity > 25%)                |                  |          |          |
| Disposal location identified for desilt material            |                  |          |          |

| ITEM                                                                            | STATUS<br>Y/N/NA | COMMENTS | PRIORITY |
|---------------------------------------------------------------------------------|------------------|----------|----------|
| <b>Type 2 and 3 controls</b>                                                    |                  |          |          |
| Installed and functional as per design                                          |                  |          |          |
| Desilting required (sediment capacity > 25%)                                    |                  |          |          |
| <b>Stockpiles</b>                                                               |                  |          |          |
| Stockpiles located minimum of 50 meters from water bodies and drains            |                  |          |          |
| Stockpiles protected/stabilised                                                 |                  |          |          |
| <b>Dewatering</b>                                                               |                  |          |          |
| Dewatering of excavations required                                              |                  |          |          |
| Permit in place for all dewatering activities                                   |                  |          |          |
| Dewatering in accordance with procedure and permit conditions                   |                  |          |          |
| Groundwater intercepted within excavations                                      |                  |          |          |
| <b>Pollution Control</b>                                                        |                  |          |          |
| Concrete washouts in place and being used                                       |                  |          |          |
| Concrete washouts have sufficient capacity                                      |                  |          |          |
| Hazardous substances stored in bunded areas (including fuel)                    |                  |          |          |
| Ancillary equipment (pumps, generators etc) stored and operated in bunded areas |                  |          |          |
| Refuelling in accordance with refuelling procedure                              |                  |          |          |
| Spill kits available within work area                                           |                  |          |          |
| Spill kits fully stocked                                                        |                  |          |          |
| <b>Additional Comments:</b>                                                     |                  |          |          |
|                                                                                 |                  |          |          |
| Inspection Conducted By:<br><br>Site Personnel's Name & Signature:              |                  |          |          |



