BHP Mitsubishi Alliance

CVM-PRO-0043

CVM PROCEDURE

Erosion and Sediment Control

Status: Approved

Version: 7.0 (11 September 2025)

Owner: BMA CVM HSS Superintendent Environment Ops

Document ID # 000197419

Table of Contents

1 Introduction 4
1.1 Objectives 4
1.2 Scope 4
1.3 Water Types 5
1.4 Application 5
1.5 Transition Period: 5
2 Environmental Authority and Commitments 6
2.1 Environmental Authority 6
2.2 Environmental Commitments 6
3 Site Description Climate 6
3.1 Climate 6
3.2 Hydrology and Topography 6
3.3 Soil and Spoil Characteristics 11
4 ESC principles 14
4.1 Principles 14
4.2 ESC Hierarchy 14
5 Planning 15
5.1 Overview 15
5.2 Stakeholder Engagement 15
5.3 Catchment Delineation 17
5.3.1 Overview 17
5.3.2 Mine Affected Water Catchments 17
5.3.3 Stormwater Catchments 17
5.3.4 Diverted Water Catchments 17
5.4 Catchment Risk Assessment 18
5.4.1 Topsoil and Spoil Classification 18
5.5 Catchment Planning 19
6 Design 19
6.1 Overview 19
6.2 Relevant Guidelines 19
6.3 Erosion Control 19
6.4 Drainage Control 20
6.4.1 Overview 20
6.4.2 Operational Drainage Controls 20
6.4.3 Catchment Separation Standard 20
6.4.4 Temporary Watercourse and Drainage Line Crossings 21
6.4.5 Drainage Controls on Access Tracks 21
6.5 Sediment Control 21
6.5.1 Overview 21
6.5.2 Sediment Basins 21

6.5.3 Design Standard....22
6.5.4 Supplementary Sediment Control Techniques....22
7 Construction....23
7.1 Overview....23
7.2 Construction Timing....23
7.3 Construction Records and Management of Change....23
8 Operation....24
8.1 Sampling and Inspections....24
8.2 Maintenance....25
9 Decommissioning....25
10 Event Investigation and Response....25
11 Performance Indicators....26
12 Data Management and Performance Reporting....26
13 Roles and Responsibilities....27
14 References....28
15 Acronyms....28
16 Version Management....29

1 Introduction

1 This Erosion and Sediment Control Plan (ESC Plan) outlines the processes and activities at Caval Ridge Mine (CVM) to minimise erosion and the release of sediment to receiving waters as a result of mining and ancillary activities.

2 The ESC Plan is developed in accordance with the BHP Mitsubishi Alliance (BMA) Erosion and Sediment Control (ESC) and Mine Affected Water (MAW) Standard (ESC and MAW Standard) which addresses the minimum design standards for ESC and MAW controls for BMA operations.

1.1 Objectives

3 The objectives of this ESC Plan are to:

- **a** Minimise and mitigate erosion and sedimentation resulting from operations as well as erosion impacts associated with clearing of vegetation;
- **b** Separation of runoff by water type;
- **c** Diversion of runoff from undisturbed areas away from areas of existing or planned disturbance;
- **d** Treatment of water from disturbed catchments via sediment controls;
- **e** Maintain the effectiveness of ESC measures through continued monitoring and improvement measures; and
- **f** Progressive rehabilitation of disturbed areas at the completion of operations within the disturbed catchment.

1.2 Scope

4 This plan considers:

- **a** **Planning –** define the catchment-based planning procedures and management objectives;
- **b** **Design –** define the minimum design standard for ESC controls;
- **c** **Construction –** define the minimum requirements for construction of ESC controls; and
- **d** **Operation and maintenance –** define the minimum monitoring requirements to assess the performance of ESC controls. Define the maintenance strategy including inspections, desilting frequency and maintenance.
- **e** **Decommissioning –** define pre-conditions for removal of ESC measures once they have served their purpose.

1.3 Water Types

5 The runoff generated at CVM is categorised into three water types, based on the likely water quality and the level of control required:

a '**Mine Affected Water (MAW)** – MAW is not managed as part of the ESC Plan. However, the ESC Plan does consider segregating MAW from stormwater and diverted water catchments. For the definition for MAW, refer to the CVM EA and to the BHP GDL Environmental Authority Definition of Mine Affected Water (BMA Tempo Documentum No. 012479022).

b '**Stormwater'** – water, other than MAW, which may include runoff from areas that are disturbed by mining operations (including spoil emplacements) that potentially contain high sediment loads but are not likely to have properties that would cause environmental harm. 'Stormwater' may be released through points associated with ESC structures constructed in accordance with this ESC Plan and water management infrastructure that is installed and operated in accordance with the CVM Water Management Plan (WMP).

c **Diverted Water catchments** - include areas where water quality is unaffected by mining operation disturbance activities.

6 This plan outlines strategies for the management of stormwater and diverted water at CVM. Strategies to manage MAW are detailed in the CVM Water Management Plan (WMP).

1.4 Application

7 This ESC Plan covers all activities at CVM and applies to all employees and contractors. The ESC Plan forms part of the CVM Environmental Management System (EMS).

1.5 Transition Period:

8 Refer to Section 1.5 in the ESC & MAW Standard for implementation dates for design, operation, sampling, monitoring & inspections.

9 Existing structures have been installed and operated in accordance with the ESC Plan in force at the time of installation. For CVM the ESC & MAW Standard does not apply retrospectively to existing disturbance areas or the planning, design and construction of existing control structures.

a Design standards set out in this ESC Plan may be applied to new works on existing / legacy structures depending on the scale of the works and based on a risk assessment (approved by the Risk Owner for Breach of Environmental Regulations at the given operation), and on any specific EA requirements.

b Operation (i.e. sampling, inspection and maintenance) of existing structures will be in accordance with Section 8 of this Plan.

2 Environmental Authority and Commitments

2.1 Environmental Authority

1 Under the Environmental Protection Act 1994 (EP Act), CVM must adhere to Environmental Authority EPML00562013 (EA). The EA includes a condition requiring BMA to develop an ESC Plan for CVM, as described in ***Table***.

2 This ESC Plan is designed to satisfy condition F26 of the EA.

Condition	Requirement
F26	An Erosion and Sediment Control Plan must be developed by an appropriately qualified person and implemented for all stages of the mining activities on the site to minimise erosion and the release of sediment to receiving waters and contamination of stormwater.

Table 1: EA condition requiring an erosion and sediment control plan

2.2 Environmental Commitments

3 This ESC Plan is also designed to satisfy internal BHP policies and commitments set out in the following documents:

a Our Requirements: Environment and Climate Change.

b Our Requirements: Health, Safety, Environment and Community Reporting.

c BHP Water Management Standard.

d BMA ESC and MAW Standard.

3 Site Description Climate

3.1 Climate

1 The climatic conditions of CVM are classified as sub-tropical, being dominated by wet summers and dry winters. Long term climate data used to assist with the statistical description of prevailing climatic conditions has been sourced from the Australian Bureau of Meteorology (BoM) climate data at the Moranbah Water Treatment Plant.

2 BoM data indicates that the Mean Annual Rainfall at Moranbah is 614mm, of which approximately 80% is received between the months of November through to March.

3.2 Hydrology and Topography

3 Topography across the Isaac River Valley in the vicinity of the site varies from approximately 200 metre elevation along the Isaac River east of CVM to approximately 450 metres elevation along portions of the Denham Range that define the western edge of the Isaac River Valley.

4 Site topography is predominantly gently undulating rises, with surface slopes typically less than 1% grading East-North East towards the Isaac River which is part of the Fitzroy River Basin.

5 CVM is located within the Isaac River catchment, a major drainage area of the Fitzroy Catchment (within the Bowen Basin). The ephemeral Isaac River flows south for approximately 230 km to join the McKenzie River, which flows onwards for approximately 150 km to the Fitzroy, a major river which enters the sea east of Rockhampton.

6 Table 2 lists the five receiving waters which flow eastwards across the mining operation. These ephemeral creeks have been diverted as the mine has been progressively developed.

7 Sediment shall be excavated from the sediment dams as required to maintain design capacity.

Storage Name	Easting (GDA94)	Northing (GDA94)	Contributing catchment and inflow sources	Function	Catchment Size (ha)	Existing Capacity (ML)
Sediment Dam N1	609324	7551385	Captures runoff from Horse Pit spoil stockpiles and haul road	Pumps to 12N Dam CWC	279.7	140
Sediment Dam N2	607435	7556364	Captures runoff from Horse Pit spoil stockpiles and haul roads	Pumps to Sediment Dam N1	217.4	225
Sediment Dam N3A	608214	7557666	Captures runoff from Horse Pit spoil stockpiles and haul road	Pumps to 12N Dam CWC	63.3	24
Sediment Dam N3B	608284	7558331	Captures runoff from Horse Pit spoil stockpiles and haul road	Pumps to N3A	31.8	14
Sediment Dam N3C	608319	7559175	Captures runoff from Horse Pit spoil stockpiles and haul road	Pumps to N3B	16.9	18
Sediment Dam S1	611533	7548663	Captures runoff from Heyford Pit spoil stockpiles and haul road	Pumps to 12N Dam CWC	66.8	75
Sediment Dam S2	613414	7546536	Captures runoff from Heyford Pit spoil stockpiles and haul road	Pumps to MIA Sediment Dam 1	89.7	111
Sediment Dam S3	614352	7545715	Captures runoff from Heyford Pit spoil stockpiles and haul road	Pumps to MIA Sediment Dam 1	179.7	86
MIA Sediment Dam 1	609852	7549232	Captures runoff from the administration and workshop industrial areas	Pumps to 12N Dam CWC	29.1	40
MIA Sediment Dam 2	610030	7549274	Captures runoff from the administration and workshop industrial areas	Pumps to MIA Sediment Dam 1	13.0	17
Mine Water Dam 12N CWC	611622	7550366	Accepts water from all sediment dams. No Pit water	Pumps water to Process Water Tank – Supplies CHPP and haul road dust suppression demands	0	1000

Table 2: Sediment Dam Design Information

8 Figure 1 shows the upstream catchments of the receiving waters. Figure 2 illustrates the creek diversions at CVM.

Creek	Description
Cherwell	Principal receiving watercourse for CVM operational water release and tributary of Isaac River.
Horse	Approximately 50% of the mine area drains to Horse Creek. The creek flows in a northerly direction towards the boundary of ML 1775 towards the confluence with Grosvenor Creek. Horse Creek has previously been diverted to allow for the CVM operations whilst maintaining fluvial processes.
Nine Mile	Tributary of Cherwell Creek which flows in a south easterly direction through CVM before joining Cherwell Creek.
Harrow	Tributary of Cherwell Creek which flows predominantly within the PDM area along the southern boundary of CVM.
Caval	A minor tributary of Cherwell Creek which flows in an easterly direction and has a licenced diversion around the product stockpile and CHPP area.

Table 3: Receiving waters at CVM

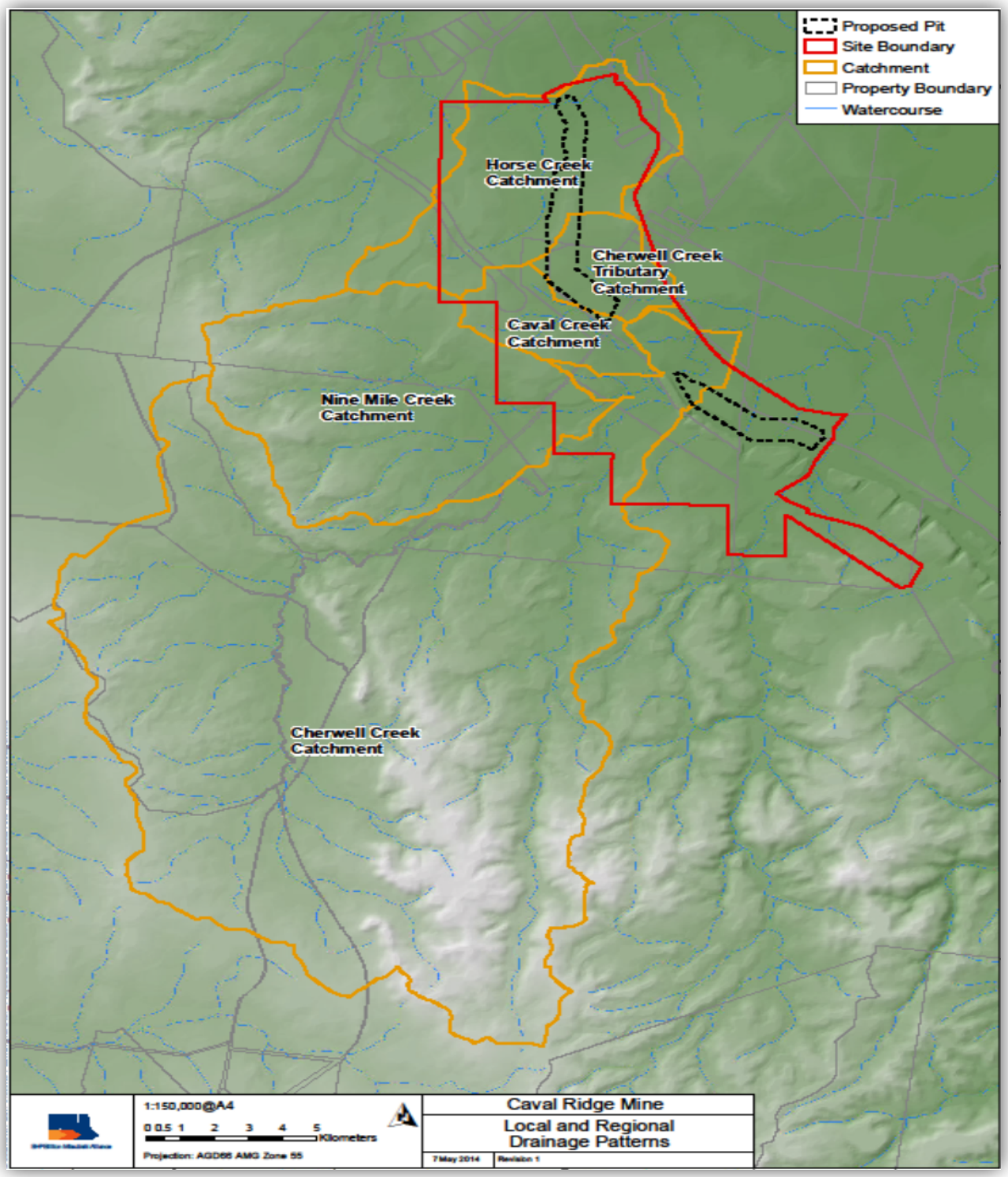

Figure 1: Local and Regional Drainage Catchments

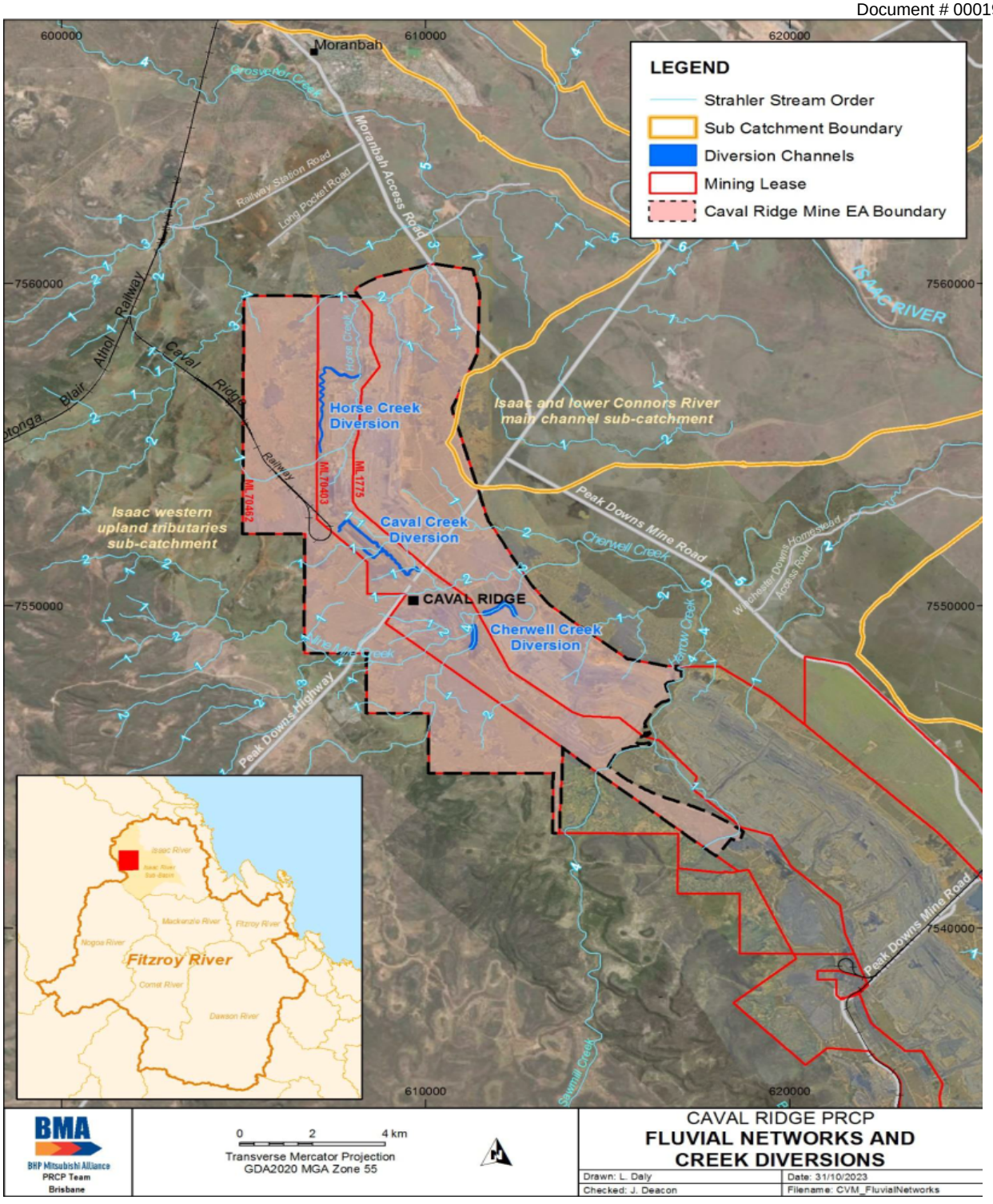

Figure 2: CVM Fluvial Networks and Creek Diversions

3.3 Soil and Spoil Characteristics

1 The natural topography of CVM is characterised by a range of topographic settings ranging from level to gently undulating plains to gravelly ridgelines and low hills. The two main surface geological groups are the erosional surfaces of highly weathered Permian sediments and depositional surfaces within the Tertiary zone.

2 Soils of the area have formed from weathered parent materials under the influence of time, land relief, moisture, temperature changes and organisms. The mine site consists of the following geomorphological land zones of Cainozoic age:

a Alluvial plains and piedmont fans adjoining the Cherwell and Heyford Pits;

b Clay deposits under gently undulating plains within the Cherwell Pit area;

c Sand deposits on extensive flat or gently undulating plains adjoining the Heyford Pit; Igneous rocks, flood basalts forming extensive plains and occasional low scarps to the north of the Cherwell Pit; and

3 A description of geological units and soil erodibility is provided in **Error! Reference source not found.**

Characteristic Lithology	Description	Erosion Potential
Quaternary Alluvium		
Fine sandy or silty materials	Recent sandy or silty Quaternary alluvium associated with current streams.	Moderate sediment contribution expected when freshly disturbed.
Unconsolidated Tertiary – Quaternary Calcareous Sediments and Clayed Alluviums		
Reactive Clays	Reactive basaltic influenced tertiary-quaternary clays and/or recent clayey Quaternary alluvium associated with current streams. Materials include reactive basaltic influenced clays developed from transported sediments of mixed origin (basaltic as well as erosion products or Tertiary and Permian landscapes); as well as heavy alluvial clay deposits on major floodplains. This group also includes boxcut type materials with similar characteristics and behaviour that are dominated by unconsolidated calcareous sediments and/or basaltic reactive clays.	High sediment contribution expected.
Unconsolidated calcareous sediments	Unconsolidated, basaltic derived, relict alluvial/colluvial calcareous Tertiary- Quaternary sediments. Deposits are typically whitish or fawn coloured, powdery calcareous (basaltic derived) materials characterized by rounded basaltic/sandstone gravel inclusions.	High sediment contribution expected.
Unconsolidated Cainozic Sediments		
Fine Sandy Clays	Unconsolidated, relict alluvial/colluvial Cainozoic sediments sourced from the dissection of Tertiary and Permian sedimentary landscape. Deposits are typically fine sandy, either loamy or clayey materials that are typically neutral to alkaline, dispersive and saline.	High sediment contribution expected. Soils can be difficult to revegetate effectively.
Tertiary Basalt		
Fresh or weathered basalt	Restricted unit. Occurs either as relatively pure insitu fresh/weathered Tertiary basalt rock, or more commonly as boxcut type materials dominated by fresh or weathered Tertiary basalt but with a mix of weathered Permian and/or unconsolidated Cainozoic sediments. Basaltic derived boxcut type materials exhibit better characteristics and behaviour than other boxcut type materials.	Sediment generation from disturbed areas would be considered low.
Permian Sedimentary Rocks (Predominantly Fresh)		
Labile mudstones, siltstones and shales	Predominantly fresh, labile, fine grained Permian sedimentary rocks (mudstones, siltstones and/or shales) that weather readily to produce clayey materials.	High sediment contribution expected. Soils can be difficult to revegetate effectively.
Semi competent siltstones and fine to medium grained sandstones	Predominantly fresh, relatively stable, grey Permian siltstones and interbedded fine to medium grained, lithic, semi-competent sandstones, or less commonly interbedded, relatively labile feldspathic sandstones and/or fine grained, calcareous sedimentary rocks (sandstones/shales). Weathers readily to produce relatively clayey spoil materials.	Moderate sediment contribution expected when freshly disturbed, but this would decline with time and rock armouring.
	This group also includes boxcut type materials with poorer characteristics and behaviour that are dominated by weathered, fine grained, lithic sandstones/siltstones.	Disturbed areas have high levels of dispersion and moderate runoff and erosion. Some rock armouring occurs with time.
Acid-forming sedimentary rocks	Fresh Permian sedimentary rocks characterized by a mineralogical suite with significant pyrite content. Acid generation is normally higher than neutralising capacity of the materials and net spoil acidity is expressed.	Moderate sediment contribution expected when freshly disturbed, but this would decline with time and rock armouring.
Coal Enriched Materials		
Carbonaceous materials	Dark, carbonaceous Permian siltstones and shales or coal enriched spoil/waste products.	The clay and silt fraction is easily mobilised, however only moderate sediment contribution is expected, mainly due to dissociation of the clay with the strong acidity present.

Table 4: Summary of soil types (from BMA, 2009, Hazelton and Murphy, 2007, and IECA, 2008)

Soil type	Approximate extents	Soil description	
Uniform Clays	North Western areas of the site Approximately 41% of the site.	Topsoil: Yellowish and reddish brown to light brownish and reddish uniform clays. Texture include clay loam to light clay. Clay content 17% - 39%. Emerson ratings 2(1) – 3(1) to some areas with 6 and 8. Non-saline (EC0.04 to 0.032 dS/m). Total CEC is high. Subsoil: Yellowish brown to brown and reddish yellow to yellowish red. Texture includes clay loams to clays. Emerson ratings of 4 to 2(1). Slightly alkaline (pH 7.1-9). Clay content 29% - 44%. Non-saline.	0.03
Yellow Duplex Soils	Associated with floodplain areas. Approximately 10% of the site.	Topsoil: Generally dark yellow to brown in colour. Single grained with underlying horizon formed by moderate angular-blocky peds. Texture is generally loam to a clay loam. Clay content approximately 22% and sand content 60%. Structurally stable Emerson rating 8/3(1). Low salinity (EC 0.09 dS/m). Slightly alkaline (pH 7.1). Total CEC is high. Exchangeable NA% is low. Subsoil: Yellowish brown showing strong consistence and are massive in structure.	0.04
Brigalow Clays	Occurs on lowlands and plains up to 1% slope. Approximately 6% of the site.	Topsoil: Generally light brown with a weak platy structure. Clay content approximately 25%. Non-saline (EC of 0.11 dS/m) and moderately alkaline (pH 8/0). Emerson rating of 3(1). Subsoil: Generally brown with moderate sub-angular blocky pedality and light clay texture. Clay content approximately 31%. Non-saline (EC 0.11 dS/m) and moderately alkaline (pH 9.9). Emerson rating of 4.	0.025
Skeletal Soils	Steeper eroded side slopes and ridgelines. Approximately 3% of the site.	Topsoil: Generally light reddish/brown with a weak angular-blocky pedal structure. Surface stones observed over the surface of the soil unit. Subsoil: Generally light reddish brown with a moderate angular blocky structure going to massive below 45cm.	0.03
Shallow Heavy Clays	Occurs on undulating plains and low hills. Approximately 9% of the site.	Topsoil: Generally very dark grey/black. Crumby structure and heavy clay texture. Stones were noticeably minimal in the soil profile. Subsoil: Generally black with a moderate sub-angular blocky pedality and heavy clay texture. Stone content increased below 100cm depth.	0.012
Dark Heavy Clays	Located mostly between Cherwell Creek and Harrow Creek. Approximately 26% of the site.	Topsoil: Generally black with a moderate sub-angular blocky pedality and heavy clay texture. Clay content is approximately 61%. Non-saline (EC 0.12 dS/m) and moderately alkaline 9pH 8.7). Emerson rating 4 and does not exhibit dispersion potential.	0.012

Table 5: Predominant geology units and soil erodibility

4 ESC principles

4.1 Principles

1 This ESC Plan adopts the three cornerstones of ESC to comply with the CVM EA, as follows:

- **a** **Erosion control** – prevention or minimisation of erosion caused by runoff on disturbed surfaces.
- **b** **Drainage control** – a secondary erosion control, prevention or minimisation of soil erosion caused by concentrated flows. Appropriate management and separation of different water types through/around the area of concern.
- **c** **Sediment control** – trapping or retention of sediment generated from either overland flow or concentrated flow.

2 Best practice sediment control measures cannot, on their own, be relied upon to provide adequate environmental protection, therefore erosion and drainage controls shall be implemented. Rehabilitation, which is the final method of erosion control, shall be in accordance with the completion criteria in the CVM EA, the BHP Coal Rehabilitation Manual and (upon its commencement) the CVM Progressive Rehabilitation and Closure Plan (PRCP).

3 For ESC measures to be effective the following fundamentals are required:

- **a** Integrate ESC measures into the planning phases of mine operations;
- **b** Separate catchments by water types and control water movement through the site;
- **c** Minimise the duration and extent of topsoil and spoil exposure where possible;
- **d** Promptly stabilise disturbed areas where possible (to reduce the impact of disturbance);
- **e** Maximise sediment retention on the site and maximise discharge of water;
- **f** Maintain all ESC measures in proper working order; and
- **g** Monitor the site and adjust ESC practices to maintain the required performance standard.

4.2 ESC Hierarchy

4 ESC and MAW management follows a similar hierarchy of controls to safety at BMA operations. The hierarchy presented in order of preference with example controls are:

- **a** **Elimination –** Minimise catchment disturbance to reduce the generation of stormwater and MAW.
- **b** **Substitution –** Progressive rehabilitation of disturbed areas to meet site specific landform criteria and minimise the generation of contaminants at the source of disturbance.
- **c** **Engineering Controls –** Design and construct suitable structural controls such as dams and drains to reduce the potential for the non-compliant discharges of contaminants to the receiving waters.
- **d** **Administrative controls –** Maintain the ESC Plan and ensure its correct implementation across operational areas at CVM and monitor the effectiveness of the controls in the receiving waters.

5 Planning

5.1 Overview

1 The objective of ESC planning is to determine a catchment's water type and risk rating in order to conceptually align and size ESC measures.

2 ESC planning shall occur for each catchment where new disturbance is planned from strategic mine plans (5-year plan to LoA) and Tactical (3mth to 2 years). A single activity/project may cross several catchments.

3 ESC planning shall occur prior to the commencement of any new disturbance, including for operations, projects and closure activities

4 Catchments shall be classified by expected water type, land use, or recorded runoff water quality (where available). Where more than one water type occurs in a catchment, the water type with the poorest water quality is to be used to classify the catchment. Alternatively, drainage works are to be used to delineate sub-catchments by water type.

5 Any activity that removes vegetation or involves the movement of topsoil and/or spoil shall require an ESC catchment assessment.

6 The Permit to Disturb (PTD) process is used to control and minimise new disturbances, premature disturbance and disturbance of rehabilitated land. Refer to the BMA Permit to Disturb Procedure and CVM Land and Biodiversity Management Plan. The PTD includes consideration of erosion and sediment impacts and determination of appropriate controls.

7 The planning process for ESC is summarised as:

- **a** Stakeholder engagement to define the planned disturbance;
- **b** Catchment delineation and classification into water types; and
- **c** Catchment risk assessment for stormwater catchments.

8 **Error! Reference source not found.** shows the ESC planning and execution summary, from the planning phase through to decommissioning and rehabilitation

5.2 Stakeholder Engagement

9 Various stakeholders should be engaged when planning for ESC, including but not limited to:

- **a** Mine Planning (particularly tactical and strategic planning);
- **b** Engineering;
- **c** Governance and Technical Stewardship – Dams (for dam safety issues):
- **d** Water Planning;
- **e** Closure Planning;
- **f** Mine Services; and
- **g** Health Safety and Environment (HSE).

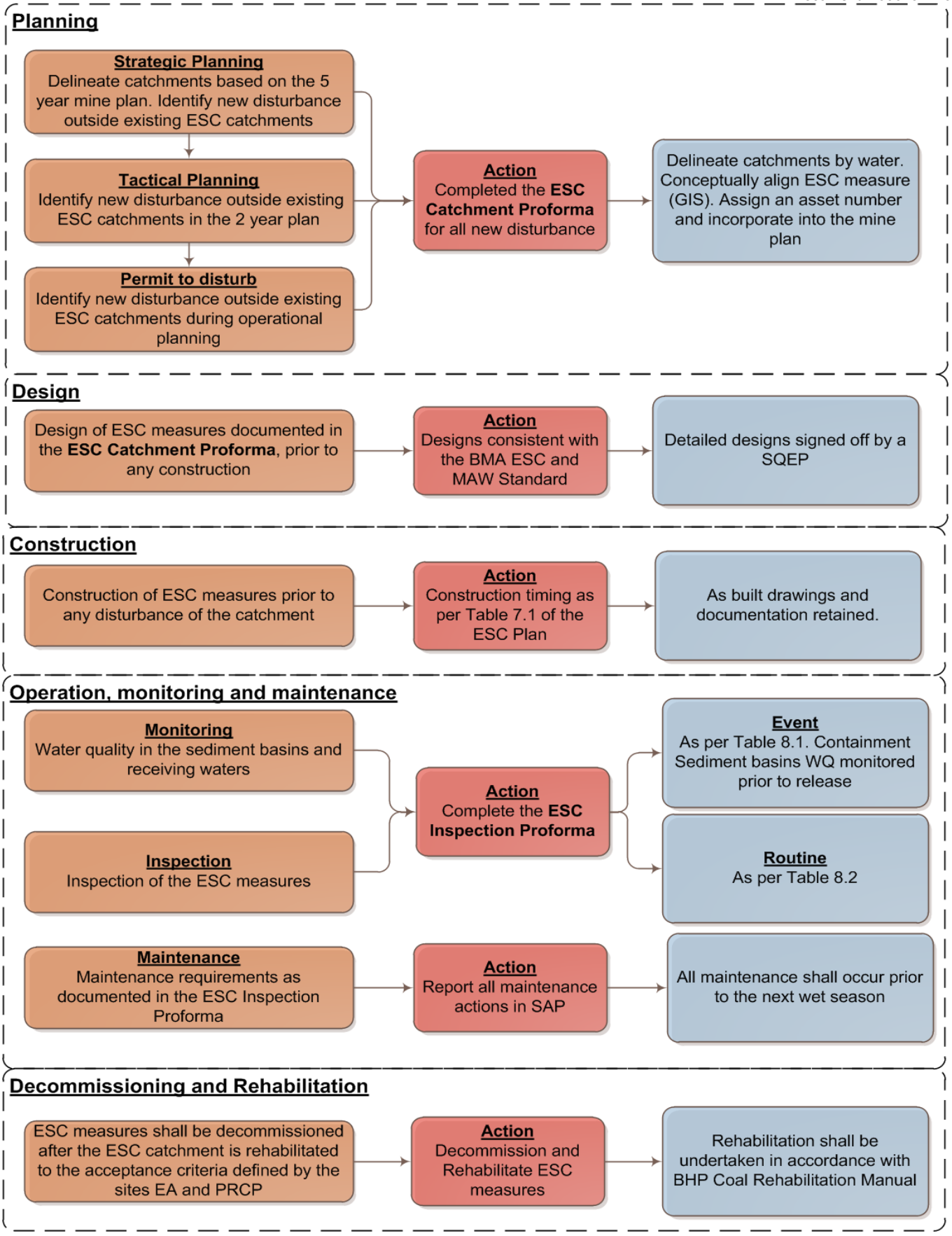

Figure 3: ESC Planning & Execution Summary

5.3 Catchment Delineation

5.3.1 Overview

10 ESC planning shall occur for each catchment where new disturbance shall occur from strategic mine plans (5-year plan) through to operations planning. A single activity/project may cross several catchments.

11 Catchments shall be classified by their expected water type, land use, or recorded runoff water quality. Where more than one runoff water type occurs in a catchment, the water type with the poorest water quality is to be used for the catchment. Alternatively, drainage works are to be used to refine the catchment delineation to have a uniform water type.

5.3.2 Mine Affected Water Catchments

12 MAW catchments are defined in accordance with the EA definition of MAW, detailed in **Section 1.3**:

13 MAW catchments should be minimised where possible using drainage controls.

5.3.3 Stormwater Catchments

14 Stormwater catchments include disturbed areas that do not meet the definition of MAW and may include:

- **a** Unrehabilitated and partially rehabilitated spoil emplacements;
- **b** Disturbed pre-strip areas;
- **c** Civil earthworks;
- **d** Topsoil stockpiles;
- **e** Haul roads without rejects used as road base;
- **f** Hardstand areas (excluding industrial/workshop areas); or
- **g** Access tracks.

15 Stormwater runoff shall be discharged through release points associated with ESC structures that have been installed in accordance with this ESC Plan.

5.3.4 Diverted Water Catchments

16 **'Diverted Water'** includes runoff from areas where water quality is unaffected by mining operations. Diverted water includes runoff from:

- **a** Undisturbed areas unaffected by mining; and
- **b** Rehabilitated areas that have achieved the rehabilitation acceptance criteria defined by the sites EA or Progressive Rehabilitation and Closure Plan (PRCP) (certification by the Administering Authority is not required); and
- **c** Exploration areas where ground disturbance for seismic works is negligible for creating potential erosion (e.g., slasher skimming the ground surface). If works are not negligible for creating potential erosion, the area shall be deemed a Stormwater (ESC) Catchment, with appropriate controls applied.

17 Diverted water catchments shall be directed around disturbed areas to reduce the size and cost of ESC and MAW measures.

18 Diverted water should be returned to the environment where practicable to reduce associated freshwater take and minimise impact to the flow regime of receiving waters.

5.4 Catchment Risk Assessment

19 The catchment risk assessment is completed after the catchments have been delineated and classified by water type. The catchment risk assessment process determines the risk rating for each catchment and is based on the following criteria:

a MAW catchment;

b Topsoil/spoil classification;

c Catchment slope;

d Disturbed catchment area (for risk rating) and total catchment area (for dam sizing); and

e Duration of disturbance.

20 This assessment allows planners and operational personnel to assess the risk rating of a catchment in accordance with the BMA ESC and MAW Standard to assist with identifying appropriate management measures prior to the commencement of any work.

21 Table 6 shows the catchment risk assessment to determine the catchment risk rating, which is based on the highest risk rating out of the four categories. The risk ratings are based on recommendations from Australian Soils and Landscapes Handbook (CSIRO, 2005) and the Best Practice Erosion and Sediment Control by the International Erosion Control Association (IECA), (IECA, 2008).

Risk Rating	Soil/spoil category	Disturbed Catchment area (ha)	Duration of disturbance	Average catchment slope
Very Low	Competent material	Less than 0.5 ha	Less than 3 months	Less than 1%
Low		0.5 to 1 ha	3 to 6 months	1% to 3%
Medium	Non-dispersive topsoil	1 to 4 ha	6 months to 2 years	3% to 10%
High	Dispersive topsoil	Greater than 4 ha	Greater than 2 years	Greater than 10%
	Non-dispersive spoil			
Very High	Dispersive spoil	Any	Any	Any
MAW	Per MAW definition in Section 1.3	Any	Any	Any

Table 6: ESC catchment risk assessment

5.4.1 Topsoil and Spoil Classification

22 For the purpose of the risk assessment, topsoil and spoil are classified into five simplified categories and recorded. The description of each topsoil and spoil category used in the risk assessment is shown in Table 7.

23 These simplified categories should be used in the absence of site-specific classifications.

24 The topsoil/spoil material across each mine site shall be categorised during the mine planning phases. These categories should be confirmed on site prior to undertaking works.

25 Runoff producing AMD (see **Section 5.3.2**) shall be treated as MAW.

Topsoil/spoil category	Description
Competent material	Typically subsoil, structurally sound and suitable for construction of earthworks
Non-dispersive topsoil	Structurally stable in water
Dispersive topsoil	Structurally unstable in water
Non-dispersive spoil	Structurally stable in water, typically associated with unweathered Permian material
Dispersive spoil	Structurally unstable in water, typically associated with weathered Tertiary material

Table 7: Description for topsoil and spoil types

5.5 Catchment Planning

26 For each catchment, a catchment plan will be completed as part of any mine planning and referred to when assessing a Permit To Disturb to ensure that no new disturbance is authorised without suitable ESC measures.

27 For some catchments, different approaches for the construction phase and operational phase should be considered.

28 The catchment plan shall be used to determine the measures required to satisfy the BMA ESC and MAW Standard and inform the detailed design of ESC controls.

6 Design

6.1 Overview

1 The design standards adopted at CVM for ESC measures are in accordance with the BMA ESC and MAW standard.

2 The design standards adopted for ESC measures are based on the catchment risk rating (***Table***6).

6.2 Relevant Guidelines

3 ESC control measures should in general be designed considering the guiding principles within:

a The BMA ESC and MAW Standard; and

b Best Practice Erosion and Sediment Control Guidelines (International Erosion Control Association (IECA), 2008).

4 Whilst the IECA Guideline is generally intended for urban environments or short-term disturbance activities, **all ESC measures shall be designed and constructed** in accordance with relevant provisions of Books 2 and 3 of the IECA Guideline (2008).

6.3 Erosion Control

5 The most cost-effective method to achieve the ESC objectives is to prevent (or minimise) erosion at the source by protecting any disturbed surfaces with some form of cover. Surface cover reduces the impact of rainfall and wind erosion. It also reduces the speed of water flowing over land.

6 Disturbed areas, excluding active mining areas, are to have a suitable ground cover established as soon as practicable.

a Areas available for permanent rehabilitation are to be revegetated in accordance with the rehabilitation criteria in the CVM EA, the BHP Coal Rehabilitation Manual, and with the approved rehabilitation plans for the site.

b Haul roads and hardstand areas will have a suitable road base to minimise erosion at the time of construction. If haul roads and hardstands use coal rejects or dispersive material, the catchment shall be classified as MAW.

c Externally draining embankment batters and haul road roll over protection bunds are to be reshaped and appropriate erosion controls applied at the time of construction.

d Topsoil stockpiles are to have appropriate erosion controls applied (vegetation preferred) as soon as possible. If topsoil stockpiles do not have erosion controls applied, the catchment risk rating may increase due to the disturbance duration. Appropriate seed mixes can be decided in consultation with the site HSE department with reference to the seed mixes within the Rehabilitation Manual.

e Disturbed footprints, such as those associated with linear infrastructure, dam embankments, clean water drain/culverts, etc, which are not available for permanent rehabilitation but which pose an erosion risk should be stabilised. Stabilisation material and practices are contained both in the IECA guidelines and in the BHP Coal Rehabilitation Manual.

6.4 Drainage Control

6.4.1 Overview

7 This section outlines the drainage control measures adopted at CVM. Drainage is used to convey and separate diverted water, stormwater or MAW. Control measures for different drainage functions are discussed as follows:

- **a** **Permanent drainage** – will be in place at the end of mine life;
- **b** **Operational drainage** – constructed on a temporary basis to convey diverted water, stormwater or MAW around the mine site. Operational drains are also required to separate catchments of different water types.

8 The design standard of all drains is determined from the anticipated design life (from the catchment risk assessment shown in (Table 6) of the structure or its purpose within the WMS.

9 The ESC Plan is applicable to operational drainage only.

6.4.2 Operational Drainage Controls

10 Specific design standards applied to operational drains that convey runoff to a sediment basin include:

- **a** Drains constructed in soil/spoil with a high or very high risk rating (see Table 6) AND with a disturbance duration of medium or higher (see Table 6) should (as a minimum) be topsoiled and seeded to minimise channel erosion;
- **b** Drains constructed in a catchment with a high risk rating (see Table 6) AND a slope with a medium or high risk rating (see Table 6) will be lined with appropriate engineered armouring (rock or similar); and
- **c** Drains constructed with a slope with a high-risk rating (see Table 6) will be lined with appropriate engineered armouring (rock or similar).

6.4.3 Catchment Separation Standard

11 Drains or bunds are used to separate catchments of different water types. The design standard, or capacity, of all drains is determined from the disturbance duration of the structure (see Table 6) or its purpose within the WMS.

12 Table 8 shows the minimum design standard for drains or bunds that separate catchments of different water types based in the BMA ESC and MAW Standard.

Contributing catchment	Receiving catchment type	Catchment risk rating (see Table 6)	Separation Design Standard (AEP)
MAW	Stormwater/Diverted		1%
Diverted	MAW		1%[a]
Diverted	Stormwater		5%
Stormwater	MAW/Diverted	Low/Medium	5%
Stormwater		High/Very High	1%

Table 8: Drainage design standard for the separation of water types

- **a** **Diverted** water that overflows to a MAW catchment and interacts with levees regulated in accordance with the *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures, should be checked against the relevant design standard in that Manual.*

6.4.4 Temporary Watercourse and Drainage Line Crossings

13 Temporary crossings of a watercourse or drainage feature as defined by the Queensland Government watercourse identification map shall adopt the design standards shown in Table 9. Note that this only relates to ESC requirements. RPP any other relevant requirements will also need to be complied with.

Disturbance Duration Risk rating (see Table 6	Design standard
Very Low/Low/Medium	Low level crossing
High	Culverts capacity of 39% AEP (0.5 exceedances per year)
	Structurally sound up to the 10% AEP for overtopping

Table 9: Temporary crossing design standard (IECA, 2008)

6.4.5 Drainage Controls on Access Tracks

14 Access tracks that drain to receiving waters shall have suitable erosion and drainage control measures, such as:

a Whoa-boys and level spreaders;

b Suitable road base material (no coarse rejects as road base);

c Erosion control of peripheral areas disturbed as part of the road construction.

6.5 Sediment Control

6.5.1 Overview

15 This section outlines the sediment control measures adopted at CVM. The catchment risk assessment is used to define the sediment control measures and in particular the sizing or need for a sediment basin.

6.5.2 Sediment Basins

16 Sediment basins can be designed for a different operational function depending upon the risk rating:

a **'Flow-through'** – Design to passively drain the sediment basin within 5 days using either a riser pipe or floating decant. For catchments with a medium or high risk rating (see Table 6and

b **'Containment'** – designed to contain the water for monitoring or treatment prior to dewatering, or to pump to the mine water management system. For catchments with a very high risk rating (see Table 6).

17 'Flow-through' and 'containment' basins are designed to the "x%ile 5 day" rainfall and are likely to be overtopped or bypassed several times per year, with the overtopping frequency decreasing with higher risk catchments.

18 All sediment basins shall have a consequence assessment in accordance with DEHP Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (DEHP, 2014).

19 Access shall be all weather and barricaded for safe vehicular and pedestrian access to the valves, control system and surface monitoring points.

20 Dams that rely on pump operation to achieve acceptable overtopping frequency and likelihood shall be fitted with automated stop/start and remote monitoring.

6.5.3 Design Standard

21 Table 10 outlines the sediment control design standard based on the catchment risk assessment (see Table 6).

22 For medium to high risk sediment basins that release to a sensitive environment (high environmental value), the 5-day percentile will be increased by 5%ile (i.e. 80%ile to 85%ile).

Risk Rating	Sediment control design standard
Very Low	No controls
Low	Supplementary sediment controls
Medium	FT[a] 80%ile 5 day
High	FT[a] 90%ile 5 day
Very High	Containment basin (95%ile 5 day)
MAW	MAW Dam

Table 10: Sediment control design standard

a **FT = 'Flow-through' sediment basin**

6.5.4 Supplementary Sediment Control Techniques

23 Supplementary sediment controls are used in areas where the ESC catchment has a low risk rating, such as:

a Excavated sediment traps;

b Rock check dams; and

c Sediment fencing/bunds.

7 Construction

7.1 Overview

1 Disturbance activities will be conducted in accordance with CVM's administrative processes that will guide the implementation of ESC, including:

- **a** The BMA ESC and MAW Standard and any relevant contractor plans and procedures;
- **b** Permit to Disturb;
- **c** MAU internal projects standard;
- **d** Project specific approvals; and
- **e** Inspections.

2 ESC and MAW measures shall be designed and constructed by suitably qualified and experienced persons as per the CVM EA. ESC and MAW measures in catchments with a Medium, High, Very High or MAW risk rating shall be designed by an RPEQ.

3 ESC measures should be put in place prior to disturbance to reduce sediment laden stormwater discharging to the receiving environment. The scheduling and timing of works is an important element of any construction activity.

7.2 Construction Timing

1 The timing of the construction of new ESC measures takes into account the risk of erosion during the construction phase of the ESC measure. Where possible, construction of ESC measures shall occur during dry periods.

2 Table 11 shows the risk rating and the required action for the construction timing based on the average monthly rainfall.

Risk Rating	Average monthly rainfall (mm)	Months	Action
Low	Less than 45	April, May, June, July, August, September, October	Catchments with low erosion risk don't need sediment controls if disturbance is less than 3 months
Medium	45 to 100	March, November	Normal ESC Planning
High	100 to 225	January, February, December	Reschedule work where possible
			No work within a watercourse
			Sediment basins required if disturbance is greater than 1 ha

Table 11: Risk rating based on average monthly rainfall during construction period.

7.3 Construction Records and Management of Change

1 Management of Change (MoC) process is to be followed for construction of ESC infrastructure.

2 Each sediment basin and drain shall be registered in SAP with a Functional Location as part of Management of Change.

3 Construction designs, records, testing, operational rules, as-built survey, basis of design and other Engineering documentation are to be saved against the Functional Location in SAP and/or Documentum as a minimum.

4 Inspection regimes are to be setup in SAP as part of project close out and prior to handover to operations, for capital projects this is the accountability of Engineering and/or Projects.

8 Operation

8.1 Sampling and Inspections

1 Sampling and inspection regimes have been put in place to monitor the performance/operation of ESC and MAW structures at CVM. As per the ESC and MAW Standard Table 1-2, sampling and inspection regimes are required to commence in FY23.

2 Inspections shall be conducted on an event basis and routinely throughout the year (refer Table 12). The **minimum** details that shall be recorded during each inspection includes:

- **a** Sediment storage volume;
- **b** Details of any drainage, erosion and sediment control measures with signs of erosion/scour that require maintenance;
- **c** Occurrences of excessive sediment deposition (whether on-lease or off-lease); and
- **d** Embankment toe, crest, spillway for cracking, settlement, slumping, erosion, scour, overtopping and seepage.

3 Persons undertaking inspections shall meet the requirements for 'Suitably Qualified' under the Environmental Authority. In this regard minimum qualifications of Environmental Scientist, Environmental Engineer, Civil Engineer or similar operational experience is accepted.

4 To assist monitoring and maintenance the sediment storage volume shall be clearly marked on each dam.

5 Water quality sampling should occur within a week of the rain event that triggers the sampling, subject to being safe to do so and access permitting.

6 An annual sampling schedule has been developed to cover the ESC and MAW Standard requirements and is available from the Site HSE team. The schedule will be reviewed annually based on the findings from the previous year.

7 Table 12 shows the **minimum** frequency of routine inspections.

8 The **minimum** details that shall be recorded during each inspection includes:

- **a** Sediment storage volume;
- **b** Details of any drainage, erosion and sediment control measures with signs of erosion/scour that require maintenance;
- **c** Occurrences of excessive sediment deposition (whether on-lease or off-lease); and
- **d** Embankment toe, crest, spillway for cracking, settlement, slumping, erosion, scour, overtopping and seepage.

9 Any failure of effectiveness of structure must be entered as an event in the site's event management system.

10 To assist monitoring and maintenance, the sediment storage volume shall be clearly marked on each dam.

11 Each embankment shall undergo an annual structural inspection by the Responsible Dam Engineer.

Control type	Minimum frequency
Erosion control infrastructure	Post-wet season inspections (prior to May)
Drainage, sediment basins and MAW dams	Pre (prior to November) and post wet season inspections

Table 12: Inspection Requirements

8.2 Maintenance

12 Maintenance that is identified by an inspection will be carried out in a timely manner. Examples of deficiencies that will trigger maintenance activities include, but are not limited to:

- **a** Damage/scouring to ESC measures;
- **b** Sediment deposition in excess of the sediment storage zone.
- **c** Damage/deterioration of access tracks or the ability to inspect/monitor, or maintain and/or operate area/infrastructure/equipment;
- **d** Spill, contaminated or waste materials accumulated/deposited in controls or their associated catchment areas; and
- **e** Outlet controls of spillways and discharge points.

13 All maintenance requirements shall be actioned in SAP. Maintenance shall be actioned prior to the next wet season (November).

9 Decommissioning

1 All drainage controls shall be decommissioned prior to the decommissioning of dams.

2 Dams shall be de-watered and de-silted prior to decommissioning. Dams shall be decommissioned so they can no longer contain water.

10 Event Investigation and Response

1 In the event of emergencies, exceptions or incidents, all reasonable actions must be taken by operations to minimise potential or actual environmental harm and notification must be given to the regulator (DES) in accordance with the requirements of the EA and the Environmental Protection Act 1994 (Qld).

2 Any events relating to erosion and sediment impacts shall be managed in accordance with the site EA, and the following internal documents:

- **a** BMA HSE STD Event Management Standard
- **b** BMA PRO HSEC External Reporting Procedure
- **c** Site based Event and Investigation Management Procedure where required

3 Any complaints received related to erosion and sediment impacts will be recorded and investigated in accordance with the EA, internal BHP documents listed above and the BMA Community Complaints and Grievance Procedure.

11 Performance Indicators

1 To assess and determine the effectiveness of ESC management on site, the performance indicators defined in Table 13 should be adopted.

Parameter	Performance Indicator
Compliance is maintained with EA conditions	ESC Plan developed and implemented in accordance with the EA. Records of monitoring and inspections are maintained.
Community complaints	No Complaints received regarding ESC impacts. Any complaints received related to erosion and sediment impacts will be recorded and investigated in accordance with the EA and BHP event reporting and investigation requirements.
Visual Inspections	Sediment basins must not contain water that has visual or odour evidence of slick, hydrocarbons and/or coal.

Table 13: Performance Indicators

12 Data Management and Performance Reporting

1 Any deficiencies observed that require remedial action will be raised in SAP to ensure the ESC remains in accordance with the intent of the design.

2 Sampling records shall be maintained through the Environmental Data Management System (EDMS).

3 Event and performance reporting will be included in the site Quarterly Environmental Management Review.

13 Roles and Responsibilities

1 General requirements and responsibilities of roles are found in various elements of CVM systems including but not limited to:

a Position Descriptions;

b Organisational Design Protocols; and

c BMA management system elements such as Standards, Procedures and Work Instructions.

2 Roles and Responsibilities specific to this ESC Plan are outlined in Table 14.

Role	Responsibility
General Manager	Overall responsibility for the implementation of the ESC Plan at CVM.
Mine Planning	Integrating water management and ESC in the mine planning process. Submit the catchment ESC plans with Permit to Disturb applications (when applicable).
Engineering	Maintain the BMA ESC and MAW standard and provide guidance on its implementation and the requirements of ESC structures
Governance & Technical Stewardship - Dams	Provide guidance on dam safety and associated requirements of dams in respect to the DEHP Manual for Assessing Consequence Categories and Hydraulic Performance of Structures.
HSE	Provide advice to operations and contractors on ESC and assist in the definition of MAW. Actively define areas where ESC measures are needed, including through the catchment plans and Permit to disturb process. Conduct site inspections of areas requiring ESC measures in accordance with this ESC Plan. Coordinate with the other departments where compliance issues are identified and corrective actions are needed.
Mine Service	Conduct site inspections in accordance with this ESC Plan, including documenting the inspection outcomes and any maintenance activities required in SAP. Complete maintenance activities in a timely manner as per the ESC Plan.
RPEQ	Consulted in the design and construction of sediment basins, at a minimum for catchments with a medium or higher catchment risk rating.
Contractors, Site Supervisors or Project Teams	Ensure stipulated and planned ESC are implemented. Inspect/monitor the effectiveness and conditions of ESC during and/or after works. If required, implement additional controls or maintenance works. Report any ESC issues or non-compliance to the HSE Team.

Table 14: Roles and responsibilities

14 References

Reference	Title
DEHP, 2013	Queensland Government Department of Environment and Heritage Protection, July 2013, *'Queensland Water Quality Guidelines 2009',* July 2013
IECA, 2008	International Erosion Control Association (Australasia), November 2008. *'Best Practice Erosion and Sediment Control'*
Landcom, 2004	Managing Urban Stormwater – Soils and Construction Volume 1 and Volume 2E, 4th *Edition, NSW government, Parramatta, March*
DEHP, 2016	Department of Environment and Heritage Protection (DEHP) (2016). Manual for assessing consequence categories and hydraulic performance of structures.
DEHP, 2011	Department of Environment and Heritage Protection (DEHP) (2013). Isaac River Sub-basin Environmental Values and Water Quality Objectives 2011.
QWQG, 2009	Queensland Government Department of Environment and Heritage Protection (2009), Queensland Water Quality Guidelines 2009.
CSIRO, 2004	McKenzie, N.J.; Isbell, R.F.; Jacquier, D.W.; Brown, K.L. Australian soils and landscapes: an illustrated compendium, CSIRO Publishing, 2004
	BHP Rehabilitation Manual
	ESC & MAW Standard
	[Environmental Authority EPML00562013]

Table 15: List of reference documents

15 Acronyms

Acronym	Meaning
AEP	Annual Exceedance Probability
AMD	Acid Mine Drainage
BoM	Bureau of Meteorology
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DEHP	Department of Environment and Heritage Protection
DES	Department of Environment and Science
EA	Environmental Authority
EC	Electrical Conductivity
EMS	Environmental Management System
EP	Environmental Protection
ESC	Erosion and Sediment Control
FT	Flow Through
GIS	Geographic Information System
HSE	Health, Safety & Environment
IECA	International Erosion Control Association
LoA	Life of Asset
MAW	Mine Affected Water
MoC	Management of Change
PRCP	Progressive Rehabilitation & Closure Plan
PTD	Permit To Disturb
QWQG	Queensland Water Quality Guidelines
REMP	Receiving Environment Monitoring Programme
RPEQ	Registered Professional Engineer of Queensland

Acronym	Meaning
SQEP	Suitably Qualified Experienced Person
WMP	Water Management Plan
WMS	Water Management System
WQ	Water Quality

Table 16: Acronym

16 Version Management

Version	Details	Date
3.2	Initial reviews	October 2016
	Erosion and sediment control plan update	
	Annual review	
	Document called for review. Update to reference documents	
3.3	Document refresh	October 2016
4.0	Major update to design standards and inspection requirements as per our EA	20 March 2020
	Minor update to the document. Changed the KM numbers to their D2 ones	
5.0	Minor update to document	2 September 2020
6.0	Annual Review	21 October 2021
6.3	Annual Review	19 July 2022
7.0	Annual Review – Include CVM Sediment Dams	11 September 2025

Table 17: Version Management