BHP Mitsubishi Alliance

Saraji Mine Environmental Evaluation Report

20 May 2019

Contents

Introduction and Purpose

On 3 May 2019, the Department of Environment and Science (**DES**) issued to BHP Coal Pty Ltd (the **Company**) a notice to conduct or commission an environmental evaluation (the **Notice**) pursuant to section 326B of the Environmental Protection Act 1994 (Qld) (the **Act**). The Notice was issued in respect of potential environmental harm caused by the release of sediment into the receiving environment (specifically, Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek) from the Saraji Mine (the **Mine**).

The Notice requires that an environmental investigation into the alleged potential environmental harm be carried out, and that an environmental report on the investigation be prepared and submitted to DES.

This Report is the Environmental Report required by the Notice.

Executive Summary

BMA has completed the investigation required by DES pursuant to the Notice. The results of that investigation are set out in this Report, along with a Program of Works to address and rectify issues identified.

This Report identifies improvements which can be made at Saraji Mine to prevent the release of sediment into the receiving environment, including improvements to erosion and sediment control structures at the mine.

The issues identified by this Report are a high priority for the Company, and the Company confirms its commitment to addressing and rectifying the issues identified by this investigation through completion of the Program of Works in a timely, safe and sustainable manner.

Environmental Investigation - Overview

Scope

The Company has investigated the sources, causes and extent of potential environmental harm likely because of sediment migration resulting from the activities of the Company at the Mine, strictly in accordance with the requirements of the Notice. Specifically, the risk of potential environmental harm has been investigated in respect of Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek.

The Company has not investigated, and this Report does not cover, any specific incident at the Mine, nor any specific notification made by the Company in respect of the release of sediment (including any specific notifications or incidents mentioned in the “Grounds” section of the Notice).

Process

The Notice requires that the investigation be carried out, and this Report be prepared by, an “appropriately qualified person”. The Notice defines an “appropriately qualified person” as a person or persons who have professional qualifications, training, skills or experience relevant to the nominated subject matter and can give authoritative assessment, advice and analysis of performance relative to the subject matter using the relevant protocols, standards, methods or literature.

This investigation carried out by the Company pursuant to the Notice has been completed by subject matter experts within the Company, with assistance from Engeny Water Management (**Engeny**).

The body of this Report states clearly who has carried out the relevant part of the investigation, and prepared the relevant part of this Report. In all cases, it is submitted that "appropriately qualified persons" have completed the investigation and preparation of this Report.

Structure of Report

The Notice contains four requirements, as follows:

1. An investigation into the current mine water management system at the Mine;
2. A risk assessment in relation to water management and erosion and sediment control at the Mine;
3. A review of the Water Management Plan and Erosion and Sediment Control Plan; and
4. Development of a program of works.

This Report deals with each of the 4 requirements in turn below, with relevant items for submission contained in Appendices to this Report.

Requirement 1

Investigation into the current mine water management system

Requirement 1(a) of the Notice requires:

> *An investigation into the current mine water management system which identifies:*
>
> *i. the environmental values associated with the receiving environment including Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek;*
>
> *ii. the clean and mine affected water catchments as per the definition in the EA, including catchment size, that may flow to Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek during rainfall events;*
>
> *iii. the existing water management and erosion and sediment control infrastructure associated with catchments that may flow to Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek during rainfall events; and*
>
> *iv. the annual exceedance probability (AEP) of the key existing infrastructure identified under Requirement 1(a)(iii).*

Engeny have completed the investigation into the matters set out in Requirement 1(a) of the Notice. Engeny's Report in respect of this Requirement 1(a) is contained in Appendix 1.

Requirement 2

Risk Assessment

Requirement 1(b) of the Notice requires:

> *A risk assessment, including actual and potential risks, in relation to water management and erosion and sediment control at Saraji Mine. This includes the development of a risk register which:*
>
> *i. describes the risk consistent with the principle of ISO31000;*
>
> *ii. scores the risk based on severity and likelihood; and*
>
> *iii. provides a risk rating for each risk identified and detail how this risk relates to BHP Coal's corporate risk acceptance criteria.*

On 13 and 14 March 2019, the Company carried out a risk assessment using the BHP Risk Management Framework (as outlined in the BHP 'Our Requirements – Risk Management (Version 6.1)' document).

The risk assessment process under the BHP Risk Management Framework involves the following steps:

1. Identify the risk event to be assessed.
2. Identify the subject matter experts to assess the risk event, considering the scope and objectives of the risk assessment.
3. Determine all possible causes of the risk event, and in respect of each cause, determine the preventative controls that should be implemented (ie. the controls which are used to manage the causes and thereby reduce the likelihood of occurrence of the risk event occurring).
4. Assess the Maximum Foreseeable Loss (MFL), on a scale of 1 to 7, for each of the following impact categories:
    a. Health and Safety;
    b. Environment;
    c. Community;
    d. Reputation;
    e. Legal; and
    f. Financial.

    The MFL is the impact sustained in the plausible worst case scenario for the relevant risk event. In a plausible worst case scenario all risk controls are assumed to be ineffective.
5. In respect of each impact category set out in Step 5, determine the mitigating controls that should be implemented (ie. the controls which will reduce the impacts which flow from a risk event once it has occurred).
6. Determine the likelihood of each impact occurring, on a scale of 0.03 (Very Rate) to 10 (Almost Certain), for the same set of categories outlined in Step 5.
7. Calculate the Residual Risk Rating (RRR) for each impact, being the numerical rating applied to an impact, calculated as the product of the relevant severity factor and the relevant likelihood factor. The RRR represents the level of residual risk associated with a risk after taking into account controls in place that have had their effectiveness assessed.
8. A risk event is classified as a "Material Risk" under BHP's risk management framework if any of the impact categories have an MFL ≥ 5 or an RRR ≥ 90. A Material Risk with an RRR ≤ 90 is considered "tolerable".

In accordance with this process, for the purposes of this investigation required by the Notice, the risk event assessed by the Company was:

> **Multiple and compounding unauthorised discharges of mine affected water (including sediment) into Spring Creek, One Mile Creek, Hughes Creek or Phillips Creek.**

A cross section of subject matter experts were present at the risk assessment, including representatives from:

(a) the BHP Coal Health, Safety and Environment Business Partnership team;

(b) the BHP Coal Environment Analysis and Improvement team;

(c) the BHP Coal Risk team;

(d) BHP Coal Closure Planning team;

(e) BHP Asset Projects team;

(f) BHP Coal Water Planning team;

(g) BHP Coal Legal Team;

(h) BHP Coal Engineering team;

(i) Saraji Dam Engineer;

(j) Saraji Mine Planning team; and

(k) Saraji Mining Services team.

A copy of the Risk Assessment, compliant with ISO31000, is attached in Appendix 2.

The risk event is classified as a “Material Risk” under BHP’s risk management framework. This is because the MFL has a level 5 score for financial impact and the RRR of the risk event is 100.

As the RRR is greater than 90, the “material risk” is deemed to not be tolerable under BHP’s Risk Management Framework. In this instance, under BHP’s Risk Management Framework, a remediation plan must be developed and implemented to improve the controls. The Program of Works set out in this Report is the required remediation plan.

Requirement 3

Management Plans

Requirement 1(c) of the Notice requires:

> *A review of the Water Management Plan and the Erosion and Sediment Control Plan to ensure that the documents meet the requirements of EA EPML00862313. The review must:*
>
> *i. provide an audit schedule that clearly specifies the timing and criteria for assessing the ongoing operation and maintenance of all erosion and sediment control measures;*
>
> *ii. provide minimum standards and requirements of sediment control structures;*
>
> *iii. where appropriate, state the revisions proposed to the Water Management Plan and Erosion and Sediment Control Plan.*

Pursuant to Requirement 2 of the Notice, where revisions are proposed to the Water Management Plan or Erosion and Sediment Control Plan under requirement 1(c)(iii), the Company must submit the revised plans to the DES as part of this Report.

Engeny have completed a review of the Mine's Water Management Plan and Erosion and Sediment Control Plan in accordance with Requirement 1(c) of the Notice.

In respect of the Erosion and Sediment Control Plan, both routine and event based inspections have been included, specifying the timing and criteria for assessing the ongoing operation and maintenance of all erosion and sediment control measures at the Mine. In addition, minimum design guidelines for drainage, sediment and erosion control are clearly set out in the ESCP, along with construction and operational guidelines.

Inspection routines have also been included in the Mine's Water Management Plan, including both routine inspections and event based inspections for pipelines, drainage, dams, levees and diversions

Copies of the revised Erosion and Sediment Control Plan and Water Management Plan are contained in Appendix 3 of this Report.

Requirement 4

Program of Works

Requirement 3 of the Notice states the following:

> *The recipient of this notice must develop and submit to the administering authority a program of works, as a result of the investigations and reviews required under Requirements 1(a) to (c). The program of works must include:*
>
> *a) works to be undertaken to mitigate risks identified under Requirement 1(b), and timeframes for completion; and*
>
> *b) works to be undertaken to construct new erosion and sediment control structures or to bring existing structures unto conformance with the new minimum standards and requirements under Requirement 1(c)(ii), and timeframes for completion.*

BHP personnel, with support from Engeny, have developed a Program of Works, contained in Appendix 4.

The Program of Works contains the following 2 types of actions:

- **Mitigation:** Actions to mitigate potential environmental harm for each catchment that is classified as a "Mine Affected Water" catchment and which may flow to Hughes Creek, One Mile Creek, Spring Creek or Phillips Creek during rainfall events. Some of these actions have already been completed, and the remaining mitigation actions will be completed by the Company in the short to medium term. Many of these actions are temporary in nature, and will be replaced by more permanent solutions which will result from further studies.
- **Studies:** Commitments to undertake studies in respect of existing and new water storage and erosion control structures, to determine the most effective and sustainable long-term solutions. These studies will necessarily take longer to complete, and long-term solutions will evolve as studies progress.

The prioritisation of both mitigation actions and studies has been determined considering a variety of factors including (without limitation) risk, ease of implementation, access, safety, resourcing, operational considerations and funding.

Using this method, we have prioritised the creek catchments in the following order:

1. One Mile Creek;
2. Hughes Creek;
3. Spring Creek; and
4. Phillips Creek.

At the same time, where there are actions which can be done quickly and easily across all creek catchments, we are seeking to have those actions completed immediately (noting that some have already been completed).

Within each creek catchment, of the remaining actions, we have then prioritised certain catchments, on the basis that certain catchments are at greatest risk of discharging directly into waterways.

On current timing, mitigation actions have already commenced and all mitigation actions listed in the Program of Works will be complete by 30 June 2026. Studies will naturally take a longer time period to complete; however, all studies in respect of longer-term solutions will be underway by 30 June 2026.

It should be noted that, in addition to the Program of Works, the Company will be developing a life of mine plan for progressive rehabilitation, which will be completed by 1 May 2023 (in accordance with the *Mineral and Energy Resources (Financial Provisioning) Act 2018* (Qld)).

Appendix 1

Saraji Mine Water Management Investigation Report (Engeny)

ENGENY
WATER MANAGEMENT

BMA

Saraji Mine Water Management System Investigation Report




May 2019

M11000_285

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DISCLAIMER

This report has been prepared on behalf of and for the exclusive use of BM Alliance Coal Operations Pty Ltd (BMA) and is subject to and issued in accordance with BMA instruction to Engeny Water Management (Engeny). The content of this report is, in part, based on information supplied to Engeny by BMA

M11000_285 SARAJI MINE WATER MANAGEMENT SYSTEM INVESTIGATION REPORT					
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Rev 0	Client Issue	Aaron Hallgath	Ben Kiernan	Aaron Hallgath	15 May 2019
Rev 1	Client Issue	Aaron Hallgath	Ben Kiernan	Aaron Hallgath	17 May 2019
Signatures					

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Appendices

List of Tables

1. INTRODUCTION

On the 3rd of May 2019, the Department of Environment and Science (DES) issued a Notice to conduct an environmental evaluation to BMA for its Saraji Mine in response to observed sediment deposition in receiving waterways (Notice).

1.1 Purpose

Engeny Water Management (Engeny) has been commissioned by BMA to assist with addressing the following requirements (the Relevant Requirements) of the Notice:

1(a) An investigation into the current mine water management system which identifies:

i. the environmental values associated with the receiving environment including Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek;

ii. the clean and mine affected water catchments as per the definition in the EA, including catchment size, that may flow to Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek during rainfall events;

iii. the existing water management and erosion and sediment control infrastructure associated with catchments that may flow to Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek during rainfall events; and

iv. the annual exceedance probability (AEP) of the key existing infrastructure identified under Requirement 1(a)(iii).

This report outlines the assessment methodology and a summary of the findings associated with the works undertaken by Engeny to address the Relevant Requirements of the Notice.

1.2 Information Supplied to Engeny

The following information was supplied by BMA to Engeny:

1. Aerial survey data (LiDAR) captured in April 2018.
2. Most recent aerial photography
3. Saraji Mine Water Management Plan
4. Saraji Mine Erosion and Sediment Control Plan
5. Geometry data including stage storage curves for water storages
6. Culvert survey information

2. ENVIRONMENTAL VALUES

This Part 2 of the Report addresses Requirement 1(a) (i) of the Notice.

The environmental values specific for Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek are outlined in Table 1 along with the environmental values for Isaac western upland tributaries documented in the EPP Water (2011).

The EPP Water (2011) classifies the Isaac River western upland tributaries aquatic ecosystem as moderately disturbed for the purposes of setting water quality objectives.

Table 2.1 Environmental Values for Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek

Environmental Value	EPP Water (Isaac western upland tributaries)	Hughes Creek	One Mile Creek	Spring Creek	Phillips Creek
Irrigation	Y	N	N	N	N
Farm supply/use	Y	Y	Y	Y	Y
Stock water	Y	Y	Y	Y	Y
Aquaculture	Y	N	N	N	N
Human consumer	Y	N	N	N	N
Primary recreation	Y	N	N	N	N
Secondary recreation	Y	N	N	N	N
Visual recreation	Y	N	N	N	N
Drinking water	Y	N	N	N	N
Industrial use	Y	N	N	N	N
Cultural and spiritual values	Y	Y	Y	Y	Y

3. CATCHMENT ANALYSIS AND CLASSIFICATION

This Part 3 of the Report addresses Requirement 1(a)(ii) of the Notice.

The surface water catchments within Saraji Mine have been delineated using aerial survey collected in April 2018 supplied by BMA.

The catchments have been firstly classified into two categories:

(1) catchments reporting to pits or voids; and

(2) catchments that may flow to Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek during rainfall events.

Those catchments that may flow to Hughes Creek, One Mile Creek, Spring Creek and Phillips Creek during rainfall events have been further categorised into mine affected water or clean water catchments using the definition of “mine affected water” in the Saraji Mine Environmental Authority EPML00862313 (the EA).

Appendix A, inclusive of Figures 1, 2 and 3 and Table 2, provides a summary of the catchments and associated classifications for Saraji Mine.

4. EXISTING WATER MANAGEMENT INFRASTRUCTURE

This Part 4 of the Report addresses Requirement 1(a)(iii) and 1(a)(iv) of the Notice.

Saraji Mine has a range of water management infrastructure and sediment control infrastructure to manage the release of mine affected water and sediment to receiving waterways.

A containment assessment has been undertaken for key infrastructure which is considered critical to the management of mine affected runoff or runoff containing elevated suspended solids. Infrastructure is considered critical to the management of runoff where, in the absence (or failure) of the infrastructure, mine affected water or sediment would be directly released to receiving waterways.

The purpose of the containment assessment is to identify the annual exceedance probability (AEP) of key existing water management and erosion and sediment control infrastructure.

The containment assessment has been undertaken for both dams and drainage systems as outlined below:

- Containment Assessment – Dams
  - Basis – The ability of the water retaining structure to contain runoff generated from a 72 hour design rainfall event.
  - Assumptions
    - Volumetric runoff coefficient of 0.7 for mixed land-use catchments and 1.0 for hardstand areas.
    - No allowance for operational volume in storage (i.e. full supply volume is available to contain design storm runoff).
    - No allowance for pumping.
  - Methodology
    - Design storm runoff calculated based on catchment area, Intensity Frequency Duration (IFD) data developed using ARR 2016 and adopted runoff coefficient.
    - Compare design storm runoff volumes for the 72 hr duration event against documented or calculated full supply volume for the water retaining structure.
    - Identify the largest AEP design storm event that the storage can contain without exceeding the full supply volume.

- Containment Assessment – Drains
  - Basis – The ability of the drainage structure to convey peak runoff rates and/or runoff volumes generated from the 50% to 1% AEP design rainfall events for the 1 hour and the 72 hr design storm durations.
  - Assumptions

- Drainage pipes/culverts were included in the assessment where survey details were provided by BHP.
- Rainfall losses
    - Pervious Land-use – 10 mm initial loss and 2.5 mm/hr continuing loss adopted; and
    - Impervious Land-use – 1 mm initial loss and 0 mm/hr continuing loss adopted.
- No allowance for blockage of drainage pipes/culverts.
- No modifications were made to the aerial survey data (i.e. removal of safety bunds).

- Methodology
    - Develop a rain-on-grid TUFLOW hydraulic model of the site using most recent aerial survey data and available culvert survey details.
    - Simulate a range of design storm events 50% AEP to 1% AEP through the TUFLOW model.
    - Identify the largest AEP design storm event that the drainage system can convey to a containment structure without being overwhelmed.

Appendix B, inclusive of Figures 4, 5 and 6 and Table 3, provides a summary of the key existing infrastructure and the associated containment assessment outcomes for Saraji Mine.

5. QUALIFICATIONS

a. In preparing this document, including all relevant calculation and modelling, Engeny Water Management (Engeny) has exercised the degree of skill, care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering principles.

b. Engeny has used reasonable endeavours to inform itself of the parameters and requirements of the project and has taken reasonable steps to ensure that the works and document is as accurate and comprehensive as possible given the information upon which it has been based including information that may have been provided or obtained by any third party or external sources which has not been independently verified.

c. Engeny reserves the right to review and amend any aspect of the works performed including any opinions and recommendations from the works included or referred to in the works if:

   (i) Additional sources of information not presently available (for whatever reason) are provided or become known to Engeny; or

   (ii) Engeny considers it prudent to revise any aspect of the works in light of any information which becomes known to it after the date of submission.

d. Engeny does not give any warranty nor accept any liability in relation to the completeness or accuracy of the works, which may be inherently reliant upon the completeness and accuracy of the input data and the agreed scope of works. All limitations of liability shall apply for the benefit of the employees, agents and representatives of Engeny to the same extent that they apply for the benefit of Engeny.

e. If any claim or demand is made by any person against Engeny on the basis of detriment sustained or alleged to have been sustained as a result of reliance upon the report or information therein, Engeny will rely upon this provision as a defence to any such claim or demand.

f. This report does not provide legal advice.

APPENDIX A

Catchment Analysis and Classification

N
W
E
S

Ramp 0 Pit
Ramp 1 Pit
Ramp 1A Pit
Jacaranda Pit
Bauhinia Pit
Coolibah Pit
HUGHES CREEK
B2
B3
B4
B8
H1
H2
H3
H4
H5
H6
H7
H8
H9a
H9b
H10
H11
H12
H13
H14
H15
H16
H18
H19
H20
H21
H22
H23
H24
H25
H26
H27
H28
H29
H30
H31
H32
H33
H34
H35
H36
H37
H38
H39
H40
H41
H42
H43
H44
H45
O1
O9
O10
O11
O22
O23

Legend
Catchment Boundary
Waterway

ENGENY WATER MANAGEMENT

0 500 1000
Scale in metres (1:25,000 @ A3)
Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966, (AGD66)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

DATE 18/04/2019
DRAWN JS
JOB NO. M11000_285

Saraji Mine

Catchment Plan

A3 | Figure 1 | A

N
W
E
S

Saraji Industrial Area

H4
O10
O23
H22
H18
O22
O21
Dogwood Pit
O9
O1
H17
O16
ONE MILE CREEK
O20
O19
O15
O7
O18
O24
O12
O6
O17
O13
O14
O5
O8
O2
S12
S7
Ebony Pit
S13
O4
O3
S2
P24
SPRING CREEK
S9
S1
P26
S5
S8
P22
S11
S4
S3
H44
S10
S6
Grevillea Pit
P1
P2
P3
P4
P5
P6

Legend

Catchment Boundary

Waterway

ENGENY

0 500 1000

Scale in metres (1:25,000 @ A3)

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966 (AGD66)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

DATE	09/04/2019
DRAWN	JS
JOB NO.	M11000_285

Saraji Mine

Catchment Plan

A3 | Figure 2 | A

DATE	09/04/2019	Saraji Mine
DRAWN	JS	Catchment Plan
JOB NO.	M11000_285	A3 Figure 3 A

Table 2 - Catchment Analysis and Classification

Catchment	Area (ha)	Reports to	Classification
B2	306.8	Open Cut Void	MAW
B3	202.5	Open Cut Void	MAW
B4	253.9	Open Cut Void	MAW
B8	271.6	Open Cut Void	MAW
H1	77.8	Hughes Creek	Clean
H2	4.1	Hughes Creek	MAW
H3	228.2	Hughes Creek	MAW
H4	22.4	Open Cut Void	MAW
H5	57.1	Hughes Creek	MAW
H6	88.4	Hughes Creek	Clean
H7	81.9	Hughes Creek	Clean
H8	3.5	Hughes Creek	MAW
H9a	2.7	Hughes Creek	MAW
H9b	8.2	Hughes Creek	MAW
H10	4.5	Hughes Creek	MAW
H11	3.3	Hughes Creek	MAW
H12	3.2	Hughes Creek	MAW
H13	2.6	Hughes Creek	MAW
H14	3.3	Hughes Creek	MAW
H15	1.5	Hughes Creek	MAW
H16	3.2	Hughes Creek	MAW
H17	27.4	Hughes Creek	MAW
H18	151.9	Open Cut Void	MAW
H19	20.4	Hughes Creek	MAW
H20	90.4	Hughes Creek	Clean
H21	169.0	Hughes Creek	MAW
H22	243.2	Open Cut Void	MAW
H23	4.3	Hughes Creek	MAW
H24	1.5	Hughes Creek	MAW
H25	3.6	Hughes Creek	MAW
H26	65.5	Hughes Creek	Clean
H27	19.2	Hughes Creek	Clean
H28	18.3	Hughes Creek	Clean
H29	13.6	Hughes Creek	Clean
H30	20.2	Hughes Creek	Clean
H31	10.6	Hughes Creek	Clean
H32	24.5	Hughes Creek	MAW
H33	4.2	Hughes Creek	MAW
H34	4.8	Hughes Creek	Clean
H35	3.0	Hughes Creek	Clean
H36	402.7	Open Cut Void	MAW
H37	32.9	Hughes Creek	MAW
H38	26.7	Hughes Creek	MAW
H39	5.1	Hughes Creek	Clean
H40	2.3	Hughes Creek	MAW
H41	1.6	Hughes Creek	MAW
H42	15.2	Hughes Creek	MAW
H43	23.8	Hughes Creek	MAW
H44	2.1	Hughes Creek	MAW
H45	57.8	Hughes Creek	MAW
O1	183.5	One Mile Creek	MAW
O2	201.8	One Mile Creek	MAW
O3	75.6	One Mile Creek	MAW
O4	58.3	One Mile Creek	MAW
O5	6.8	One Mile Creek	MAW
O6	34.3	One Mile Creek	MAW
O7	5.9	One Mile Creek	MAW
O8	6.4	One Mile Creek	MAW
O9	262.9	Open Cut Void	MAW
O10	73.2	Open Cut Void	MAW
O11	47.1	Open Cut Void	MAW

Catchment	Area (ha)	Reports to	Classification
O12	67.7	One Mile Creek	MAW
O13	0.9	One Mile Creek	MAW
O14	0.5	One Mile Creek	Clean
O15	1.6	One Mile Creek	MAW
O16	1.9	One Mile Creek	MAW
O17	31.2	One Mile Creek	MAW
O18	9.4	One Mile Creek	MAW
O19	5.5	One Mile Creek	MAW
O20	31.7	One Mile Creek	MAW
O21	5.0	One Mile Creek	MAW
O22	9.6	One Mile Creek	MAW
O23	14.8	Open Cut Void	MAW
O24	10.9	One Mile Creek	MAW
P1	47.9	Phillips Creek	MAW
P2	3.4	Phillips Creek	MAW
P3	3.6	Phillips Creek	MAW
P4	26.0	Phillips Creek	MAW
P5	25.0	Phillips Creek	MAW
P6	24.6	Phillips Creek	MAW
P7	11.7	Phillips Creek	MAW
P8	2.6	Phillips Creek	MAW
P9	30.4	Phillips Creek	MAW
P10	30.9	Phillips Creek	MAW
P11	58.0	Phillips Creek	MAW
P12	11.8	Phillips Creek	MAW
P13	29.6	Phillips Creek	MAW
P14	7.4	Phillips Creek	MAW
P15	45.8	Phillips Creek	MAW
P16	5.5	Phillips Creek	MAW
P17	2.6	Phillips Creek	MAW
P18	423.9	Open Cut Void	MAW
P19	15.2	Phillips Creek	MAW
P20	6.8	Phillips Creek	Clean
P21	2.2	Phillips Creek	MAW
P22	9.3	Phillips Creek	MAW
P23	22.7	Phillips Creek	MAW
P24	5.7	Phillips Creek	MAW
P25	0.9	Phillips Creek	MAW
P26	4.1	Phillips Creek	MAW
P27	15.9	Phillips Creek	MAW
P28	37.4	Phillips Creek	MAW
P29	3.7	Phillips Creek	MAW
S1	151.9	Spring Creek	MAW
S2	10.4	Spring Creek	MAW
S3	2.8	Spring Creek	MAW
S4	98.0	Spring Creek	MAW
S5	25.8	Spring Creek	MAW
S6	559.0	Open Cut Void	MAW
S7	922.9	Open Cut Void	MAW
S8	1.9	Spring Creek	MAW
S9	14.6	Spring Creek	Clean
S10	11.0	Spring Creek	MAW
S11	2.7	Spring Creek	MAW
S12	18.9	Spring Creek	MAW
S13	5.2	Spring Creek	MAW

APPENDIX B

Existing Water Management Infrastructure

N
W E
S

Ramp 0 Pit
Ramp 1 Pit
Jacaranda Pit
Ramp 1A Pit
Stubline 3
Bauhinia Pit
R2 Lowwall Dam
R2 Fill Point Dam
R2/3Tailings Dam
HUGHES CREEK
R4 Sump
Dudley's North
Coolibah Pit
Evaporation Dam
Dudley's Dam
R6 Header Dam
Evaporation Header Dam
Ramp 8N Pit

Legend
- Dam/Storage
- Rock Filter Wall
- Drainage Channel
- Sediment Sump
- Waterway

ENGENY WATER MANAGEMENT

0 500 1000
Scale in metres (1:25,000 @ A3)
Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966 (AGD66)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia Zone 55

DATE	13/05/2019
DRAWN	JS
JOB NO.	M11000_285

Saraji Mine
Water Management and Sediment Control

Infrastructure Plan

A3 | Figure 4 | A

N
W
E
S
Saraji Industrial Area
Ramp 8N Pit
Dogwood Pit
ONE MILE CREEK
Wilkies Dam
Stubline10
R9 Lowwall Dam
Bulge Dam
Ebony Pit
R12 Lowwall Dam
SPRING CREEK
R12S Lowwall Dam
R13N Lowwall Dam
Grevillea Pit
R14 Lowwall Dam
Legend
Dam/Storage
Rock Filter Wall
Drainage Channel
Sediment Sump
Waterway
ENGENY
0 500 1000
Scale in metres (1:25,000 @ A3)
Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966 (AGD66)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55
DATE 13/05/2019
DRAWN JS
JOB NO. M11000_285
Saraji Mine
Water Management and Sediment Control
Infrastructure Plan
A3 Figure 5 A

N
W
E
S

Ebony Pit

R12 Lowwall Dam

SPRING CREEK

Stubline 13 Dam

R12S Lowwall Dam

R13N Lowwall Dam

Farmhouse Dam

Grevillea Pit

R14 Lowwall Dam

R15 Highwall Dam

PHILLIPS CREEK

Hakea Pit

R15N Haul Road Sump

Legend

- Dam/Storage
- Rock Filter Wall
- Drainage Channel
- Sediment Sump
- Waterway

ENGENY WATER MANAGEMENT

0 500 1000

Scale in metres (1:25,000 @ A3)

Map Projection: Transverse Mercator
Horizontal Datum: Australian Geodetic Datum 1966 (AGD66)
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 55

DATE	13/05/2019
DRAWN	JS
JOB NO.	M11000_285

Saraji Mine
Water Management and Sediment Control

Infrastructure Plan

A3 | Figure 6 | A

Table 3 - Existing Water Management Infrastructure

Existing Infrastructure	Purpose	Type	AEP Containment
Bulge Dam	MAW	Dam	1% AEP
Dudley's Dam	MAW	Dam	5% AEP
Dudley's Dam	MAW	Drain	1% AEP
Dudley's Dam North	MAW	Dam	1% AEP
Dudley's Dam North	MAW	Drain	1% AEP
Evap Ponds Header Dam	MAW	Dam	5% AEP
Evaporation Dam	MAW	Dam	1% AEP
Evaporation Dam	MAW	Drain	2% AEP
R12 South Lowwall Dam	MAW	Dam	<50% AEP
R13 Nth Lowwall Dam	MAW	Dam	10% AEP
R15 Highwall Dam	MAW	Dam	1% AEP
R15 Highwall Dam	MAW	Drain	1% AEP
Ramp 12 Lowwall Dam	MAW	Dam	1% AEP
Ramp 14 Lowwall Dam	MAW	Dam	1% AEP
Ramp 15 North HR Sump	MAW	Dam	50% AEP
Ramp 15 North HR Sump	MAW	Drain	2% AEP
Ramp 2 Fill Point Dam	MAW	Dam	1% AEP
Ramp 2 Lowwall Dam	ESC	Dam	1% AEP
Ramp 2/3 Tailings	MAW	Dam	1% AEP
Ramp 4 Lowwall Sump	MAW	Dam	20% AEP
Ramp 9 Lowwall Dam	MAW	Dam	50% AEP
Stubline 10 Dam	MAW	Dam	1% AEP
Stubline 10 Dam	MAW	Drain	1% AEP
Stubline 13 Dam	MAW	Dam	5% AEP
Stubline 13 Dam	MAW	Drain	1% AEP
Stubline 3 Dam	MAW	Dam	1% AEP
Wilkies Dam	MAW	Dam	5% AEP
Wilkies Dam	MAW	Drain	50% AEP

Appendix 2

Risk Assessment

Risk Event Rating

Title: Multiple and compounding unauthorised discharge or release of mine affected water (inlcuding sediment) from Saraji Mine into One Mile Creek, Hughes Creek, Spring Creek and Phillips Creek

Risk Type: HSEC

Risk Event	Causes			Impacts			Most Impacted	Non $ MFL	MFL Level	MFL Justification	Severity Rating	Severity Justification	Likelihood Rating	Likelihood Justification	RRR	Materiality
	Cause Name	Preventive Control	Current Control Effectiveness	Impact Name	Mitigating Control	Current Control Effectiveness										
Multiple and compounding unauthorised discharge or release of mine affected water (inlcuding sediment) from Saraji Mine into One Mile Creek, Hughes Creek, Spring Creek and Phillips Creek	1. Historic Mine Design	Closure Planning	**Adequate**	1. **Financial: Level 5**	Legal response to breach	**Adequate**	**F**	**4**	**5**	**Financial: Level 5** Restricted growth options, combined with clean-up costs, with potential for minor to moderate immediate production impacts, and potential for fines and penalties (BHP Share). **Health & Safety:** No health & safety impact. **Environment: Level 3** Potential for moderate impacts (<1 year) to ecosystem services and water resources. **Reputation: Level 4** With regional and possibly national media attention, and the potential for general public and NGO adverse reaction with interest from regulators, reputational impact is considered relatively severe. **Legal: Level 4** With a breach / non-compliance against water requirements under the EA, there is the potential for investigation for alleged major regulatory breach as a potential for prosecution. **Community: Level 2** Given the surrounding landholders (<10) and proximity to town, combined with an impact to livelihood on those landholders <6 months, the impact to the local cummunity is considered relatively minor.	**10**	Severity ratings are the same as the MFL as mitigating controls are deemed ineffective to reduce the impact to a lower level based on the current Our Requirements Risk Management definitions **Severity rating is based on Environment as it has the highest RRR.** **Financial: Level 5 (100)** **Health & Safety: (0)** **Environment: Level 3 (10)** **Reputation: Level 4 (30)** **Legal: Level 4 (30)** **Community: Level 2 (3)**	**10**	**Severity rating is based on Environment as it has the highest RRR.** **Financial: Unlikely (0.3)** **Health & Safety: (0)** **Environment: Almost Certain (10)** **Reputation: Likely (3)** **Legal: Likely (3)** **Community: Almost Certain (10)**	**100**	**Material Risk**
		Remediation (where possible) of historical mine design (e.g. pulling back an overburden dump)	**Inadequate**		External Stakeholder Management	**Adequate**										
		Environmental Authority (EA) amendment	**Inadequate**		Incident Management Team	**Adequate**										
	2. Mine Design	Integration of water management into mine planning and dump designs	**Inadequate**	2. **Health & Safety: No health & safety impact.**	N/A	**N/A**										
		Life of Asset planning	**Adequate**	3. **Environment: Level 3**	Incident Management Team	**Adequate**										
		Closure Planning	**Adequate**		Clean-up process	**Adequate**										
	3. Separation of clean water and mine affected water	Integration of water management into mine planning	**Inadequate**	4. **Reputation: Level 4**	Monitoring	**Adequate**										
		Effective Water Management System	**Inadequate**		Incident Management Team	**Adequate**										
	4. Ineffective Water Management System	Water Mangement Strategy	**Adequate**	5. **Legal: Level 4**	External Stakeholder Management	**Adequate**										
		Development and implementation of Water Management Plan	**Inadequate**		Legal response to breach	**Adequate**										
		Use of Water Balance Model	**Adequate**		ICAM investigation	**Adequate**										
		Development and implementation of Erosion and Sediment Control Plan	**Inadequate**	6. **Community: Level 2**	External Stakeholder Management	**Adequate**										
	5. Inadequate water or erosion and sediment control structures or other supporting infrastructure (eg. pipes, pumps, drainage etc)	Minimum design standards	**Inadequate**		Incident Management Team	**Adequate**										
		Use of Water Balance Model	**Adequate**		External Stakeholder Management	**Adequate**										
		Use of RPEQ for all structures	**Inadequate**													
	6. Ineffective maintenance of water or erosion and sediment control structures or other supporting infrastructure	Preventative Maintenance Strategies	**Inadequate**													
		Inspections	**Inadequate**													
		Governance (including audit process)	**Inadequate**													
	7. Ineffective operation of water or erosion and sediment control structures or other supporting infrastructure	Release Contaminant Model	**Adequate**													
		Water Release Procedure and Monitoring	**Adequate**													
		Operating Manuals (regulated structures)	**Adequate**													
		Monitoring and TARPS	**Adequate**													
		Training and awareness	**Inadequate**													
	8. Severe Weather Event exceeding capacity	Wet weather preparedness	**Adequate**													
		Weather alerts	**Adequate**													
	9. Damage to Water Management and Sediment Control infrastrucuture	Seperation water or erosion and sediment control structures or other supporting infrastructure from vehicles and equipment	**Inadequate**													
		Signage	**Inadequate**													
		SOPs	**Inadequate**													
		Task based risk assessment	**Adequate**													
		Induction, training and awareness	**Adequate**													
	10. Seepage from tailings storage facility (TSF) into watercourse	Adequate seperation of TSF from watercourse	**Inadequate**													
		Minimising water stored in TSF	**Adequate**													
		Operating Manual	**Adequate**													
	11. Ineffective progressive rehabilitation	Life of Asset planning	**Adequate**													
		Closure Planning	**Adequate**													

Appendix 3

Saraji Mine Water Management Plan and Erosion and Sediment Control Plan

BHP

SRM-PLN-0051
SRM Water Management Plan

15 May 2019

Contents

Introduction

Purpose

The primary purpose of this Water Management Plan (WMP) is to minimise the release of contaminants to the receiving environment and ensure water resource use at Saraji Mine (SRM) does not adversely impact the local and regional environment.

Under the *Environmental Protection Act 1994* (EP Act), SRM must adhere to Environmental Authority EPML00862313 (EA). The EA includes a condition requiring BMA to develop a Water Management Plan for SRM. This WMP has been prepared to comply with condition W30 of the SRM EA which stipulates that a Water Management Plan must:

a) provide for effective management of actual and potential environmental impacts resulting from water management associated with the mining activity carried out under this environmental authority; and

b) be developed. in accordance with the administering authority's guideline Preparation of water management plans for mining activities and include:

- ***I.*** a study of the source of contaminants
- ***II.*** a water balance model for the site;
- ***III.*** a water management system for the site;
- ***IV.*** measures to manage and prevent saline drainage;
- ***V.*** measures to manage and prevent acid rock drainage;
- ***VI.*** contingency procedures for emergencies; and
- ***VII.*** a program for monitoring and review of the effectiveness of the water management plan.

This WMP also meets the obligations of BHP Our Requirements: Environment and Climate Change.

Scope

This WMP describes SRM's planning, operational and reporting requirements for minimising impacts within the defined area of influence for water resources.

This WMP primarily outlines management of waters classified as Mine Affected Water (MAW) in accordance with the EA, noting however that waters in which sediment is the primary contaminant of concern are managed under the ***Erosion and Sediment Control Plan*** (ESCP).

This WMP covers anyone involved in planning or executing exploration, operational or closure activities at SRM.

The plan forms part of the SRM Environmental Management System (EMS).

This WMP must be implemented in conjunction with the ***SRM Mine Affected Water Release Procedure.***

Overview of Operations

The SRM Complex is located 20 km north of Dysart in the Bowen Basin coalfields. The mine encompasses Mining Leases ML1775, ML1782, ML1784, ML2360, ML2410, ML70142, ML70294, ML70298, ML70328 and ML700021 totalling some 10,500 hectares. These leases are held by the joint venture partners and mining activity is authorized under ***SRM EPML008862313.***

The open cut operation consists of ten pits over a strike length of approximately 30 kilometres and uses four to five draglines and a truck/shovel overburden removal operation. The open cut operation also consists of one coal processing plant where mined coal is sorted, washed and blended to meet supply demand specifications.

Figure 1 below shows the site layout in relation to water transfer pipelines and surrounding waterways.

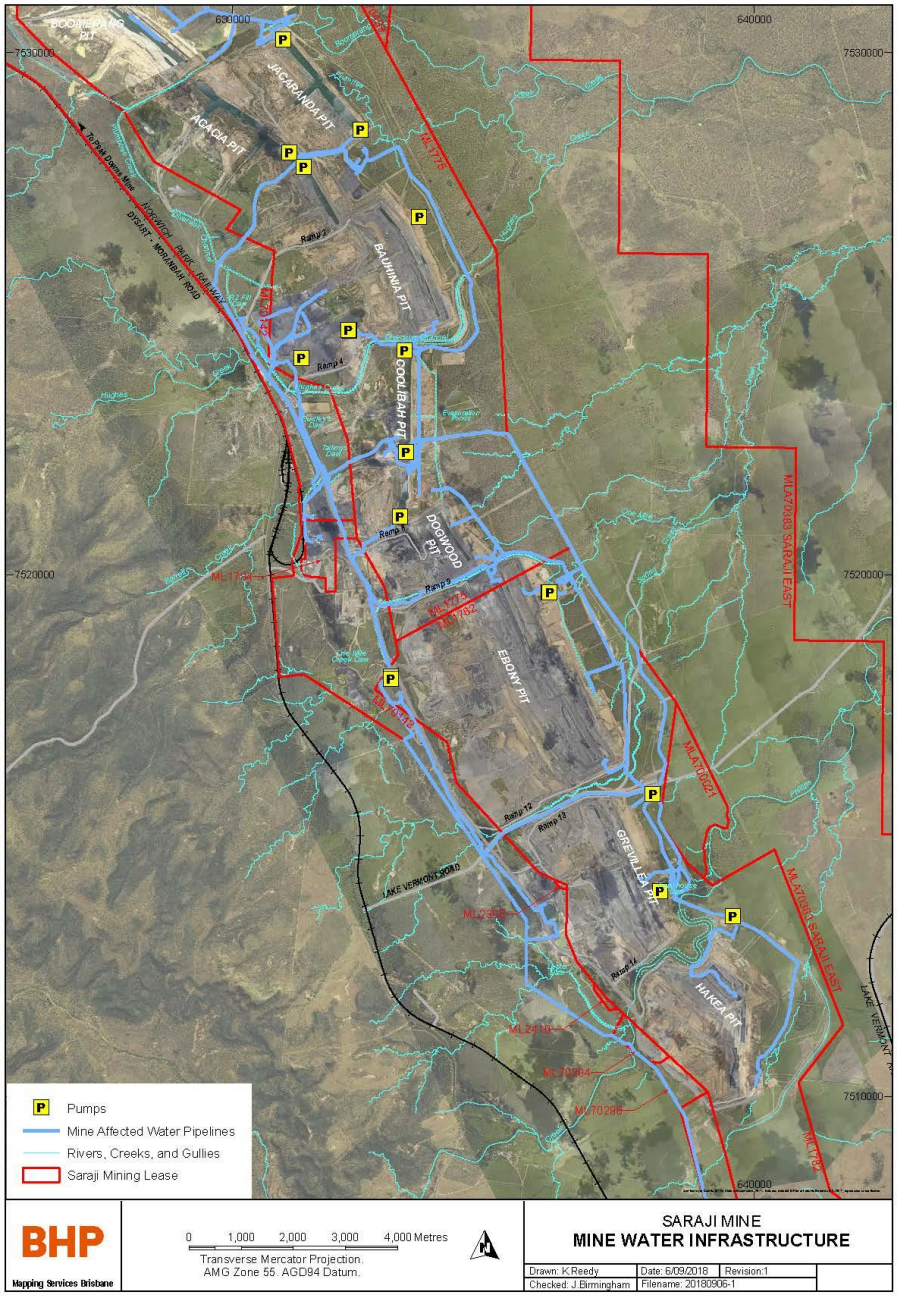


Figure 1: Site layout of SRM Mine showing waterways and MAW pipe network.

Baseline Environment

Pre-Mining Land Use

Land use varied between dryland forage cropping for cereal crops on fertile cracking clay scrub soils in southern areas of the leases, moderate density grazing on coarser textured Brigalow clay soils and lower density grazing on texture contrast eucalypt plains and Tertiary lateritic rises.

Climate

A summary of long-term regional climatic data is presented in ***Table 1***. The data has been obtained from the Bureau of Meteorology Station, Moranbah (Station Number 034038). The data was obtained from Moranbah due to proximity of the station and accessibility of the information.

Table 1: Regional Climatic Data (Moranbah Water Treatment Plant data 1972-2012)

Climatic Characteristic	Value
Annual Average Rainfall	614.2mm
Annual Average Evaporation	2336mm
Mean Maximum Temperature	29.7°C
Mean Minimum Temperature	16.7°C
Mean Max Temperature Range	23.7 - 34.0°C
Mean Min Temperature Range	9.9 - 21.9°C
Prevailing Wind Direction	E-SE at 2 to 5 m/sec

Saraji rainfall data shows that 80% of annual rainfall is received in the November to March period, with 47% of the annual total received in the three month period December to February. The average number of rain days per year is 51, with 31 of these occurring during the November to March period. Rainfall of medium to high intensity can occur during this period due to cyclonic rain depressions or summer thunderstorms.

A typical rainfall pattern for Saraji may include:

- Thunderstorms during late spring/early summer (i.e. October – December) with erratic frequency and rainfall.
- Wet season rainfall (typically through January – March) with heavy soaking falls for periods of up to several days.
- Dry season winter/early spring (i.e. April – September) with infrequent falls from passing cold fronts.

On average, evaporation exceeds rainfall for each month of the year. Annual evaporation at Moranbah, which is situated 70 km to the north, is 2336 mm per annum giving an annual moisture deficit of approximately 1700 mm. Open water surface evaporation exceeds median rainfall by a significant margin and it is only during periods of storm or cyclone related activity that rainfall exceeds evaporation.

High intensity rainfall events are common, hence surface runoff can be substantial. The average evaporation exceeds average rainfall 12 months of the year, hence water stress is expected to be a significant factor in the performance of future rehabilitation of disturbed land, particularly on slopes or where topsoil thickness is limited and the underlying spoil may be compacted.

Geology

The natural topography of Saraji Mine areas is characterised by a range of topographic settings ranging from level to gently undulating plains to gravely 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.

Soils of the area have formed from weathered parent materials under the influence of time, land relief, moisture, temperature changes and organisms. Predominant soil types are generally related to their position on the slopes of the catchment and can be broadly divided into the following types:

- Mountains and Ridges Assemblage - Shallow, coarse textured and rocky siliceous sand (uniform soils);

- Stony Hills Assemblage - Hard pedal duplex soils with colour range from red through brown to yellow or mottled yellow, neutral to alkaline;
- Footslopes and Lowlands Assemblage - Hard pedal duplex soils with colour range of red, brown and mottled yellow, alkaline reaction.;
- Weathered Clay Plains Assemblage- Hard pedal duplex soils with colour range of red, brown, yellow and black, alkaline reaction;
- Brigalow Plains Assemblage- Self-mulching, cracking clay. Uniform soil, colour range of red and brown to black;
- Alluvial Plains and Terraces Assemblage - Hard pedal duplex soils with colour range or red, brown and yellow.

Significant Watercourses

SRM is located close to the western edges of the catchment of the Isaac River, a major drainage area of the Fitzroy catchment (Figure 3). The Isaac River is the main watercourse situated east of the mine. The Isaac River converges with the Connors and Mackenzie Rivers and eventually joins the Fitzroy River, which flows initially north and then east towards the east coast of Queensland. The Fitzroy River flows into the Coral Sea at Rockhampton (adjacent to Casuarina Island).

The Isaac River has a catchment area of approximately 1,215 km2. At a broader regional scale, the greater Isaac- Connors sub-catchment area (at the junction with the Mackenzie River) is approximately 22,000 km2 and the total Fitzroy Basin catchment area to the coast is approximately 140,000 km2. From a broad regional context, the mine area represents a very small part of greater regional catchments and is located very high in the headwaters of the catchment. The elevation of the Isaac River channel bed in the study area and through the existing SRM mine is approximately 180 to 360 metres above sea level.

All of the drainage lines are directed in a general easterly direction, rising in the Cherwell Range immediately west of SRM. The creeks comprise of eight ephemeral creeks, and minor tributaries which flow eastwards across some, or all of the mining operations. These creeks from north to south include: Boomerang, Plumtree, Hughes, Barrett, One Mile, Spring, South and Phillips Creeks. The catchments of these local creeks are shown in ***Figure 4***. Flows are towards the Isaac River, which is about 20km to the east of the mine. The Isaac River flows southwards for approximately 130km to join the Mackenzie River, which flows onwards for approximately 150km to the Fitzroy River, a major river which enters the sea east of Rockhampton. Flow mainly occurs for a short period during and immediately after rainfall events. Assessment of available stream flow data indicates that base flow is limited and appears to be sustained by surface base flow stores rather than distinct groundwater contribution. Base flow that recedes after rainfall events is typically limited to a few days (up to approximately one or two weeks) after surface runoff (quick flow) has drained from contributing sub-catchments.

Grazing is the dominant land use in the catchment, and would be expected to contribute large quantities of sediment- laden runoff into some creeks upstream of the mine area during storm events. Use of the water up and downstream of the mine is limited because of the ephemeral nature of the creeks. Permanent waterholes do not exist in the creeks which cross lease areas. The first permanent waterholes occur in the Isaac River, some 20 kilometres to the east of Saraji Mine.

Hydrological studies of the environment surrounding SRM have been undertaken and include:

- SRM Q1000 Review- undertaken in August 2012. This involved a Mining Pit Highwall Creek Ingress Investigation, which provided estimates of levee alignment and levee level requirements for an AEP 1 in 1000 design flood event.
- Receiving Environment Monitoring Program (REMP)- EA requirement. Includes a hydraulic overview and aquatic condition assessment of the streams potentially affected by mine water releases. Also included in the REMP is an overview of the local environmental values and water quality objectives associated with downstream waterways.
- Aquatic Ecosystem Health Project (AEHP)- completed four (4) wet season sampling regimes and the REMP is into its fifth year.

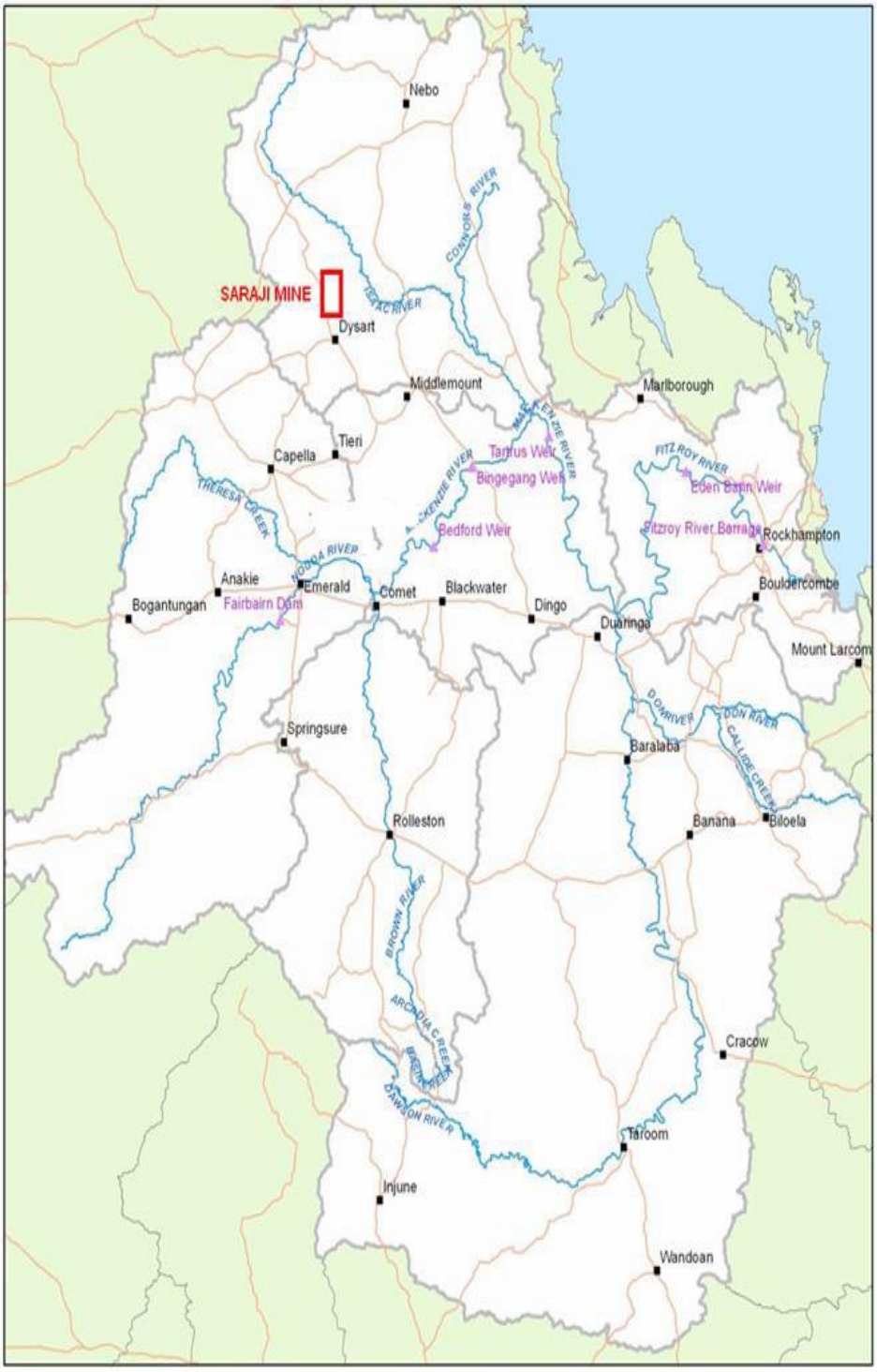


Figure 3 Regional drainage and location map

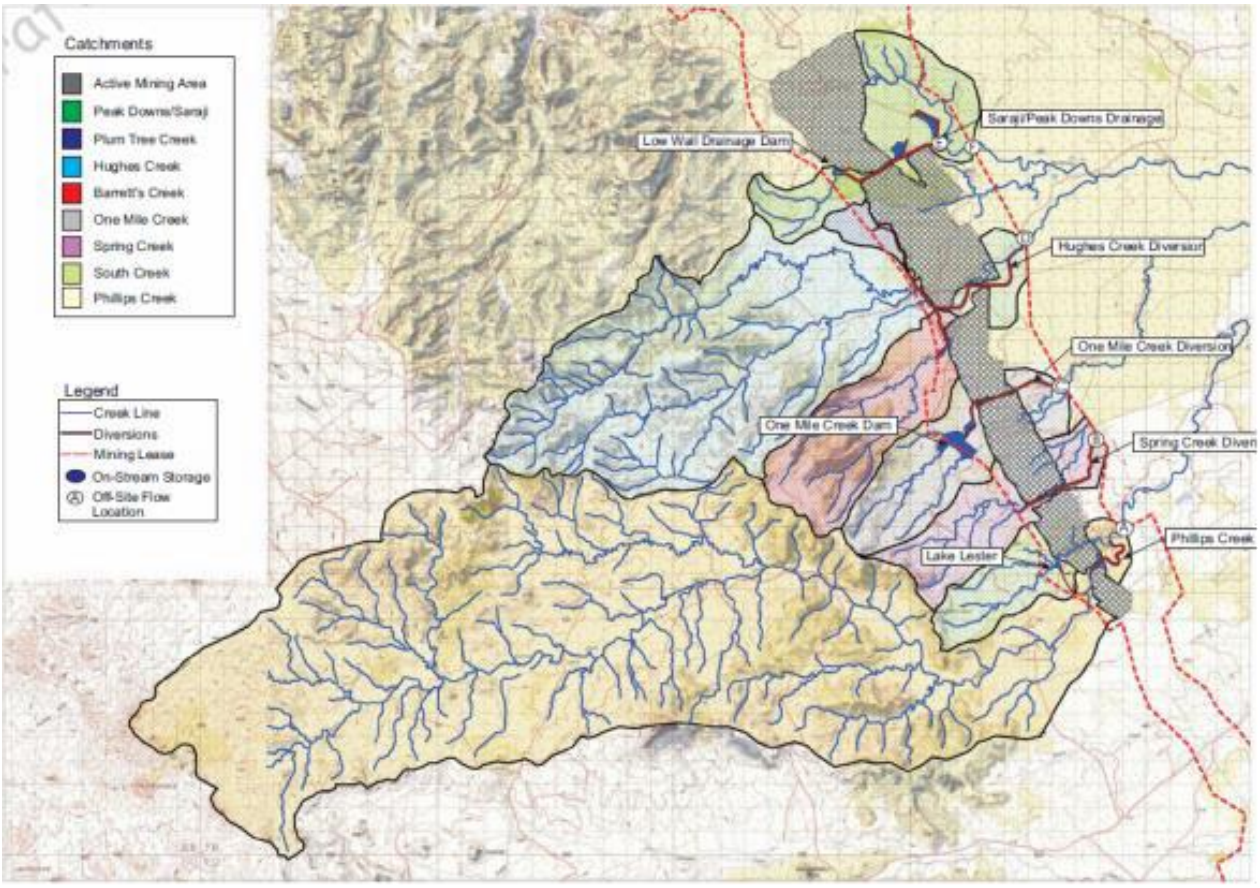


Figure 4 Catchments of Local Creeks at SRM

Surface Water Quality

Environmental Values

The watercourses within and surrounding SRM site are ephemeral in nature and provide seasonal habitat for aquatic fauna and flora. The watercourses are noted to as having slight to moderate disturbance from current mining and grazing activities.

The surrounding land is currently dominated by agricultural grazing, dryland cropping and other mining operations. The primary industry values for SRM Creeks are for stock watering and farm supply / use. Potential other environmental values such as recreational use are considered unlikely to be of significance due to unreliable and infrequent flows in the ephemeral streams.

The Environmental Values for the receiving environment of SRM are outlined in ***Table 2***.

Table 2 Environmental Values

Environmental Value		Near Field (Hughes, One Mile, Spring, Phillips)
Aquatic Ecosystems	**HVE**	
	SMD	X
	HD	
Primary Industries	**Irrigation**	
	Farm Use	X
	Stock Watering	X (beef cattle- limited post rainfall)
	Aquaculture	
Recreation and Aesthetics	**Primary Recreation**	
	Secondary Recreation	
	Visual Appreciation	
Human consumer	**Consuming wild/stocked fish**	
Drinking Water	**Suitable raw water**	
Industrial Use	**Mining**	
Cultural and Spiritual Values	**Indigenous**	X
	Symbolic	
	Lifestyle	

Groundwater

A regional groundwater investigation of SRM and its surrounds was conducted in 2007 and is documented in ***Groundwater Review 2007***. The study was undertaken specifically to address the requirements of ***Environmental Authority EPML00862313***.

The study found that on a regional basis, the hydro-geological regime is relatively simple consisting of:

- Confined coal seam aquifers containing poor quality water, which is generally unsuitable for stock use.

- Overlying confined basal Tertiary sand/gravel aquifers of maximum three (3) meters thickness and thin inter-bedded, lensoid sand aquifers within the Tertiary, containing reasonable quality water suitable for stock use.
- Localised unconfined alluvial aquifers containing good quality water associated with the watercourses and creeks.

A review of the groundwater monitoring data was performed for SRM in 2013. The review shows the data recorded has had no mining related impacts on groundwater levels or groundwater quality at any of the monitored landholder bores. Monitoring for this program continues to occur on a quarterly basis.

Overall there is limited use of groundwater on the adjoining properties with most landholders relying to a large degree on dams or the Mackenzie River pipeline for their water supplies.

Groundwater bores have also been established near the R2/3 Tailings Dam to monitor for possible leachate from the dam and are listed as part of the associated Operational Plan.

BMA is currently working with DES to re-define the groundwater contaminant trigger values in accordance with the updated DSITI guideline.

Figure 5 includes a map of the groundwater monitoring sites and the groundwater flow maps.

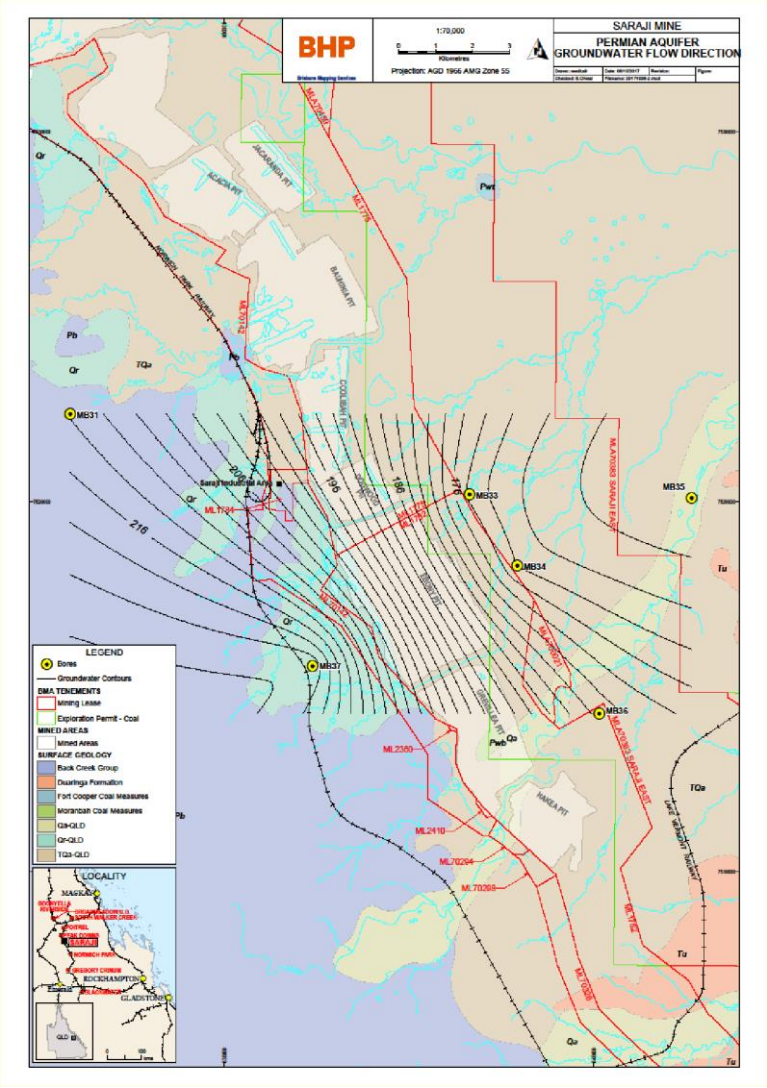


Figure 5 SRM Groundwater Flow Map

Area of Influence

SRM's area of influence was determined in accordance with the **BHP Our Requirements: Environment and Climate Change** and is based on SRM's potential direct, indirect, and cumulative impacts on the environment.

Key Features and the area of influence for BMA's operations are mapped in the ***Mine2Map QLD Area of Influence Viewer***. The process for defining and mapping the area of influence is detailed in the ***Coal HSE Environment and Climate Change Plan***.

Sources of Contamination

Operating open cut and underground coal mines have a range of well recognised contaminant sources which have significant potential to adversely impact downstream water quality. These mine sites require management either at source of contamination or at drainage collection points to prevent impact downstream. The major potential source of contamination is related to land disturbance in which deeper sediments are exposed to surface runoff. Such land disturbance and sources of contamination at SRM site are associated with a number of particular disturbance categories including:

- Spoil areas- Large areas of exposed spoil can be a substantial source of salt and sediment during runoff events and also potential seepage.
- Open pits- A large quantity of saline alkaline water collects in operational pits during intense wet periods. This water must be pumped to other storages to enable mining operations to continue.
- Haul roads- Very high runoff coefficient associated with the heavily compacted road surface can exacerbate sediment loads.
- Industrial Areas- Very high runoff coefficient exacerbates sediment loads.
- Tailings Dams and Disposal Areas- Dams with insufficient freeboard or structural faults can allow coal wastes to escape an impoundment.
- Topsoil stripped areas- Subsoils in the area are often saline, hence topsoil stripped areas can generate saline surface runoff as well as high turbidity colloidal suspensions.
- CHPP- Water network – major piping and drainage infrastructure.
- Coal stockpiles- Storm events can generate saline runoff and coal fines and leachate from stockpiles of coal.
- Reject stockpiles- Storm events can generate saline runoff and coal fines and leachate from reject areas.
- Rejects disposal areas- drainage from these areas has potential for acid leachate generation.
- Rehabilitation areas- Newly developed rehabilitation – e.g. top-soiled and seeded carries high erosion risk until vegetation cover is satisfactory. Potential for significant sediment yield as well as some saline water.

A summary of the potential sources of contamination, the type of contamination and mechanism of contamination is presented in ***Table 3.***

Table 3: Summary of Potential Sources of Contamination

Contaminant Source	Potential Contaminants	Mechanisms of Contamination
Runoff from disturbed land	Suspended Solids (Turbidity), Dissolved Solids (sodium, chloride, sulphate), +/- pH, metals	Erosion, overland flow, capillary rise of salts, sodic spoils (elevating pH), acid generating rejects (lowering pH)
Runoff from rehabilitated land (contaminant loading expected to be significantly lower than disturbed areas)	Suspended Solids (Turbidity), Dissolved Solids, +/- pH, Dissolved Solids (sodium, chloride, sulphate), +/- pH, metals	Erosion, overland flow, capillary rise of salts, sodic spoils (elevating pH),
Release of recycled waters from tailings dams, sewage treatment plants, industrial areas, etc.	Suspended Solids (Turbidity), Dissolved Solids (sodium, chloride, sulphate), +/- pH, hydrocarbons, pathogenic micro-organisms, metals	Releases from dams (seepage, catastrophic failure, by wash), pipes, drains, spills, acid generating rejects (lowering pH) ineffective sewage treatment, release from sewage ponds
Release of waters from pits and storages	Suspended Solids (Turbidity), Dissolved Solids (sodium, chloride, sulphate), +/- pH, metals	Releases from dams (seepage, catastrophic failure, by wash), pipes, drains, etc
Release of waters from pipe infrastructure including the CRWN	Suspended Solids (Turbidity), Dissolved Solids (sodium, chloride, sulphate), +/- pH, metals	Releases from pipe infrastructure (leaks, valve failures, ruptures)
Release of waters from sediment dams	Suspended Solids (Turbidity), Dissolved Solids (sodium, chloride, sulphate), +/- pH, metals	By wash, capacity reduced due to sedimentation
Spilt or leaking flammable and combustible liquids and chemicals	Hazardous or toxic products, +/- pH, metals.	Contamination of land and surface runoff causing impact to regional water systems.

Water Quality Impacts

The quality of mine water storages and receiving waters are monitored regularly as required by the mine's EA ***Environmental Authority EPML00862313***. Further details of the monitoring requirements are detailed in the ***Monitoring Control & Evaluation*** section of this Plan***.***

Water Management System & Controls

Water managed under this WMP on-site is categorised into the following 2 groups:

1. Clean Water
    a. Diverted clean water from undisturbed areas within or around the active disturbance site;
    b. Clean water from disturbed areas (i.e. spoil dumps) which have been rehabilitated; and
    c. Pipeline / potable water.
2. Mine affected water (operational water) as that term is defined in the SRM environmental authority.

As outlined in the Scope, waters from catchments determined to only require erosion and sediment control are managed under the ESCP.

The objectives of the Mine Water Management System (MWMS) include:

- To divert water away from areas affected by mining activities;
- Contain water from areas disturbed by mining activities;
- Prevent release of water of non-compliant quality;
- Sustainably divert and discharge water suitable for release; and
- Reuse all captured water where possible for dust suppression and process requirements.

Water Balance Model

The water balance model is managed by Water Planning (P&T Resource Engineering) at the asset level and by the Mine Planning Department at the site level.

SRM has developed a water balance model to assist with management of its stored water inventories, releases and investigations into improved water management. The ***GoldSim*** model has been specifically designed for water management investigations covering the entire mine site including breakdown of all catchments.

GoldSim is a dynamic model which simulates the operation of the site's water management system and is based on a daily time step process in which a complete account of water stored and transferred can be achieved. The model accounts for the following:

- Climatic variability;
- Catchment runoff and collection;
- Pit dewatering;
- Water reuse in support of mine operations and the CHPP;
- Pumped and gravity transfers;
- Haul Road and hard stand watering for dust suppression;
- Evaporative losses, ground water seepage; and
- Spills – controlled and passive from mine storages to SRM Creeks,

The ***GoldSim*** model has been formulated to enable SRM to test the capability of its water management system and identify improvement initiatives. The model is confined by a series of operational guidelines which can be altered to test the capability of the system under a range of scenarios.

Operational Water Requirements

The major water demand for the site arises from coal processing and dust suppression. The mine water system has been configured to maximise the re-use of water on site with the aim to reduce the amount of raw water consumed by the operation.

Regulated Structures

The EA requires the consequence category of any structure to be assessed by a suitably qualified and experienced person against the administering authority's *Manual for Assessing Consequence Categories and Hydraulic Performance of Structures.*

The ***SRM Regulated Structures Register*** outlines the water storages and levees at SRM that have been determined to be regulated structures as a result of their consequence category assessment.

Regulated structures are inspected annually by suitably qualified and experienced persons in accordance with EA requirements.

Water Transfers & Pumping

SRM has constructed an extensive pipe and pump network designed to meet the mines needs of:

- Transferring water to required operational infrastructure (i.e. CHHP's);
- Processing or treatment;
- Transferring mine affected water to release storages to release off site when EA release criteria is met;
- Dewatering of sumps and pits to allow for the continuation of mining;
- Dust suppression; and
- Mine expansion/construction activities.

Figure 6 summarises the pumping infrastructure onsite at SRM.

Water Transfer Agreement

A ***Transfer of Water Between Sites Agreement*** exists between Norwich Park Mine (NPM), Caval Ridge Mine (CVM), Peak Downs Mine (PDM), and Saraji Mine (SRM). Mine water from the Saraji Mine's mine water system may be pumped into either Jacaranda Pit or Bulge Dam where it may then be on-pumped via Central Region Water Network (CRWN) to Norwich Park or Peak Downs.

In the Agreement, the mine sites have committed to complying with the relevant EA conditions. Commitments include:

- The volume, pH and electrical conductivity of water is monitored and recorded;
- Water is used in a way as to prevent environmental harm and health incidences; and
- Awareness of the General Environmental Duty is communicated.

Water movement between the sites is monitored and captured via Scada software in real time and has the capability of providing feedback for volumes transferred (rate or totals) and the quality of the water plus the added function of leak detection. This system is also verified both visually and also checked against a 1SAP work order as a functional compliance check.

CRWN Pipeline Operation and Maintenance

The CRWN or Backbone Pipeline facilitates the water transfers between NPM, CVM, PDM and SRM. BHP have installed and commissioned the Backbone Pipeline as per a RPEQ design, inclusive of installation of flow meters as per the relevant Australian Standard Technical Specification, ATS 4747. As per this standard, flow meters are required to be designed to a specification that delivers a calibration with permissible limits of error within +/- 2.5% under laboratory conditions and +/- 5% insitu.

While Saraji Mine may not have full access to use the CRWN exclusively, the maximum rate that water may be pumped along the CRWN to Norwich Park and Peak Downs is 240 L/s and 4,200 L/s, respectively. An overview of the CRWN pipeline network is shown in ***Figure 7*** and ***Figure 8***

Inspections and mechanical, electrical and general maintenance (including slashing, vegetation control and visual integrity checks) are managed via 1SAP as per the CRWN maintenance schedule and OEM recommendations. All maintenance tasks are executed by the Infrastructure & Asset Management (IAM) Care & Maintenance team, who are fully inducted to perform the maintenance tasks across the length of the CRWN pipeline. Actions and findings from the inspections are recorded into 1SAP and further work orders are implemented, as required.

SRM implements the ***SRM Procedure Mine Affected Water Pipe/Drain Failure Response Plan*** to outline the Trigger Action Response Plan (TARP) and actions required in the event of a leak, valve failure or rupture of the pipeline.

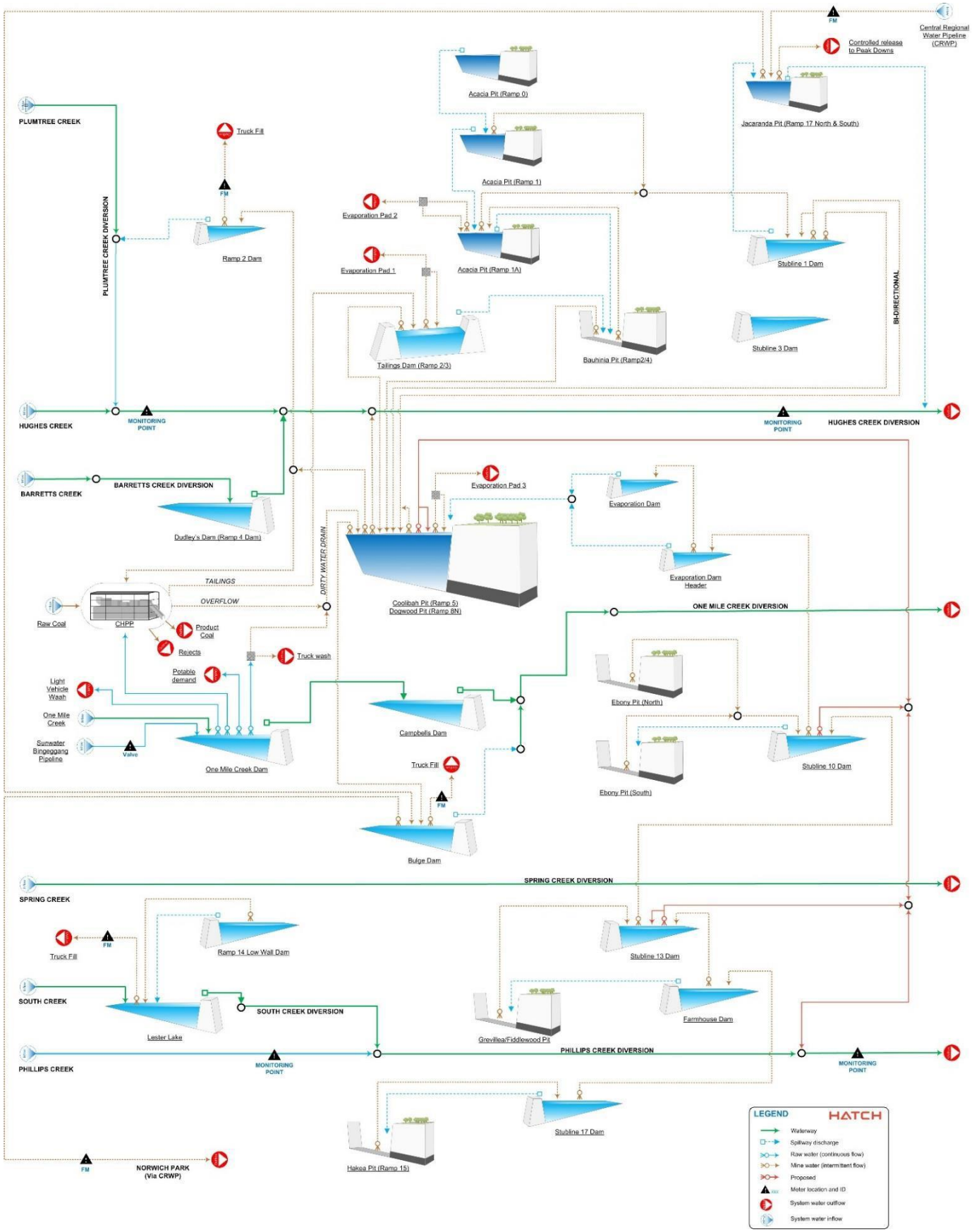


Figure 6: Schematic of water transfers / pumping

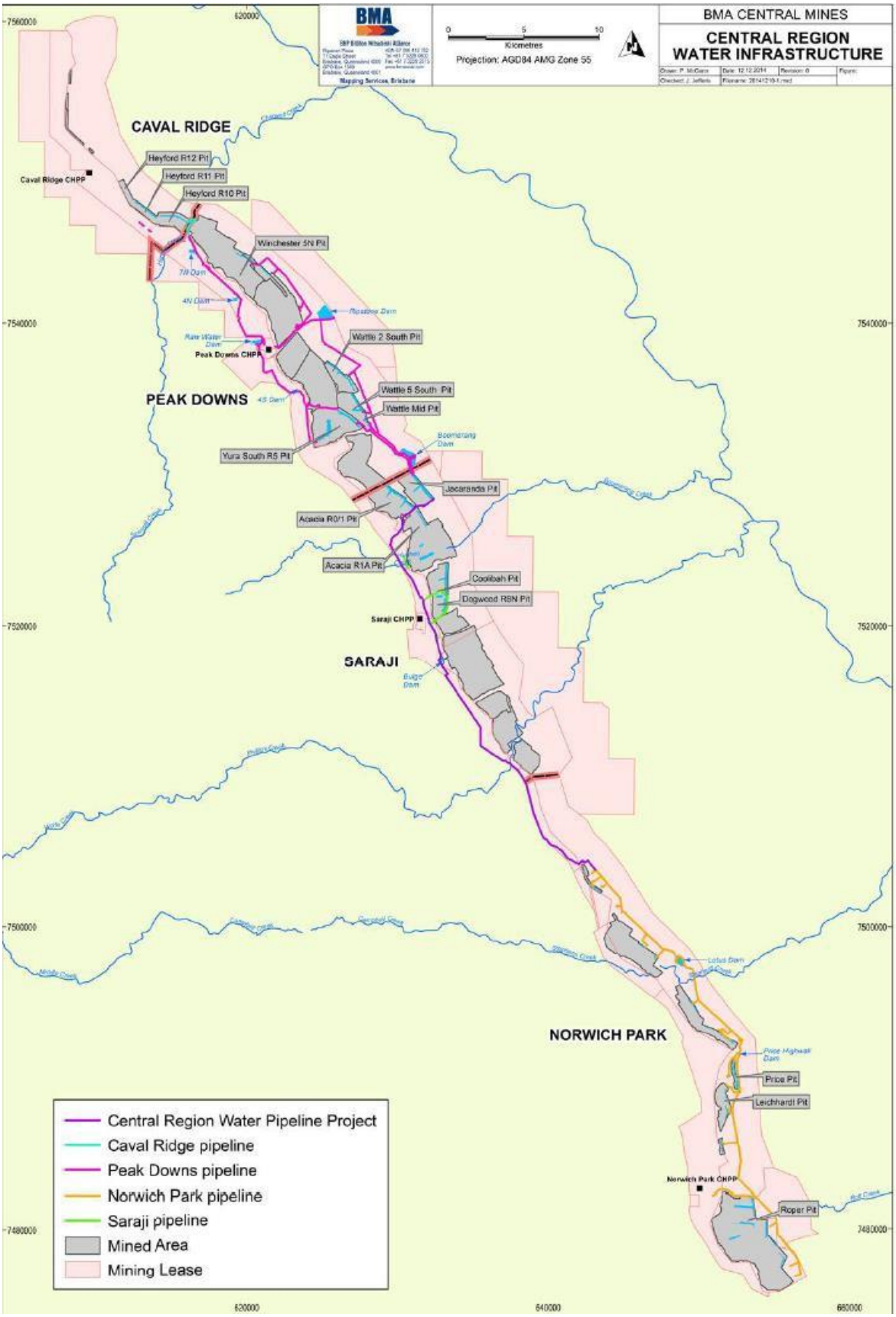


Figure 7 BMA Central Region Water Infrastructure

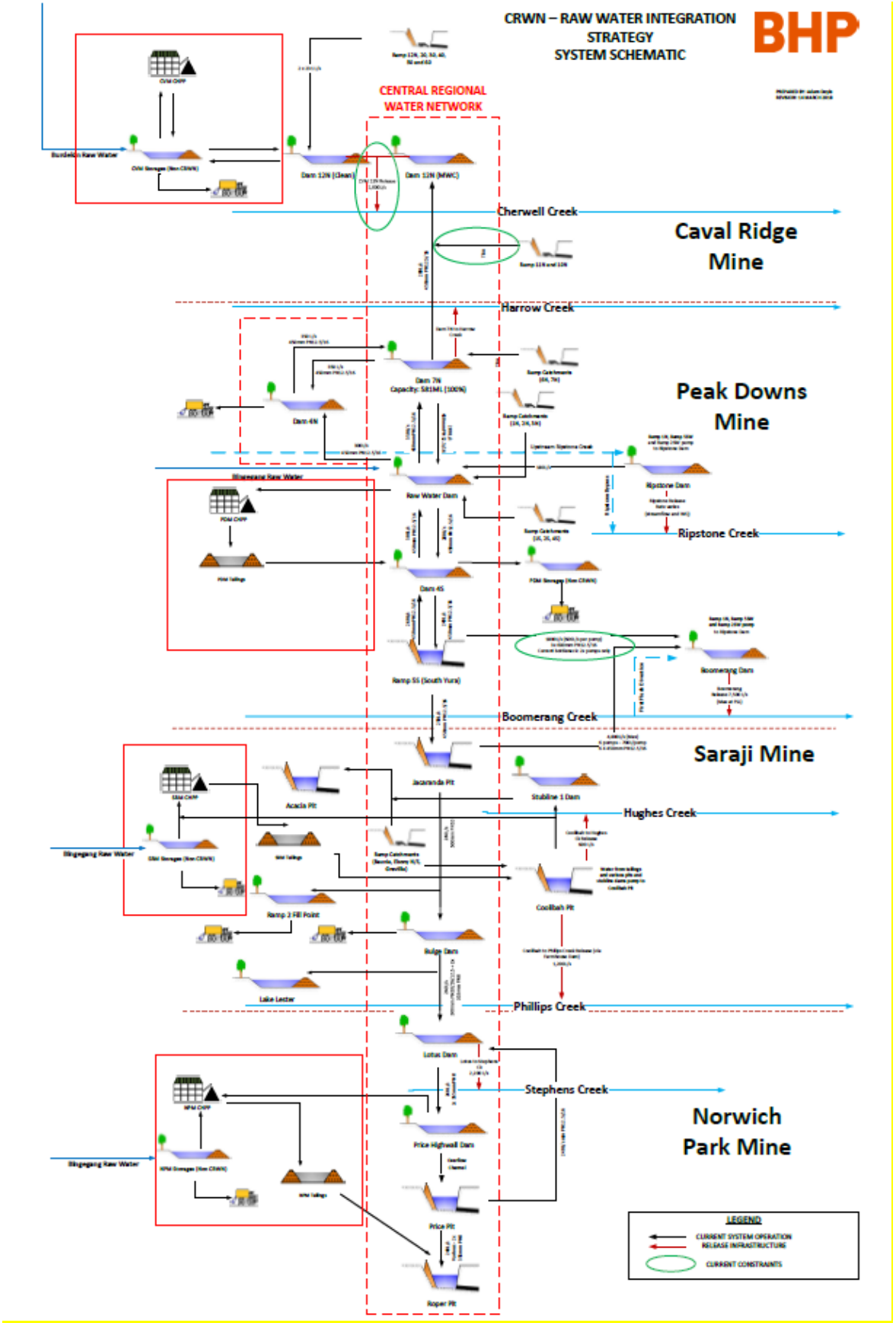


Figure 8 CRWN Pipeline Schematic

Water Supply Infrastructure

The water supply infrastructure for SRM encompasses the following components:

- Potable water supply;
- Mine water supply; and
- Sewage effluent.

Saline Drainage & Acid Rock Drainage Management

The water management system provides a range of measures for capturing mine-affected saline waters and delivering to the Central Coolibah Pit for secure containment and reuse in supporting mine operations such as coal processing and dust suppression. A number of storage dams that have been constructed have the pump capability to redirect to other storage areas. This is to prevent an unauthorised release, or for release when stream flow conditions and stored water quality meet the existing Environmental Authority conditions.

SRM has developed a comprehensive spoil inventory database to enable it to improve rehabilitation outcomes by understanding the characteristics of its spoils and overburden prior to planning rehabilitation treatments. The site spoil inventory is predominantly alkaline as shown by the water quality in surface storages and pits, however, minor volumes of delineated strata of the Permian carboniferous shales and mudstones are very saline and can generate very low pH when weathering. This is confirmed in the ***SRM Post Mine Spoil Characterisation***.

Management measures for these hostile materials include:

- Selective placement of newly excavated spoil to areas in prestrip dumps which will be encapsulated by benign spoil as the dump develops.
- Capping hostile in situ spoil with benign spoil before applying rehabilitation treatments, such as top-soiling, rock. Mulch and drainage works.
- Directing drainage to retention dams for reuse in mine activities.
- Ongoing rehabilitation monitoring programs aimed at detecting surface and near surface changes in pH and salinity. Ongoing water quality monitoring programs on storages and pits which store surface runoff and leachate from mine-affected areas and structures.

Water Releases

The water balance model results indicate that the risk of uncontrolled release from the water management system is low.

Criteria set in the EA ***EPML00862313*** provides environmental triggers under which compliant release of mine affected water to Hughes, One Mile, Phillips Creeks and associated Isaac River can occur.

Dams Lake Lester (RP1), Dudley's Dam (RP2), Farmhouse Dam & R15 Highwall Dam (RP4), Campbell's Dam (RP5), Coolibah Pit (RP6), OMCD (RP7) and R2 Fill Point Dam (RP9) are the only authorised mine water discharge points. Further details regarding release criteria and associated monitoring of the receiving environment are documented in the EA ***EPML00862313***, ***REMP Design*** and ***SRM Mine Affected Water Release Procedure***.

Creek / River Diversions

SRM has diverted creeks/ rivers to allow for the continuation of mining and/or diverting water away from active mining areas.

The mine has diverted the following systems:

- Phillips Creek
- Hughes Creek
- Spring Creek
- One Mile Creek

- Plumtree Creek
- Barrett Creek
- Southern Creek

Creek Levees

Flood protection is provided via flood protection levees that were constructed to prevent pit inundation up to the 1:1000 AEP and also protect the industrial area.

The details of protection levees are listed in the ***SRM Regulated Structures Register***, which include:

- Phillips Creek Levee; and,
- Barrett Creek Levee.

Treated Sewage Effluent

Treated sewage effluent produced on-site must only be released in accordance with the relevant conditions of the EA. Where the treated effluent is to be used for the purposes of dust suppression and irrigation (surface or sub-surface), sampling results of treated effluent is required to meet the minimum triggers established as per the EA.

Monitoring & Control Verification

The objective of SRM's water monitoring program is to determine the effectiveness of the site's water management system.

Monitoring and verification of the effectiveness of implemented controls is conducted through:

- Periodic review of this WMP and environmental risk assessments;
- Internal audits, including HSE Assurance audits and site based compliance audits;
- Field Leadership activities; and
- Review of SAP events.

Monitoring Program

Water monitoring requirements for SRM are documented in the ***SRM Monitoring Procedure***. The monitoring program includes:

- Receiving waters - creek and river water quality and level;
- Release and water storages - water quality and level;
- Groundwater quality and levels;
- Water transferred to Norwich Park and Peak Downs;
- Contaminated water released to land (from the sewage treatment plant); and
- Weather (rainfall volume and intensity).

Further monitoring details are outlined in the ***Receiving Environment Monitoring Program (REMP) Design***, and ***SRM Mine Affected Water Release Procedure***.

SRM uses a combination of telemetry equipment, in-situ sampling and laboratory analysis to meet the requirements of the monitoring program.

Sampling

All determinations of water quality must be:

- Performed by a suitably qualified person or body possessing the appropriate experience and qualifications to perform the required measurements.
- Made in accordance with methods prescribed in the latest edition of the administering authority's Water Monitoring and Sampling Manual.

The SRM HSE Department must ensure all equipment used for water quality monitoring is identified and documented. Field equipment must be prepared and calibrated in accordance with manufacturers' guidelines and the administering authority's *Water Monitoring and Sampling Manual*.

All laboratory analysis must be conducted by a NATA accredited laboratory with an internal quality control and auditing process.

The SRM HSE Department must ensure that all data collected as part of water monitoring program is loaded and stored in **SAP** – the central repository for all environmental data, as outlined in the ***Coal HSEC Reporting Standard***.

Monitoring data is regularly reviewed by the HSE Department to ensure continuity and compliance with the monitoring program objectives and requirements.

Inspections

Inspections of MAW infrastructure are crucial to the ongoing effectiveness of the WMP. The inspection should assess the condition of the structure and operability of any associated pumping and pipelines.

All inspections must be documented in 1SAP. Where required, subsequent notifications should be raised for any required maintenance works.

Table 6 defines the routine inspections required to be completed at SRM. RPEQ inspections are also required for regulated structures on an annual basis.

Infrastructure	Minimum Frequency
Pipeline	Immediately after start-up (unless start-up occurs on night shift, in which case inspection to be carried out at earliest time possible on proceeding day shift) For pipelines without leak detection, daily inspections while in use For pipelines with leak detection, weekly inspections while in use
Drainage	Bi-monthly
Dam or Levee (regulated)	Refer to Operational Plan
Dam or Levee (non-regulated)	Annual
Diversion	Annual

Event-based Inspections

In addition to routine inspections, operational inspections are also required following a rainfall event exceeding the containment capacity of drainage or a dam.

Table 7 defines the event-based inspections required to be completed at SRM.

Structure Containment Capacity	Trigger for Routine Inspection
<50% AEP	1 in 1.58-year event (e.g. Annually or 71mm in 24 hours)
50% AEP	1 in 2-year event (e.g. 81mm in 24 hours)
20% AEP	1 in 5-year event (e.g. 115mm in 24 hours)
10% AEP	1 in 10-year event (e.g. 130mm in 24 hours)
5% AEP	1 in 20-year event (e.g. 164mm in 24 hours)
1% AEP	1 in 100-year event (e.g. 233mm in 24 hours)

The requirement for event based inspections are outlined in the operational plans.

Investigative Monitoring

The EA requires investigative monitoring to be undertaken due to an uncontrolled discharge of mine affected water, or a release event where the downstream water quality characteristics for the receiving environment exceed the upstream results.

The details of the investigations, monitoring data and the actions taken to prevent environmental harm must be documented. Refer to ***SRM Mine Affected Water Release Procedure***.

Emergency & Contingency Planning

Emergencies and contingency planning are covered in the following key documents:

- *SRM MAN Incident Management Manual;*
- *TARP Severe Weather & Cyclone;*
- *SRM STD Working In and Around Water; and*
- *SRM PRO Mine Affected Water Pipe/Drain Failure Response Plan*
- *Regulated dam operational plans and emergency action plans*

Training

Effective site water management requires providing training and awareness. Training will be undertaken in accordance with the ***T&D TRACKS Training System Guidelines*** (or equivalent) under the BMA and Site induction bundles.

Environmental awareness is included in the SRM Induction which includes the following topics:

- Water Management.

Reporting

Reporting associated with Group HSE requirements is facilitated by the HSE Reporting Function. Data required for reporting is maintained in the environmental database (EnviroSys), refer to P***rocedure HSE Data Collection and Recording***.

Reporting on performance against water monitoring program must be in accordance with the ***Standard Coal HSEC Reporting*** and regulatory conditions.

When monitoring results do not conform to the identified requirements, the HSE Department must advise and consult with the risk owner(s) responsible for the non-conforming plant or process and provide input into corrective or preventative actions.

Event Response & Reporting

In the event of emergencies, incidents or exceptions, all reasonable actions must be taken by Operations to minimise environmental harm, or the risk thereof. If required, the HSE Department must also notify the Administrating Authority as per EA conditions.

Emergency response must be in accordance with the ***SRM Crisis and Emergency (Incident) Management Manual*** and spills must be contained and cleaned up in accordance with ***SRM Spill Response Procedure***.

Events must be reported in accordance with the ***Standard Coal HSEC Reporting***.

Complaint Management

Complaints must be managed in accordance with the ***Community Complaints Grievance Procedure*** (or equivalent) and EA requirements.

References

Reference	Title
BHP Portal	Our Requirements: Environment and Climate Change
BHP Portal	Our Requirements: Health, Safety, Environment and Community Reporting
BHP Portal	Our Requirements: Risk Management
BHP Portal – BLD	BLD.007 Coal Risk Management Process
KM# 15748256	Coal HSE Environment & Climate Change Plan
KM# 15703136	Coal Authorisations - Target Environmental Outcomes – Approved
BHP Portal – BLD	Standard Coal HSEC Reporting
BHP Portal – BLD.011	Procedure HSE Data Collection and Recording
KM# 8487451	BMA T&D TRACKS Training System Guidelines
KM#6968772	BMA PRO Crisis and Emergency Management Procedure - EMT
KM#7625027	BMA PRO Community Complaints Grievance Procedure
https://environment.des.qld.gov.au/assets/documents/regulation/era-mn-assessing-consequence-hydraulic-performance.pdf	Manual for Assessing Consequence Categories and Hydraulic Performance of Structures
https://www.ehp.qld.gov.au/water/monitoring/sampling-manual/	Water Monitoring and Sampling Manual
KM#10813120	SRM Mine Affected Water Release Procedure
KM#6010899	SRM Crisis and Emergency (Incident) Management Manual
KM#5824587	SRM Risk Management Procedure
KM#9107552	SRM Risk Register
KM#15135487	SRM Spill Response Procedure
KM#7311654	Groundwater Review 2007
https://gis-prod-bma.apac.ent.bhpbilliton.net/arcgisportal/home/	Mine2Map Qld Area of Influence
KM#	Transfer Water Agreement
KM#7231526	SRM Post Mine Spoil Characterisation
KM#	REMP Design
KM#10104886	SRM Regulated Structure Register
KM#15092773	SRM Monitoring Procedure
KM#16080452	TARP Severe Weather & Cyclone
KM#12076860	SRM STD Working In and Around Water
KM#	SRM PRO Mine Affected Water Pipe/Drain Failure Response Plan
KM#16311164	SRM SWI Water and Soil Sampling
KM#16311148	SRM SWI - Shallow Groundwater Sampling
KM# 14851847	Geotechnical Procedure Non-Regulated Dam Inspections
KM# 15951342	Regulated dam operational plans and emergency action plans

Terms and Definitions

Term/Acronym	Definition
BoM	Australian Bureau of Meteorology
Discharge	Discharges via spillway or dam overflow.
Release	Active initiation of release via pipe or pump
Should	The word 'should' is to be understood as non-mandatory, advising or recommended.
WMP	Water Management Plan

Version Management

Version	Details
0.0	Draft for comment
0.1	Reviewed comments incorporated
1.0	Initial Release
2.0	Updated to align with changes to GLD.009 and to EMS framework
2.A	Updated to align with changes to GLD.009 and BMA Water Management Standard
3.0 & 3.A	Updated to align with Our Requirements for Environment and Climate Change (July 2017)
3.B	Update to area of influence and target environmental outcome (TEOs) sections (January 2018)
4.0	Major update as a result of Environmental Evaluation, principally to inspection requirements and CRWN.

BHP Mitsubishi Alliance

SRM-PLN-0014

SRM PLAN

Erosion and Sediment Control Plan

Status: Final

Version: 6.0 (May 2019)

Owner: HSE Superintendent

Reserved for iPICK barcode

Table of Contents

1 Introduction

Purpose

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

Objectives

2 The objectives of this ESCP include:

- **a** to minimise and mitigate erosion and sedimentation resulting from operations as well as erosion impacts associated with clearing of vegetation along banks of drainage lines;
- **b** to prevent the degradation of water quality resulting from erosion and sedimentation through continued monitoring and improvement measures;
- **c** separation of runoff from disturbed and undisturbed areas where practicable;
- **d** diversion of water from disturbed catchments into mine water storages or sediment dams;
- **e** diversion of clean water away from areas of existing or planned disturbance;
- **f** rehabilitation of disturbed areas to allow vegetation propagation and regrowth;
- **g** improvement to the integrity of areas prone to erosion through temporary and permanent erosion control techniques; and
- **h** the provision of information necessary to implement effective erosion control measures.

Scope

3 This plan addresses, but is not limited to:

- **a** erosion and sedimentation controls;
- **b** management of surface water flow from operational areas;
- **c** operational measures and mitigation techniques to manage erosion and sedimentation impacts; and
- **d** measures to minimise the release of sediment to receiving waters.

Application

4 This ESCP covers all activities at SRM and applies to all BMA employees and contractors. The ESCP forms part of the SRM Environmental Management System (EMS).

2 Environmental Authority and Commitments

Environmental Authority

1 Under the *Environmental Protection Act 1994* (EP Act), SRM must adhere to Environmental Authority EPML00862313 (EA). The EA includes a condition requiring BMA to develop an Erosion and Sediment Control Plan for SRM, as described in Table 1.

2 This ESCP is designed to satisfy condition W35 of the EA.

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

Condition	Requirement
W35	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 storm water.

Environmental Commitments

3 This ESCP 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

3 Site Description

Climate

1 The climatic conditions of SRM 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 The Intensity-Frequency-Duration (IFD) chart for SRM is provided in Figure 1.

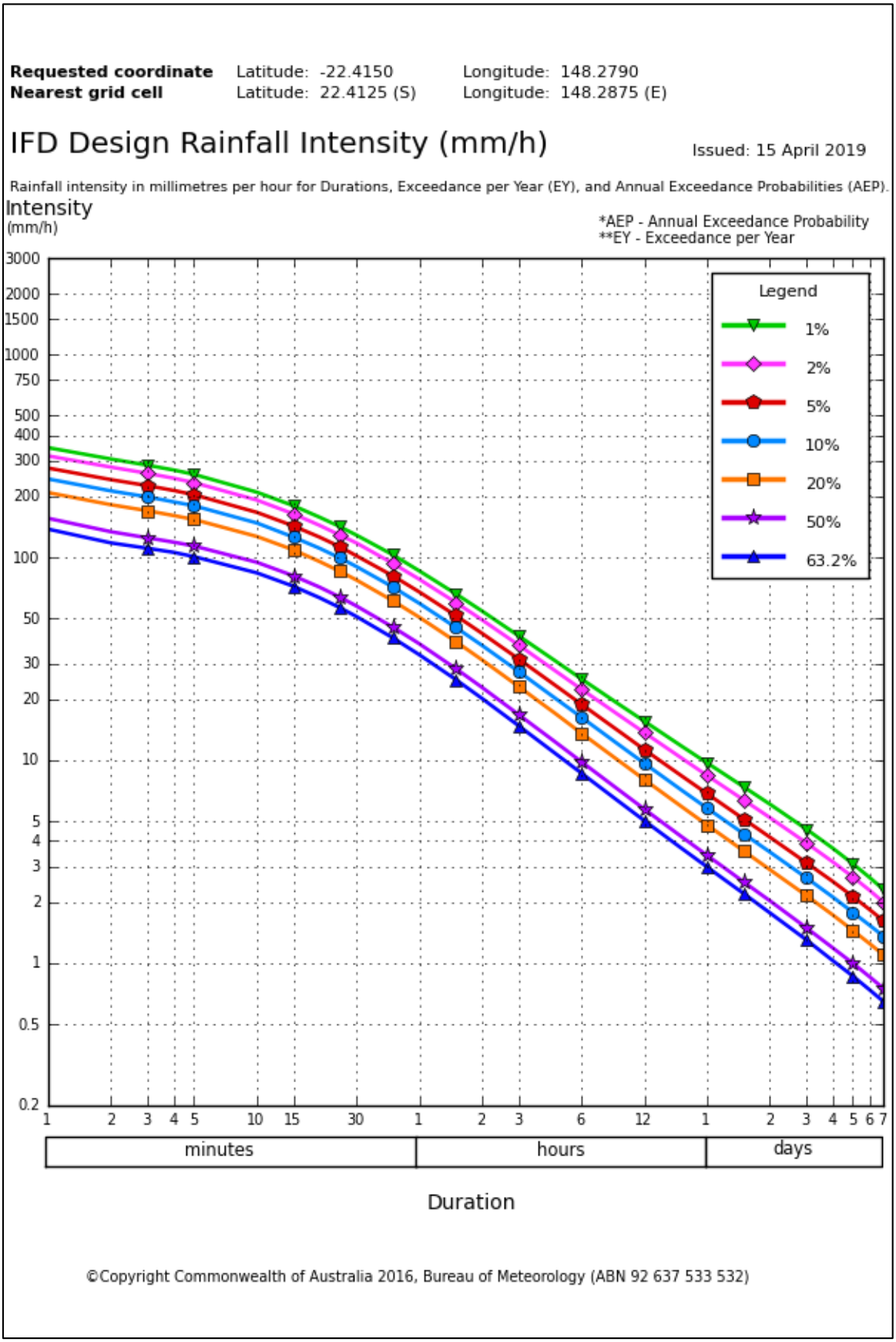


Figure 1: SRM Rainfall IFD Chart

4 Localised flooding can also occur in tributaries of the Isaac River due to high intensity thunderstorms or long duration rain events.

Hydrology and Topography

5 SRM is located in the Isaac-western upland tributaries, directly north of Dysart and approximately 70km south of Moranbah in Central Queensland. The topography of SRM is dominated the Cherwell Range running along the western boundary of the mine and by flat to gently sloping landforms and low rolling hills draining into ephemeral tributaries which flow to the Isaac River.

6 The local drainage regime comprises of eight ephemeral creeks and minor tributaries which flow eastwards across the mining operation. These creeks have been diverted as the mine has been progressively developed. The eight (8) diversions, from north to south, are described in Table 2.

Table 2: Stream diversions at SRM

Creek	Description
Boomerang Creek	Diverted within Peak Downs Mine, however the downstream reaches flow through the north-eastern lease areas of SRM.
Plumtree Creek	Diverted south into Hughes Creek.
Hughes Creek	Diverted and passes between Coolibah and Bauhinia Pits.
Barretts Creek	Diverted north into Hughes Creek Diversion.
One Mile Creek	Diverted and passes between Dogwood and Ebony Pits.
Spring Creek	Diverted and passes between Ebony and Grevillea Pits.
South Creek	Diverted into Phillips Creek.
Phillips Creek	Diverted and passes between Grevillea and Hakea Pits.

7 The catchments associated with the creeks at SRM are shown in Figure 2.

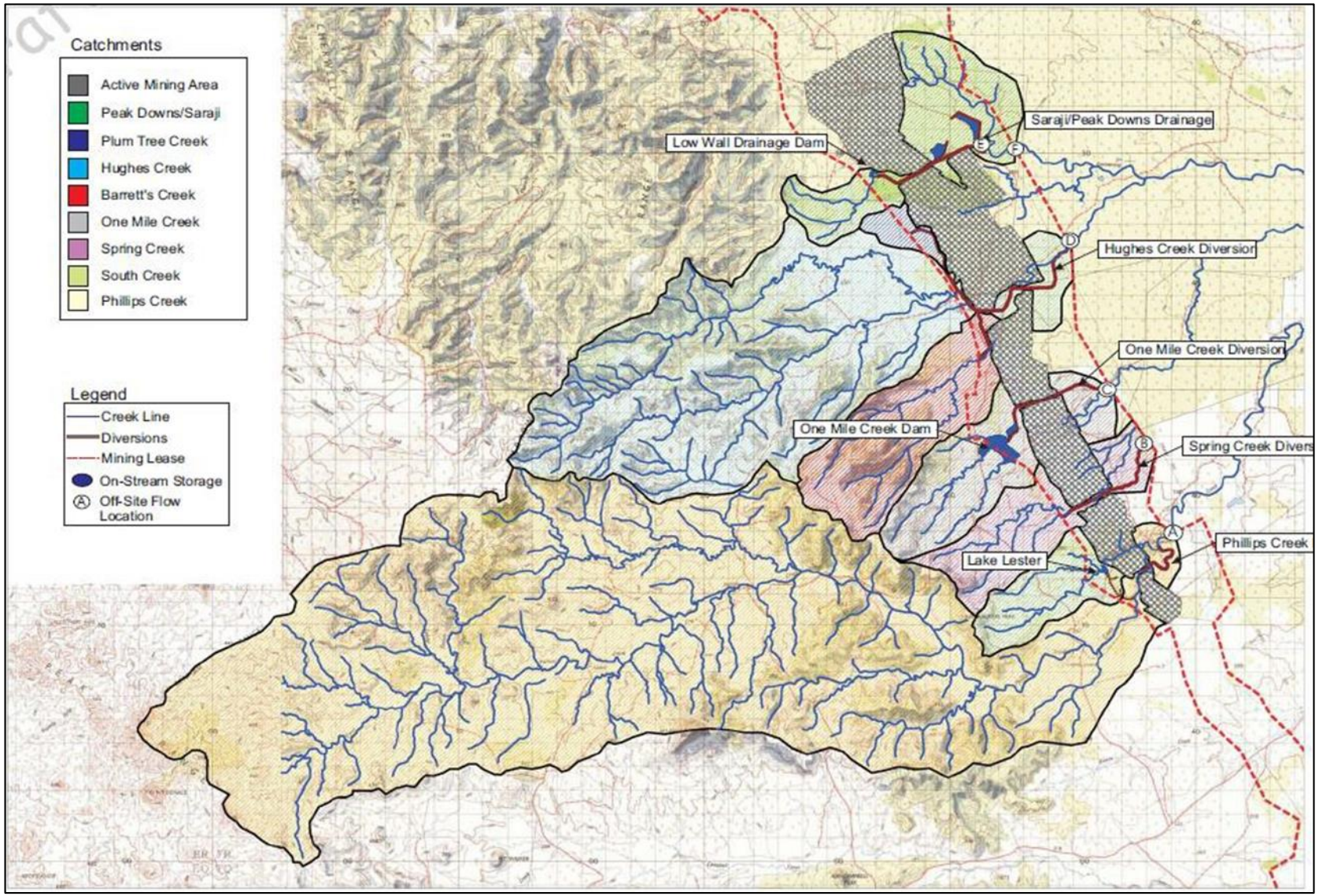


Figure 2: Catchments

Soil and Spoil Characteristics

8 The natural topography of Saraji Mine areas is characterised by a range of topographic settings ranging from level to gently undulating plains to gravely 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.

9 Soils of the area have formed from weathered parent materials under the influence of time, land relief, moisture, temperature changes and organisms. Predominant soil types are generally related to their position on the slopes of the catchment and can be broadly divided into the following types:

- **a** Mountains and Ridges Assemblage: Shallow, coarse textured and rocky siliceous sand (uniform soils);
- **b** Stony Hills Assemblage: Hard pedal duplex soils with colour range from red through brown to yellow or mottled yellow, neutral to alkaline;
- **c** Footslopes and Lowlands Assemblage: Hard pedal duplex soils with colour range of red, brown and mottled yellow, alkaline reaction;
- **d** Weathered Clay Plains Assemblage: Hard pedal duplex soils with colour range of red, brown, yellow and black, alkaline reaction;
- **e** Brigalow Plains Assemblage: Self-mulching, cracking clay. Uniform soil, colour range of red and brown to black; and
- **f** Alluvial Plains and Terraces Assemblage: Hard pedal duplex soils with colour range or red, brown and yellow.

10 A description of geological units and soil erodibility is provided in Table 3.

Table 3: Predominant geology units and soil erodibility

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.

4 Planning

1 Erosion and Sediment Control (ESC) should be incorporated into and considered during the planning stages of any activity or project that includes ground disturbance.

2 Activities which may cause erosion and sedimentation impacts include, but are not limited to:

- **a** Vegetation or land clearing;
- **b** Stockpiling of topsoil, coal, imported aggregate or other material;
- **c** Earthworks and machinery movement;
- **d** Mine development resulting in any exposed surfaces; and
- **e** Grading of roads and associated traffic.

3 The Permit to Disturb (PTD) process is used to control and minimise new disturbances, pre-mature disturbance and disturbance to rehabilitated land. Refer to the BMA Permit to Disturb Procedure and BMA Vegetation Clearing Procedure. The PTD includes consideration of erosion and sediment impacts and determination of appropriate controls.

Stormwater or Mine Affected Water (MAW)

4 The crucial first step in ESC planning is to determine whether the water from the catchment associated with the activity or project can be managed as stormwater. That is, that the water is not Mine Affected Water (MAW) in accordance with the definition of MAW in the EA.

5 As such, the following steps should be undertaken in ESC management to facilitate the correct design process:

- **a** Collect relevant data on the area of the activity or project, including location, size/extent, duration of the activities and the associated catchment.
- **b** Consult with HSE to determine if the associated water can be managed as stormwater. This step may require the collection/review of water quality data.
- **c** If the water can be managed as stormwater, consult with the relevant stakeholders to determine the appropriate controls and design requirements.
- **d** If the water is determined to be MAW, refer to the Water Management Plan for further guidance on management of the water. However, erosion controls should still be implemented to reduce sedimentation of MAW structures.

Stakeholder Engagement

6 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;
- **d** Water Planning;
- **e** Closure Planning;
- **f** Mine Services; and
- **g** Health Safety and Environment (HSE).

Principles of Erosion and Sediment Control (ESC)

7 The key guiding principles of ESC focus on both minimising erosion and controlling sediment. It is critical that both are considered during planning rather than just focusing on sediment control in isolation (i.e. sediment dam or basins).

8 Table 4 outlines the key guiding principles, derived from the Best Practice Erosion and Sediment Control Guidelines (International Erosion Control Association (IECA)) that should be considered during the planning stage of an activity or project.

Table 4: Key guiding principles of ESC

ESC Principles (Derived from IECA)	Example Applications for Mining ESC
Plan for and design suitable ESC for each site/project prior to disturbance	Development and implementation of site ESCP's
Minimise the extent and duration of soil disturbance and exposure to erosion	Minimising disturbance footprint Scheduling/timing of works Progressive rehabilitation
Control water movement through the site	Clean water diverted around disturbed areas Permanent and temporary drainage features Design of allowable flow velocities to minimise soil erosion/bulk sediment transfer
Minimise soil erosion and conservation of topsoil	Design of erosion control features to minimise soil loss (e.g. slope grades and length, soil surfaces, scour protection) Conservation of topsoil resources to use for rehabilitation post disturbance.
Maximise sediment retention on the site	Design of sediment dam/basins, traps, fences etc for sediment entrapment
Promptly stabilise/rehabilitate disturbed areas	Scheduling of rehabilitation/revegetation Rehabilitation plant species selection
Monitoring and maintenance of ESC to maintain required performance standards	Scheduling and budgeting of maintenance strategies (e.g. desilting) Monitoring of ESC performance

5 Design

Commencement of Design Standards

1 The design standards set out in this ESCP take effect on and from 30 May 2019 (Design Standards Effective Date).

2 For SRM infrastructure designed or constructed prior to the Design Standards Effective Date, BMA has developed a works program to bring this infrastructure into compliance with the design standards set out in this ESCP.

Relevant Guidelines

3 The design of erosion and sediment control measures should be generally designed considering

the guiding principles within:

a Best Practice Erosion and Sediment Control Guidelines (International Erosion Control Association (IECA), 2008); and

b DEHP Manual for Assessing Consequence Categories and Hydraulic Performance of Structures.

4 Whilst the IECA Guideline is generally intended for urban environments or short-term disturbance activities, it encompasses strategies that can be adapted for the mining environment. This includes providing design criteria more suitable for permanent ESC controls that takes into account sensitive receiving environments.

Key Considerations

5 The design of ESC is generally influenced by a number of site and project specific characteristics. These include:

a The scale and type of the disturbance.

b The soil types and/or slopes.

c The locality of the disturbance.

d Any site-specific legislative requirements or hydraulic/structural design requirements.

e Other constraints such as available space, agreed maintenance frequencies and any sensitive receptors.

6 The design of erosion and sediment control structures is to be determined through engagement with the relevant stakeholders. Where a sediment basin or dam is required, a flow chart has been developed by Saraji Mine to assist with determining the steps required in the design and construction of a water storage structure (Refer to Appendix A). This includes consultation with the G&TS Dams team and potentially review of the DEHP Manual for Assessing Consequence Categories and Hydraulic Performance of Structures to determine whether the structure will be considered a regulated structure.

Erosion Control

7 Erosion control is the action of minimising the potential for soil erosion. General principles to manage soil erosion include controlling the flow rate of runoff before it develops into an erosive force and protecting soil surfaces with some form of cover.

8 The application of temporary erosion control can be implemented to reduce short term impacts as part of the 'wet weather management plan'. However, this is not a long-term solution due to the nature of mining operations and further controls are required to mitigate this risk. Examples include:

a Minimise the area of disturbance where possible and schedule the disturbance such that it is not exposed for longer than is necessary.

b Where the surface is to be disturbed, topsoil should be stripped and stockpiled in line with *SRM PLN Topsoil and Disturbance Management Plan*.

c Clean water should be diverted around the disturbed and/or sensitive areas where possible.

d Exposed surfaces should then be protected with surface cover as soon as practical after works to assist in reducing surface erosion.

e Rehabilitation should be undertaken to provide a stable and vegetated landform and should be completed in accordance with the *BMA Sustainable Landform Guideline* and *SRM PLN Rehabilitation Management Plan*. Surface treatment must consider the type of material/rock suitable for the required slope and velocity to ensure the selected material is fit for purpose. Table 5 provides guidance on selecting an appropriate surface cover based on slope.

f Where disturbance has occurred within a waterway, the area should be revegetated as soon as possible. Consideration should be given to the use of a soil binder, coir mesh or rock/topsoil matrix, depending on the significance of the waterway, to stabilise the surface during vegetation establishment.

Table 5: Typical surface treatments for erosion control

Flatland (flatter than 1 in 10)	**Mid Slopes (1 in 10 – 1 in 4)**	**Steep Slopes (steeper than 1 in 4)**
Minor works (e.g Construction of site facilities, temporary topsoil stockpile)		
Gravelling Mulching Revegetation Rock mulching Erosion control blankets	Revegetation Rock mulching Rock armoring Mulching well anchored Erosion control blankets, mats and mesh	Revegetation Hydromulch Rock armoring Erosion control blankets, mats and mesh
Major works (e.g Overburden emplacement, creek diversion, major creek crossing)		
Revegetation	Revegetation Mulching well anchored Rock armoring	Revegetation Hydromulch Rock armoring

Drainage Control

9 Runoff can be controlled in a number of ways to reduce the risk of erosion. Table 6 outlines the options, criteria and principles that should be considered in the design of drainage controls. Designs should consider velocity and the material type and sizing required to manage those velocities.

Table 6: Drainage Control options and criteria

Drainage Control	**Function**	**Minimum Design Criteria**	**Justification**
Low Gradient Drainage Controls (Gradient < 10%)		The minimum design criteria for drainage conveyance is the 1 in 10-year Average Reoccurrence Interval (ARI). Drains near MAW catchments and high-risk areas should consider whether a more conservative design event is required.	Designed to have a non-erosive hydraulic capacity to convey. The design criteria is aligned with IECA Guidelines for maximum design life.
Catch Drain	Intercept and convey runoff from disturbed areas into sediment control structure or reduce runoff entering disturbed areas		
Major Diversion Channel	Generally permanent diversion of large concentrated flows		
Flow Diversion Bank	Diversion (if materials are available) of minor flows at the base of fill slopes and/or cross drainage on unsealed roads		
Steep-gradient Drainage Controls (Gradient > 10%)			
Chute	Discharge of concentrated flows down steep slopes and control of flow into sediment dams/basins		
Level Spreader	Conversion of minor concentrated flows into sheet flow		
Slope Drain	Discharge of minor flows down steep slopes and into bushland/receiving environment		

10 Other important drainage aspects to consider to support ESC management include:

a Where ever safe and practicable to do so, haul roads should be graded such that they are internally draining.

b Flow diversion banks should be used during the construction of service crossings through a waterway or any disturbance activities in which clean water can be diverted around the activity to prevent erosion.

Sediment Control

11 In Queensland, due to higher intensity (concentrated) rainfall and the dispersive nature of soils, the preferred and most effective sediment control are sediment basins/dams (Type 1). Type 1 controls are the most conservative and are considered the most effective in long-term sediment entrapment.

12 Small-scale sediment controls (Type 2 and 3) like silt fences and berms may be appropriate controls on a temporary basis during small-scale, short-term construction/exploration stages prior to implementing erosion protection measures such as revegetation.

13 Due to the magnitude in size for many mining activities, Figure 3 provides guidance on determining sediment control requirements, based on the disturbance catchment size.

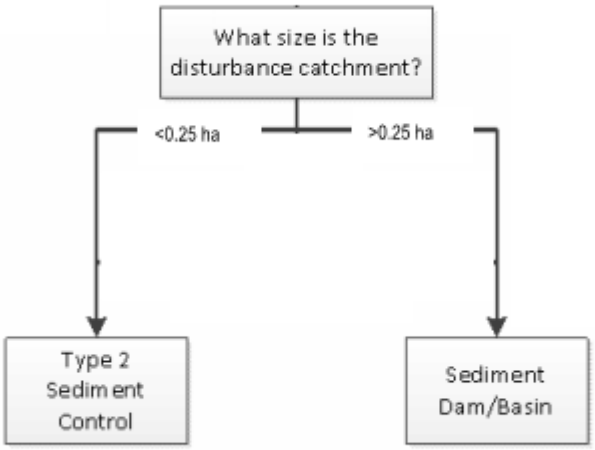


Figure 3: Sediment Control Flow Chart

14 The Type 1, 2 and 3 sediment controls are defined and discussed in IECA. Table 7 below outlines some typical Type 1 and 2 sediment controls and applications on mine sites.

Table 7: Type 1 and 2 Sediment Controls

Control Type	Sediment Control	Example Applications
Type 1	Sediment Basin/Dam	Overburden emplacement
Type 2	Mulch Berm Rock Filter Dam Sediment Fence Sediment Sump	On site facilities (e.g new administration building, carpark etc.) Temporary topsoil stockpiles

15 For larger scale projects a sediment dam or basin will be required. Any proposed sediment basin or dam should be assessed against the DEHP Manual for Assessing Consequence Categories and Hydraulic Performance of Structures in consultation with the G&TS team. The correct naming convention for sediment dams/basins should be adhered to:

a If the storage is designed/constructed to be pumped it is a sediment dam.

b If the storage is designed/constructed as a passive system it is a sediment basin.

16 The dam or basin will act to capture eroded or disturbed soil that is entrained in surface water runoff during rain events. IECA outlines a number of Type 1 sediment controls which are summarised in Table 8.

Table 8: Type 1 Sediment Controls

Sediment Control Type	Soil and/or catchment conditions
Type A	The duration of soil disturbance within a given discharge catchment exceeds 12 months. Most effective basin for clayey soils.
Type B	The duration of soil disturbance within a given discharge catchment, does not exceed 12 months
Type C	Less than 33% of soil finer than 0.02mm and no more than 10% of soil is dispersive Most effective within non-dispersive, low clay sandy soils.
Type D	An alternative to Type A or Type B when it is demonstrated that automatic chemical flocculation is not reasonable or practical.

17 Sediment dams or basins should be designed in an accordance with the principles and criteria outlined in Table 9 in conjunction with IECA. The minimum total volume of a sediment basin or dam equates to the sum of the settling volume and the sediment volume. Consideration should also be given to providing sufficient freeboard between the top of embankment and the settling volume maximum water level.

Table 9: Design criteria for sediment basins

Design Parameter	Minimum Design Criteria	Justification	Alternative Design Criteria
Sediment Dam/Basin Type	Type D	Type D have traditionally been used on mine sites to capture sediment. Type D do not require flocculation, specialist services and excessive up keep which is generally why they are used on mine sites.	Type A or B can apply if there is data to support this type being effective for the catchment.
Settling Volume	The settling volume should be designed for the 95th percentile, 5-day rainfall volume where $R_{(95\%, 5\text{-day})}$ = 65.6mm for SRM	IECA recommends a x-percentile 5-day event settling volume for Type D structures. The 95th percentile has been selected as a conservative approach as it is applied to long-term sediment dams/basins and/or when discharging to sensitive receiving environments.	85th percentile, 5-day volume is justifiable for use if there are volume or cost constraints.
Sediment Volume – for runoff from catchments with steep grades and/or long slopes (e.g. spoil dumps)	Sediment volume can be calculated using the Revised Universal Soil Loss Equation (RUSLE). The sediment volume should be based on a 12-month period. For information on calculating the soil-loss volume refer to IECA.	A sediment volume based on a 12-month RUSLE calculation is appropriate for a mining environment to align with agreed maintenance frequencies whilst maintaining adequate storage for sediment control.	
Sediment Volume – for runoff from catchments without steep grades (<1 in 10) and/or long slopes	50% of the settling dam/basin volume	Aligned with IECA and for relatively flat catchments, 50% of the settling dam/basin volume is approximately equivalent to the 12-month RUSLE volume	
Settling Zone Depths and Length to Width Ratios	Min. settling depth= 0.6m Length/width ratio=3:1.	In accordance with requirements of a Type D. For more guidance refer to Book 1, Appendix B of IECA BPESC.	Note that the length to width ratio is a desirable standard and therefore, where space restrictions apply, it is acceptable if these criteria are not met.
Emergency Spillway	1 in 50 year ARI event	In accordance with Book 1, Appendix B of IECA.	

6 Construction

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

a This ESCP and any relevant Contractor plans and procedures;

b Type 1 sediment dams will require assessment against the DEHP Manual for Assessing Consequence Categories and Hydraulic Performance of Structures in consultation with engineering and/or the G&TS Dams team;

c The design of any Type 1 structure will be assessed by the required engineering or G&TS team who will decide if external certification is required;

d Permit to Disturb;

e Project specific approvals; and

f Inspections.

2 Erosion and sediment control 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. Where possible, construction should be undertaken in the dry season to limit the likelihood of rainfall events impacting construction or the effectiveness of ESC measures as they are established.

7 Inspection, Monitoring and Maintenance

1 Inspections of ESC controls are crucial to their ongoing effectiveness.

2 The inspections should assess the condition of the structure and turbidity water quality data should be obtained where possible to monitor the effectiveness of the control.

3 All inspections must be documented in a register. Required maintenance works will be included in the register.

Inspections

4 Table 10 defines the routine inspections required to be completed at SRM.

Table 10: Routine inspections

ESC Control	Minimum Frequency
Erosion controls	Annually
Drainage controls	Quarterly
Sediment controls	Quarterly

5 In addition to routine inspections, inspections are also required following a rainfall event exceeding the containment capacity of a drainage or Type 1 sediment control structure.

6 Table 11 defines the event-based inspections required to be completed at SRM.

Table 11: Event-based inspections

Structure Containment Capacity	Trigger for Event based Inspection
<50% AEP	1 in 1.58-year event (e.g. Annually or 71mm in 24 hours)
50% AEP	1 in 2-year event (e.g. 81mm in 24 hours)
20% AEP	1 in 5-year event (e.g. 115mm in 24 hours)
10% AEP	1 in 10-year event (e.g. 130mm in 24 hours)
5% AEP	1 in 20-year event (e.g. 164mm in 24 hours)
1% AEP	1 in 100-year event (e.g. 233mm in 24 hours)

7 Sediment dams should be managed such that the discharged water is not significantly different to upstream conditions. To assist with sediment dam management, consideration should be given towards dewatering structures prior to a rain event that is likely to produce runoff using a pump, siphon or floating decant.

Maintenance

8 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 to soil stabilization controls;
- **b** Damage/deterioration of earthen embankments/walls that has the potential to affect its structure integrity;
- **c** Sediment deposition in sediment basins/dams/drains that is approaching or exceeding engineered limits/tolerances;
- **d** Sediment deposition in the inlets and outlets of structures;
- **e** Damage to erosion and/or sediment controls;
- **f** Damage/deterioration of access tracks or the ability to inspect/monitor, or maintain and/or operate area/infrastructure/equipment;
- **g** Spill, contaminated or waste materials accumulated/deposited in controls or their associated catchment areas; and
- **h** Performance of controls/devices is apparently diminished, or compromised.

8 Performance Indicators

1 To assess and determine the effectiveness of ESC management on site, the performance indicators defined in Table 12 should be adopted.

Table 12: Performance indicators

Parameter	Performance Indicators
Compliance is maintained with EA Conditions.	Erosion and Sediment Control Plan developed and implemented in accordance with the EA. Historical records of monitoring reports and inspections are maintained. Historical records of release and discharge water quality, where recorded, is maintained on EnviroSys or similar environmental database.
Community complaints	No complaints received regarding erosion and sediment control impacts. All complaints received from the community or workforce related to erosion and sediment impacts will be recorded and investigated in accordance with EA requirements for investigating complaints.
Visual Inspection	Sediment basins and dams must not contain waters that have visual or odorous evidence of slick, hydrocarbons and/or coal.

9 Data Management and Reporting

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

Event Investigations and Reporting

2 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).

3 Investigation and reporting of events must occur as per the *BMA Event Notification Procedure*, *BMA Event Investigation Protocol* and *BMA HSEC Reporting Procedure*.

Complaints

4 Complaints should be managed in accordance with *BMA Community Complaints and Grievance Procedure.*

10 Roles and Responsibilities

1 General requirements and responsibilities of roles are found in various elements of BMA 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 ESCP are outlined in Table 14.

Table 13: Roles and responsibilities

Role	Responsibilities
General Manager	• Overall responsibility for the implementation of the ESCP at SRM.
Mine Planning	• Integrating water management and ESC in the mine planning process. • Submit erosion and sediment control plans with Permit to Disturb applications (when applicable).
Engineering	• Provide guidance on the design and associated requirements of ESC structures.
Governance & Technical Stewardship – Dams	• Provide guidance on the design and associated requirements of ESC structures in respect of the DEHP Manual for Assessing Consequence Categories and Hydraulic Performance of Structures. • Inspect unregulated ESC structures pre- and post-wet season
HSE	• Provide advice to operations and contractors on ESC and assist in use of the definition of MAW. • Actively define areas where ESC measures are needed, including through the Permit to Disturb process. • Conduct site inspections of areas requiring ESC measures pre- and post-wet season and after significant rainfall events where required. • Coordinate with the other departments where compliance issues are identified and corrective actions are needed.
Mine Services	• Conduct the inspections defined in this ESCP, including documenting the inspection outcomes and any maintenance activities required in SAP. • Complete maintenance activities in a timely manner.
RPEQ	• May be consulted in the design and construction of sediment dam/basins.
Contractors, Site Supervisors, or Project Teams	• Ensure stipulated and planned erosion and sediment controls are implemented. • Inspect/monitor the effectiveness and condition of erosion and sediment controls during and/or after works. If required, implementing additional controls or maintenance works. • Report any erosion and sediment control issues or non-compliance to the HSE Team.

11 Terms and Definitions

Term	Definition
BMA	BM Alliance Coal Operations Pty Ltd
DES	Department of Environment and Science
EA	Environmental Authority EPML00862313
RPEQ	Registered Practicing Engineer in Queensland, either internal or external consultant.

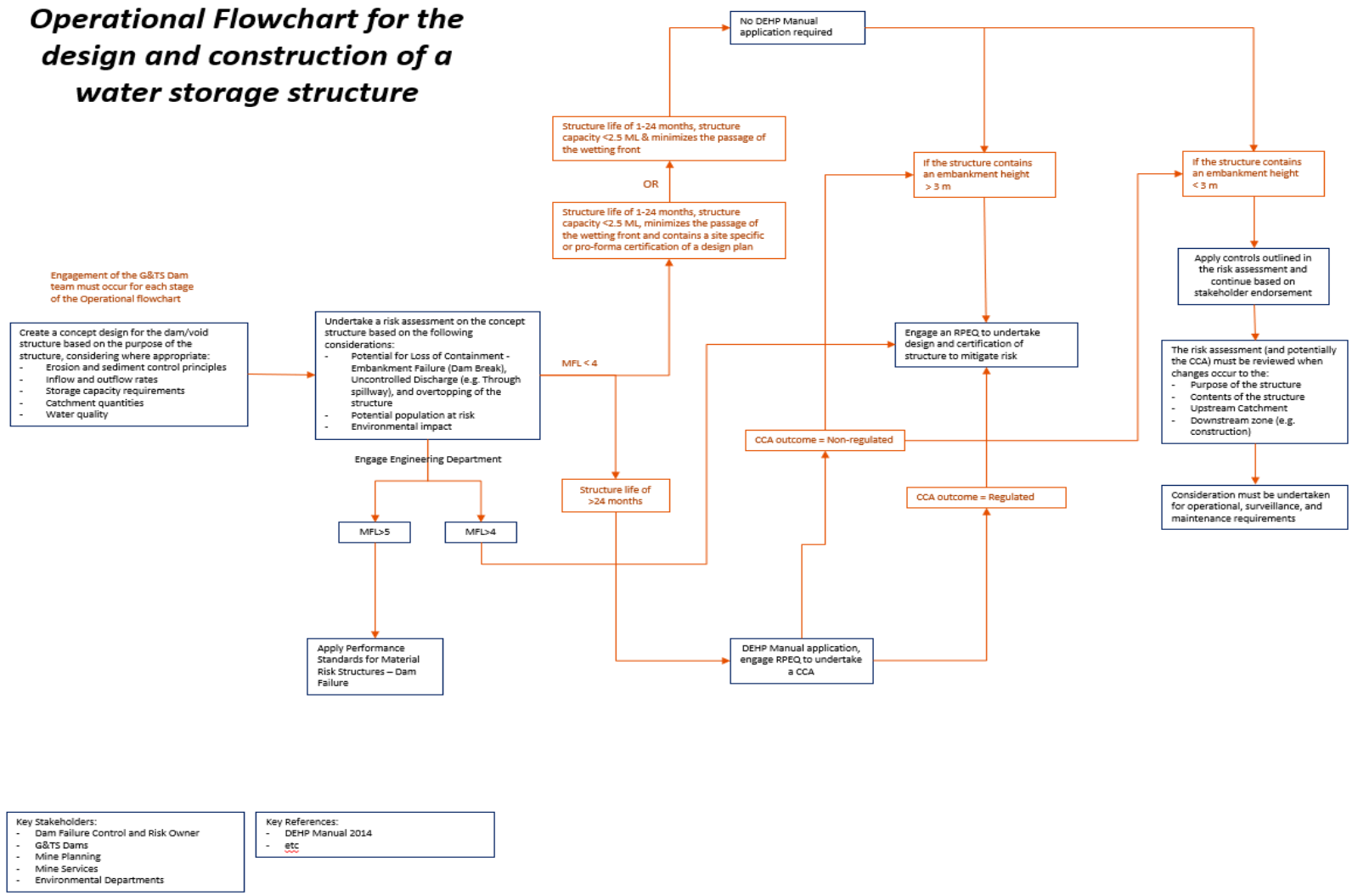
12 References

References	Title
KM#7391767	BMA Sustainable Landform Guideline
KM#11086839	BMA HSE Permit to Disturb Procedure
KM#5021650	BMA Incident Notification Procedure
KM#8363039	BMA 1SAP BMA Event Investigation Protocol
KM#7322001	BMA HSEC Reporting Procedure
KM#5913900	BMA Complaints Management Procedure
KM#8146878	SRM Environmental Authority EPML00862313
KM#5874177	SRM Rehabilitation Management Plan
KM#5811595	SRM Topsoil and Disturbance Management Plan
KM#5811599	SRM Environmental Water Management Plan
KM#12105720	SRM Land and Biodiversity Management Plan
	Guideline—Activities in a watercourse, lake or spring associated with a resource activity or mining operations WAM/2008/3435
	Best Management Practices for managing water, erosion and sediment control on construction sites (IECA, 2004)

13 Version Management

Version	Details
5.0	Minor terminology changes
6.0	Major update as a result of Environmental Evaluation, principally to design standards and inspection requirements.

Appendix A – Flowchart: Design of a Water Storage



Appendix 4

Program of Works

Creek	Catchment	Classification	Type	Action	Timing
Hughes Creek	All	MAW	Study	Commence study in respect of the preferred long term sustainable solution to prevent mine affected water (including sediment) runoff into Hughes Creek	30-Jun-25
Hughes Creek	H01	Clean	--	No action required	--
Hughes Creek	H02	MAW	Mitigation	Develop and implement operating controls for the Ramp 2 Fillpoint Dam	31-Dec-19
Hughes Creek	H03	MAW	--	No action required. Runoff is captured by the Tailings Dam.	--
Hughes Creek	H04	MAW	--	No action required. Runoff is captured by an open-pit void, and does not flow to Hughes Creek, One Mile Creek, Spring Creek or Phillips Creek. This catchment is outside the scope of the EE.	--
Hughes Creek	H05	MAW	Mitigation	Install drainage to ensure catchments drain to Ramp 4 LW Sump and H19 water storage and pump back into Tailings Dam (subject to engineer of record sign-off)	31-Dec-19
Hughes Creek	H05	MAW	Study	Commence study in respect of the preferred long term sustainable solution for catchments H05, H14, H19, H32, H33, H37	30-Jun-23
Hughes Creek	H05	MAW	Mitigation	Redirect water from haul road Ramp 4 into settling area	Completed
Hughes Creek	H06	Clean	--	No action required	--
Hughes Creek	H07	Clean	--	No action required	--
Hughes Creek	H08	MAW	Mitigation	Install several small sumps alongside Hughes Creek as a temporary sediment control measure	30-Jun-20
Hughes Creek	H08	MAW	Mitigation	Re-grade haul road away from Hughes Creek	30-Jun-21
Hughes Creek	H08	MAW	Study	Commence study in respect of a permanent sediment structure in-stream to catch sediment from catchments H08, H09a, H09b, H11, H24	30-Jun-21
Hughes Creek	H09a	MAW	Mitigation	Install several small sumps alongside Hughes Creek as a temporary sediment control measure	30-Jun-20
Hughes Creek	H09a	MAW	Mitigation	Re-grade haul road away from Hughes Creek	30-Jun-21
Hughes Creek	H09a	MAW	Study	Commence study in respect of a permanent sediment structure in-stream to catch sediment from catchments H08, H09a, H09b, H11, H24	30-Jun-21
Hughes Creek	H09b	MAW	Mitigation	Install several small sumps alongside Hughes Creek as a temporary sediment control measure	30-Jun-20
Hughes Creek	H09b	MAW	Mitigation	Re-grade haul road away from Hughes Creek	30-Jun-21
Hughes Creek	H09b	MAW	Study	Commence study in respect of a permanent sediment structure in-stream to catch sediment from catchments H08, H09a, H09b, H11, H24	30-Jun-21
Hughes Creek	H10	MAW	Mitigation	Drain water into H26 and install sediment structures No coal hauled along the H10 access road	30-Jun-20
Hughes Creek	H10	MAW	Study	Commence study in respect of a permanent sediment trap to catch run-off	30-Jun-22
Hughes Creek	H11	MAW	Mitigation	Install several small sumps alongside Hughes Creek as a temporary sediment control measure	30-Jun-20
Hughes Creek	H11	MAW	Mitigation	Re-grade haul road away from Hughes Creek	30-Jun-21
Hughes Creek	H11	MAW	Study	Commence study in respect of a permanent sediment structure in-stream to catch sediment from catchments H08, H09a, H09b, H11, H24	30-Jun-21
Hughes Creek	H12	MAW	Mitigation	Install sump alongside Hughes Creek as a temporary sediment control measure	31-Dec-19
Hughes Creek	H12	MAW	Study	Commence study in respect of a permanent sediment structure in-stream to catch sediment from catchments H12, H13, H15	30-Jun-21
Hughes Creek	H13	MAW	Mitigation	Install sump alongside Hughes Creek as a temporary sediment control measure	31-Dec-19
Hughes Creek	H13	MAW	Study	Commence study in respect of a permanent sediment structure in-stream to catch sediment from catchments H12, H13, H15	30-Jun-21
Hughes Creek	H14	MAW	Mitigation	Install drainage to ensure catchments drain to Ramp 4 LW Sump and H19 water storage and pump back into Tailings Dam (subject to engineer of record sign-off)	31-Dec-19
Hughes Creek	H14	MAW	Study	Commence study in respect of the preferred long term sustainable solution for catchments H05, H14, H19, H32, H33, H37	30-Jun-23
Hughes Creek	H15	MAW	Mitigation	Install sump alongside Hughes Creek as a temporary sediment control measure	31-Dec-19
Hughes Creek	H15	MAW	Study	Commence study in respect of a permanent sediment structure in-stream to catch sediment from catchments H12, H13, H15	30-Jun-21
Hughes Creek	H15	MAW	Mitigation	Develop and implement maintenance strategy to regularly clean existing drains of sediment and rejects	Completed
Hughes Creek	H16	MAW	Mitigation	Install sediment traps in the spillway	31-Dec-19
Hughes Creek	H16	MAW	Study	Commence study in respect of a mine water storage structure (or upgrade of Dudley Dam) and integrated drainage / contouring	30-Jun-22
Hughes Creek	H17	MAW	Mitigation	Construct replacement effluent polishing ponds	30-Jun-21
Hughes Creek	H17	MAW	Study	Commence study in respect of a mine water storage structure	30-Jun-22
Hughes Creek	H18	MAW	--	No action required. Runoff is captured by an open-pit void, and does not flow to Hughes Creek, One Mile Creek, Spring Creek or Phillips Creek. This catchment is outside the scope of the EE.	--
Hughes Creek	H19	MAW	Mitigation	Install drainage to ensure catchments drain to Ramp 4 LW Sump and H19 water storage and pump back into Tailings Dam (subject to engineer of record sign-off)	31-Dec-19
Hughes Creek	H19	MAW	Study	Commence study in respect of the preferred long term sustainable solution for catchments H05, H14, H19, H32, H33, H37	30-Jun-23
Hughes Creek	H20	Clean	--	No action required	--
Hughes Creek	H21	MAW	Mitigation	Re-grade haul road away from Hughes Creek (to the west) and install sediment structure on western side of haul road	30-Jun-21
Hughes Creek	H21	MAW	Study	Commence study in respect of drainage to direct run-off to mine water storage structure	30-Jun-22
Hughes Creek	H22	MAW	--	No action required. Runoff is captured by an open-pit void, and does not flow to Hughes Creek, One Mile Creek, Spring Creek or Phillips Creek. This catchment is outside the scope of the EE.	--
Hughes Creek	H23	MAW	Study	Commence study in respect of a sediment dam to catch sediment from catchments H23 and H25	30-Jun-22
Hughes Creek	H23	MAW	Mitigation	Undertake rehabilitation works	30-Jun-23
Hughes Creek	H24	MAW	Mitigation	Install several small sumps alongside Hughes Creek as a temporary sediment control measure	30-Jun-20
Hughes Creek	H24	MAW	Mitigation	Re-grade haul road away from Hughes Creek	30-Jun-21
Hughes Creek	H24	MAW	Study	Commence study in respect of a permanent sediment structure in-stream to catch sediment from catchments H08, H09a, H09b, H11, H24	30-Jun-21
Hughes Creek	H25	MAW	Study	Commence study in respect of a sediment dam to catch sediment from catchments H23 and H25	30-Jun-22
Hughes Creek	H25	MAW	Mitigation	Undertake rehabilitation works	30-Jun-23
Hughes Creek	H26	Clean	--	No action required	--
Hughes Creek	H27	Clean	--	No action required	--
Hughes Creek	H28	Clean	--	No action required	--
Hughes Creek	H29	Clean	--	No action required	--
Hughes Creek	H30	Clean	--	No action required	--
Hughes Creek	H31	Clean	--	No action required	--
Hughes Creek	H32	MAW	Mitigation	Install drainage to ensure catchments drain to Ramp 4 LW Sump and H19 water storage and pump back into Tailings Dam (subject to engineer of record sign-off)	31-Dec-19
Hughes Creek	H32	MAW	Study	Commence study in respect of the preferred long term sustainable solution for catchments H05, H14, H19, H32, H33, H37	30-Jun-23

Creek	Catchment	Classification	Type	Action	Timing
Hughes Creek	H33	MAW	Mitigation	Install drainage to ensure catchments drain to Ramp 4 LW Sump and H19 water storage and pump back into Tailings Dam (subject to engineer of record sign-off)	31-Dec-19
Hughes Creek	H33	MAW	Study	Commence study in respect of the preferred long term sustainable solution for catchments H05, H14, H19, H32, H33, H37	30-Jun-23
Hughes Creek	H33	MAW	Mitigation	Redirect water from haul road Ramp 4 into settling area	Completed
Hughes Creek	H34	Clean	--	No action required	--
Hughes Creek	H35	Clean	--	No action required	--
Hughes Creek	H36	MAW	--	No action required. Runoff is captured by an open-pit void, and does not flow to Hughes Creek, One Mile Creek, Spring Creek or Phillips Creek. This catchment is outside the scope of the EE.	--
Hughes Creek	H37	MAW	Mitigation	Install sediment control structures along bank of Hughes Creek	30-Jun-20
Hughes Creek	H37	MAW	Study	Commence study in respect of the preferred long term sustainable solution for catchments H05, H14, H19, H32, H33, H37	30-Jun-23
Hughes Creek	H38	MAW	Mitigation	Install sediment control structures along bank of Hughes Creek	30-Jun-20
Hughes Creek	H39	Clean	--	No action required	--
Hughes Creek	H40	MAW	Mitigation	Install sediment trap	30-Jun-20
Hughes Creek	H41	MAW	Mitigation	Install sediment trap	30-Jun-20
Hughes Creek	H42	MAW	Mitigation	Install sediment sumps	31-Dec-19
Hughes Creek	H42	MAW	Study	Commence study in respect of a permanent sediment structure outside of mining area to catch sediment from the high-wall, and integrated drainage for catchments H42, H43, H44, H45	30-Jun-20
Hughes Creek	H43	MAW	Mitigation	Install sediment sumps	31-Dec-19
Hughes Creek	H43	MAW	Study	Commence study in respect of a permanent sediment structure outside of mining area to catch sediment from the high-wall, and integrated drainage for catchments H42, H43, H44, H45	30-Jun-20
Hughes Creek	H44	MAW	Mitigation	Install sediment sumps	31-Dec-19
Hughes Creek	H44	MAW	Study	Commence study in respect of a permanent sediment structure outside of mining area to catch sediment from the high-wall, and integrated drainage for catchments H42, H43, H44, H45	30-Jun-20
Hughes Creek	H45	MAW	Mitigation	Install sediment sumps	31-Dec-19
Hughes Creek	H45	MAW	Study	Commence study in respect of a permanent sediment structure outside of mining area to catch sediment from the high-wall, and integrated drainage for catchments H42, H43, H44, H45	30-Jun-20

Creek	Catchment	Classification	Type	Action	Timing
One Mile Creek	All	MAW	Study	Commence study in respect of the preferred long term sustainable solution to prevent mine affected water (including sediment) runoff into One Mile Creek	30-Jun-24
One Mile Creek	O01	MAW	Mitigation	Install high-wall pump at Wilkies Dam	30-Jun-20
One Mile Creek	O01	MAW	Mitigation	Undertake works to raise and re-align intersection and haul road at One Mile Junction	30-Jun-20
One Mile Creek	O01	MAW	Study	Commence study in respect of potential water storage structure/s for catchments O01, O05, O06, O13	30-Jun-22
One Mile Creek	O01	MAW	Mitigation	Install culvert under the haul road to direct flow of water into Wilkies Dam	Completed
One Mile Creek	O01	MAW	Mitigation	Re-grade haul road to direct flow of water into Wilkies Dam	Completed
One Mile Creek	O02	MAW	Mitigation	Install temporary mine water storage structure and pump back into mine water management system	30-Jun-21
One Mile Creek	O02	MAW	Mitigation	Undertake rehabilitation works	30-Jun-26
One Mile Creek	O03	MAW	Study	Commence study in respect of a permanent mine water storage structure (or upgrade of Bulge Dam), with integrated drainage/contouring, for catchments O03, O04	30-Jun-22
One Mile Creek	O03	MAW	--	No mitigation action required. Runoff is captured by Bulge Dam.	--
One Mile Creek	O04	MAW	Study	Commence study in respect of a permanent mine water storage structure (or upgrade of Bulge Dam), with integrated drainage/contouring, for catchments O03, O04	30-Jun-22
One Mile Creek	O04	MAW	--	No mitigation action required. Runoff is captured by Bulge Dam.	--
One Mile Creek	O05	MAW	Mitigation	Install high-wall pump at Wilkies Dam	30-Jun-20
One Mile Creek	O05	MAW	Mitigation	Undertake works to raise and re-align intersection and haul road at One Mile Junction	30-Jun-20
One Mile Creek	O05	MAW	Study	Commence study in respect of potential water storage structure/s for catchments O01, O05, O06, O13	30-Jun-22
One Mile Creek	O06	MAW	Mitigation	Install high-wall pump at Wilkies Dam	30-Jun-20
One Mile Creek	O06	MAW	Mitigation	Undertake works to raise and re-align intersection and haul road at One Mile Junction	30-Jun-20
One Mile Creek	O06	MAW	Study	Commence study in respect of potential water storage structure/s for catchments O01, O05, O06, O13	30-Jun-22
One Mile Creek	O06	MAW	Mitigation	Install temporary rock checks and sediment sumps along the haul road	Completed
One Mile Creek	O07	MAW	Mitigation	Undertake works to contour the bench along bank of One Mile Creek	31-Dec-19
One Mile Creek	O07	MAW	Mitigation	Undertake rehabilitation works	30-Jun-26
One Mile Creek	O08	MAW	Mitigation	Re-grade haul road longitudinally (north to south) and lift haul road	30-Jun-20
One Mile Creek	O08	MAW	Mitigation	Install temporary rock checks and sediment sumps along the haul road	Completed
One Mile Creek	O09	MAW	--	No action required. Runoff is captured by an open-pit void, and does not flow to Hughes Creek, One Mile Creek, Spring Creek or Phillips Creek. This catchment is outside the scope of the EE.	--
One Mile Creek	O10	MAW	--	No action required. Runoff is captured by an open-pit void, and does not flow to Hughes Creek, One Mile Creek, Spring Creek or Phillips Creek. This catchment is outside the scope of the EE.	--
One Mile Creek	O11	MAW	--	No action required. Runoff is captured by an open-pit void, and does not flow to Hughes Creek, One Mile Creek, Spring Creek or Phillips Creek. This catchment is outside the scope of the EE.	--
One Mile Creek	O12	MAW	Mitigation	Install drainage in catchment to direct run-off to O02 catchment	30-Jun-20
One Mile Creek	O12	MAW	Mitigation	Upgrade in-stream rock checks to manage residual run-off from catchment (including development and implementation of a maintenance strategy for these rock checks)	30-Jun-20
One Mile Creek	O12	MAW	Study	Commence study in respect of potential water storage structure/s, with integrated drainage / contouring	30-Jun-23
One Mile Creek	O13	MAW	Mitigation	Install high-wall pump at Wilkies Dam	30-Jun-20
One Mile Creek	O13	MAW	Mitigation	Undertake works to raise and re-align intersection and haul road at One Mile Junction	30-Jun-20
One Mile Creek	O13	MAW	Study	Commence study in respect of potential water storage structure/s for catchments O01, O05, O06, O13	30-Jun-22
One Mile Creek	O14	Clean	--	No action required	--
One Mile Creek	O15	MAW	Mitigation	Install several small sumps alongside One Mile Creek for catchments O15, O16, O19	30-Jun-20
One Mile Creek	O15	MAW	Study	Commence study in respect of a permanent sediment structure in-stream to catch sediment for catchments O15, O16, O19	30-Jun-20
One Mile Creek	O16	MAW	Mitigation	Install several small sumps alongside One Mile Creek for catchments O15, O16, O19	30-Jun-20
One Mile Creek	O16	MAW	Study	Commence study in respect of a permanent sediment structure in-stream to catch sediment for catchments O15, O16, O19	30-Jun-20
One Mile Creek	O17	MAW	Mitigation	Install a medium sized sump	30-Jun-20
One Mile Creek	O17	MAW	Study	Commence study in respect of a permanent sediment structure outside of mining area to catch sediment from the high-wall, and integrated drainage for catchments O17, O18, O21, O22	30-Jun-20
One Mile Creek	O18	MAW	Mitigation	Install a medium sized sump	30-Jun-20
One Mile Creek	O18	MAW	Study	Commence study in respect of a permanent sediment structure outside of mining area to catch sediment from the high-wall, and integrated drainage for catchments O17, O18, O21, O22	30-Jun-20
One Mile Creek	O19	MAW	Mitigation	Install several small sumps alongside One Mile Creek for catchments O15, O16, O19	30-Jun-20
One Mile Creek	O19	MAW	Study	Commence study in respect of a permanent sediment structure in-stream to catch sediment for catchments O15, O16, O19	30-Jun-20
One Mile Creek	O20	MAW	Mitigation	Install temporary sediment structure	30-Jun-20
One Mile Creek	O21	MAW	Mitigation	Install a medium sized sump	30-Jun-20
One Mile Creek	O21	MAW	Study	Commence study in respect of a permanent sediment structure outside of mining area to catch sediment from the high-wall, and integrated drainage for catchments O17, O18, O21, O22	30-Jun-20
One Mile Creek	O22	MAW	Mitigation	Install a medium sized sump	30-Jun-20
One Mile Creek	O22	MAW	Study	Commence study in respect of a permanent sediment structure outside of mining area to catch sediment from the high-wall, and integrated drainage for catchments O17, O18, O21, O22	30-Jun-20
One Mile Creek	O23	MAW	--	No action required. Runoff is captured by an open-pit void, and does not flow to Hughes Creek, One Mile Creek, Spring Creek or Phillips Creek. This catchment is outside the scope of the EE.	--
One Mile Creek	O24	MAW	--	No action required. Runoff is captured by Stubline 10 Dam.	--

Creek	Catchment	Classification	Type	Action	Timing
Phillips Creek	All	MAW	Study	Commence study in respect of the preferred long term sustainable solution to prevent mine affected water (including sediment) runoff into Phillips Creek	30-Jun-26
Phillips Creek	P01	MAW	--	No action required. Runoff is captured by Ramp 14 Fillpoint Dam.	--
Phillips Creek	P02	MAW	Mitigation	Install drainage to drain run-off into the P01 catchment and into the Ramp 14 Fill Point Dam	30-Jun-21
Phillips Creek	P02	MAW	Study	Commence study in respect of a mine water storage structure (or upgrade of Ramp 14 Fill Point Dam) for catchments P02, P03	30-Jun-22
Phillips Creek	P03	MAW	Mitigation	Consider relocation of stockpile in P03 catchment	30-Jun-21
Phillips Creek	P03	MAW	Mitigation	Install drainage to drain run-off into the P01 catchment and into the Ramp 14 Fill Point Dam	30-Jun-21
Phillips Creek	P03	MAW	Study	Commence study in respect of a mine water storage structure (or upgrade of Ramp 14 Fill Point Dam) for catchments P02, P03	30-Jun-22
Phillips Creek	P04	MAW	Mitigation	Install sumps on both sides of haul road to catch haul road run-off	30-Jun-21
Phillips Creek	P04	MAW	Study	Commence study in respect of a mine water storage structure (or upgrade of Lester Dam) for catchments P04, P05, P06, P07, P14	30-Jun-25
Phillips Creek	P05	MAW	Mitigation	Install sumps on both sides of haul road to catch haul road run-off	30-Jun-21
Phillips Creek	P05	MAW	Study	Commence study in respect of a mine water storage structure (or upgrade of Lester Dam) for catchments P04, P05, P06, P07, P14	30-Jun-25
Phillips Creek	P06	MAW	Mitigation	Install sumps on both sides of haul road to catch haul road run-off	30-Jun-21
Phillips Creek	P06	MAW	Study	Commence study in respect of a mine water storage structure (or upgrade of Lester Dam) for catchments P04, P05, P06, P07, P14	30-Jun-25
Phillips Creek	P07	MAW	Mitigation	Install sumps on both sides of haul road to catch haul road run-off	30-Jun-21
Phillips Creek	P07	MAW	Study	Commence study in respect of a mine water storage structure (or upgrade of Lester Dam) for catchments P04, P05, P06, P07, P14	30-Jun-25
Phillips Creek	P07	MAW	Mitigation	Develop and implement maintenance strategy clean existing drains of sediment and rejects	Completed
Phillips Creek	P07	MAW	Mitigation	Install rock checks and sediment sumps along the haul road	Completed
Phillips Creek	P08	MAW	Mitigation	Install drainage to direct run-off to the P08 catchment sump and utilise P08 catchment sump as a temporary sediment structure	30-Jun-21
Phillips Creek	P08	MAW	Study	Commence study in respect of multiple water storage structures for catchments P08, P09, P12, P13, P15	30-Jun-23
Phillips Creek	P08	MAW	Study	Commence study in respect of multiple water storage structures for catchments P08, P09, P12, P13, P15	30-Jun-23
Phillips Creek	P09	MAW	Mitigation	Install drainage to direct run-off to the P08 catchment sump and utilise P08 catchment sump as a temporary sediment structure	30-Jun-21
Phillips Creek	P09	MAW	Study	Commence study in respect of multiple water storage structures for catchments P08, P09, P12, P13, P15	30-Jun-23
Phillips Creek	P10	MAW	Mitigation	Commence work to cap and rehabilitate the dump area	31-Dec-19
Phillips Creek	P10	MAW	Mitigation	Install pumps to pump mine affected water into Mine Water Management System	31-Dec-19
Phillips Creek	P11	MAW	Mitigation	Install a sediment structure	30-Jun-20
Phillips Creek	P11	MAW	Mitigation	Rehabilitate the P11 catchment area	30-Jun-26
Phillips Creek	P12	MAW	Mitigation	Install drainage to direct run-off to the P08 catchment sump and utilise P08 catchment sump as a temporary sediment structure	30-Jun-21
Phillips Creek	P12	MAW	Study	Commence study in respect of multiple water storage structures for catchments P08, P09, P12, P13, P15	30-Jun-23
Phillips Creek	P12	MAW	Mitigation	Develop and implement maintenance strategy clean existing drains of sediment and rejects	Completed
Phillips Creek	P12	MAW	Mitigation	Install rock checks and sediment sumps along the haul road	Completed
Phillips Creek	P13	MAW	Mitigation	Install drainage to direct run-off to the P08 catchment sump and utilise P08 catchment sump as a temporary sediment structure	30-Jun-21
Phillips Creek	P13	MAW	Study	Commence study in respect of multiple water storage structures for catchments P08, P09, P12, P13, P15	30-Jun-23
Phillips Creek	P14	MAW	Mitigation	Install sumps on both sides of haul road to catch haul road run-off	30-Jun-21
Phillips Creek	P14	MAW	Study	Commence study in respect of a mine water storage structure (or upgrade of Lester Dam) for catchments P04, P05, P06, P07, P14	30-Jun-25
Phillips Creek	P15	MAW	Mitigation	Install drainage to direct run-off to the P08 catchment sump and utilise P08 catchment sump as a temporary sediment structure	30-Jun-21
Phillips Creek	P15	MAW	Study	Commence study in respect of multiple water storage structures for catchments P08, P09, P12, P13, P15	30-Jun-23
Phillips Creek	P16	MAW	Mitigation	Install a sediment structure	30-Jun-21
Phillips Creek	P17	MAW	Mitigation	Install a sediment structure	30-Jun-21
Phillips Creek	P18	MAW	--	No action required. Runoff is captured by an open-pit void, and does not flow to Hughes Creek, One Mile Creek, Spring Creek or Phillips Creek. This catchment is outside the scope of the EE.	--
Phillips Creek	P19	MAW	Mitigation	Install a temporary sediment control structure	30-Jun-20
Phillips Creek	P19	MAW	Study	Continue study in respect of a turkey's nest dam	30-Jun-21
Phillips Creek	P20	Clean	--	No action required	--
Phillips Creek	P21	MAW	Mitigation	Install a sediment structure	30-Jun-21
Phillips Creek	P22	MAW	--	No action required. Runoff is captured by S13 Dam.	--
Phillips Creek	P23	MAW	Mitigation	Install a temporary sediment control structure	30-Jun-21
Phillips Creek	P23	MAW	Study	Commence study in respect of a small sediment structure	30-Jun-21
Phillips Creek	P24	MAW	Mitigation	Install a temporary sediment control structure	30-Jun-21
Phillips Creek	P24	MAW	Study	Commence study in respect of a water storage structure for catchments P24, P26	30-Jun-21
Phillips Creek	P25	MAW	Mitigation	Install small scale sediment structure	30-Jun-21
Phillips Creek	P26	MAW	Mitigation	Install a temporary sediment control structure	30-Jun-21
Phillips Creek	P26	MAW	Study	Commence study in respect of a water storage structure for catchments P24, P26	30-Jun-21
Phillips Creek	P27	MAW	Mitigation	Install sediment sumps	30-Jun-21
Phillips Creek	P27	MAW	Study	Commence study in respect of a permanent sediment structure outside of mining area to catch sediment from the high-wall, and integrated drainage for catchments P27, P28	30-Jun-22
Phillips Creek	P28	MAW	Mitigation	Install sediment sumps	30-Jun-21
Phillips Creek	P28	MAW	Study	Commence study in respect of a permanent sediment structure outside of mining area to catch sediment from the high-wall, and integrated drainage for catchments P27, P28	30-Jun-22
Phillips Creek	P29	MAW	--	No action required. Runoff is captured by Ramp 15 Highwall Dam.	--

Creek	Catchment	Classification	Type	Action	Timing
Spring Creek	All	MAW	Study	Commence study in respect of an alternative long term sustainable solutions to prevent mine affected water (including sediment) runoff into Spring Creek	30-Jun-21
Spring Creek	All	MAW	Study	Continue study in respect of the diversion of Spring Creek to Phillips Creek	Ongoing
Spring Creek	S01	MAW	Mitigation	Install temporary water storage structure in S01 to catch drainage	30-Jun-21
Spring Creek	S01	MAW	Mitigation	Re-grade S02 catchment to ensure drainage into S01 catchment	30-Jun-21
Spring Creek	S01	MAW	Study	Commence study in respect of water storage structures for catchments S01, S02, S04	30-Jun-22
Spring Creek	S02	MAW	Mitigation	Install temporary water storage structure in S01 to catch drainage	30-Jun-21
Spring Creek	S02	MAW	Mitigation	Re-grade S02 catchment to ensure drainage into S01 catchment	30-Jun-21
Spring Creek	S02	MAW	Study	Commence study in respect of water storage structures for catchments S01, S02, S04	30-Jun-22
Spring Creek	S03	MAW	Mitigation	Install temporary in-stream sediment structures	30-Jun-21
Spring Creek	S03	MAW	Mitigation	Raise the haul road	30-Jun-23
Spring Creek	S04	MAW	Mitigation	Install temporary water storage structure and pump back into mine water management system	30-Jun-21
Spring Creek	S04	MAW	Study	Commence study in respect of water storage structures for catchments S01, S02, S04	30-Jun-22
Spring Creek	S04	MAW	Mitigation	Potential rehabilitation works to S04 (depending on outcomes of Spring to Phillips creek diversion)	30-Jun-26
Spring Creek	S05	MAW	Mitigation	Install drainage to direct run-off from S05 and S08 catchments into Ebony Pit	30-Jun-21
Spring Creek	S06	MAW	--	No action required. Runoff is captured by an open-pit void, and does not flow to Hughes Creek, One Mile Creek, Spring Creek or Phillips Creek. This catchment is outside the scope of the EE.	--
Spring Creek	S07	MAW	--	No action required. Runoff is captured by an open-pit void, and does not flow to Hughes Creek, One Mile Creek, Spring Creek or Phillips Creek. This catchment is outside the scope of the EE.	--
Spring Creek	S08	MAW	Mitigation	Install drainage to direct run-off from S05 and S08 catchments into Ebony Pit	30-Jun-21
Spring Creek	S09	Clean	--	No action required	--
Spring Creek	S10	MAW	Mitigation	Install drainage to direct run-off from S10 catchment into S04 catchment	30-Jun-21
Spring Creek	S10	MAW	Mitigation	Develop and implement maintenance strategy to clean existing drains of sediment and rejects	Completed
Spring Creek	S10	MAW	Mitigation	Install rock checks and sediment sumps along the haul road	Completed
Spring Creek	S11	MAW	Mitigation	Install temporary in-stream sediment structures	30-Jun-21
Spring Creek	S11	MAW	Mitigation	Raise the haul road	30-Jun-23
Spring Creek	S11	MAW	Mitigation	Develop and implement maintenance strategy to clean existing drains of sediment and rejects	Completed
Spring Creek	S11	MAW	Mitigation	Install rock checks and sediment sumps along the haul road	Completed
Spring Creek	S12	MAW	Mitigation	Install drainage to re-direct run-off to water storage	30-Jun-21
Spring Creek	S12	MAW	Study	Commence study in respect of a permanent sediment structure outside of mining area to catch sediment from the high-wall, and integrated drainage for catchments S12, S13	30-Jun-22
Spring Creek	S13	MAW	Mitigation	Install drainage to re-direct run-off to water storage	30-Jun-21
Spring Creek	S13	MAW	Study	Commence study in respect of a permanent sediment structure outside of mining area to catch sediment from the high-wall, and integrated drainage for catchments S12, S13	30-Jun-22
Spring Creek	S13	MAW	Mitigation	Install rock checks and sediment sumps along the haul road and develop maintenance strategy to clean out sediment and rejects	Completed