Replacement Hail Creek Functional Design Report- Cover Note

Hail Creek Mine Eastern Margin Extension Project – DETSI Information Request
Matters Relating to the Replacement Hail Creek Functional Design Report

The Department of Environment, Tourism, Science and Innovation (DETSI) issued an additional Information Request (IR) on 31 July 2025 for the Hail Creek Open Cut (HCOC) – Eastern Margin Extension Project (the Project) environmental authority amendment application. The IR raised additional technical matters related to the Hail Creek Functional Design Report (the Report) (version 3), requiring supplementary information.

This cover note provides a summary of the changes made to the original Report as presented in the Replacement Hail Creek Functional Design Report (version 4) to address DETSI's additional IR item 11.

The changes due to the additional IR response are presented in **Table 1**.

Table 1 IR Items addressed in the Hail Creek Functional Design Report

IR Item	Summary of DETSI IR	Relevant Section of Replacement Report
11	a) Demonstration that all diversion and drain designs comply with requirements for erosion resistance, hydraulic stability, and long-term self-sustainability in accordance with OSW/2019/4599 was requested. b) Identification of locations where design criteria are exceeded (e.g., localised exceedances of shear stress, velocity, or stream power) and provision of mitigation or design improvements was requested. c) Inclusion of a comprehensive monitoring and adaptive management plan with clear performance triggers, as required by the Watercourse Diversion Guideline, was requested.	The Report has been updated to address the IR: a) Section 7. b) Section 8. c) Section 9.

This Replacement Hail Creek Functional Design Report (version 4) replaces previous versions of this report.

Hail Creek Diversion

Replacement Functional Design Report

Hail Creek Coal Holdings Pty Limited

Level 44, 1 Macquarie Place, Sydney NSW 2000

Prepared by:

SLR Consulting Australia

SLR Project No.: 623.030360.00001

Client Reference No.: R01

25 November 2025

Revision: v4.0

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
V1.0	30 August 2024	Elysśa De Carli, Tomoko Shimamoto	Jack McConchie, Tim Cohen	Emma Williams
V2.0	17 September 2024	Elysśa De Carli, Tomoko Shimamoto	Jack McConchie, Tim Cohen	Emma Williams
V3.0	28 April 2025	Elysśa De Carli, Tomoko Shimamoto	Jack McConchie, Tim Cohen	Emma Williams
V4.0	25 November 2025	Elysśa De Carli, Amelia Horne Tomoko Shimamoto	Chris Meikle	Emma Williams

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Hail Creek Coal Holdings Pty Limited (HCC) (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

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1.0 Introduction

Hail Creek Coal Holdings Pty Limited (HCC) has commissioned SLR Consulting Pty Ltd (SLR) to undertake functional design of a diversion of Hail Creek to support an Environmental Authority (EA) Amendment at Hail Creek Open Cut (HCOC). The proposed diversion of Hail Creek will support future mine works and expansion of Homevale Pit.

The Hail Creek Functional Design Report (the Repor) was submitted to the Department of Environment, Tourism, Science and Innovation (DETSI) in response to the Information Request (IR) issued on 15 March 2024. A subsequent IR was issued by DETSI on 31 July 2025. Version 4.0 of the Report has been updated to address administrative amendments, climate change sensitivity model run and the additional IR items, as outlined in the accompanying cover note.

The report has been prepared in accordance with the requirements of the Department of Natural Resources, Mines and Energy (DNRME) Guideline*: Works that interfere with water in a watercourse – watercourse diversions* (DNRME, 2019) and with the Australian Coal Association Research Program (ACARP) *Criteria for functioning river landscape units in mining and post mining landscapes* (ACARP, 2014). This report describes the basis of design for the diversion, the design approach, and modelling outcomes to demonstrate that a self-sustaining system can be achieved. The objective of this report is to provide a functional design of the Hail Creek Diversion and demonstrate the watercourse diversion design process meets the outcomes identified in the DNRME (2019) Guidelines.

1.1 Scope of Services

The scope of services for this Project includes the following:

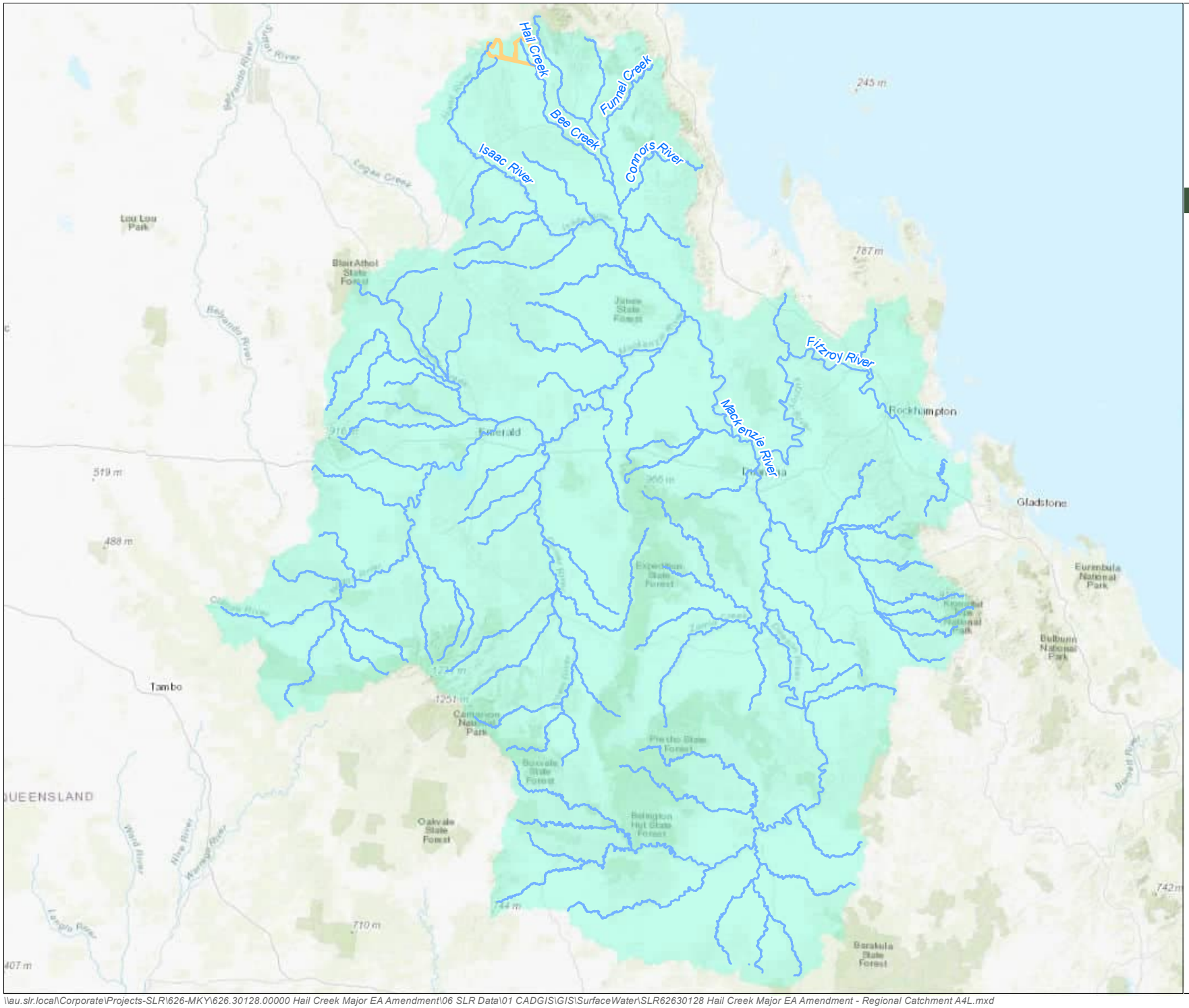
- Geomorphic and vegetation assessment of the existing watercourse.
- Hydrologic conditions of the existing watercourse.
- The proposed watercourse diversion route, hydraulic geometry and details on any temporary works required as part of a staged process towards the final permanent watercourse diversion.
- Hydraulic conditions of the existing watercourse and proposed watercourse diversion.
- Details of the substrate on which the watercourse diversion will be constructed.
- Details of the sediment transport regime for the existing watercourse and the diversion design.
- Development of conceptual diversion design drawings and reporting of functional design.
- Development of a proposed monitoring program for the diversion including a revegetation plan.
- A statement of how the watercourse diversion meets the DNRME (2019) Guideline outcomes.

2.0 Study Area

Hail Creek is an ephemeral creek situated within the upper reaches of the Isacc River sub-basin, which forms part of the greater Fitzroy River Basin (**Figure 2-1**). Ephemeral streams flow only in response to precipitation, experiencing flow for fewer than 35 days a year, sit above the water table year-round and are therefore not fed by groundwater. The creek originates in relatively steep relief to the northeast of HCOC and flows from north to south intersecting HCOC between the Main Western and Carinyah Pits. Hail Creek is a fourth-order stream with many tributaries in the region flowing from the north and west, including Schammer Creek. The catchment upstream of the diversion is approximately 6.6 km^2.

2.1 Proposed Diversion

An indication of the proposed diversion corridor alignment, across the western margin of Homevale Pit, is shown in **Figure 2-2**. The diversion corridor is further refined in **Section 7.0**, following an option assessment of varying diversion alignments. The diversion corridor runs through natural ground trending from north to south before reconnecting to a downstream section of Hail Creek. The diversion corridor alignment has been made in conjunction with site-specific considerations for HCOC outlined in **Section 3.3** below.



HAIL CREEK MINE

MAJOR EA AMENDMENT

REGIONAL CATCHMENT

FIGURE 2-1

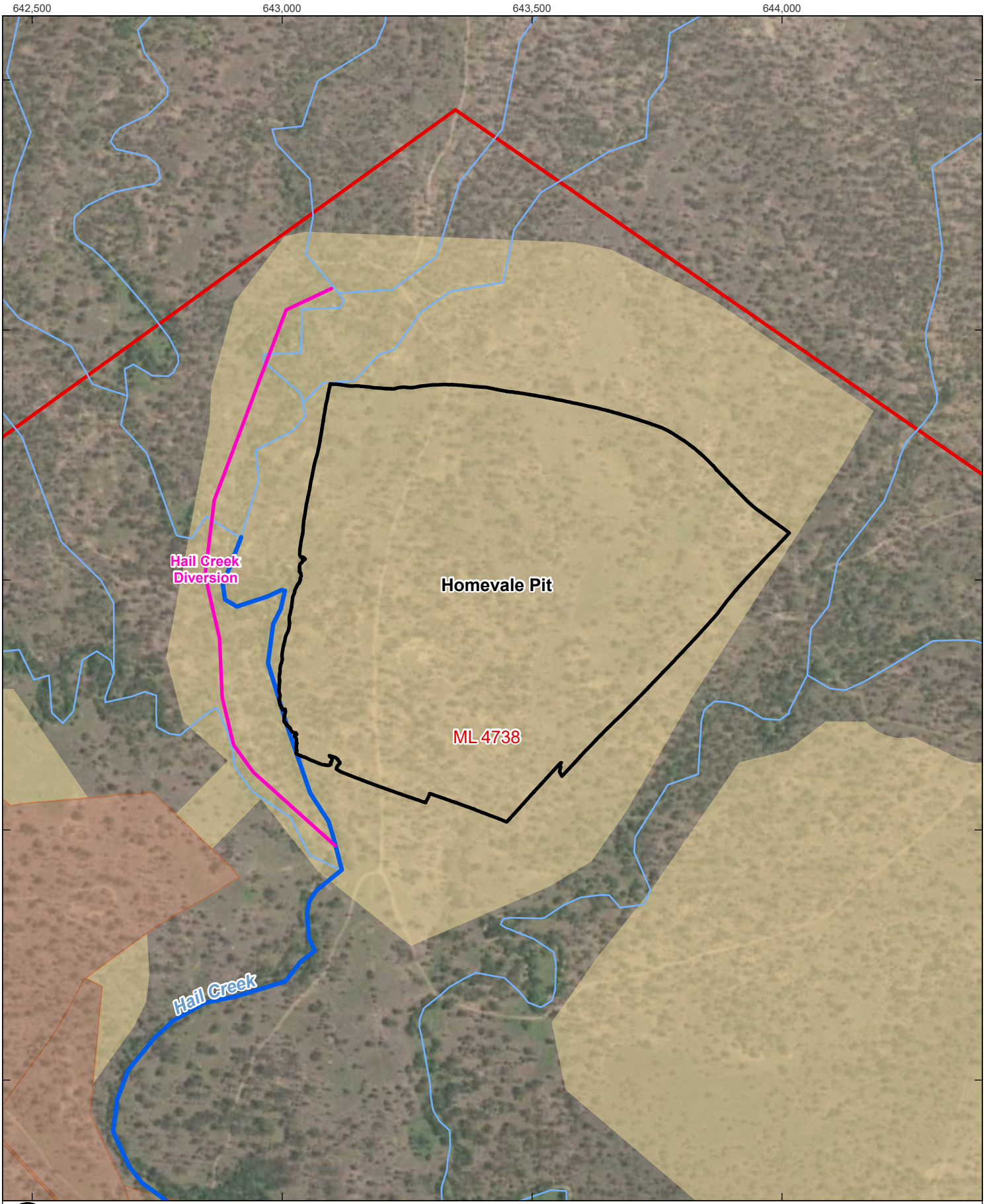
- Major Watercourse
- Mining Lease
- Fitzroy Basin

0 25 50 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:3,000,000 at A4
Project Number:	626.30128.00000
Date:	15-Apr-2025
Drawn by:	AS

SLR

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0 100 200 m

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:10,000 at A4
Project Number:	623.030360.00001
Date Drawn:	22-Aug-2024
Drawn by:	AS

LEGEND

- Proposed Hail Creek Diversion
- Watercourse (Water Act 2000)
- Drainage Line
- Hail Creek Mining Lease
- Pit Extent
- Proposed Disturbance Boundary
- EA Authorised Extent of Disturbance

HAIL CREEK FUNCTIONAL DESIGN

KEY SITE FEATURES

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FIGURE 2.2

Path: \\au.slr.local\Corporate\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGIS\GIS\623030360_ArcPro\623030360_working.aprx\623030360_HailCrkSchammerCrkDiv_HailCreekKeySiteFeatures

3.0 Engineering and Design Requirements

There are currently two recognised guidelines for the design of watercourse diversions within Queensland. These guidelines have been developed by DNRME and ACARP:

- *Guideline: Works that interfere with water in a watercourse – watercourse diversions* (DNRME, 2019).
- *Criteria for functioning river landscape units in mining and post mining landscapes* (ACARP, 2014).

Both the DNRME and ACARP Guidelines were developed based on previous research completed by ACARP in the early 2000s. This included assessment of existing diversion performance and the development of design and rehabilitation criteria for watercourse diversions.

3.1 DNRME Guideline

3.1.1 Diversion Design Outcome Requirements (Permanent Watercourse Diversions)

The DNRME (2019) Guideline states that all permanent watercourse diversions should aim to achieve the following key objectives:

- Be self-sustaining and include geomorphic and vegetation features of regional watercourses and the surrounding landscape.
- Where possible, positively contribute to river health values for the system.
- Not impose liability on the State, the proponent, or the community to maintain the watercourse diversion and its associated components.

A self-sustaining watercourse diversion functions without features or characteristics that rely on ongoing maintenance or that imposes a financial or other burden on the proponent, government or the community.

DNRME (2019) Guideline outcomes and key guiding principles for functional design of permanent watercourse diversions are listed in **Table 3-1** and have been used to develop the design for the Hail Creek Diversion. A key component of the design is based on the understanding of the current creek conditions and adjoining environment. This understanding has been developed through the geomorphology and riparian assessments and the hydrological and hydraulic assessment of the existing Hail Creek watercourse and proposed diversion in this report.

Table 3-1 DNRME (2019) Guideline outcomes and key principles for functional design of permanent watercourse diversions

DNRME (2019) Guideline Outcomes	Key Principles	Relevant Section(s)
Outcome 1: The permanent watercourse diversion incorporates natural features (including geomorphic and vegetation) present in the landscape and in local watercourses.	The watercourse diversion should incorporate geomorphic and riparian vegetation features appropriate to the landscape in which the watercourse diversion is located. Revegetation is planned, managed, and monitored and utilises a trajectory pathway to ensure self-sustaining vegetation communities are achieved.	**Section 7.0** **Section 7.5**
Outcome 2: The permanent watercourse diversion maintains the existing hydrologic characteristics of surface water and groundwater systems.	The watercourse diversion maintains the hydrologic characteristics of surface water flows and groundwater interactions where they exist. A watercourse diversion should minimise any impacts on upstream and downstream reaches.	**Section 8.0** **Section 7.0**
Outcome 3: The hydraulic characteristics of the permanent watercourse diversion are comparable with other local watercourses and are suitable for the region in which the watercourse diversion is located.	The watercourse diversion includes sufficient floodplain corridor width so as to allow for natural channel evolution processes. Watercourse design relies on grade, planform and vegetation as mechanisms to manage stream energy and may include artificial structures that do not require ongoing maintenance.	**Section 7.0 and Section 8.0** **Section 7.0**
Outcome 4: The permanent watercourse diversion maintains a sediment transport regime that allows the watercourse diversion to be self-sustaining, while minimising any impacts to upstream and downstream reaches.	The watercourse diversion does not cause erosive or depositional events inconsistent with the existing sediment transport regime unless designed to promote watercourse health. The watercourse diversion maintains a sediment transport regime that: a) Is comparable with upstream and downstream reaches or local watercourse with geomorphic characteristics similar to the existing watercourse reaches on which the watercourse diversion is proposed; and b) Suitable for the region in which the watercourse diversion is located.	**Section 8.4**
Outcome 5: The permanent watercourse diversion and associated structures maintain equilibrium and functionality and are appropriate for all substrate conditions they encounter.	Watercourse diversion design, construction, operation, and monitoring are appropriate to the substrate characteristics on which the watercourse diversion is constructed. A watercourse diversion should achieve the best environmental outcome regardless of substrate material encountered along the watercourse diversion route.	**Section 7.0** and **Section 9.0**

3.1.2 Design Criteria

The DNRME (2019) Guideline also outlines the following design criteria for consideration when developing a proposed functional design. These have been considered in the design of the Hail Creek Diversion (DNMRE, 2019):

- The watercourse diversion should tie-in with the existing or receiving watercourse within the resource tenure boundary.
- The equilibrium and performance of a watercourse diversion is assisted by vegetation within the watercourse diversion and adjoining floodplain and does not include artificial structures for grade control that require ongoing maintenance.
- The length of the channel should be equivalent to the length of the watercourse it replaces.
- Bed grade/slope should be equivalent to the existing watercourse.
- Batter slopes should be designed to maintain channel equilibrium through different substrate.

The DNRME (2019) Guideline also nominates a set of hydraulic design criteria which have been adapted from original ACARP research. These hydraulic design criteria were developed based on assessment of existing Bowen Basin streams and watercourse diversions and are considered reflective of stable hydraulic conditions for ephemeral systems in central Queensland. The hydraulic design criteria are summarised in **Table 3-2** and include the following:

- Shear stress (in Newtons per square metre (N/m^2)) which is a function of discharge, flow depth and hydraulic gradient and represents the tractive force acting on sediment particles and is used to determine the threshold of motion for sediment. High shear stress provides an indication of potential erosion in cohesive sediments or movement of non-cohesive sediments. It also provides a measure of the ability of vegetation to withstand flow.
- Stream power (in Watts per square metre (W/m^2)) which is a function of hydraulic gradient, flow width and flow rate and represents the energy available to do work on the channel. High stream power values generally result in elevated erosion potential.
- Velocity (in metres per second (m/s)) which is a function of flow rate and cross-sectional area and is a simplified measure of erosion potential. Generally higher velocities result in higher erosion potential, however, stream power and shear stress are more reliable indicators of erosion and sediment transport potential.

Table 3-2 Hydraulic Design Criteria for reach average stream power, velocity, and shear stress for streams within the Bowen Basin (DNRME 2019, adopted from ACARP 2002)

Scenario	Stream Power (W/m^2)	Velocity (m/s)	Shear Stress (N/m^2)[1]
39 % AEP[2] (no vegetation)	<35	<1.0	<40
39 % AEP (vegetated)	<60	<1.5	<40
2 % AEP	<150	<2.5	<80[1]

1. DNRME values are taken from ACARP 2002 as the <50 N/m^2 value in DNRME (2019) Guideline is incorrect.
2. AEP = Annual Exceedance Probability

3.2 ACARP Guidelines

A series of ACARP projects established a set of key hydraulic, geomorphic and revegetation criteria for watercourse diversion design developed from natural watercourses within the Bowen Basin. These include:

- ACARP Project C8030 (2000) – Maintenance of Geomorphic Processes in Bowen Basin River Diversions.
- ACARP Project C9068 (2002) – Bowen Basin River Diversions Design and Rehabilitation Criteria.
- ACARP Project C20017 (2014) – Criteria for functioning river landscape units in mining and post mining landscapes.

The following concepts were developed from the findings the ACARP projects and should be considered in the design of a watercourse diversion:

- The watercourse is part of a system.
- Watercourses are dynamic systems.
- Each watercourse is unique.
- The watercourse has thresholds (for equilibrium and function).
- The concept of a stable (fixed) watercourse is often unrealistic.
- A watercourse diversion in equilibrium has an increased chance of achieving long-term community, agency, and mine objectives.

As a first preference, hydraulic criteria of the existing watercourse should be used to develop design parameters for the watercourse diversion. ACARP (2002) guideline values were derived for hydraulic criteria to assist with watercourse diversion design for velocity, stream power, and shear stress and adopted by DNRME (2019) Guidelines (**Table 3-2)**. The minimum requirement when undertaking a hydraulic analysis is to review the watercourse and diversion energy conditions for the 2 % (50-year Average Recurrence Interval (ARI)) and 50 % AEP flood events, the 39% AEP (2-year ARI) has also been modelled.

ACARP (2014) presents the development of design parameters for alluvial and threshold channel design (**Table 3-3**). A key update in these design criteria is the differentiation between systems with high bedload sediment supply (transport limited) and those that have low bedload but still may have high suspended load (supply limited). Hail Creek is currently closer to transport limited than equilibrium or supply limited, with excess sediment supplied from upstream and localised erosion processes.

In addition, ACARP (2014) provides recommendations on shear stress thresholds for vegetation types and communities as part of rehabilitation activities used in watercourse diversions. These are summarised in **Table 3-4**. The long-term performance of the diversion under both operating and closure scenarios is also recommended to be addressed, with performance objectives included in **Table 3-5**.

Table 3-3 Alluvial channel design parameters (ACARP, 2014)

Stream Type	Sediment Transport Group	Stream Power (W/m^2) 39 % AEP	Stream Power (W/m^2) 2 % AEP
Alluvial	Supply limited	15-35	50-100
	Transport limited	35-60	80-150
Bedrock controlled	n/a	50-100	100-350

Table 3-4 Recommended vegetation shear stress thresholds (ACARP, 2014)

Vegetation Type	Maximum Shear Stress (N/m^2)
Buffel grass	40
Structurally diverse suite of established native vegetation	120

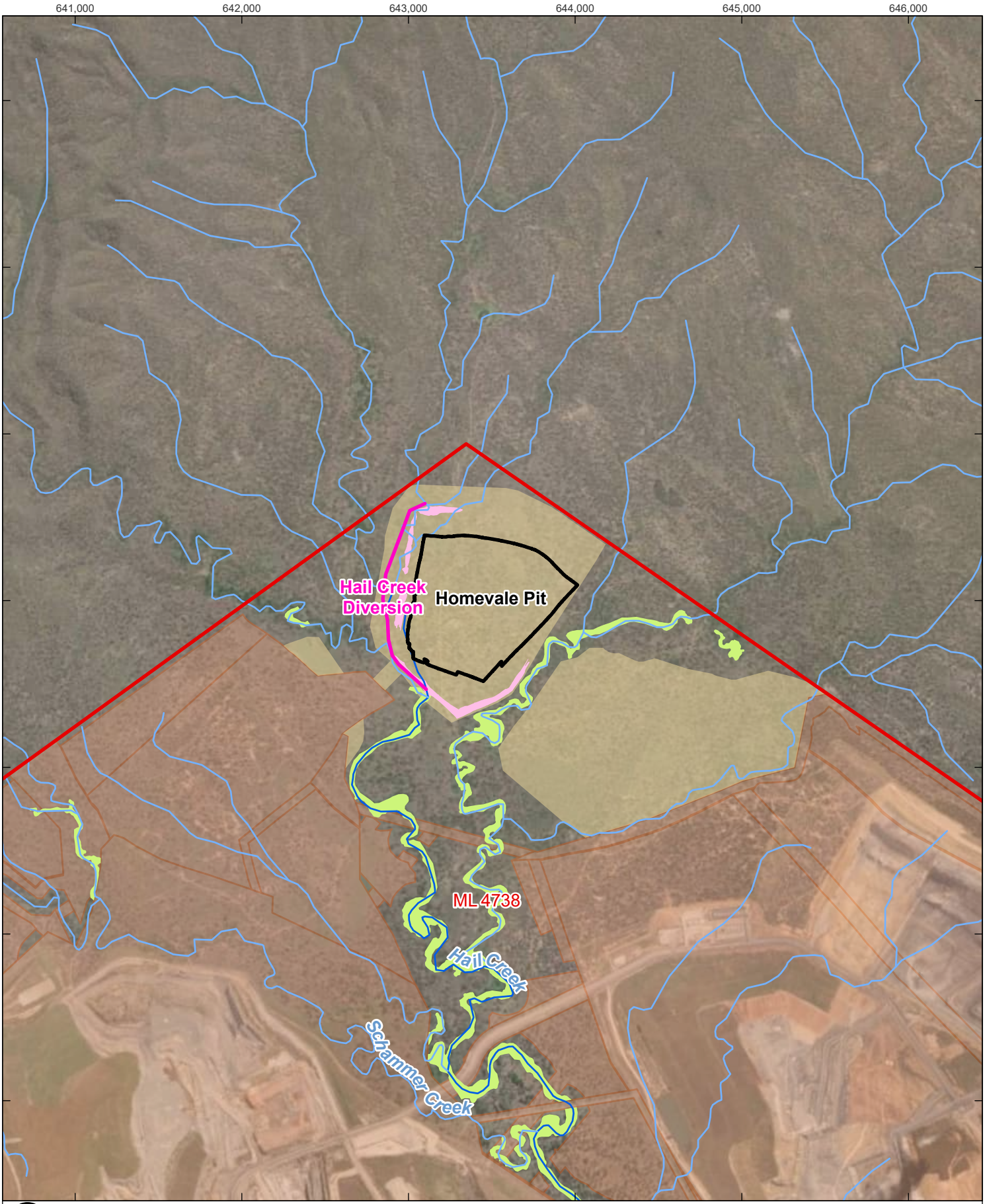
Table 3-5 Threshold design events (ACARP, 2014)

Consequence of channel scour	During Mine Life	Post Mining
Scour that threatens mine infrastructure	To be determined by mine operator	n/a
Scour that threatens public infrastructure	To be determined in consultation with relevant stakeholder (asset owner)	To be determined in consultation with relevant stakeholder (asset owner)
Scour that threatens capture of watercourse into open cut pit	1 in 1,000 AEP	Probable Maximum Flood

3.3 HCOC Site Specific Considerations

In addition to relevant regulatory and design guidelines, the following basis of design criteria and site-specific considerations for HCOC have been incorporated into the diversion design objectives (**Figure 3-1**):

- The extent of the diversion must be within the specified mining lease (ML) and proposed EA Extent of Disturbance boundary.
- The extent of the diversion must be within 50 metre (m) set back distance from proposed pit extents for Homevale Pit (HCC standard).
- The creek diversion must be suitable for a timeframe of at least 25 years (permanent for the operational life), and potential prevailing weather events.
- The extent of the diversion must consider mining infrastructure and future mine planning objectives (e.g. culverts, clean water diversion routes, light vehicle roads, haul roads).
- The extent of the diversion must consider the location of Black Ironbox (*Eucalyptus raveretiana*) trees identified as Species of National Environmental Significance and avoid primary and secondary impacts (**Section 6.0**).



0 0.5 1 km

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Drawn by:	AS

LEGEND

- Proposed Hail Creek Diversion
- Watercourse (Water Act 2000)
- Drainage Line
- Hail Creek Mining Lease
- Pit Extent
- Proposed Disturbance Boundary
- EA Authorised Extent of Disturbance
- Homevale Bund
- Black Ironbox

HAIL CREEK FUNCTIONAL DESIGN

HAIL CREEK MINE CONSIDERATIONS

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FIGURE 3.1

Path: \\au.slr.local\Corporate\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGIS\GIS\623030360_ArcPro\623030360_working.aprx\623030360_HailCrkSchammerCrkDiv_HailCreekMineConsiderations

3.3.1 Environmental Authority EPML00661913

The land schedule within the Hail Creek Mine EA (EPML00661913) requires that all areas significantly disturbed by mining activities must be rehabilitated in accordance with specified Rehabilitation Requirements. The EA provides the rehabilitation landform criteria for the post mining land use of watercourses (**Table 3-6**).

Table 3-6 Rehabilitation Requirements for Water Infrastructure including diversions (EPML00661913)

Rehabilitation Goal	Rehabilitation Objectives	Indicators	Completion Criteria
Long term safety	Remnant infrastructure areas are safe for humans and animals now and in the foreseeable future.	a) Presence of waste materials both domestic and industrial; b) Structural integrity of infrastructure retained; c) Stable and uniform ground surface; d) Exposure to hazardous materials; e) Safe access routes; and f) Appropriate decommissioning of regulated structures and other dams.	i) Evidence that risks from remnant infrastructure have been minimised and if necessary, control measures are in place to meet agreed requirements. ii) Facilities and equipment are to be decommissioned and removed unless remaining for an agreed post operational use as informed by stakeholder engagement strategy.
Non-polluting	1. Infrastructure areas are free of waste and hazardous materials both domestic and industrial. 2. Polluted water contained/ treated on site. 3. Final landform water storages are non-polluting and meet water quality parameters suitable; or preferred closure options such as agricultural use.	a) Presence of legacy dams; b) Presence of waste materials both domestic and industrial; c) Exposure to toxic or hazardous materials; d) Substrate parameters; e) Exposure to ARD materials; f) Exposure to saline materials; g) Exposure to sodic materials; and h) Surface water monitoring upstream and downstream indicates no negative impacts on downstream receptors.	i) Evidence that contaminated land has been remediated in accordance with environmental regulation. ii) Evidence that water storages are contained with any overflows into external surface water systems. iii) Evidence through surface water monitoring that surface water quality is not negatively impacted by final rehabilitation.
Stable	1. Infrastructure areas provide a stable and uniform ground surface suitable for preferred final land use. 2. All infrastructure is structurally and operationally compliant at point of closure and meets agreed post operational land use standards. 3. Vegetation cover is established to minimise soil loss rates.	a) Slope and drainage systems that optimise erosion resistance, functionality, and structural integrity; b) Downstream impact and sustaining final land use; c) Slope and drainage systems that optimise erosion resistance, functionality, and structural integrity; d) Record of slope failure; and e) Vegetation type and density.	i) Evidence that stability of the landform has improved over time as rehabilitation established. ii) Evidence that disturbed land by mining activities does not have a rate of soil loss that exceeds that rate in relevant reference sites. iii) Vegetation types and density are comparable with relevant reference sites. iv) Evidence that foliage in rehabilitated areas is comparable with relevant reference sites.
Able to sustain final land use	Soil biological, chemical, and physical properties provide support to preferred land use.	a) Growth media biological, chemical and physical components and ameliorants are present to allow vegetative cover establishment. b) The following indicators are comparable with relevant reference sites: organic matter, soil nutrients, invertebrate activity, soil texture, topsoil and grown media depth, physical and chemical property limits.	i) Evidence that physical, chemical, and biological properties of the growing media are similar to relevant reference sites. ii) Evidence of nutrient cycling/accumulation occurs at a rate comparable with relevant reference sites (and based on monitoring/research).
	Native ecosystem diversity and sustainability are commensurable within the preferred final landform use.	a) Vegetation contains a diversity (trees, shrubs, herbs, grass) comparable of that of relevant reference sites; b) Vegetation communities have been designed to enhance connectivity across site and adjoining landscape; c) Plant recruitment; d) Exotic species diversity and abundance; e) Exotic species identification and management; f) Ground layer contains protective ground cover and habitat structure; g) Groundcover diversity; h) Groundcover abundance; i) Ecosystem health; and j) Native fauna species.	i) Evidence that the diversity of plant species is similar to that of relevant reference sites. ii) Species in rehabilitated areas show evidence of flowering, viable seed setting, germination and emergence. iii) Evidence of generational succession of trees and shrubs apparent in rehabilitated areas. iv) Protective ground cover provided by litter material is comparable to that of the relevant reference sites. v) Evidence that vegetation is in a condition (i.e. dieback of trees, attrition limits, live/healthy trees, flowers/fruit on trees) comparable to that of the relevant reference sites. vi) Evidence that native fauna species are present and consistent with the native habitats established in those areas.
	Established grazing land is productive and sustainable.	a) Grass species are desirable - Perennial, Palatable and Productive; b) Pasture health; c) Land condition; d) Pasture condition; and e) Forage condition.	Evidence that at least condition B of ‘ABCD grazing land condition framework.’ has been achieved.

4.0 Site Characterisation

4.1 Geology

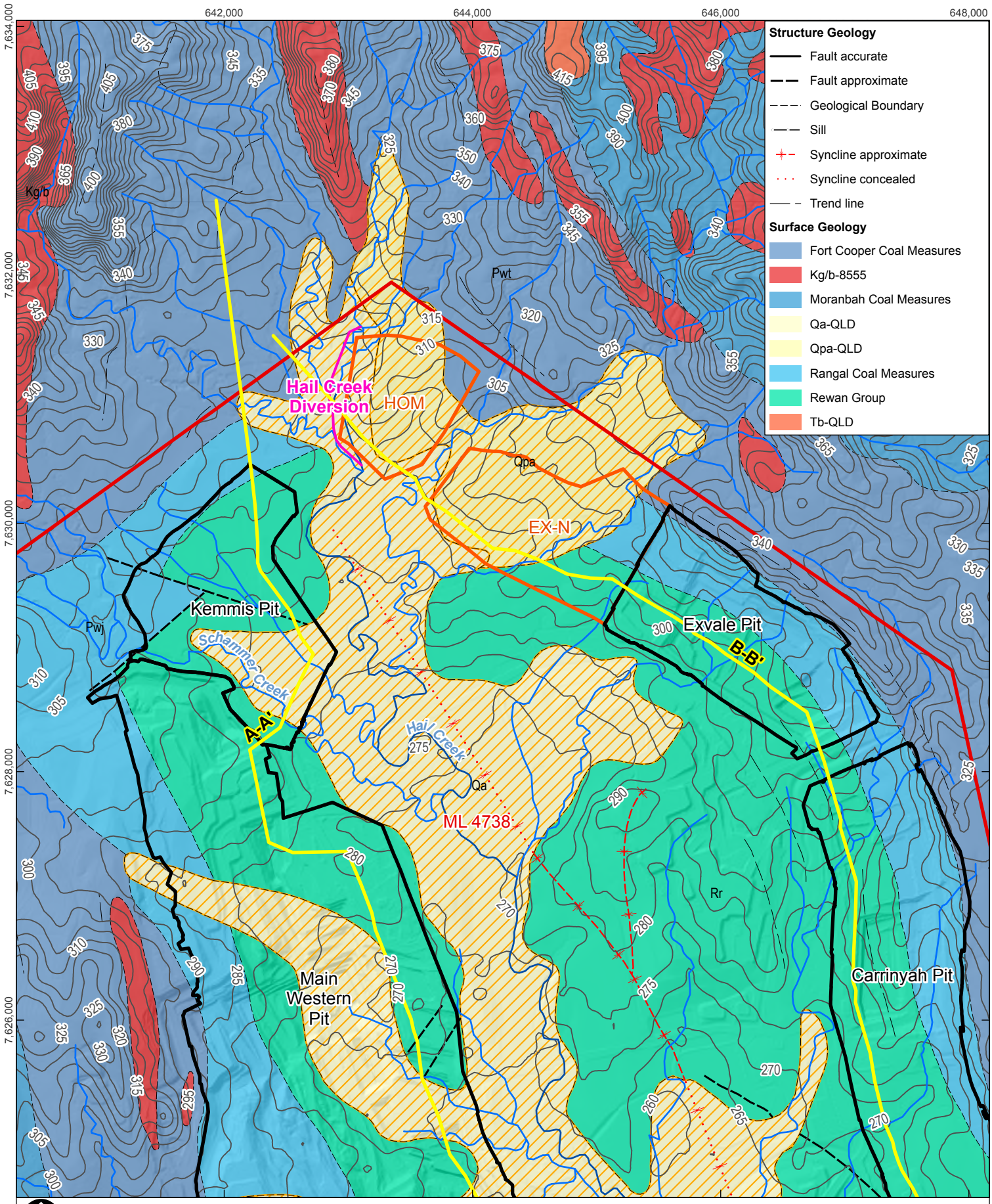
HCOC is located in the northern part of the Bowen Basin, a foreland sedimentary basin that spans approximately 200,000 square kilometres (km^2) in central eastern Queensland. The local geology consists of Permian Coal Measures (Moranbah, Fort Cooper, and Rangal Coal Measures). The Permian strata are unconformably overlain by the Triassic aged sedimentary rocks of the Rewan Group. Volcanic intrusions and extrusions of Tertiary and Cretaceous age are also present within the region. Mt Gotthardt, a cretaceous aged granodiorite intrusion, lies immediately to the west of HCOC. Other intrusions in the form of basaltic plugs, dykes and sills exist to the north and south of HCOC as a part of the Nebo Volcanic Complex. The solid geology is overlain in places by shallow Quaternary alluvial sediments localised along rivers and creeks. The surface geology is depicted in **Figure 4-1** and a geological cross-section derived from the HCOC geological model depicted in **Figure 4-2**.

HCOC lies at the northern end of the Hail Creek Syncline which is oriented north-northwest to south-southeast. Faulting (with relatively modest displacement) is common within the Permo-Triassic sequence. The published geological mapping for the approximate position of a number of mapped faults are included in the geological cross-section (**Figure 4-2**).

The entire Hail Creek Diversion corridor runs south across an area of Quaternary Alluvium, underlain from north to south by the Fort Cooper Coal Measures, the Rangal Coal Measures, and the Rewan Formation at its southern end. There is no detailed information on the nature and thickness of the alluvium in this area. However, based on the nearest available data from monitoring bores drilled in the alluvium around Brumby Waterhole, the alluvium could be 5 m to 10 m thick, dominated by clay, with lenses of clayey sand and gravel in places (SLR Report Ref: HCOC EAA Groundwater R01 v8.0-28Apr25, dated 28 April 2025). These geological units are described below:

- Quaternary alluvium - Clay, silt, sand, and gravel; flood-plain alluvium.
- Rewan Formation – Dominant rock arenite to mudstone. Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone, minor volcaniclastic pebble conglomerate.
- Rangal Coal Measures - Dominant rock arenite to mudstone. Calcareous sandstone, calcareous shale, mudstone, coal, concretionary limestone.
- Fort Cooper Coal Measures - Dominant rock sedimentary - Lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff, tuffaceous (cherty) mudstone.

Depth of weathering extends approximately 30 m below ground level based on observations from the site-wide geological model (depicted in **Figure 4-2**, SLR Report Ref: HCOC EAA Groundwater R01 v8.0-28Apr25, dated 28 April 2025). Details of the diversion channel substrate will need to be taken into further consideration during detailed design of the proposed Hail Creek Diversion corridor and explored further using subsurface investigation.



0 0.5 1 k

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:40,000 at A4
Project Number:	623.030360.00001
Date Drawn:	04-Nov-2025
Drawn by:	AS

LEGEND

- Hail Creek Diversion
- Major Watercourse
- Minor Watercourse
- Topographic Contour (5mAHD)
- Cross Section
- Hail Creek Mining Lease
- Approved Open Cut Mining
- Proposed Extension Pit
- Alluvium Extent

HAIL CREEK FUNCTIONAL DESIGN

SURFACE GEOLOGY

SLR

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FIGURE 4.1

Path: H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGIS\GIS\623030360_ArcPro\623030360_working.aprx\623030360_HailCrkSchammerCrkDiv_HailCreekSurfaceGeology

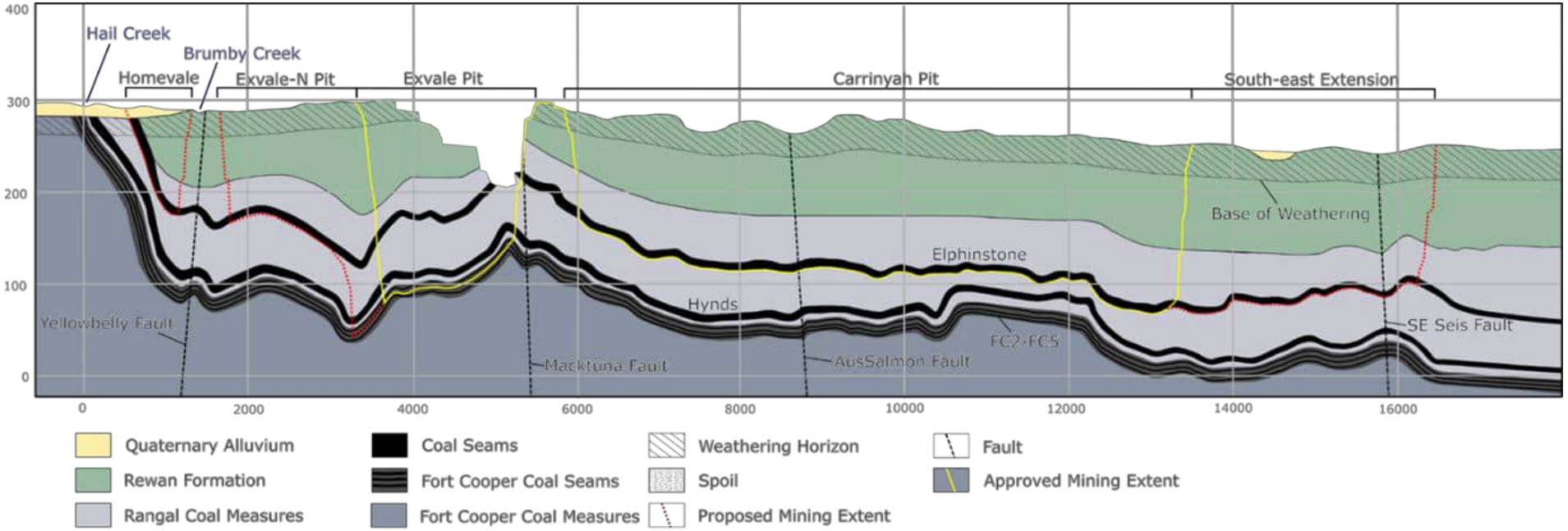


Figure 4-2 Geological cross-section B-B' (Queensland Government n.d.)

4.2 Regolith & Soils

Regolith profiles were assessed to determine the depth of weathered substrate along the diversion corridor route using CSIRO Depth of Regolith spatial extents (Wilford et al., 2015) (**Figure 4-3**).

Regolith profiles along the proposed diversion corridor are estimated to range from approximately 6-14 m thick as the creek flows from north to south. The proposed diversion corridor also sits within the mapped extent of Quaternary alluvium for Hail Creek, the thickness of which is unknown along the diversion corridor alignment. Weathered bedrock (regolith) and Quaternary alluvium were observed along exposed channel margins of Hail Creek during SLR's site inspection and are discussed in further detail in **Section 5.1**.

The thickness of regolith and alluvium has implications for engineering design of the proposed watercourse diversion regarding the depth of the cut to exposed fresh bedrock and for the stability of the diversion. Determination of the underlying bedrock morphology, that is the spatial and longitudinal extent of bedrock within the proposed diversion corridor alignment is required as these attributes will fundamentally control channel stability in the diversion reach. Details of the diversion channel substrate will need to be further considered through a geotechnical investigation to quantify the nature and depth of underlying regolith and alluvium and inform detailed design of the proposed Hail Creek Diversion.

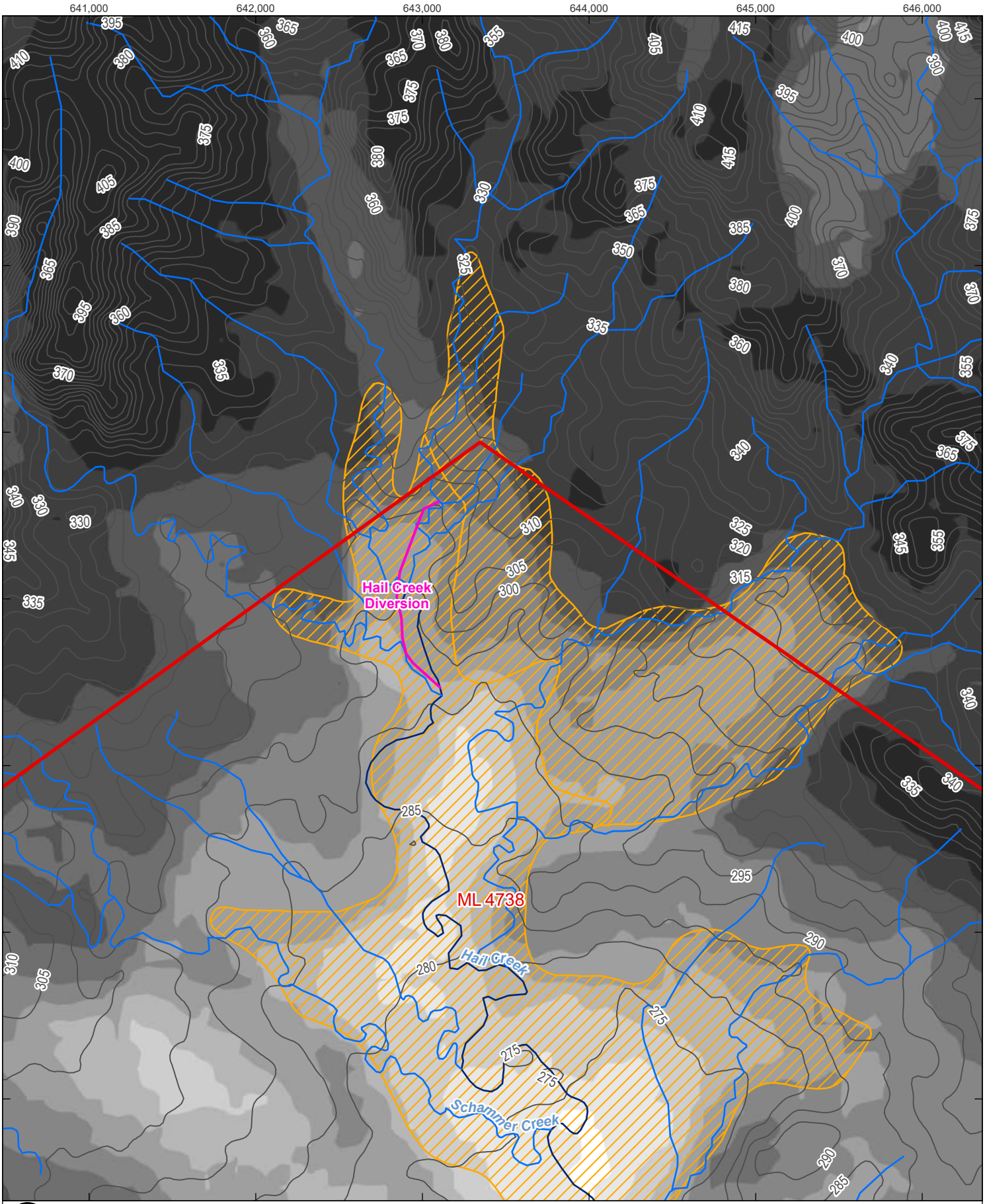
Soil information exists for the eastern margins of HCOC and can be broadly applied to the area for the Hail Creek Diversion corridor for the purposes of this report. Comprehensive soil information along the diversion corridor route will be required to inform the detailed design. The parent material belongs to the Permian Rangal Coal Measures, Triassic Rewan Group, and the Quaternary alluvium geological units. From these, six profile classes have been identified by Landloch (2020) (**Table 4-1**).

SLR previously conducted a HCOC erosion risk assessment (report 626.30099-R02-Hail Creek Erosion Risk Assessment, Revision 2.0, dated 8 June 2023) to quantify the average soil loss from different surface cover options following closure. For the area surrounding Kemmis Pit, with no grass cover, erosion has been estimated between 12 and 25 tonnes per ha per year (t/ha/yr) which is classed as moderate, and >150 t/ha/yr which is classed as extremely high.

The final design of the diversion will require appropriate soil and revegetation strategies to mitigate soil erosion. Excess supply of sediment from earthworks close to the diversion can negatively impact vegetation establishment required to reduce energy in the new channel. The functional design assumes that topsoil application and treatment are assessed and allow for vegetation to successfully establish. Further investigations and detail relating to soil suitability and erodibility will need to be determined at the detailed design stage.

Table 4-1 Soil Profile Classes for HCOC

Soil Profile Class	Description
Deep Clays	• Clay, silt, sand, gravel - Floodplain alluvium; • Moderate Permeability; and • Depth 1200-1500 mm.
Saline Deep Clays	• Clay, silt, gravel - Floodplain alluvium; • Dermosol; • Moderate Permeability; and • Depth: 1100-1500 mm.
Sandstone Duplex	• Texture contrast soils with a sand or loam textured topsoil overlying a clear change to clay textured subsoil; • Depth > 0.75 m; and • Situated on hillslopes.
Hillcrest Clays (predominantly Red Dermosols)	• Red to brown gradual clays; • Non-sodic and non-saline; and • Depth 600 mm or less.
Gravelly Alluvial	• Occurring in creek beds, banks, and flood levees; • Highly variable depending on current and past stream velocities; and • Clays, sands, gravels, and some areas with cobbles.



0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:30,000 at A4
Project Number:	623.030360.00001
Date Drawn:	22-Aug-2024
Drawn by:	AS

LEGEND

- Proposed Hail Creek Diversion
- Watercourse (Water Act 2000)
- Drainage Line
- Topographic Contour (5mAHD)
- Hail Creek Mining Lease
- Alluvium Extent

Depth of Regolith (m)

0 - 2	10 - 12
2 - 4	12 - 14
4 - 6	14 - 16
6 - 8	16 - 18
8 - 10	18 - 20

HAIL CREEK FUNCTIONAL DESIGN

DEPTH OF REGOLITH

SLR

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FIGURE 4.3

Path: \\au.slr.local\Corporate\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGIS\GIS\623030360_ArcPro\623030360_working.aprx\623030360_HailCrkSchammerCrkDiv_HailCreekRegolith

4.3 Hydrogeology

The three main hydrogeological units within the Project Area with the most potential to store and transmit significant quantities of groundwater are:

- Permeable horizons within the Quaternary alluvium (unconfined/confined – associated with the more significant creek lines and tributaries).
- Coal seams within the Permian coal measures – typically the most permeable horizons within the coal measures strata (confined aquifers (coal seams) and confining units (interburden).
- Regolith (the upper weathered rock horizon where the water table fluctuates, typically towards the base of this zone). The regolith is present across the Rewan Formation, RCM, FCCM, and MCM where they naturally outcrop/sub-crop and will have significant variation in hydraulic properties (unconfined/semi confined).

Along the proposed Hail Creek Diversion there is no groundwater monitoring data. The only available information on groundwater levels are predictions from the numerical groundwater model. The alignment and depth of the proposed diversion are not anticipated to intersect either the predicted pre-mining or post-mining water table. Modelled groundwater levels are in the order of 2 m to 12 m below the minimum diversion channel bed elevation.

Like all creeks in the vicinity of HCOC, Hail Creek is ephemeral and only flows occasionally in response to significant rainfall runoff events. These occasional flows may locally recharge areas of the alluvium via losses through the bed of the creek / diversion channel depending on the clay / fines content of the alluvium along the course of the channel. Any enhanced localised recharge to the alluvium may then seep to the underlying regolith (weathered Permian coal measures).

5.0 Geomorphic Assessment

The existing geomorphic environment of Hail Creek was determined through analysis of aerial imagery captured in March 2024, site-wide Light Detection and Ranging (LiDAR) captured in March 2024, and site observations from a 7-day field programme undertaken from 31 May to 6 June 2024.

During the field programme the creek was inspected as per DNRME (2019) Guideline requirements, including:

- Along the length of the watercourse to be diverted, including at least 1 km upstream and downstream of the tie in locations of the proposed watercourse diversion.
- Along other watercourses intercepted along the proposed diversion route, including existing drainage features.
- Along the proposed diversion route.

A Relative Elevation Model (REM) was derived from site-wide LiDAR (March 2024) to help visualise the geomorphic form and condition of the creek (**Figure 5-1**). This figure includes chainages along Hail Creek marked for ease of reference. The REM was created by extracting elevations from the Hail Creek bed at 10 m intervals along the channel. A Digital Elevation Model (DEM) was then created by interpolating between the elevation points. This DEM was then subtracted from the LiDAR to provide the REM relative to the creek bed.

The following section provides a summary of the existing geomorphic condition (character and behaviour) of Hail Creek with key site observations.

5.1 Geomorphic Characterisation

Hail Creek can be categorised as a confined to partly confined, bedrock margin controlled, discontinuous floodplain pocket, sandy to small boulder bed river as per the River Styles Framework (Fryirs & Brierly, 2023). The geomorphic character of Hail Creek is summarised in **Table 5-1** and representative photographs shown in **Figure 5-2**.

Hail Creek transitions from confined and bedrock-controlled gorge reaches in its headwaters to partly confined reaches with discontinuous floodplain pockets at its downstream extent. Channel width and depth are highly variable and are largely controlled by the degree of bedrock valley confinement, with variable bed and bank bedrock outcrops. Hydraulic geometry parameters of Hail Creek are further explored below in **Section 5.2**.

Floodplain features included old meanders and what were interpreted as erosional ledges. In-channel geomorphic units included both bank attached and longitudinal mid-channel bars (ranging from sand to small boulder grainsize). In-channel geomorphic units included both bank attached and longitudinal mid-channel bars (ranging from sand to cobble grain size). Possible sand slugs were observed at the downstream extent of Hail Creek, suggesting progressive aggradation and infilling of the creek is occurring, as has previously been reported for creeks in the area and is a result catchment scale processes (Hydrobiology, 2015). Bed materials are discussed below in **Section 5.3**.

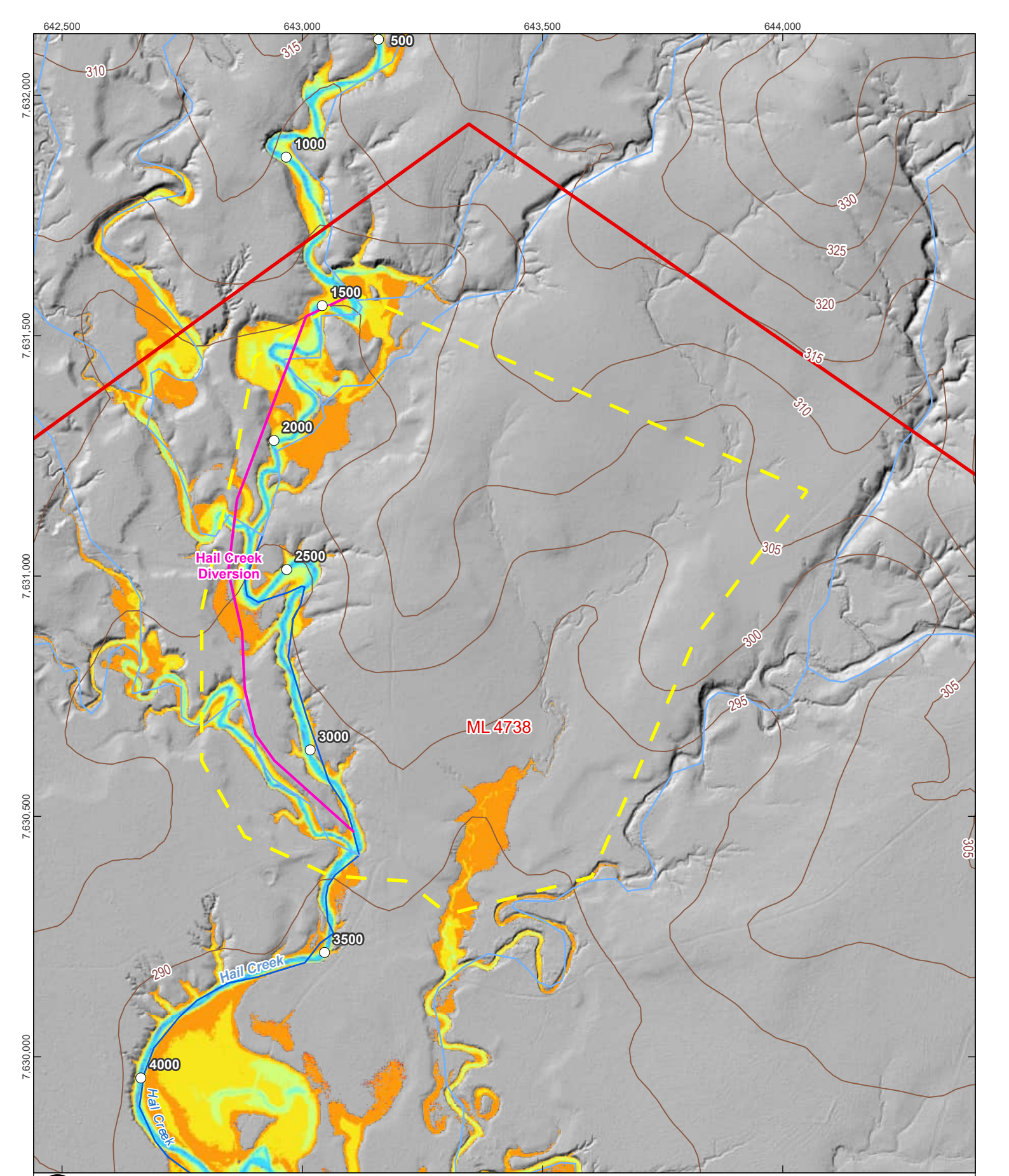
Numerous deeply incised gullies were also observed feeding into Schammer Creek from the surrounding landscape from local surface water runoff. These gullies appeared to be incised into the surrounding geology and Quaternary alluvium. Channel bank materials ranged from fresh bedrock to regolith and alluvium along the reach (**Figure 5-3).** There is mature riparian vegetation (trees) growth within the channel and on channel margins with evidence of scour at the base of individual trees.

General geomorphic condition also varied and included higher value areas of morphological diversity and habitat value, as well as reaches showing a greater degree of impact and lower habitat values e.g. signs of channel incision, widening and aggradation in downstream reaches.

Determination of rates of historical channel change are beyond the scope of this Project and not specified within ACARP Criteria (2014), however it is recommended that such an assessment be undertaken to support the geomorphic characterisation of Hail Creek prior to detailed design. From rates of channel change and lateral stability, inferences can be made on sediment transport conditions (supply versus transport limited), which are critical to support detailed engineering design.

Table 5-1 Geomorphic Character of Hail Creek

Geomorphic Character	Hail Creek
Geomorphic characterisation	Confined to partly confined, bedrock margin controlled with discontinuous floodplain pockets.
Channel geometry	Highly variable because of bedrock confinement.
Channel pattern	Single, low to moderate sinuosity.
Geomorphic units	In-channel ledges, old meanders, intercepting tributaries. Longitudinal gravel to small boulder and sand bars, possible sand slugs. In-channel mature vegetation.
Geomorphic behaviour	Limited lateral activity because of confinement. Low flow channel sits within broader bankfull channel. Evidence of flood debris 2 m to 3 m above channel bed.
Sediment transfer behaviour	Assumed transport limited, sandy to small boulder bed materials.



0 100 200 m

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:10,000 at A4
Project Number:	623.030360.00001
Date Drawn:	21-Aug-2024
Drawn by:	AS

LEGEND

- Hail Creek Chainage (m)
- Watercourse (Water Act 2000)
- Drainage Line
- Proposed Hail Creek Diversion
- Topographic Contour (5mAHD)
- Hail Creek Mining Lease
- Area of Disturbance

Relative Elevation Model (m)

<-1	2 - 3
-1 - 0	3 - 4
0 - 1	4 - 5
1 - 2	5 - 6

HAIL CREEK FUNCTIONAL DESIGN

GEOMORPHIC CHARACTER OF HAIL CREEK

SLR

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FIGURE 5.1

Path: \\au.slr.local\Corporate\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGIS\GIS\623030360_ArcPro\623030360_working.aprx\623030360_HailCrkSchammerCrkDiv_HailCreekGeomorphology



Figure 5-2 Hail Creek channel diversity



Figure 5-3 Regolith and alluvium bank material

5.2 Hydraulic Geometry

The longitudinal profile of Hail Creek was derived from site-wide LiDAR acquired in March 2024 and separated into four reaches based on distinct breaks in slope (**Figure 5-4**). The length and grade of each reach were determine using rise/run and are listed in **Table 5-2**. The location of tributaries that intercept the creek are shown on the longitudinal profile.

Further geometric parameters were determined for the reach to be diverted including channel bankfull width and depth, channel sinuosity, and meander wavelength (**Table 5-3**).

The length of Hail Creek to be diverted is within Reach 2. It is approximately 1.5 km long with a bedgrade of 0.006 and has a single tributary (**Figure 5-4**). This reach of Hail Creek is considered steep for an alluvial system, with stability likely contingent on the presence of bedrock exposures in the channel. Two tributaries enter at the beginning (upstream end) of the diversion. Average sinuosity for the diversion reach was 1.1 and the reach is classified as sinuous.

Cross-sections were acquired at 500 m intervals along the reach to be diverted to determine channel width and depth at both bankfull and low flow conditions (**Figure 5-5**). Cross-sectional dimensions were determined for seven cross-sections derived from site wide LiDAR. A conservative approach was applied when identifying bankfull and low flow dimensions where no obvious floodplain/geomorphic features were evident using comparison with the developed REM, hydraulic modelling outputs of the existing scenario and existing descriptions of the area (Hydrobiology, 2015). Bankfull channels are the product of high-energy channel forming flows capable of moving large amounts of sediment. Low flow channels are limited to a narrow area of the river channel and reflect more common higher-frequency but low magnitude flows.

Width and depth of the bankfull channel were highly variable, confined by bedrock controls or broadened by inflow from tributaries. Reach averaged bankfull width was 15.3 m and depth 3.1 m. A low flow channel lies within with broader bankfull channel with a reach averaged width of 2.3 m and a depth of 0.8 m. Meander wavelength was estimated from bankfull channel widths and ranged from 153 m to 215 m.

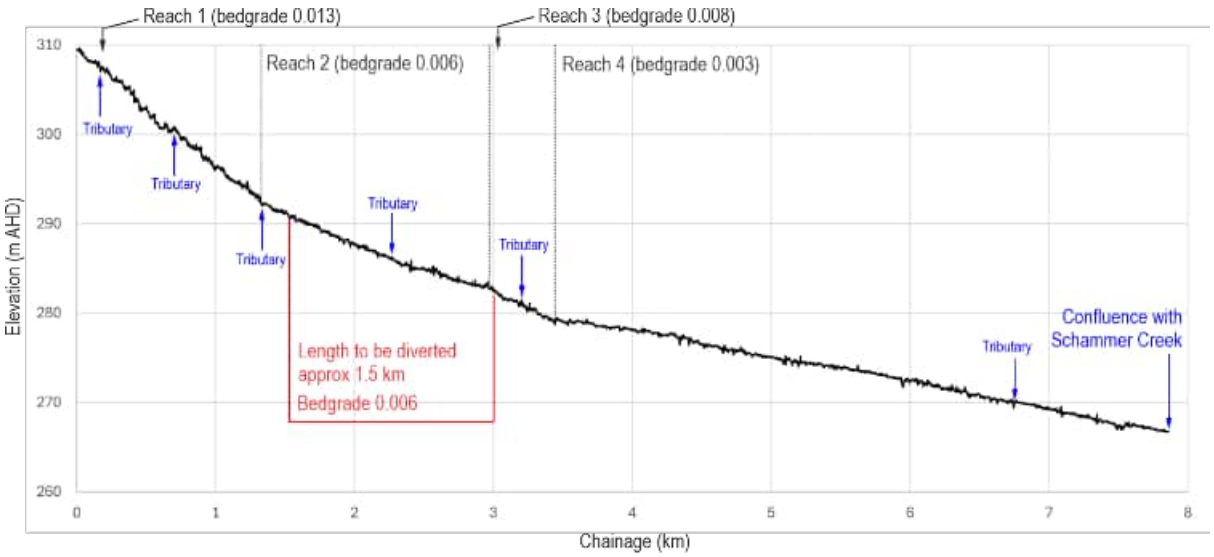


Figure 5-4 Longitudinal profile of Hail Creek

Table 5-2 Bedgrade of Hail Creek

Parameter	Hail Creek				Total
	Reach 1	Reach 2	Reach 3	Reach 4	
Length (km)	1.35	1.65	0.45	11.30	14.75
Bed grade (m/m)	0.013	0.006	0.008	0.003	n/a
Sinuosity	1.3 (sinuous)	1.1 (sinuous)	0.9 (straight)	1.1 (sinuous)	1.1 (sinuous)

Table 5-3 Hydraulic geometry of the length of Hail Creek to be diverted

Parameter	Hail Creek (reach average)	Hail Creek (min and max)
Length to be diverted (km)	1.5	-
Bed grade (m/m)	0.006	-
Average low flow channel width (m)^	2.3	0.3-3.1
Average low flow channel depth (m)^	0.8	0.6-1.3
Average bankfull channel width (m)^	15.3	10.7-17.7
Average bankfull depth (m)^	3.1	2.3-4.9
Sinuosity	1.1 (sinuous)	-
Meander wavelength*	153 to 215	-

* Meander wavelength = 10 to 14 times channel width

^ Based on cross-sections every 500m

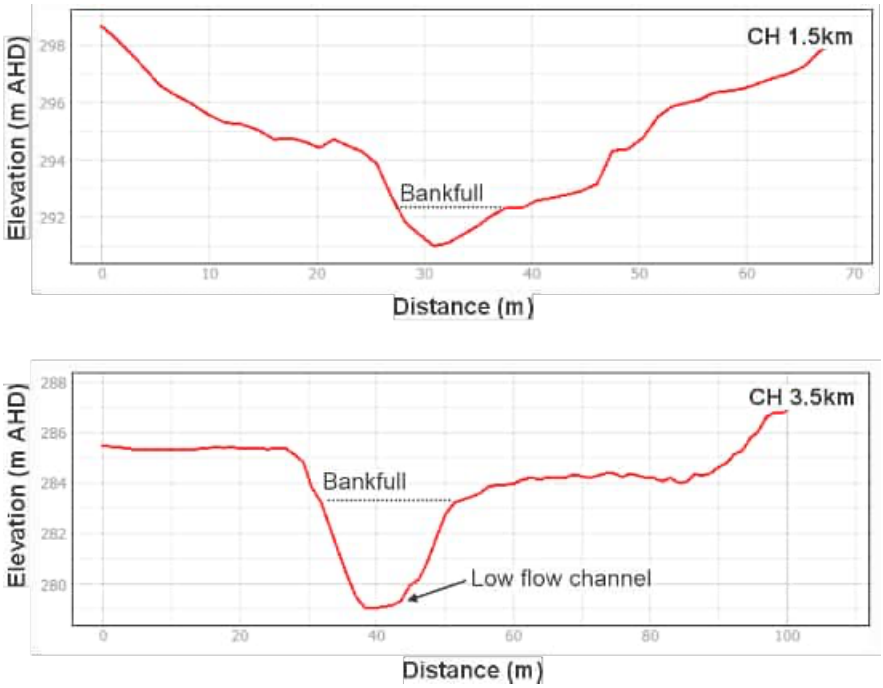


Figure 5-5 Example Hail Creek channel cross-sections

5.3 Bed Material Assessment

Hail Creek was observed to have a considerable volume of stored bed sediment which varied in thickness from 0 m (where bedrock outcropping occurred) to an estimated 4 m in areas where thicker sand units were observed. This bed sediment can be mobilised during flow events and contributes to sediment delivery downstream.

The bed material size of Hail Creek was variable and ranged from silty sands through to cobbles and small boulders (**Figure 5-6**). Sediment grab samples were acquired at 1 km intervals and at sites of specific interest along the reach to be diverted and analysed for particle size distribution through dry sieving methods. The dominant particle size was well-graded sand with gravel (**Figure 5-7**). The grain size reflected represents the dominant grainsize observed within the Hail Creek channel yet does not account for the full spectrum of grainsize variability within the system.

Sand slugs were observed in the downstream reaches of Hail Creek, derived from accelerated rates of catchment erosion over the past century and by recent accelerated bank erosion caused by localised impacts from the mine. More broadly within the Fitzroy River Basin (within which Hail Creek is located) the export of sediment and the mean suspended sediment concentrations have been estimated as the highest for all Queensland coastal catchments under both natural and disturbed conditions (Neil et al., 2002).

This suggests that most of the catchment affected by the proposed diversion is transport limited, where sediment supply is greater than the potential sediment transport capacity. This suggests, provided the diversion replicates the features of the existing watercourse, that aggradation would be expected to occur within the diversion channel from sediment sourced upstream and delivered through the sediment cascade. It should be noted that this is a qualitative assessment based on key site observations and pre-existing information for the area.



Figure 5-6 Variability in bed material for Hail Creek

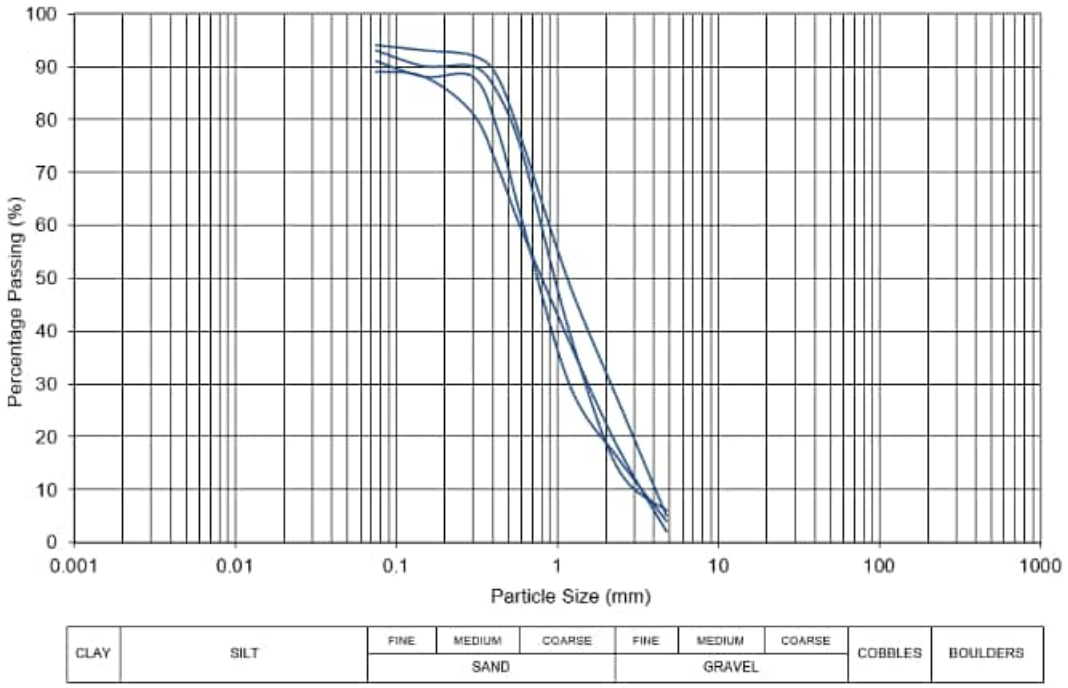


Figure 5-7 Particle size distribution of Hail Creek bed materials

6.0 Riparian Assessment

6.1 Existing Reach

A field assessment of the vegetation communities within the existing reaches of Hail Creek was undertaken by SLR Ecologists on 4 and 5 June 2024. The findings of the assessment indicate that this length of Hail Creek flows through remnant vegetation of Regional Ecosystem (RE) 11.3.25 - *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines (**Figure 6-1**). Approximately 1 km downstream of the impact area was also surveyed and indicated that this section of Hail Creek flows through remnant vegetation of RE 11.3.25(a) - *E. raveretiana* (sometimes emergent), *E. tereticornis* and *Melaleuca fluviatile* woodland. *E. raveretiana* is listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) RE 11.3.25a is outside the potential impact area. All efforts should be made to avoid impacting individuals of *E. raveretiana.*

Vegetation communities adjacent to Hail Creek include RE 11.3.4 and RE 11.9.9. Few non-native species were observed within the riparian vegetation, including isolated patches of Buffel Grass (*Cenchrus ciliaris*), Red natal (*Melinis repens*), and some individuals of Prickly Pear (*Opuntia sp.*).

Ground-truthed RE's associated with Hail Creek and their dominant vegetation are outlined below:

- 11.3.25 – *Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines.
- 11.3.25a – *E. raveretiana* (sometimes emergent), *E. tereticornis* and *Melaleuca fluviatilis* woodland.
- 11.3.4 – *E. tereticornis* and/or *Eucalyptus spp*. woodland on alluvial plains.
- 11.9.9 – *E. crebra* woodland on fine-grained sedimentary rocks.

A full list of species identified within each RE and accompanied photos of the vegetation mapped are provided in **Appendix A**.

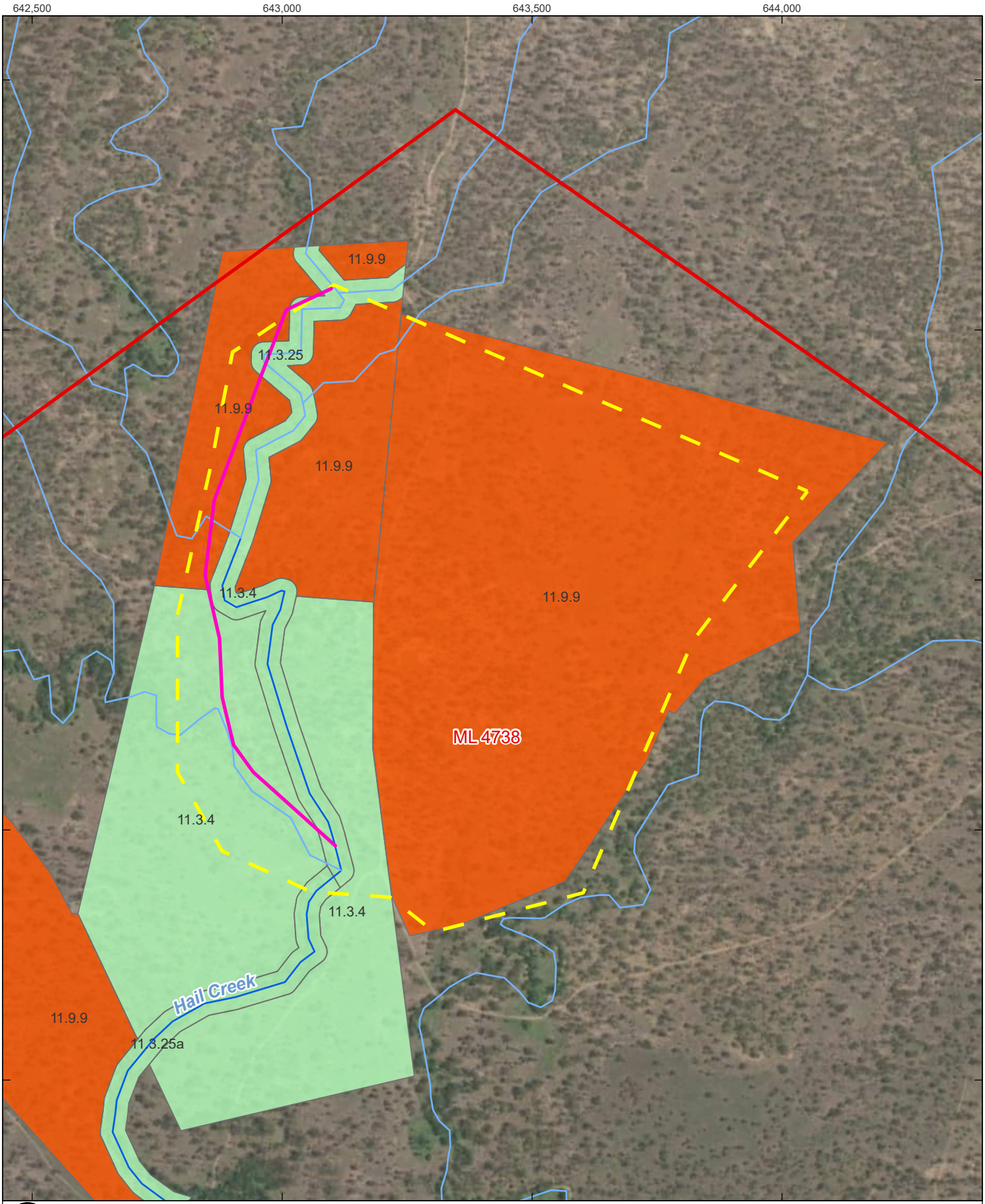
6.2 Area of Disturbance

A field assessment of the vegetation communities within the area of disturbance of the Hail Creek Diversion corridor was also undertaken (SLR Report Ref: 623.030360.00001-Hail Creek Functional Design-v4.0_20251125.docx). The surveys indicate the proposed diversion area is within remnant vegetation communities of RE 11.9.9 and RE 11.3.4, as well as non-remnant communities with a species composition similar to RE 11.3.4 and RE 11.9.9 (**Figure 6-1**). Weed species were observed within the area of disturbance, including some individuals of Prickly Pear (*Opuntia sp.*). The ground-truthed RE's associated with the area of disturbance and their dominant vegetation are outlined below:

- 11.3.4 – *E. tereticornis* and/or *Eucalyptus spp*. woodland on alluvial plains (species list outlined above).
- 11.9.9 – *E. crebra* woodland on fine-grained sedimentary rocks (species list outlined above).
- Non-remnant – RE 11.9.9 and RE 11.3.4 which has been cleared and modified for cattle yards:
    - *E. crebra*
    - *E. erythrophloia*

- *C. tessellaris*
- *C. dallachiana*
- *Grevillea striata*

A full list of species identified within each RE and accompanying photographs of the vegetation mapped are provided in **Appendix A**. Revegetation of the watercourse diversion can be found in **Section 7.5.**



0 100 200 m

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:10,000 at A4
Project Number:	623.030360.00001
Date Drawn:	21-Aug-2024
Drawn by:	AS

LEGEND

- Proposed Hail Creek Diversion
- Watercourse (Water Act 2000)
- Drainage Line
- Hail Creek Mining Lease
- Area of Disturbance

Ground-Truthed Regional Ecosystem (2024)

- Remnant- Of Concern
- Remnant- Least Concern

HAIL CREEK FUNCTIONAL DESIGN

HAIL CREEK VEGETATION MAPPING

SLR

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FIGURE 6.1

Path: \\au.slr.local\Corporate\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGIS\GIS\623030360_ArcPro\623030360_working.aprx\623030360_HailCrkSchammerCrkDiv_HailCreekDiversion

7.0 Diversion Design

7.1 Design Objectives

As set out previously, the goal of the diversion design is to create a functioning and self-sustaining system between the reaches upstream and downstream of the diversion, ensuring continuity of discharge and sediment transfer along the new creek alignment.

Multiple design considerations were adopted to support this goal as required by the DNMRE (2019) Guidelines and identified as examples of best practice within ACARP (2014) Criteria. For example, including:

- A meandering alignment for the proposed diversion was maintained. The functionality for sinuous bends to consume excess energy and reduce hydraulic parameters successfully maintains the existing hydraulic conditions of Hail Creek.
- No hydraulic control structures (e.g. drop structures) were used within the diversion or other structures that would require maintenance after relinquishment of the mine lease.
- The proposed diversion complies with DNRME (2019) hydraulic design criteria for stream power, shear stress and velocity to maintain sediment transport equilibrium.
- Comprehensive and appropriate revegetation is required to provide hydraulic roughness and additional resilience to enable long-term successful diversion performance.

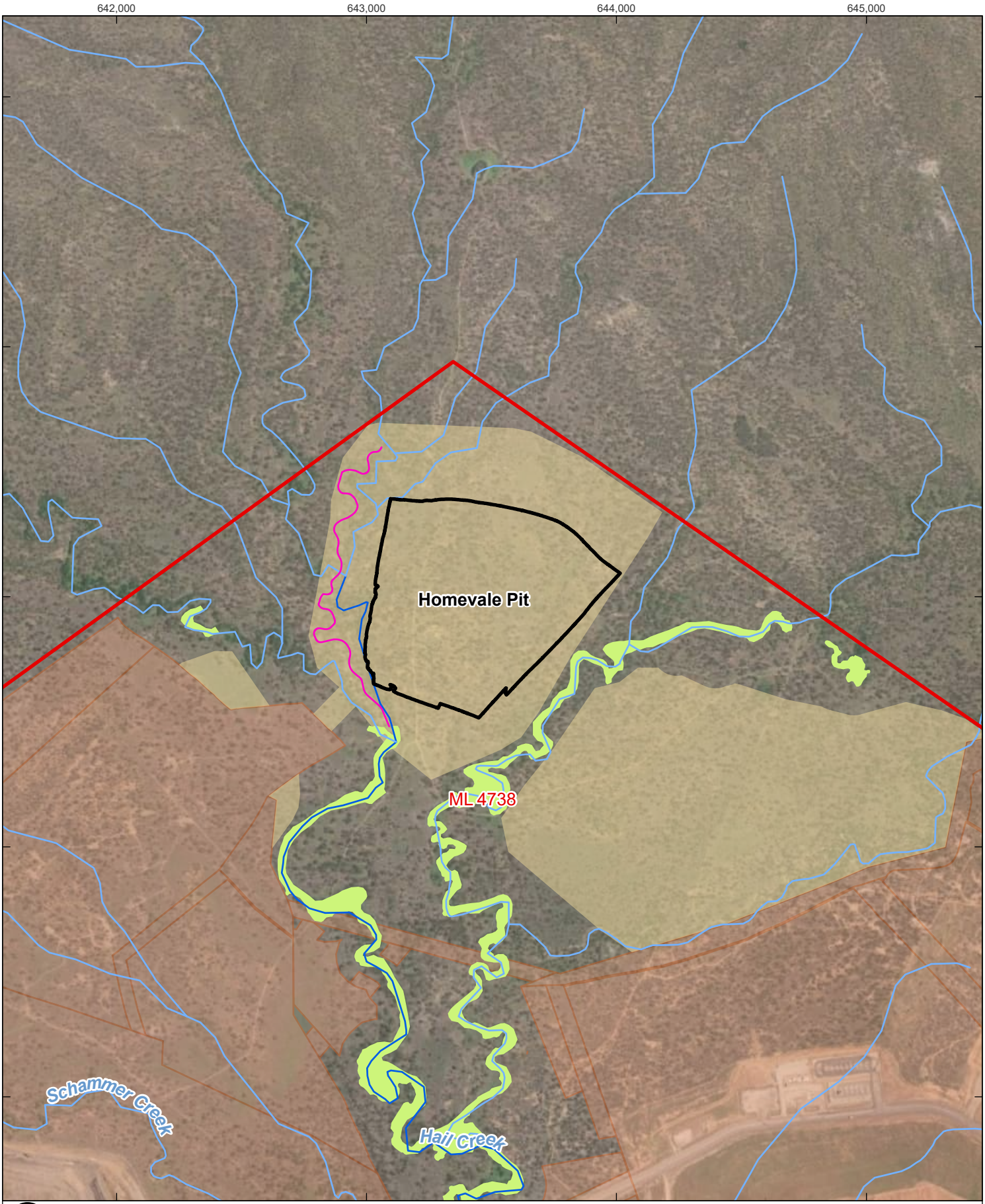
7.2 Diversion Alignment

The proposed Hail Creek Diversion corridor alignment design and general arrangement has been refined from the corridor indication discussed in previous sections to the alignment depicted in **Figure 7-1** and **Figure 7-2**. This corridor alignment was refined through four iterations of analysis, to ensure it met the HCOC site-specific considerations as outlined in **Section 3.3** and the DNMRE (2019) Guideline as outlined in **Section 3.1.2**. The refined alignment is more sinuous than the indicated proposed diversion corridor alignment discussed and shown in previous sections predominately to meet the following requirements of the DNRME (2019) Guidelines:

- The watercourse diversion should tie-in with the existing or receiving watercourse within the resource tenure boundary.
- The length of the channel should be equivalent to the length of the watercourse it replaces.
- Bed grade/slope should be equivalent to the existing watercourse.

Design drawings are included in **Appendix B**.

The proposed diversion corridor alignment does not pass through or near any spoil. Therefore, no consideration to the geotechnical stability has been given to spoil in this assessment. Placement of spoil created from the diversion will be considered during the detailed design phase.



0 250 500 m

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	623.030360.00001
Date Drawn:	22-Aug-2024
Drawn by:	AS

LEGEND

- Proposed Hail Creek Diversion
- Major Watercourse
- Minor Watercourse
- Hail Creek Mining Lease
- Pit Extent
- Proposed Disturbance Boundary
- EA Authorised Extent of Disturbance
- Black Ironbox

HAIL CREEK FUNCTIONAL DESIGN

HAIL CREEK MINE DIVERSION ALIGNMENT

SLR

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FIGURE 7.1

Path: \\au.slr.local\Corporate\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGIS\GIS\623030360_ArcPro\623030360_working.aprx\623030360_HailCrkSchammerCrkDiv_HailCreekMineDiversionAlignment

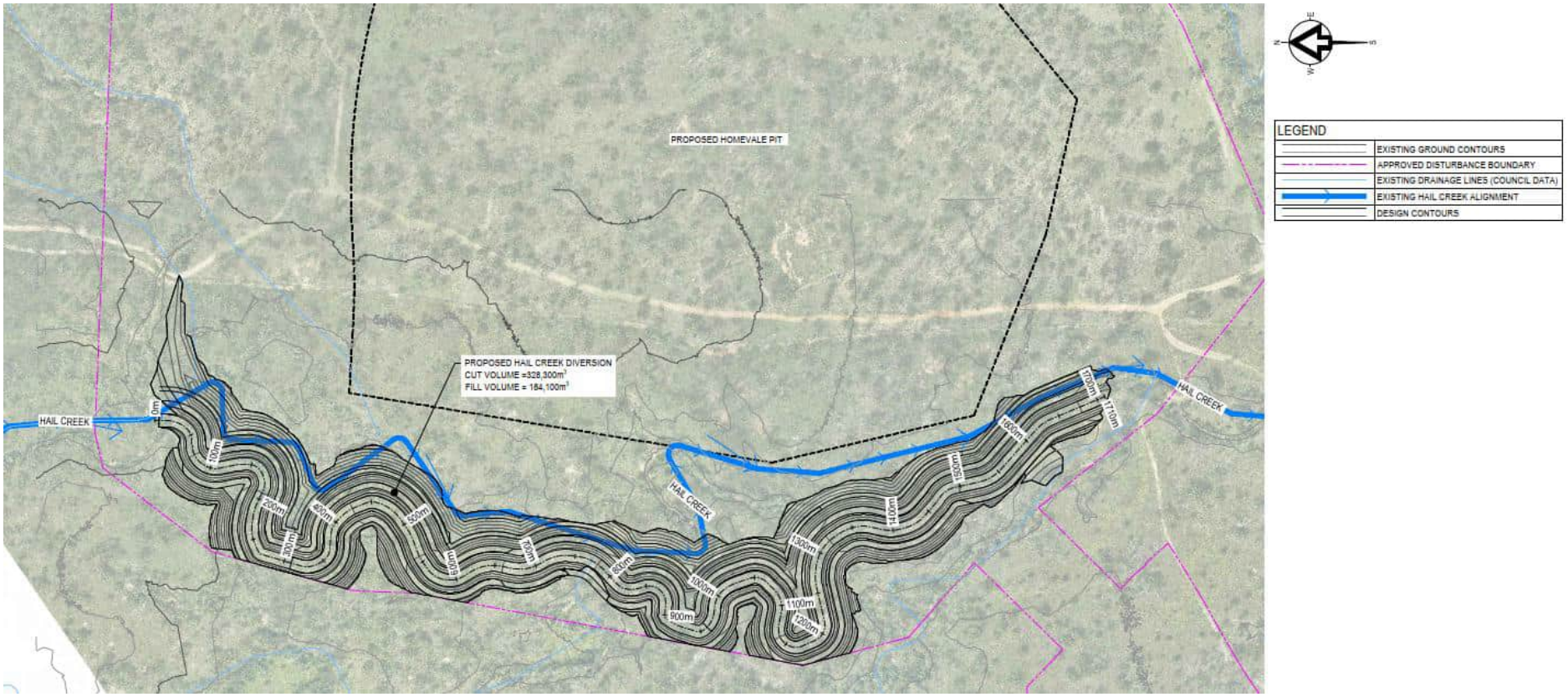


Figure 7-2 Proposed Hail Creek Diversion Corridor general arrangement

7.3 Diversion Hydraulic Geometry

The functional diversion design geometries are presented in **Table 7-1**. Typical cross-sections of the proposed diversion are provided in **Figure 7-3** and with design drawings in **Appendix B**.

Four iterations were computed for the proposed diversion to deliver a design that met HCOC site considerations, functioned hydraulically and satisfied ACARP (2014) Criteria and DNRME (2019) Guidelines. Channel dimensions such as the base bed width were increased at 5m intervals per iteration to reflect input parameters of hydraulic modelling.

The proposed diversion length and grade are comparable to the reach of Hail Creek to be diverted (**Table 7-1**). The first approximately 800 m of the diversion has a gradient of 0.0085 which is steeper than the existing creek, dictated by the terrain and the required tie-in point to accommodate flow from upstream and mid-point tributaries.

Channel width and depth are comparable to the reach averaged channel geometry of the existing reach to be diverted (see **Table 5-3**). Geomorphic features of have also been included in the design including irregular meanders and floodplain benching as per DNRME (2019) Guidelines and ACARP (2014) Criteria for functioning watercourse diversions. These dimensions have been optimised to accommodate hydraulic requirements and site-specific considerations.

The proposed channel side slopes have a maximum gradient of 3H:1V for the low flow and bankfull channel. This contributes to a large diversion footprint. To maintain the grade of the proposed alignment, sections of large cut and increased works footprint are required because of the existing topography and to tie in with existing and ground levels and features.

The floodplain benching width is constrained to site-specific features such as tributary tie-in points and the approved disturbance boundary on the western side of the proposed diversion and eastern side of the Homevale Pit. The width was tested in iterations of hydraulic modelling. The floodplain benching width can be reassessed during the detailed design phase.

Table 7-1 Hydraulic geometry of Hail Creek Diversion

Diversion Parameters	Hail Creek Diversion Design
Diversion length (km)	1.65
Bed grade (m/m)	0.0056 – 0.0085
Average channel bed width (m)	15
Average channel depth (m)	3
Average floodplain benching width (m)	7

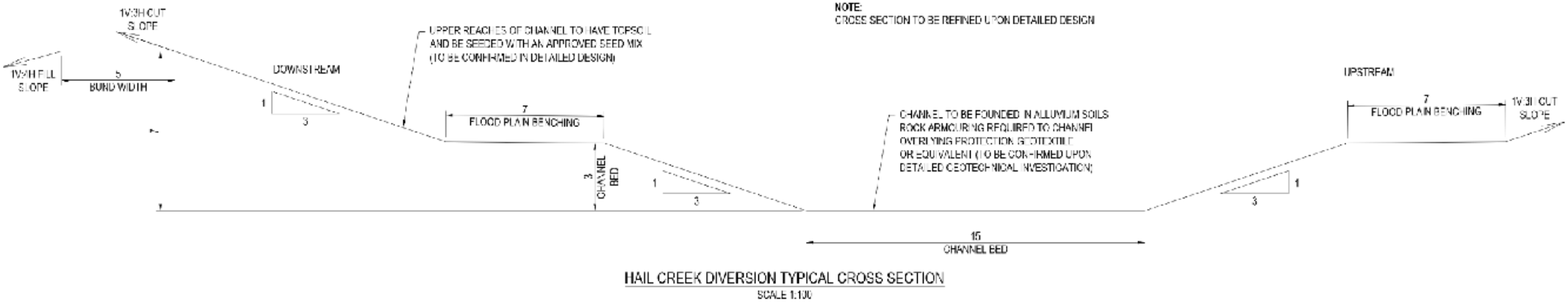


Figure 7-3 Hail Creek Diversion design typical cross section

7.4 Additional Design & Construction Considerations

There are multiple design and construction considerations that will be investigated and developed further throughout the detailed design phase of the Project, including:

- Rock batter chutes will be implemented into the design where required to manage tributary inflows and reduce energy conditions at these points. Rock batter chutes will be designed at 30 to 45 degree angles to the diversion to best manage the confluence of flows.
- Rock armouring may be required to be implemented during the detailed design phase on some meander bends/areas where high bed shear stress is identified to prevent meander migration (subject to geometry and channel substrate) prior to suitable vegetation establishment. Ideally rock armouring will be required at the frequency of current bedrock control and at a greater rate to accommodate the increase in slope.
- Target revegetation to aid in bank stabilisation may be required to be implemented in areas where high bed shear stress is identified during the detailed design phase.
- Where required and upon findings of a geotechnical assessment, compacted clay lining of the channel bed may be incorporated to prevent water loss to the subsurface and/or potential interaction with groundwater. This would be investigated further as part of a geotechnical investigation in detailed design stage.

It is expected that the current functional design will be refined and modified during the detailed design phase of the Project to reflect optimisations that stem from stakeholder recommendations or subsequent mine workings (e.g. changes in pit design, bundwall requirements, surface water drainage). The current design does not incorporate a bundwall between the diversion and the pit as this information was unavailable at the time of reporting. Note large scale design changes may require updates to the geomorphological, hydrological or ecological assessments.

7.4.1 Additional Surface Water Drainage

In addition, surface water flows identified at the northern extent of Homevale Pit will need to be addressed in detailed design. It has been recommended that these flows be managed through clean water diversions/drainage associated with bundwall development during the construction of Homevale Pit. This would divert surface water flows to the east to meet up with eastern tributaries. The contributing flows have been considered in the hydrology and hydraulic assessment.

7.4.2 Waterway Barrier Works

Waterways that provide fish passage are a Matter of State Environmental Significance under the Queensland *Environmental Offsets Act 2014*, and works within waterways that have the potential to impact fish passage (waterway barrier works) are regulated under the *Fisheries Act 1994*.

Under the Queensland *Fisheries Act 1994*, a 'waterway' is a river, creek, stream, watercourse, drainage feature or inlet of the sea, which can have permeant or ephemeral freshwater or saltwater flows, and be natural or modified. Waterways can include any channel or pathway along which fish are expected to move if they connect isolated waterbodies and fish habitats (on floodplains or in waterway channels) to other defined waterways at times of flow (including elevated and overbank flows). Watercourse diversions are considered waterway barrier works as they have the potential to reduce cross-sectional area, increase water velocities or change drown-out characteristics of waterways.

While some waterway barrier works have accepted development design guidelines (Accepted Development Requirements for Waterway Barrier Works), most waterway barrier works projects require development approval. Approvals for the diversion will need to be explored and potential modifications to the diversion design may be required to accommodate fish passage.

7.5 Revegetation

Revegetation of the Hail Creek Diversion will be required to achieve the performance criteria for diversions as described in the HCOC EA (EPML00661913) (**Table 3-6**) and as per DNMRE (2019) Guidelines and ACARP (2014) Criteria.

Disturbance of existing vegetation within the proposed diversion floodplain areas shall be minimised during construction to reduce the extent of rehabilitation and revegetation required.

Where possible and practical, revegetation will include the native species which are characteristic to RE 11.3.25(a), and 11.3.4 (see species list in **Appendix A**). Species found in neighbouring REs and which are associated with the natural surrounding waterways may also be included (RE 11.9.9, 11.3.4, and 11.9.7a). The revegetation should achieve the following:

- Geomorphic and vegetation features similar to those in the local landscape.
- Maintain a sediment transport regime that does not impact on upstream and downstream reaches.
- No ongoing maintenance required.

The revegetation approach should be separated into planting zones, reflecting variable geomorphic and hydraulic environments in the diversion channel e.g., bed and banks of the low flow channel, overbank flood zones and benches, and other areas including levees, bunds, embankments and rehabilitation laydown areas where applicable. Delineation of these zones will be determined during detailed design when more information on soils and soil management is available.

Areas identified in the hydraulic modelling as having high bed shear stress should be considered for targeted revegetation and bank stabilisation during the detailed design phase.

A staged approach to revegetation works and planting should be utilised to provide stable vegetation cover to protect the works from erosion and weed spread. To ensure vegetation has sufficient time for establishment, it is suggested that the diversion be kept offline for one to two wet seasons. Planting will be undertaken both during and after construction at an appropriate time of the year to maximise the potential for successful rehabilitation.

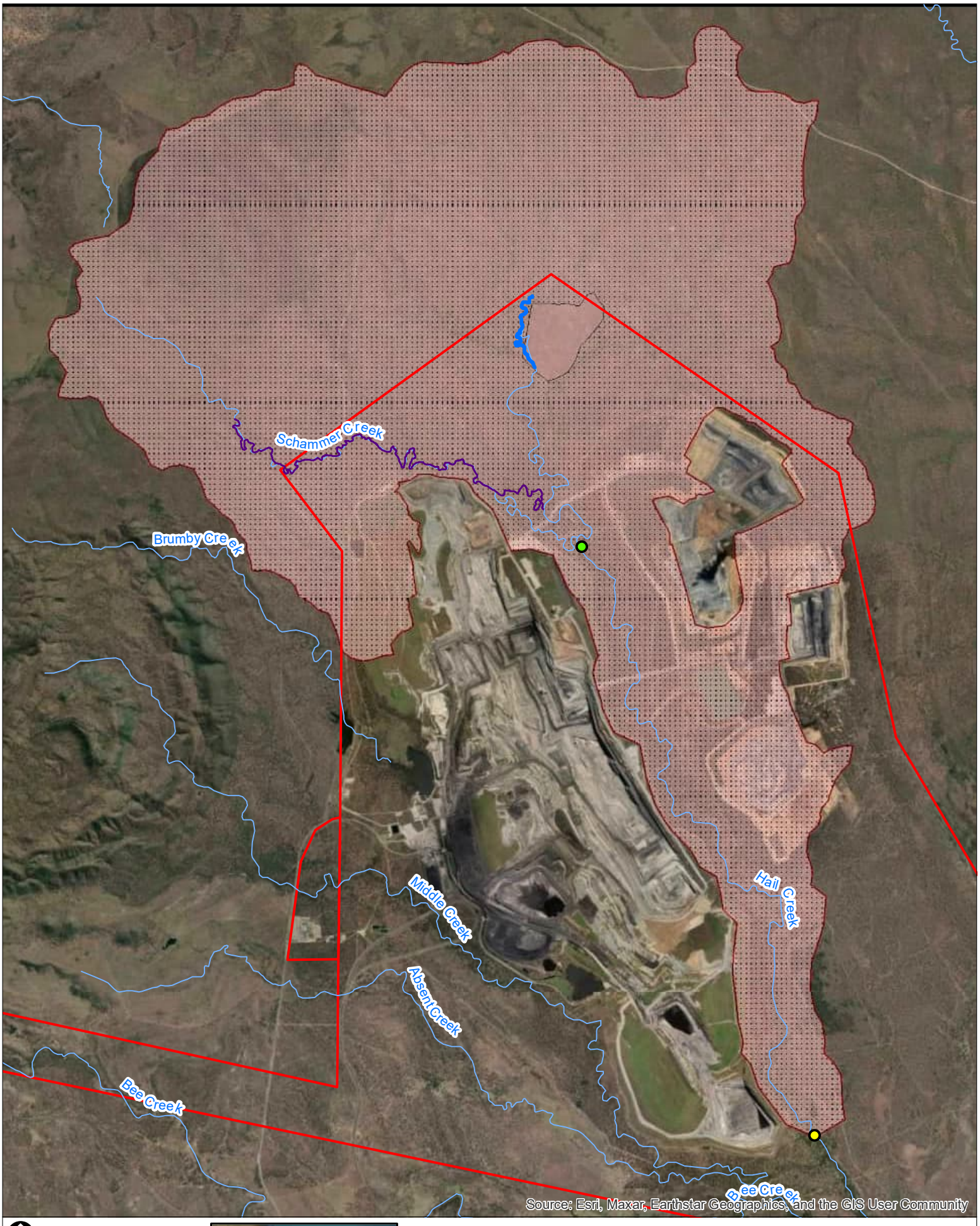
Biosecurity formalities including wash-down facilities should be put in place during revegetation works to prevent the induction of additional invasive species and prevent the spread of established species.

8.0 Hydrologic and Hydraulic Assessment

Hail Creek is located north of the mine site and flows from north to south intersecting HCOC between the Main Western and Carinyah Pits. Hail Creek is a fourth-order stream with numerous tributaries, including Schammer Creek. The catchment is depicted in **Figure 8-1**.

Hydraulic modelling was undertaken to understand the system's hydraulic and sediment transport behaviour. Existing and design scenarios were run to determine the impacts of the proposed Hail Creek Diversion.

The details of the hydraulic assessments are described below.



0 1,000 2,000 Meters

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:75,000 at A4
Project Number:	620.030360
Date:	03-Sep-2025
Drawn by:	SS

SLR



Legend

- Diversion alignment
- Watercourses
- Diverted Catchment
- Existing Catchment
- Mining Lease
- Main Catchment Outlet
- Upper Catchment Outlet

HAIL CREEK MINE
SCHAMMER CREEK FUNCTIONAL DESIGN

Catchment Boundary

Data Source: DNRME watercourses and ESRI Basemap imagery.
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Figure 8-1

\\au.slr.local\Corporate\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CAD\GIS\GIS\Surface_Water\Figures\623.030360_HC_Figure8-1_004.mxd

8.1 Streamflow Assessment

The impacts to streamflow in Hail Creek from diverting a portion of the catchment around Homevale Pit were assessed by analysing streamflow characteristics in the form of annual flow volumes and event-based flow hydrographs at key locations downstream of the proposed diversion.

The Water Monitoring Information Portal provided discharge information from the closed Bee Creek gauging station (130411A) operated by the Department of Regional Development, Manufacturing and Water. The gauge is located some 55 km downstream of the proposed diversion and has a contributing catchment area of approximately 1,306 km^2.

Annual flow volumes were estimated for both the Hail Creek Main (i.e. to junction with Bee Creek) and the Hail Creek Upper (i.e. to junction with Schammer Creek) catchment areas by applying a factor to the gauged flows equivalent to the ratio of the catchment area to the gauge catchment area, as illustrated in **Table 8-1**.

For the purposes of the analysis, it was assumed that the rainfall-runoff relationship and rainfall spatial distribution for the Hail Creek catchments was consistent with the wider gauge catchment.

Table 8-1 Applied Catchment Area Ratios

Catchment	Area (km^2)	Difference v Existing	Ratio as % of Gauge Catchment
Gauge 130411A	1,306	-	-
Existing Hail Creek Main	97.9	-	7.5 %
Diverted Hail Creek Main	96.8	-1.1 %	7.4 %
Existing Hail Creek Upper	72.0	-	5.5 %
Diverted Hail Creek Upper	70.9	-1.5 %	5.4 %

As shown in **Table 8-1**, the proposed development of Homevale Pit and the Hail Creek Diversion will result in a reduction in catchment area of 1.1 % and 1.5 % for the Hail Creek Main and Hail Creek Upper catchments, respectively.

Therefore, the analysis showed that annual streamflow volumes for the Hail Creek Main catchment will be reduced by approximately 1.1 %, and for the Hail Creek Upper catchment annual streamflow volumes will be reduced by approximately 1.5 %. The negligible change is illustrated by the comparative annual flow exceedance curves provided in **Figure 8-2** and **Figure 8-3.**

Flow hydrographs were extracted from the TUFLOW hydraulic model (refer **Section 8.3**) at a reporting location on Hail Creek approximately 850 m downstream of the proposed diversion. Flow hydrographs were extracted for the existing and developed (diversion) scenarios, for the 2 % and 39 % AEP events. The results are illustrated in **Figure 8-4**, which shows that in each event, the flow hydrograph shape is consistent between each scenario. The peak flows and flow volumes are shown to marginally decrease in the developed scenario compared to the existing scenario in each event, as expected given the minor reduction in catchment area.

Based on the above analyses, the hydrology and flow regime of Hail Creek will not be adversely affected by the proposed diversion.

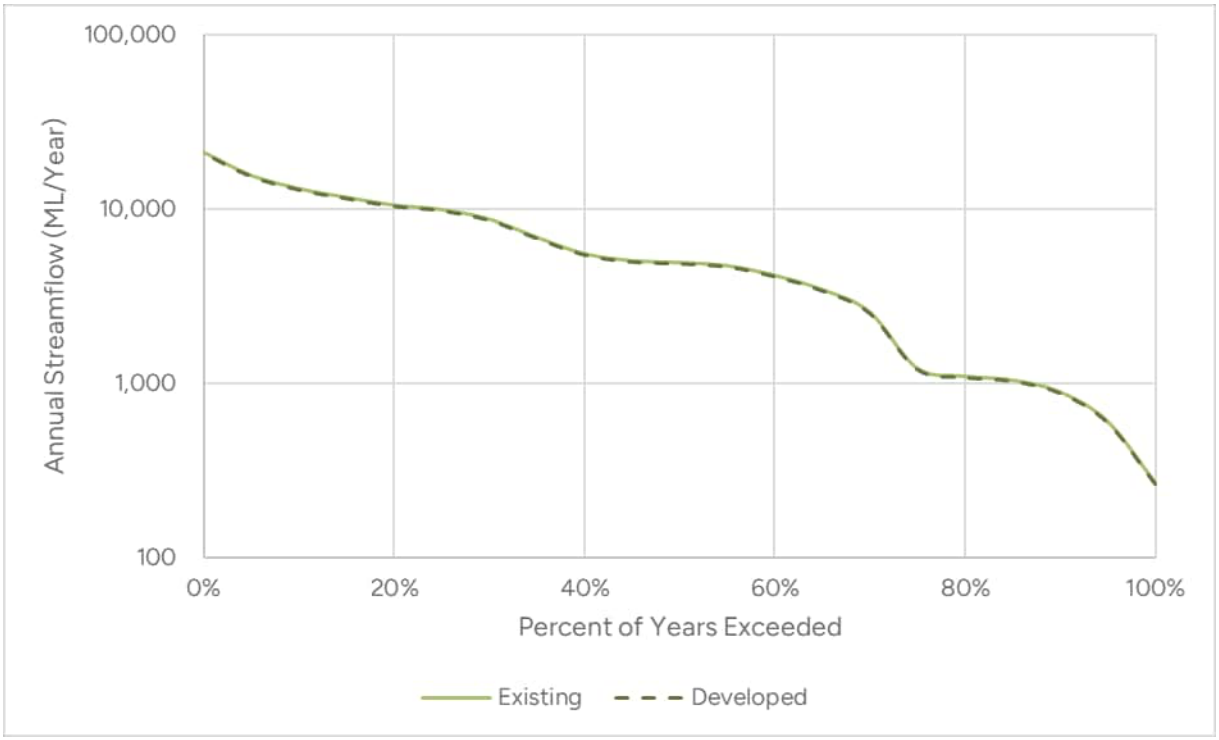


Figure 8-2 Impact to Annual Flow Exceedance Volume – Hail Creek Main Catchment

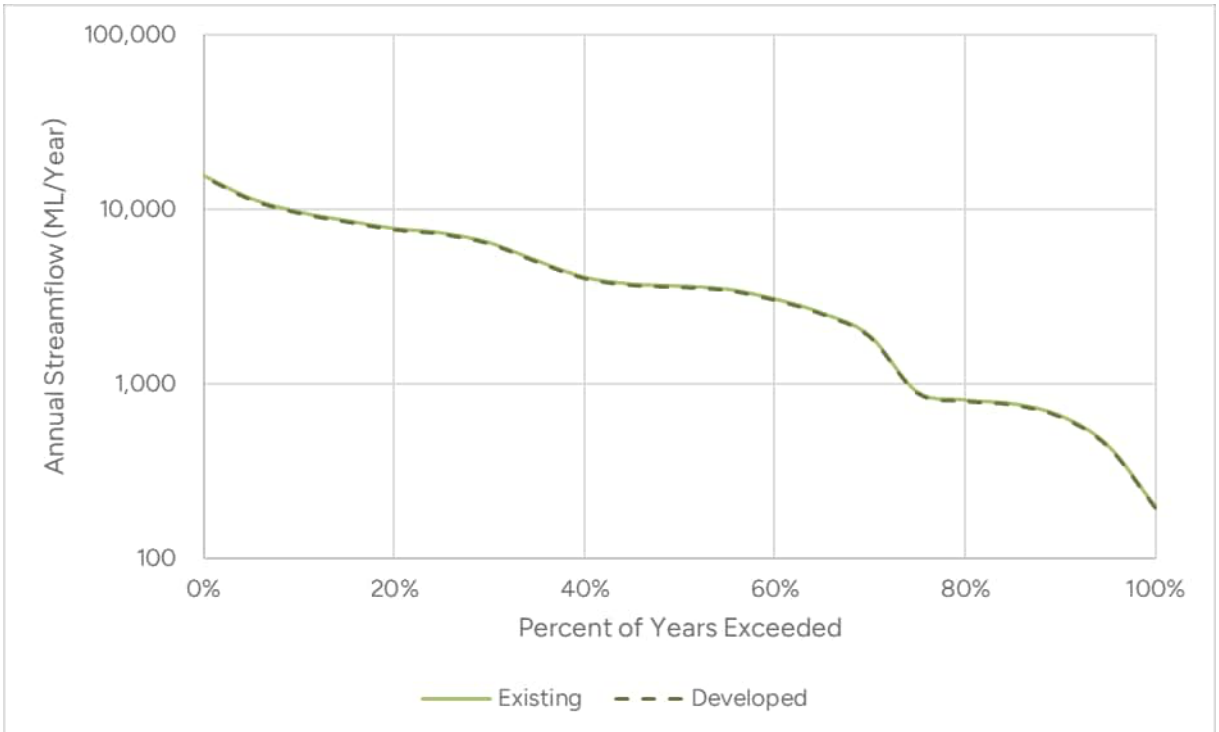


Figure 8-3 Impact to Annual Flow Exceedance Volume – Hail Creek Upper Catchment

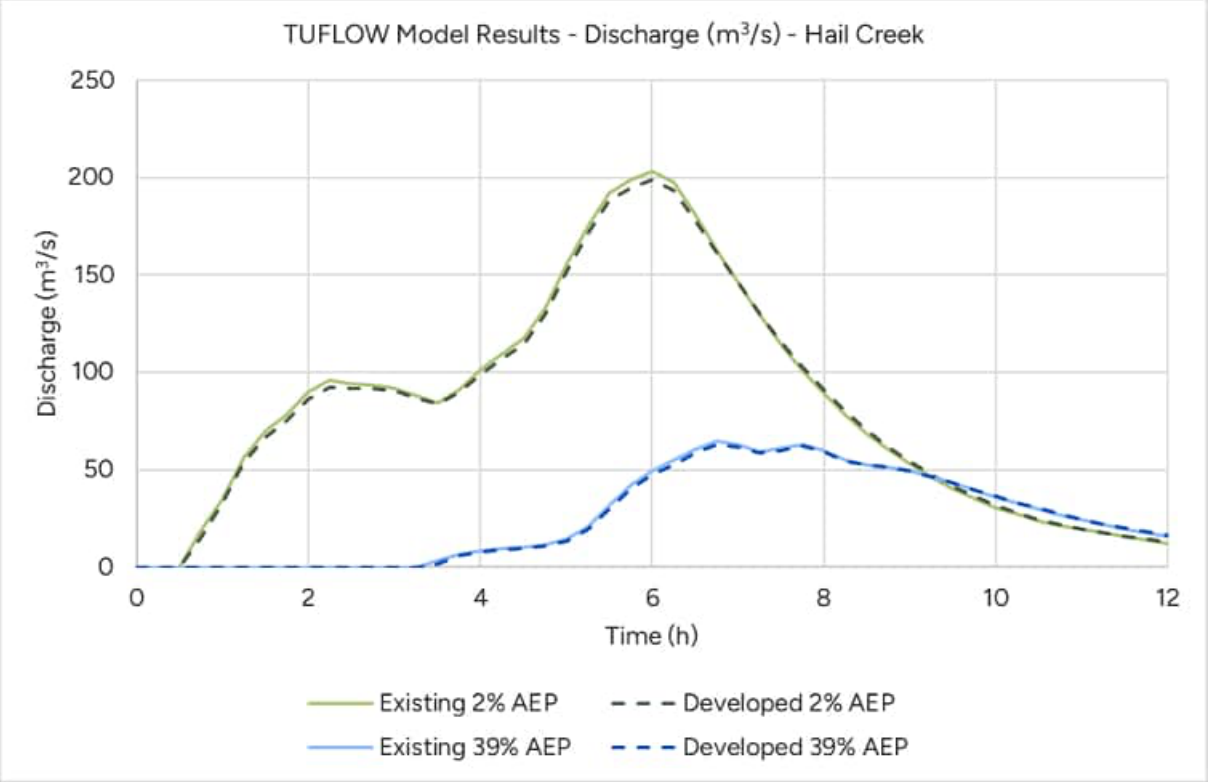


Figure 8-4 TUFLOW Model Results – Flow Hydrographs – Hail Creek

8.2 Hydrologic Modelling

SLR has previously developed and calibrated a WBNM hydrologic model of the Hail Creek Mine as part of Hail Creek Mine Progressive Rehabilitation and Closure Plan Flood Risk Assessment (SLR, 2023) and the Hail Creek Mine Eastern Margin Extension - EA Amendment (SLR, 2024). The hydrologic model developed for these Projects was used as a basis for the Hail Creek Diversion functional design.

8.2.1 WBNM model development

WBNM was used to develop existing and design flood hydrology for the Hail Creek Diversion functional design.

The existing model scenario (E06) was based on current catchment conditions and were delineated based on the Shuttle Radar Topography Missions data and 2024 LiDAR DEMs.

The diversion scenario (FD02) was based on the existing model scenario but revised based on the diversion scenario DEM (refer to **Figure 8-8**).

The WBNM model layouts for Hail Creek for the existing and diversion scenarios are shown in **Figure 8-5** and **Figure 8-6** respectively.

635000 636000 637000 638000 639000 640000 641000 642000 643000 644000 645000 646000 647000 648000

7636000 7635000 7634000 7633000 7632000 7631000 7630000 7629000 7628000 7627000 7626000 7625000 7624000 7623000 7622000 7621000 7620000 7619000

HAIL01 HAIL02 HCTA01 HCTB01a HCTE01 HCTD01 HCTC01A HCTB02 HCTD02 SCTA01 HCTA02 HAIL03 HCTB01b SCTA02a SCHA01 SCTC01c HAIL03b HCTD03 HCTF01 SCTA02b SCTC01b BETD01 SCHA02a SCTC01a SCHA03c SCTC01d BETE01 SCTA03 HAIL04 HCTG01 HCTJ01 SCHA02b SCHA03a SCTC01e HCTH02 SCHA04a SCHA03d HCTH03 HAIL05 SCHA03b BETF01 BRUM01 HCTQ01 HCTJ02 SCTB01a SCTB01b BETG01 HAIL06 BRUM02 HCTI01 BETH01 HCTJ04 HCTK01 HCTL01 MIDD01 HAIL07 BCD01 HCTJ03 BETQ01 HCTM01 BCD02 HAIL08 HCTN01 HCTO01 HCTM02 MIDD03 BCD03 HCTM03 ABS03 HAIL09 HCTM04 MIDD04 CTB01 ABS04 BETP01 BEE11 BEE12 BETU01 BETQ01 BEE15 HAIL10 HCTQ04

Image Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.4 0.8 1.6 km

LEGEND

- Site Boundary
- WBNM Sub-catchments

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A3
Project Number:	623.030360
Date:	03-Sep-2025
Drawn by:	TS

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Scenario
WBNM Model Setup

SLR

Figure 8-5

\\au.slr.local\Corporate\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADG\GIS\Surface_Water\Figures\623.030360_HC_Figure8-5_WBNM_Ex_001.mxd

635000 636000 637000 638000 639000 640000 641000 642000 643000 644000 645000 646000 647000 648000

7636000 7635000 7634000 7633000 7632000 7631000 7630000 7629000 7628000 7627000 7626000 7625000 7624000 7623000 7622000 7621000 7620000 7619000

HAIL01 HAIL02 HCTA01 HCTB01a HCTE01 HCTD01 HCTC01A HCTB02 HCTD02 SCTA01 HCTA02 HAIL03 HCD1 HCD2 HCD3 SCTA02a SCTC01c HAIL03b SCHA01 SCTA02b SCTC01b HCTD03 HCTF01 BETD01 SCHA02a SCTC01a SCHA03c SCTC01d BETE01 SCTA03 HAIL04 HCTG01 HCTJ01 SCHA02b SCHA03a SCTC01e HCTH02 SCHA04a SCHA03d HCTH03 SCHA03b HAIL05 HCTQ01 BETF01 BRUM01 SCTB01a HCTJ02 SCTB01b BETG01 HAIL06 BRUM02 HCTI01 BETH01 HCTJ04 HCTK01 HCTL01 MIDD01 HAIL07 BCD01 HCTJ03 BETQ01 HCTM01 BCD02 HAIL08 HCTN01 HCTO01 HCTM02 MIDD03 BCD03 HCTM03 ABS03 HAIL09 HCTM04 MIDD04 CTB01 ABS04 BETP01 BEE11 BEE12 BETU01 BETQ01 BEE15 HAIL10 HCTQ04

Image Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.4 0.8 1.6 km

LEGEND

- Site Boundary
- WBNM Sub-catchments

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:50,000 at A3
Project Number:	623.030360
Date:	03-Sep-2025
Drawn by:	TS

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Scenario
WBNM Model Setup

SLR

Figure 8-6

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek.SchammerCreek Dive\06 SLR Data\01 CAD\GIS\GIS\Surface_Water\Figures\623.030360_HC_Figure8-6_WBNM_FD_001.mxd

8.2.2 Design Rainfall Depths

Point design rainfall depths for the 39 %, 2 %, 1 % and 1 in 1000 (0.1 %) AEP events were obtained from the Bureau of Meteorology Intensity-Frequency-Duration portal (**Table 8-2**). Areal Reduction Factors were not applied to the rainfall depths, as the sub-catchments draining to the diversion are relatively small (approximately 6 km^2).

Table 8-2 Rainfall Intensity-Frequency-Duration Data

Storm Duration (min)	Design AEP Event Rainfall Depth (mm)			
	39 %	2 %	1 %	0.1 %
30	32.4	57.3	62.3	99.1
45	38.2	68.2	74.2	118
60	42.2	76.3	83.2	132
90	47.8	89	97.4	155
120	51.7	99	109	173
180	57.6	115	128	203
270	64.1	136	152	241
360	69.4	153	172	274
540	78.3	182	208	330
720	85.8	207	238	379
1080	98.7	249	289	460
1440	110	283	330	526
1800	119	312	365	580
2160	127	337	395	626
2880	142	378	443	700

8.2.3 Design Storm Events and Temporal Patterns

The WBNM model was simulated for the 39 %, 2 %, 1 % and 0.1 % AEP rainfall events with a range of storm durations between 30-minutes to 48-hours in accordance with ARR (2019).

To represent the distribution of the rainfall over the event duration, point temporal patterns were used from the East Coast (North) region, obtained from the Australian Rainfall and Runoff (ARR) Data Hub. For each AEP-duration combination, the design storm temporal pattern which produced a peak flow nearest to the mean peak flow of the suite of 10 temporal patterns was adopted as the design storm. Preference was given to flows greater than the mean, with a bias factor of 2 applied.

For the 0.1 % AEP event, in accordance with the procedures outlined in ARR (2019), the Generalised Short Duration Method (GSDM) temporal pattern was applied. The GSDM temporal pattern, which is applicable for short durations (up to and including 6-hours only), was extended to the 12-hour event with time steps adjusted accordingly. For the 0.1 % AEP event, the model was simulated for durations ranging from 30-minutes to 12-hours. The adopted temporal pattern for Hail Creek was selected for the storm events based on a focal point in the main creek (HAIL05).

A critical duration assessment was undertaken using the hydraulic model. The results of the assessment are provided in **Section 8.3.2.6**.

8.2.4 Design Rainfall Losses

Rainfall initial and continuing losses for the catchment were sourced from the ARR Online Data Hub. The initial loss for each design storm event was calculated by subtracting the median pre-burst rainfall depth from the global catchment initial loss, in accordance with the methodology outlined in ARR. The adopted global initial loss values are shown in **Table 8-3**. The initial loss for the 0.1 % AEP event was set at 0 mm, as an event of this magnitude would typically occur after a period of significant antecedent rainfall.

Table 8-3 Rainfall Losses

Parameter	Adopted Value
Initial loss (mm)	22.0
Continuing loss – pervious (mm/h)	0.8

8.2.5 Lag Parameter

A catchment lag parameter of 1.6 was applied for the design storm events, which is within the bounds recommended in the WBNM documentation. This was also the lag parameter determined from model calibration which validates its adoption.

8.2.6 Climate Change

A climate change sensitivity run was undertaken for the diversion scenario using the long-term (year 2100) and Shared Socioeconomic Pathway (SSP) of SSP5-8.5, using the latest ARR guidelines (2019). This sensitivity run was undertaken for the purpose of testing the capacity of the diversion drain under climate change.

8.2.7 Results

The peak flows produced by the WBNM model for the existing and diversion scenarios at sub-area HAIL05 (refer to Upper Main catchment outlet point in **Figure 8-1**) are listed in **Table 8-4**. The hydrological model was calibrated as part of the Hail Creek Mine Progressive Rehabilitation and Closure Plan Flood Risk Assessment (SLR, 2023) and the Hail Creek Mine Eastern Margin Extension - EA Amendment (SLR, 2024). A critical duration assessment was undertaken using the hydraulic model. The results of the assessment are provided in **Section 8.3.2.6**.

Table 8-4 Flood Hydrology for Hail Creek

Event	Peak Flow (m^3/s)	Critical Storm Duration (h)	Temporal Pattern
39 % AEP existing	117.8	9	TP7
39 % AEP diversion	116.5	9	TP7
2 % AEP existing	389.6	6	TP10
2 % AEP diversion	384.7	6	TP10
1 % AEP existing	444.8	6	TP10
1 % AEP diversion	439.0	6	TP10

Event	Peak Flow (m^3/s)	Critical Storm Duration (h)	Temporal Pattern
1 in 1000 AEP existing	763.0	3	GSDM
1 in 1000 AEP diversion	753.6	3	GSDM

8.3 Hydraulic Assessment

The hydraulic models from the Hail Creek Mine Progressive Rehabilitation and Closure Plan Flood Risk Assessment (SLR, 2023) and the Hail Creek Mine Eastern Margin Extension - EA Amendment (SLR, 2024) were adopted for use in this assessment, with appropriate updates made to make the model fit for purpose. The details of modelling undertaken as part of this assessment are summarised below.

It has been assumed that the reach of Hail Creek to be diverted will be removed or disturbed by future mine works. The mine works will therefore be abutting the diversion.

8.3.1 Software

A 2-dimensional hydrodynamic computational hydraulic model of the Project Area was developed using the industry standard software TUFLOW (Build 2023-03-AE). Details of the model setup and results are provided below.

8.3.2 Model Development

8.3.2.1 Topography

The model topography for the existing scenario was based on the 2022 and 2024 LiDAR. A model grid of 5 m was chosen, with a sub-grid sampling distance of 1 m, which was considered to provide adequate model resolution for the purposes of this assessment. The diversion design DEM as designed by the SLR Civil Team was incorporated into the design scenario. It should be noted that Homevale Pit was not included in the topography for either scenario since it is protected by a levee up to and including the 0.1 % AEP event. The TUFLOW setup for the existing scenario and diversion scenario are shown in **Figure 8-7** and **Figure 8-8**, respectively.

8.3.2.2 Hydraulic Roughness

The hydraulic roughness for the model was determined through site observations during the geomorphic assessment and from aerial imagery. The following Manning's n values were adopted for the various land uses in the model are listed in **Table 8-5**.

Table 8-5 TUFLOW model Manning's n values

Land use	Manning's n
Light Scrub	0.05
Medium Scrub	0.07
Cleared	0.03
Vegetated Waterways	0.09
Waterbodies	0.02
Road / rail / hardstand	0.025
Existing Creek	0.04
Hail Creek Diversion	0.04

8.3.2.3 Inflows

Flow hydrographs for the TUFLOW model were extracted from the WBNM hydrologic model. The hydrographs were applied as inflow boundaries via source area polygons as total or local inflows at appropriate locations.

8.3.2.4 Hydraulic Structures

Some culverts at existing haul road crossings of Hail Creek were incorporated in the model. The structures were included in the model as 1-dimensional elements. Relevant culvert details were provided by HCC. Where culvert data was not available, other existing culvert crossings were represented in the model as localised modifications (openings) of the model topography using the built-in z-line feature functionality of TUFLOW. All culverts are located more than 3 km downstream of the diversion and therefore have no effect on the results or assessment of effects.

8.3.2.5 Boundary Conditions

The downstream model boundary was applied as a stage-discharge relationship based on the water surface gradient in the vicinity of the boundary. The stage-discharge relationship was calculated using the in-built functionality within the TUFLOW software, and a flood surface gradient of 0.2 %. The boundary is located more than 3 km downstream from the area of interest and has more than 20 m difference in terrain level compared to the area of interest. The boundary is also located downstream of two haul roads which act as hydraulic controls. Therefore, the boundary has no effects on the flood levels at the area of interest or the assessment of the potential effects of the diversion of Hail Creek.

8.3.2.6 Critical durations

The critical durations for the hydraulic model scenarios are shown in **Table 8-6**.

Table 8-6 Critical Durations for hydraulic model scenarios

Event	Critical Storm Duration (h)
39 % AEP existing	180 min TP5, 540 min TP7
39 % AEP diversion	180 min TP5, 540 min TP7
2 % AEP existing	120 min TP8, 180 min TP8, 360 min TP10
2 % AEP diversion	180 min TP8, 360 min TP10
1 % AEP existing	270 min TP9, 540 min TP6
1 % AEP diversion	270 min TP9, 540 min TP6
1 in 1000 AEP existing	60 min, 90 min, 120 min, 180 min GSDM
1 in 1000 AEP diversion	60 min, 90 min, 120 min, 180 min GSDM

638000 639000 640000 641000 642000 643000 644000 645000 646000 647000 648000

7635000 7634000 7633000 7632000 7631000 7630000 7629000 7628000 7627000 7626000 7625000 7624000 7623000 7622000

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.3 0.6 1.2 km

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:40,000 at A3
Project Number:	623.030360
Date:	03-Sep-2025
Drawn by:	TS

LEGEND

- Site Boundary
- TUFLOW Model Extent
- Downstream boundary
- Culverts
- Inflows

Topography (mAHD)
High : 335
Low : 200

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Scenario
TUFLOW Model Setup

SLR

Figure 8-7

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADD\GIS\GIS\Surface_Water\Figures\623.030360_HC_Figure8-7_TUFLOW_EX_001.mxd

638000 639000 640000 641000 642000 643000 644000 645000 646000 647000 648000

7635000 7634000 7633000 7632000 7631000 7630000 7629000 7628000 7627000 7626000 7625000 7624000 7623000 7622000

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.3 0.6 1.2 km

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:40,000 at A3
Project Number:	623.030360
Date:	04-Nov-2025
Drawn by:	TS

LEGEND

- Site Boundary
- TUFLOW Model Extent
- Downstream boundary
- Culverts
- Inflows
- Hail Creek Diversion

Topography (mAHD)
High : 335
Low : 200

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Scenario
TUFLOW Model Setup

Figure 8-8

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADD\GIS\GIS\Surface_Water\Figures\623.030360_HC_Figure8-8_TUFLOW_FD_002.mxd

8.3.3 Existing Hydraulic Model Results

The results for the existing scenario including peak flood level, flood depth, velocity, bed shear stress and stream power are mapped in **Appendix C.**

Areas with high values of bed shear stress, stream power and velocities may have higher erosion potential depending on the characteristics and resistance of the substrate.

The results indicate that the flows from Hail Creek and its eastern tributary approach the fringes of the Homevale Pit footprint from the west and south-eastern boundary during the 2 % AEP flooding event.

PLACEHOLDER

Figure 8-9 shows the 0.1% AEP peak flood extent in for the existing scenario, which is representative of the floodplain corridor width. The floodplain width varies from approximately 40m to 200m.

643000

7631000

Depth (m)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- Above 3.5

0 25 50 100 Meters

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:4,000 at A3
Project Number:	623.030360
Date:	11-Sep-2025
Drawn by:	TS

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Depths - 1 in 1000 AEP

SLR

Figure 8-9

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADG\SIG\SSurface_Water\Figures\623.030360_HC_Figure8-9_ExistingFloodplainCorridorWidth_001.mxd

8.3.4 Diversion Design Hydraulic Model Results

The model was updated with the design DEM for the Hail Creek Diversion. Design parameters used in the diversion are depicted in **Section 7.0** and **Table 7-1**. Peak flood level, depth, velocity and stream power mapped results are included in **Appendix D**.

The results indicate that Hail Creek will not breach the Homevale Pit walls for any design event up to and including the 0.1 % AEP flood. However, shallow flood depths intersect the pit in the south-eastern corner from the eastern tributary. Refer to the EA Amendment Report v4.3 that includes a levee for the flooding caused by the eastern tributary, as part of the landform. **Appendix E** illustrates the variability along the diversion channel for peak velocity, bed shear stress and stream power. The results also show that the 0.1% AEP flood is contained within the diversion (refer to **Figure 8-10**). The floodplain corridor in the diversion scenario is approximately 40 m to 150 m wide. It should be noted that the climate change scenario event for the 0.1% AEP event is also contained within the diversion; refer to **Appendix F**.

643000

7631000

Depth (m)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- Above 3.5

0 25 50 100 Meters

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit
- Hail Creek Diversion

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:3,500 at A3
Project Number:	623.030360
Date:	04-Sep-2025
Drawn by:	TS

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Depths - 1 in 1000 AEP

SLR

Figure 8-10

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADG\SIG\Surface_Water\Figures\623.030360_HC_Figure8-10_diversion_capacity.mxd

Figure 8-11 shows the velocity values for the diversion channel and upstream and downstream of the channel. **Figure 8-12** shows the location of the upstream, downstream and diversion channels. **Table 8-7** summarises the reach-averaged results from the long sections down the centre line of the existing watercourse and diversion channel.

It is noted that ACARP Design Criteria are based on HEC-RAS modelling, which is cross-sectionally averaged, as opposed to TUFLOW model results, which are depth-averaged. The TUFLOW results were analysed at several cross-sections which showed that the extraction of the parameters through the central alignment was generally consistent with the cross-sectional average.

Table 8-7 Results of hydraulic modelling (reach-averaged) for Hail Creek

Event	Hail Creek reaches	Velocity (m/s)	Shear Stress (N/m^2)	Stream Power (W/m^2)
39 % AEP	Upstream Reach Existing	1.67	72.9	146.3
	Upstream Reach Post-Diversion	1.72	77.0	158.9
	Diversion Reach Existing	1.85	61.9	117.5
	Diversion Reach	1.78	52.8	95.4
	Downstream Reach Existing	1.78	54.9	97.9
	Downstream Reach Post-Diversion	1.45	41.0	68.5
	ACARP Design Criteria	**<1.5**	**<40**	**<60**
2 % AEP	Upstream Reach Existing	2.26	106.4	286.6
	Upstream Reach Post-Diversion	2.46	127.8	383.2
	Diversion Reach Existing	2.28	82.3	186.8
	Diversion Reach	2.34	76.4	183.7
	Downstream Reach Existing	2.08	68.2	141.0
	Downstream Reach Post-Diversion	1.75	53.2	104.0
	ACARP Design Criteria	**<2.5**	**<80**	**<150**

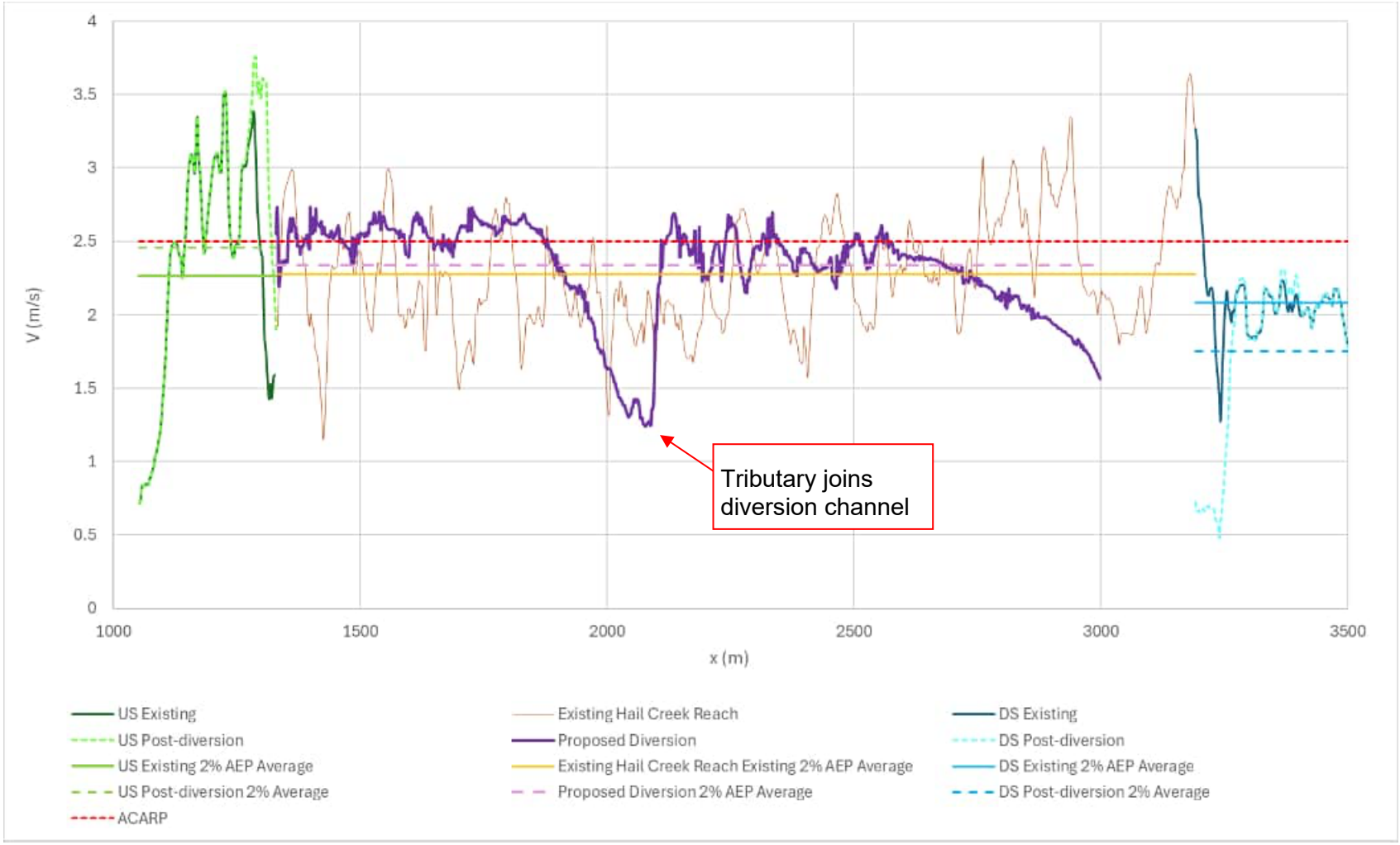
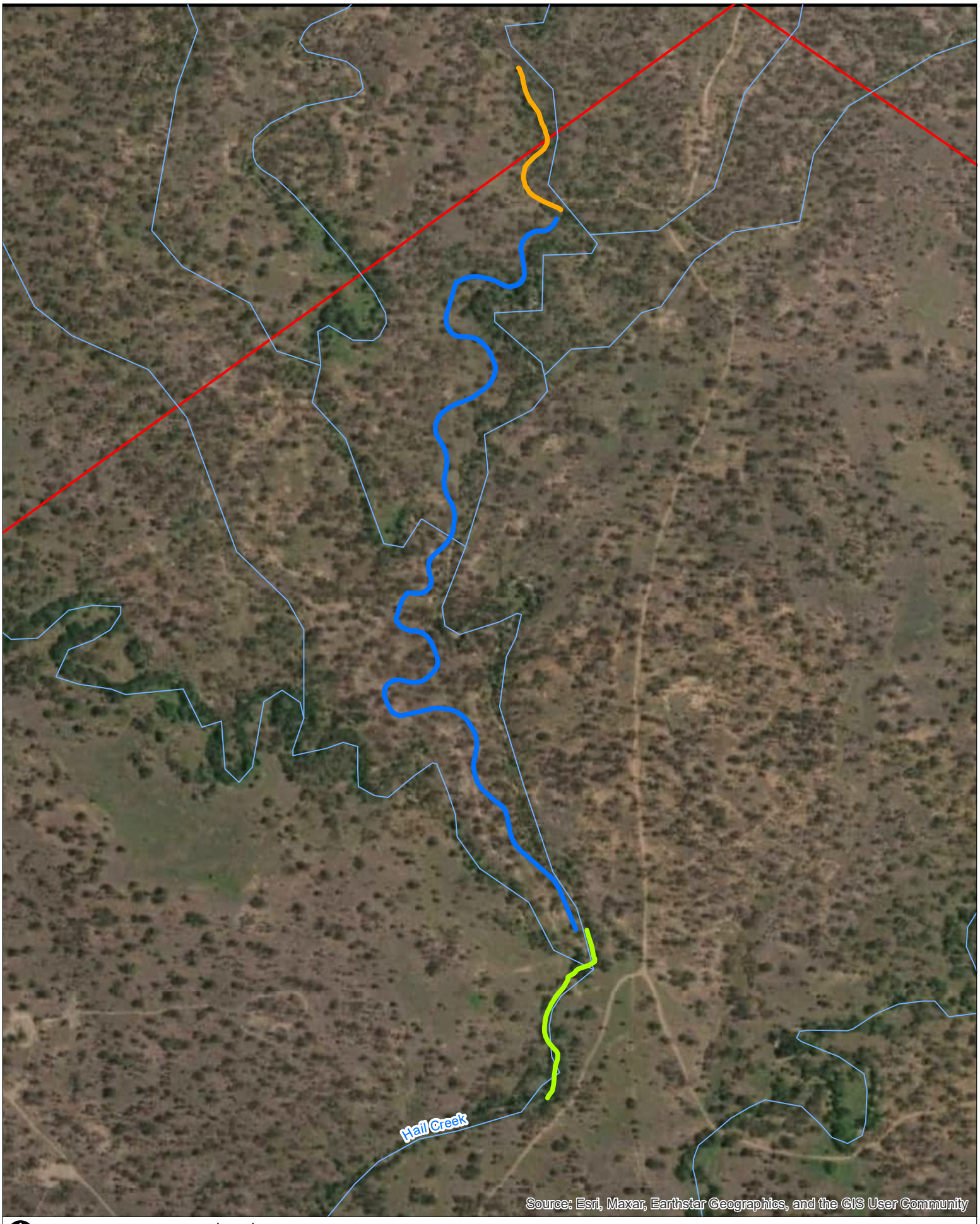


Figure 8-11 Velocity long-section in the 2 % AEP event (US denotes upstream, DS denotes downstream)



0 100 200 Meters

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A4
Project Number:	620.30112
Date:	03-Sep-2025
Drawn by:	TS

Legend

- Diversion Reach
- Upstream Reach
- Downstream Reach
- Watercourses
- Mining Lease

HAIL CREEK MINE
FUNCTIONAL DESIGN HAIL CREEK

Reaches for Long-Section Ouput

SLR

Data Source: DNRME watercourses and ESRI Basemap imagery.
DISCLAIMER: All information within this document may be based on external sources.
SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

Figure 8-12

H:\Projects\SLR\623-TSV\623.030360.00001-Hail Creek-Schammer Creek Dive\06 SLR Data\01 CAD\GIS\GIS\Surface_Water\Figures\623.030360_HC_Figure8-12_Longsection_001.mxd

The 2 % AEP average velocity upstream of the diversion is increased in the diversion scenario because of the high velocity close to the tie-in point. This increases the average value upstream compared to the existing situation. However, the mean velocity is below the ACARP recommended value of 2.5 m/s. The velocities within the diversion reach are of similar magnitude and variation to the existing reach of Hail Creek that is being diverted. Both the existing and diversion scenarios have lower average velocities than the ACARP values. Downstream of the diversion, the velocities are decreased at the diversion tie-in point compared to the downstream reach in the existing scenario. The average velocity values are therefore decreased from the existing to the diversion scenario.

The stream power values within Hail Creek during a 2 % AEP event are generally above the ACARP recommended value for both the existing and post-diversion scenarios. Stream power values immediately upstream of the diversion at the tie-in point are increased because of the high velocities. This results in increases of the average stream power within this reach. Given the localised nature, the potential erosion can be managed through scour protection at the tie-in point. Within the diversion reach, the stream power values are similar in the diversion scenario to the existing scenario. The average stream power value is slightly decreased under the diversion scenario. Downstream of the diversion reach, stream power values decrease at the tie-in point and therefore slightly decrease the average stream power values relative to the existing scenario. Tie-in points will be further refined in the detailed design stage to minimise scour.

Bed shear stress values upstream of the diversion reach are higher than the ACARP recommended value of 80 N/m^2 for both existing and post-diversion scenarios. Like the velocity and stream power results, the bed shear stress at the tie-in point increases significantly under the diversion scenario, thus increasing the average shear stress value. Within the diversion reach, the average shear stress value decreases to below the ACARP recommended value. Downstream of the diversion reach, the shear stress decreases at the tie-in point hence decreasing the average shear stress in the diversion scenario.

In the 39 % AEP design event, although the average velocity values for all reaches are above the ACARP guideline value (1.5 m/s), the average values for the diversion scenario generally decrease compared to the existing situation, apart from the upstream reach which increases slightly.

The results for stream power and bed shear stress follow a similar pattern, where results are generally above the ACARP values but the values for the diversion scenario are similar to or less than the existing scenario. It should be noted that the decrease in hydraulic parameters at approximately Chainage 2100 (refer to arrow on **Figure 8-11**) is due to a tributary joining the diversion channel.

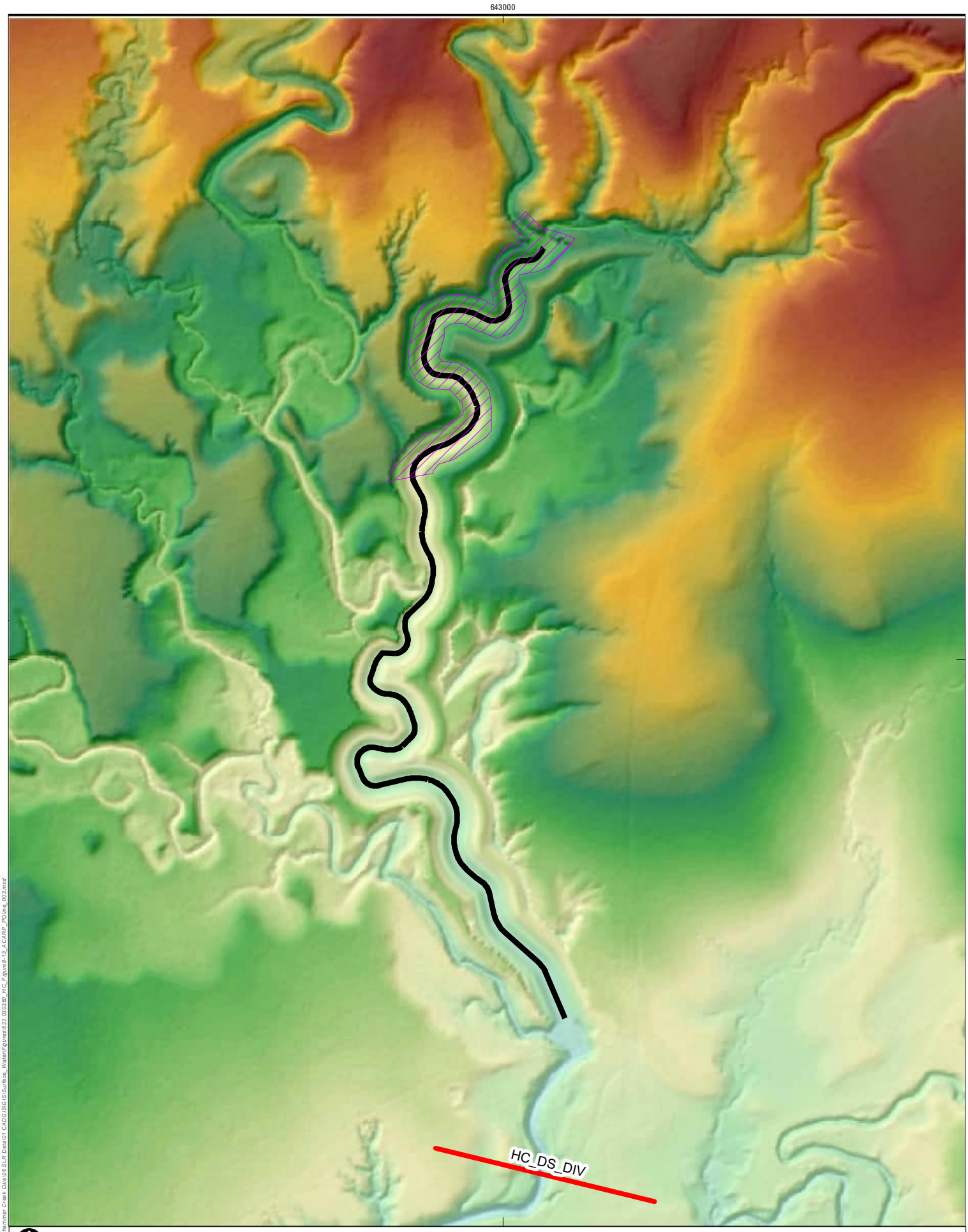
The majority of diversion design parameters for stream power, velocity and bed shear stress for both the 39 % AEP and 2 % AEP events are within the variances seen in the existing hydraulic conditions, excluding the tie-in points and at tributary inflow points. Although some parameters are outside the range of DRNME (2019) Guideline values for supply/transported limited systems, the majority of values decrease relative to the existing scenario values. This analysis demonstrates that the diversion is feasible from a hydraulic and geomorphic perspective with a low risk of instability, both currently and in the future. It is recommended that scour protection measures are implemented as part of detailed design for the upstream tie-in point of the diversion, and other localised areas exhibiting high potential erosion risk (depending on the channel material).

Figure 8-13 shows the sections of the diversion where the bed shear stress is higher in the diversion scenario than the existing scenario in the 2% AEP event (refer to long-section in **Appendix E.1.3**). Armouring of this section of the diversion channel, and other areas where

high bed shear stress has been identified and should be considered during detailed design phase to provide channel stability and protect against meander migration.

8.3.5 Pre/post-mining hydrology and connectivity

An analysis was undertaken of the peak flow downstream of the diversion for the existing scenario and diversion scenario at the flow extraction line HC_DS_DIV as shown in **Figure 8-13**. Hydrographs of the 39% AEP, 2% AEP , 1% AEP and 0.1% AEP critical duration events are shown in **Figure 8-14**, **Figure 8-15**, **Figure 8-16**, and **Figure 8-17** respectively. The peak flow decreases in the diversion scenario by approximately 0.8% to 2.6% compared to the existing scenario. These results indicate that there have been marginal changes in the flow downstream of the diversion.



0 25 50 100 Meters

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,000 at A3
Project Number:	623.030360
Date:	11-Sep-2025
Drawn by:	TS

LEGEND

- Mitigation Area
- Flow extraction line
- Hail Creek Diversion

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

ACARP Exceedence Area and Flow Extraction Line

Figure 8-13

H:\Projects-SLR\623.TSV\623.030360.00001 Hail Creek Schlammer Creek Dive\06 SLR Data\01 CAD\GIS\GIS\Surface_Water\Figures\623.030360_HC_Figure8-13_ACARP_POline_003.mxd

Figure 8-14 39% AEP peak flow comparison

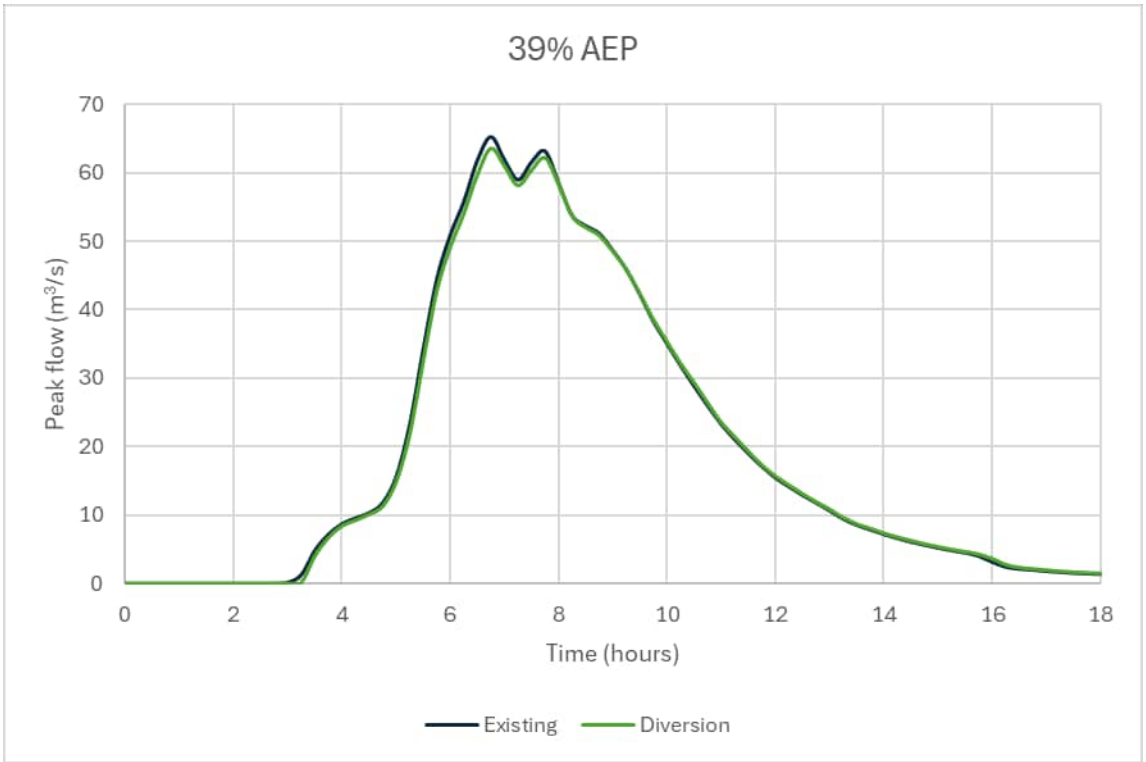


Figure 8-15 2% AEP peak flow comparison

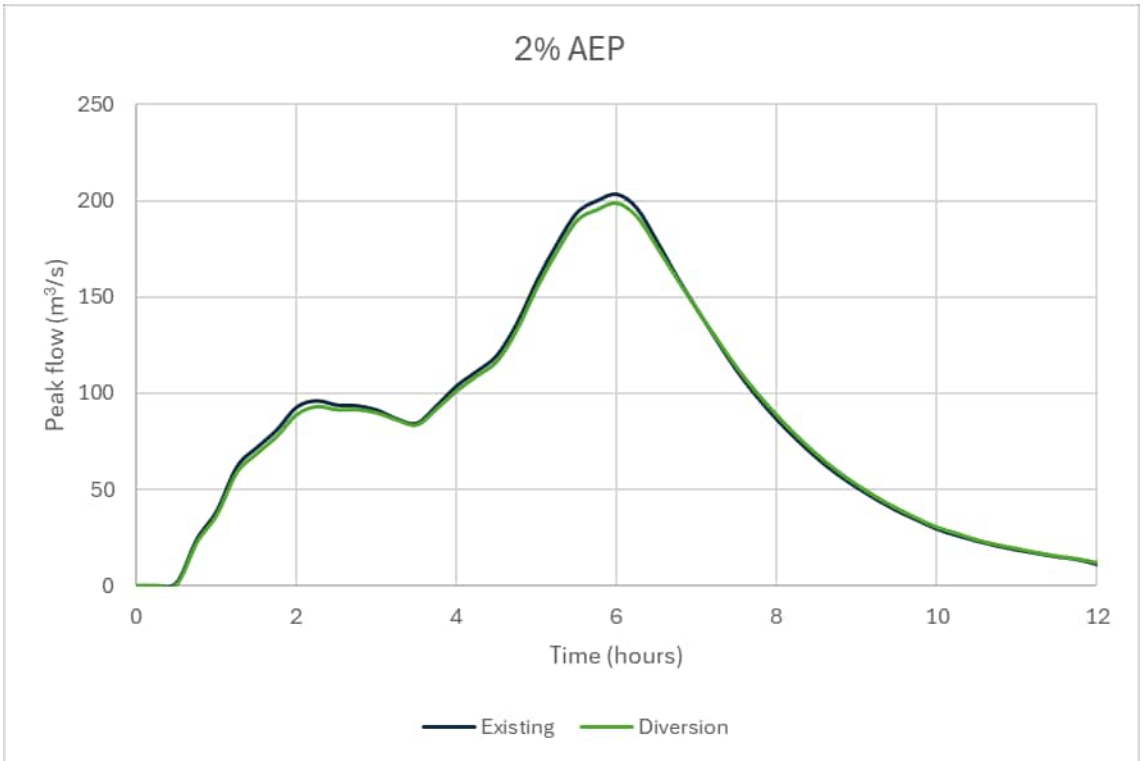


Figure 8-16 1% AEP peak flow comparison

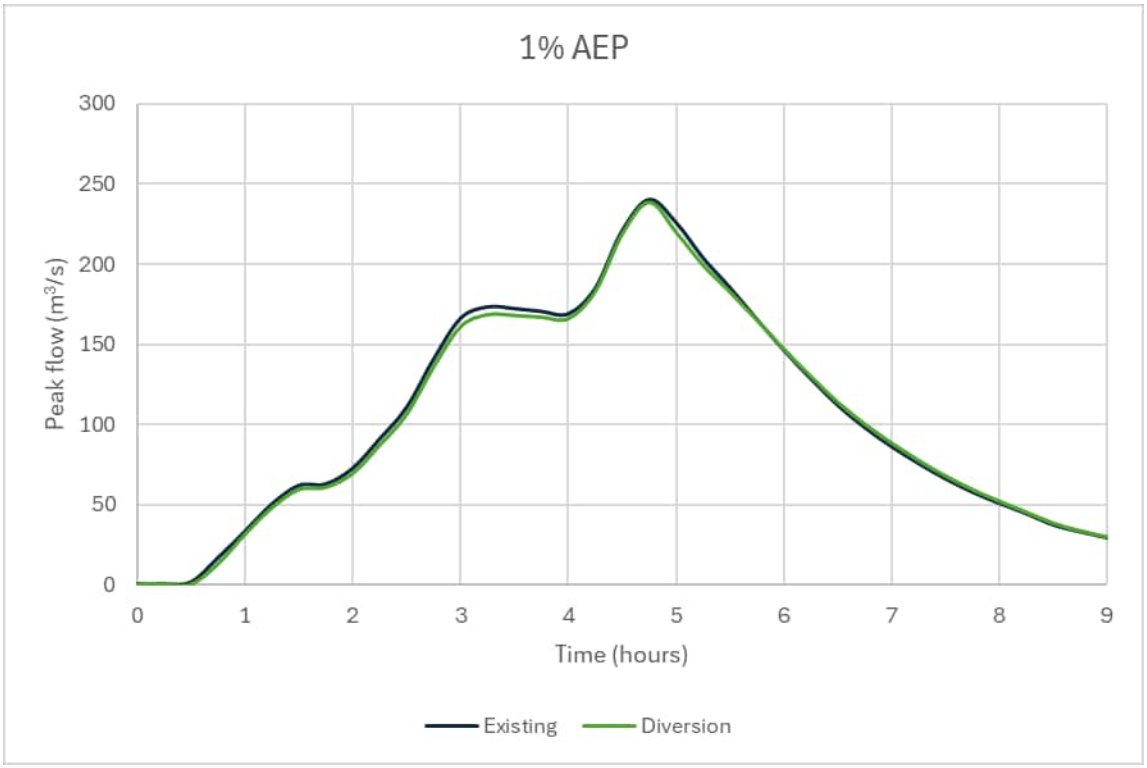
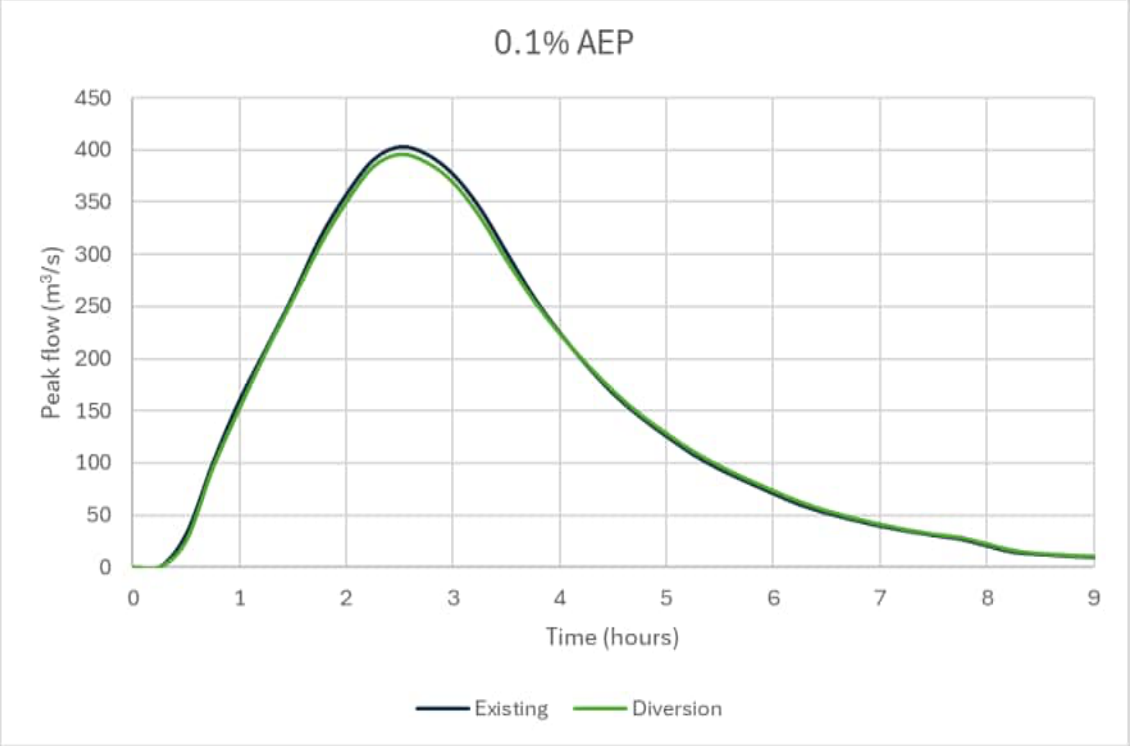


Figure 8-17 0.1% AEP peak flow comparison



8.3.6 Vegetation resilience

ACARP (2014) provides recommendations on shear stress thresholds for vegetation types and communities as part of rehabilitation activities used in watercourse diversions (depicted in **Section 3.2** and **Table 3-4**). The diversion design parameters fall above the ACARP recommended value for buffel grass (40 N/m^2) but within the recommended value for a structurally diverse suite of established native vegetation (120 N/m^2). As outlined in **Table 8-7** and **Appendix E**, the results of the hydraulic modelling illustrate that velocities, bed shear stress and stream power are generally reduced in the diversion relative to the existing scenario. **Section 7.5** provides details of the proposed revegetation strategy. This involves the establishment of native vegetation similar to the existing landscape. Therefore, the outcomes of the hydraulic modelling indicate that the vegetation within the diversion will exhibit resilience similar to existing conditions and ACARP guidelines.

A summary of additional erosion thresholds for different boundary materials are listed in **Table 8-8**. These thresholds should be used to determine revegetation strategies addressed in **Section 7.5**.

Table 8-8 Erosion thresholds for different boundary materials (ACARP, 2014)

Boundary Category	Boundary Type	Shear stress erosion threshold (N/m^2)
Soils	Fine colloidal sand	1.5
	Sandy loam (non-colloidal)	1.9
	Alluvial silt and silty loam (non-colloidal)	3
	Firm loam and fine gravel	4
	Stiff clay and alluvial silts (colloidal)	12
Gravel/Cobble	25 mm, 50 mm, 150 mm and 300 mm	15, 30, 100 and 200 respectively
Vegetation	Mature buffel grass	40
	Structurally diverse, good quality, established native vegetation (ground cover shrubs, trees and instream vegetation if / as appropriate)	120
Biodegradable erosion control matting	Jute mat	22
	Coconut fibre with net	110
Non-degradable rolled erosion control products	Un-vegetated	145
	Partially established	285
	Fully vegetated	380

8.3.7 Limitations

The erosion potential analysis was undertaken based on the ACARP guidelines listed in **Section 3.2**. ACARP guideline values were determined using HEC-RAS 1-d modelling, as this was the commonly used software at the time the guideline was published. However, currently, 2-d modelling is the industry standard method of modelling parameters such as velocity and bed shear stress in two-dimensional flow, as is the case for the existing Hail Creek and proposed diversion. The TUFLOW software is an accepted and widely used software package for this purpose.

The ACARP Design Criteria are based on HEC-RAS modelling, which provides cross-sectionally averaged outputs, as opposed to TUFLOW model results, which are depth-averaged. The TUFLOW results were analysed at several cross-sections which showed that the extraction of the parameters through the central alignment was generally consistent with the cross-sectional average.

8.4 Sediment Transport Model

In accordance with Outcome 4 of the DNRME (2019) Guideline*: Works that interfere with water in a watercourse for a resource activity - watercourse diversion authorised under Water Act 2000,* a sediment transport model was developed. Outcome 4 for the functional design stage states:

> *The permanent watercourse diversion maintains a sediment transport regime that allows the watercourse diversion to be self-sustaining, while minimising the impacts to upstream and downstream reaches.*
>
> *An appropriate sediment transportation model should provide an investigation of the current watercourse and proposed watercourse diversion sediment transportation regime.*

Whilst the Guideline requires a sediment transport model, it does not provide any further details. The ACARP (2014) sediment transport method for watercourse diversion design of alluvial channels was therefore adopted for the assessment as the best practice approach. The ACARP method includes key assessments:

1. Develop models for stream flow events with the capacity to mobilise and transport sediment. The events modelled are typically 2 % AEP (50-year ARI) and 39 % AEP (2-year ARI).
2. Determine whether the short to long-term bed load sediment supply is either transport-limited or supply-limited.
3. Identify whether the stream type of the existing and the design diversion is alluvial or bedrock controlled.
4. Identify and develop the proposed diversion stream, cross-section geometry, and bedgrade.
5. Compare the theoretical sediment transport capacities of the diversion reach with the natural reaches. The annual bedload capacity of the diversion should be within +/-20 % of the natural upstream and downstream reaches.

To assess the diversion design, sediment transport modelling was conducted to compare rates within the existing creek and the proposed diversion. Sediment transport modelling can be performed using sediment transport capacity (STC) formulae, sediment transport models, or sediment impact assessment methods to determine a sediment transport load. It is noted that STC computations do not take account of sediment inflow, erosion, or deposition but can be used to calculate theoretical reach-averaged sediment transport capacity. This assists in understanding current and future geomorphological conditions.

Sediment transport modelling is limited in areas like Hail Creek because of a lack of high-quality sediment datasets and the intermittent nature of the flows. As a result, ACARP developed a methodology which uses stream power as a substitute for STC where bedload supply and transport datasets are absent or unreliable. Stream power, as determined using the TUFLOW model, has been described earlier in this report.



While sediment data is limited, a 1-D HEC-RAS model was developed for both the existing creek and the proposed diversion to provide a qualitative assessment of the proposed diversion's impact on sediment transport within the reach.

8.4.1 Software

For this analysis, a one-dimensional steady-state model was developed in HEC-RAS to assess the hydraulic impacts of the diversion against the performance criteria outlined in the DNRME (2019) Guidelines. HEC-RAS sediment transport analysis was used to model sediment transport and to determine the sediment load and capacity to transport load. The results of this model are provided as average cross-section values.

STC is the amount of sediment a unit of water can transport. The function describes the capacity for bed and suspended load. The results can provide discharge rating curves to help predict fluvial processes. The 1-D HEC-RAS model can estimate the STC for each cross-section under different flow regimes.

8.4.2 Model Development

8.4.2.1 Methodology

Diversion design parameters are modelled under both the 39 % AEP (2-year ARI) and 2 % AEP (50-year ARI) peak discharge hydrographs developed using the WBNM model.

Central Queensland has been noted to have limited high-quality datasets for sediment transport, making modelling difficult (ACARP, 2014). ACARP (2014) guidelines note that the sediment transport function developed by Yang (1973) is best suited for central Queensland. This equation is most accurate for rivers with the dominant grain size of sand.

The following parameters (**Table 8-9**) were adopted in the models.

Table 8-9 HEC-RAS Model Parameters

Parameter	Value
Sediment Transport Function	Yang
Sorting Method	Active Layer
Fall Velocity Method	Toffaleti

8.4.2.2 Model Inputs

Sediment grading was adopted from the sediment samples collected and analysed during the geomorphic field programme. The samples classified the primary stream particle as very coarse sand 2.0 mm. The field programme also measured sediment grading at a number of locations. A particle size distribution (PSD) curve of Hail Creek (**Figure 8-18**) is required for the sediment transport model and is further described in **Section 8.4.3.** The bed material is classified as silty sands to cobbles and small boulders, with sand with gravel as the dominant particle size.

The existing and designed stream lengths adopted for the sediment transport models are 2 km long. Other properties are listed in **Table 8-10**.

The hydraulic roughness or Manning's n values were determined through previous assessments and adopted throughout this report. The values listed in **Table 8-11** were used in the HEC-RAS model for the various land uses in the model.

No sediment rating curves of Hail Creek were available. The HEC-RAS manual provides guidance on sediment rating curves based on stream gauging information. The Water Monitoring Information Portal WMIP provided discharge information from the closed Bee Creek gauging station (130411A) (refer to **Figure 8-19**) operated by the Department of Regional Development, Manufacturing and Water. It is crossed by the Suttor Development Road (Bee Creek Alert station number 533122), approximately 4 km south of the southern end of HCOC. This gauging station has been in operation since March 2011, although there appears to be no official rating curve/equation for the gauge. The available raw water level data for this gauge shows that levels of more than 1 centimetre (cm) were recorded only 23 % of the time, >10 cm 18 % of the time, and levels exceeding 1 m 7 % of the time. Mackay's standard soil erosion loss is 4,220-22,700 t/km/yr (Olive, 1985). This information was used to establish a sediment rating curve and sediment boundary conditions in HEC-RAS. The sediment rating curve adopted is shown in **Figure 8-18**. While there is considerable uncertainty regarding the accuracy and reliability of the rating curve defined in this manner, this uncertainty has no effect when comparing the existing situation with that after the diversion. The relative changes in sediment transport are likely to be valid.

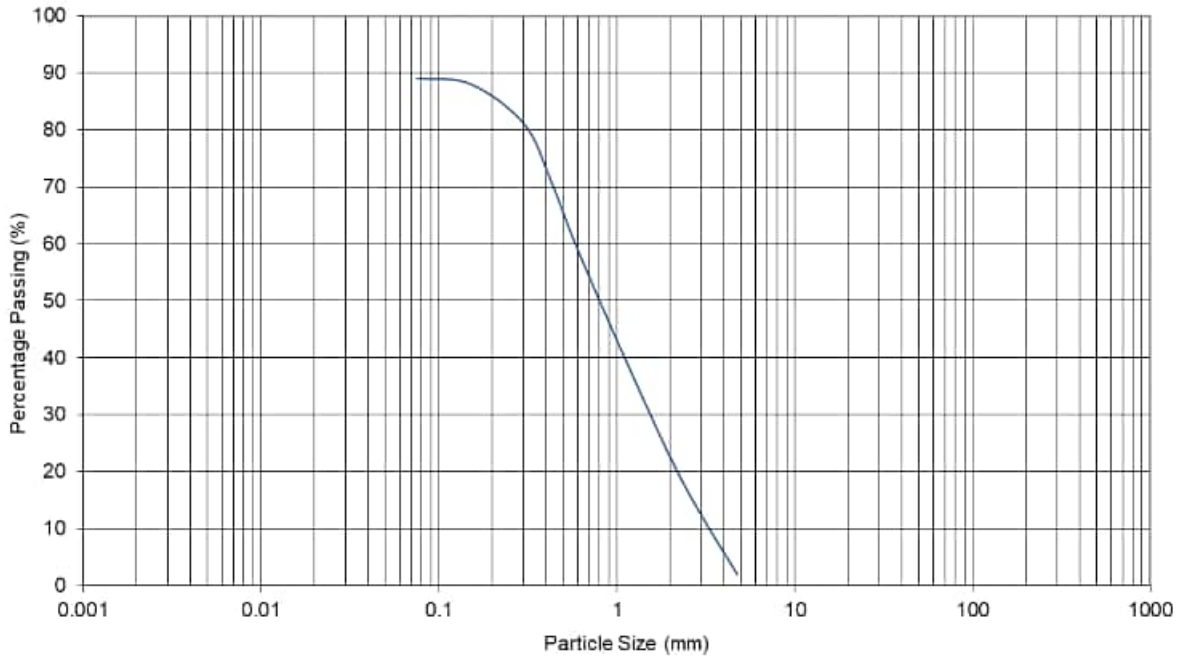


Figure 8-18 PSD Curve

625000 630000 635000 640000 645000 650000 655000 660000 665000

7635000 7630000 7625000 7620000 7615000 7610000 7605000 7600000 7595000 7590000 7585000

Bone Creek
Moonlight Creek
Oaky Creek
Cooper Creek
Nine Mile Creek
Schammer Creek
Brumby Creek
Four Mile Creek
Hail Creek
Middle Creek
Absent Creek
Anna Creek
Noah Creek
Walker Creek
Bee Creek
Teviot Creek
Sandy Creek
Kemmis Creek
Plumtree Creek
Walker Creek
Bee Creek
Cooper Creek
Carborough Creek
North Creek
Spring Creek
Thirty Mile Creek
Humbug Gully
Long Gully
Spring Gully
Thirty Mile Creek

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 1 2 4 km

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:150,000 at A3
Project Number:	623.030360
Date:	11-Sep-2025
Drawn by:	TS

LEGEND

- Site Boundary
- Watercourses
- Bee Creek Gauging Station

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Bee Creek Gauging Station

Figure 8-19

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel06 SLR Data\01 CADG\SIG\SIS\Surface_Water\Figures\623.030360_HC_Figure8-19_gauge_001.mxd

Table 8-10 HEC-RAS Input Parameters

Parameter	Value
Temperature	25°C
Specific Gravity	2.65 (g/m^3)
Upstream Boundary Conditions	- 2 % AEP peak discharge at critical duration - 39 % AEP peak discharge at critical duration
Downstream Boundary Conditions	Normal depth, 0.006, as determined by the downstream channel grade.

Table 8-11 HEC-RAS Mannings Roughness Values

Land use	Manning's n Value
Existing Creek	0.04
Hail Creek Diversion	0.04

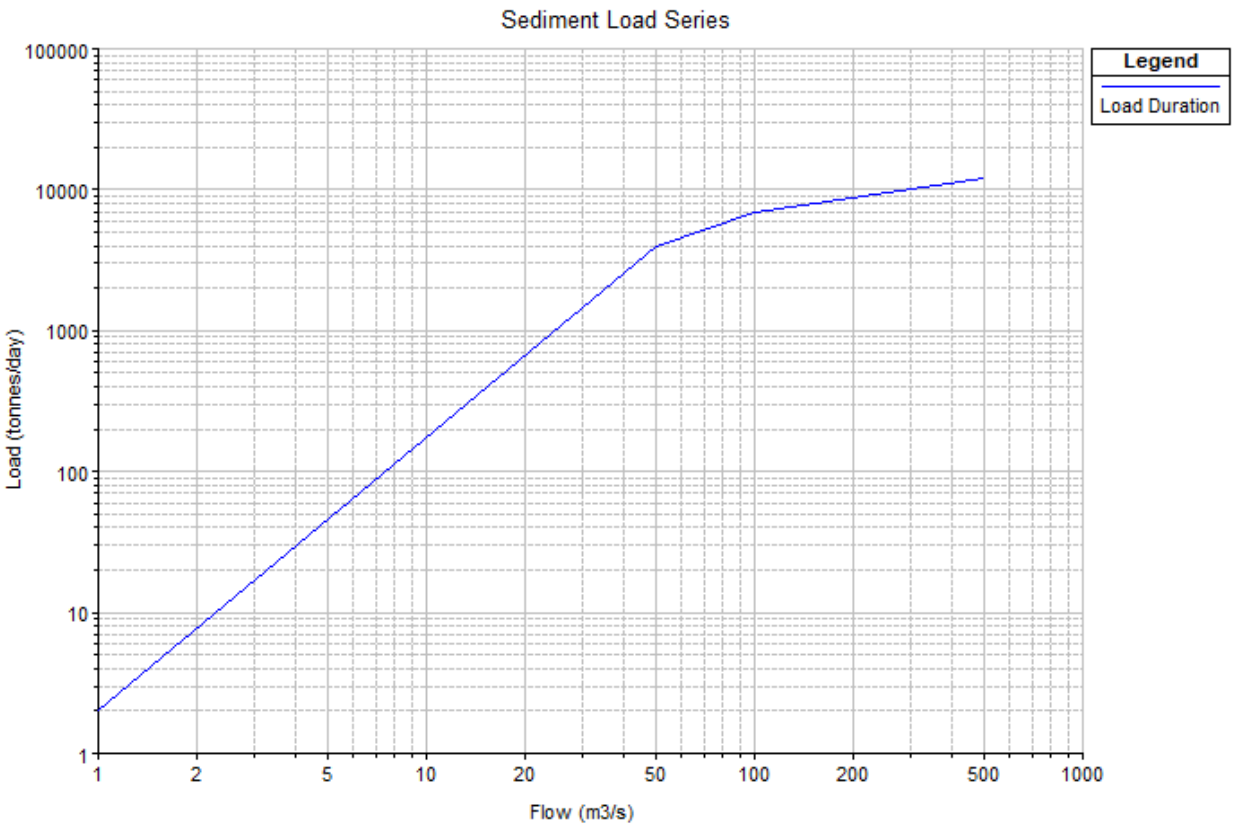


Figure 8-20 Sediment Rating Curve

8.4.3 Sediment Transport Results

The sediment transport assessment reviews the effects of the diversion on stream reaches upstream and downstream and considers both direct and indirect impacts. The results from the HEC-RAS sediment transport model are shown in **Figure 8-21** for the 39 % and 2 % AEP events. The results include the estimates developed for the annual capacity of Hail Creek and the sediment loads. These estimates are compared to determine the sediment transport mechanism of the stream.

The sediment load is impacted more during the higher velocity 2 % AEP event compared to the 39 % AEP event, as expected. The 39 % AEP event increases in sediment load rate compared to the existing case. This is consistent with the soil erosion loss in the Mackay region. The capacity is less than the annual sediment supply rate, and therefore, the sediment transport can be classified as transport-limited (i.e. the sediment transport capacity is less than the sediment supply provided by the catchment). The sediment load increases downstream, indicating the ability to maintain the sediment transport regime. The proposed Hail Creek Diversion is, therefore, self-sustaining and alluvially controlled.

In both the 39 % and 2 % AEP scenarios, the existing case results in a sediment load that is 15 % lower than that of the diversion design case. This is within the acceptable ACARP guidelines as the bedload capacity of the design reach is within +/-20 % of the natural upstream and downstream reaches. The functional design is therefore considered to achieve Outcome 4.

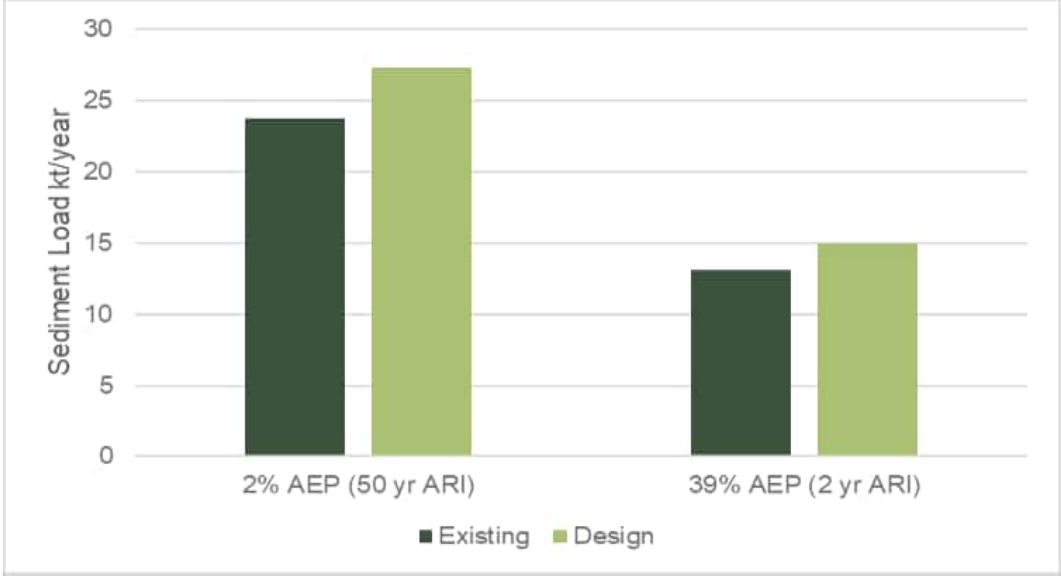


Figure 8-21 Sediment Transport Capacity Results

8.4.4 Sediment Transport Modelling Limitations

It is noted that there are a number of limitations to sediment transport modelling, including, but not limited to:

- The results are limited to the accuracy of the input data. Data used in this assessment was provided HCC and by the field program. Field data was collected at discrete locations and, therefore, cannot fully capture the variability over the length of the diversion, particularly with regard to the sediment grading.
- The choice of sediment transport formula can drastically affect the results. The Yang transport equation used in the model was adopted based on the recommendation by the ACARP guidelines as outlined in the 2014 report. This equation was recommended for central Queensland and is most accurate for rivers with sand being the dominant grain size, as is the case for Hail Creek.
- The rating curves have considerable uncertainty when estimated from public data; however, as noted earlier, while there is considerable uncertainty regarding the accuracy and reliability of the rating curve, this uncertainty has no effect when comparing the existing situation with that after the diversion. The relative changes in sediment transport are likely to be valid.

Improving the dataset, such as providing sediment curves and historical flow rates and including more spatial variability, may improve the accuracy of the results of the sediment model. However, for comparison purposes it is considered reasonable for functional design.

8.5 Groundwater

An assessment has been made of the proposed diversion in relation to groundwater, and specifically any potential changes to existing surface water – groundwater interactions.

Hail Creek is ephemeral and not supported by groundwater discharge (baseflow) i.e., it is not directly connected to the groundwater system. This situation is maintained by the proposed diversion which is not anticipated to intersect the water table. This conclusion is based on the water table elevations predicted along the diversion at various stages of the mining operations from a numerical groundwater model previously prepared by SLR for HCC (report 626.30128-R03 Hail Creek Open Cut Eastern Margin Extension, Groundwater Modelling Technica Report Revision 4.0, dated 17 April 2025).

There are no identified receptors in the vicinity of the natural channel reach or the diversion that are dependent on groundwater connectivity. The Bureau of Meteorology National Atlas of Groundwater Dependant Ecosystems (GDE Atlas) (BoM, 2017) is a national scale mapping tool that delineates sites with the potential for dependence on groundwater. The GDE Atlas mapping designates sites as having high, moderate or low potential for groundwater dependence. The GDE Atlas is considered a “first pass” tool to inform an initial assessment of the potential for Groundwater Dependent Ecosystems (GDE) in an area, which may then be ground-truthed by field surveys. It is not a robust tool for identifying whether GDEs actually exist within a study area. SLR has prepared an assessment on the terrestrial and aquatic GDE (report 626.30128.00018 Hail Creek Open Cut Eastern Margin Extension - Terrestrial and Aquatic Groundwater Dependant Ecosystems Revision 4.0, dated 29 April 2025).

The GDE Atlas designates a “high potential” for aquatic GDEs along much of Hail Creek and a “moderate potential” for aquatic GDEs along the reach to be diverted. However, given the ephemeral nature of the watercourse, this designation is considered erroneous, and it is highly unlikely that aquatic GDEs exist along this section of Hail Creek. Potential terrestrial GDEs are identified along the lower reaches of Hail Creek but not along the reach to be diverted. Terrestrial GDE surveys at selected locations on Hail Creek are scheduled for the 2024 dry

season to determine their actual presence (or not), sensitivity, and level of dependence on groundwater.

The lack of surface water – groundwater connectivity along the section of Hail Creek to be diverted, and the absence of identified groundwater receptors in the vicinity of the natural channel or the diversion, means that there is not anticipated to be any significant impact on groundwater resources or groundwater dependent receptors caused by the diversion.

9.0 Diversion Monitoring Program

A monitoring program for Hail Creek Diversion has been developed in accordance with the ACARP (2001) Project C9068 Monitoring and Evaluation Program for Bowen Basin River Diversions. This was necessary in the absence of a standardised HCC approach to onsite diversion monitoring.

HCC has one current creek diversion (Brumby Creek Diversion and Dam) with the following obligations for monitoring as per the Water Licencing requirements:

- The licensee is required to monitor the performance of the works by way of a report prepared by a registered professional engineer to coincide with:
  - At renewal of the water licence.
  - At any time if alarming, unusual, or otherwise unsatisfactory conditions are observed.
- The report must detail the following:
  - The performance of the works by way of comparison with the design report, approved plans, and specifications.
  - Surveys to identify and quantify any changes to the licenced works.
  - Detail any remedial works to be undertaken.

A monitoring program in accordance with ACARP (2001) criteria is required by DNRME (2019) Guidelines and is described below for the Hail Creek Diversion. There are four key stages to the monitoring programme. These are described in detail and summarised in **Table 9-1**. Monitoring will be conducted over three reaches:

- A control reach located upstream of the diversion - from chainage marker 0.5 km to 1.5 km along Hail Creek (depicted in **Figure 5-1**).
- The reach to be diverted – from chainage marker 1.5 km to 3.5 km along Hail Creek (depicted in **Figure 5-1**).
- The downstream reach, located immediately downstream of the diversion - from chainage marker 3.5 km to 4.5 km (depicted in **Figure 5-1**).

Table 9-1 Diversion monitoring program stages (ACARP, 2001)

Monitoring Stage	Objective
Baseline Monitoring	To establish a baseline dataset (e.g. LiDAR and photographs) that can be used for comparison at the time of licence renewal or diversion relinquishment.
Construction and Establishment Monitoring	To ensure the diversion is constructed to the correct specification through technical oversight of construction and documentation of as constructed works, including any amendments from design.
Operations Monitoring	To monitor and evaluate the diversion's performance and confirm that this is consistent with the original design intent.
Relinquishment Monitoring	To demonstrate that the diversion is operating as a watercourse and has reached equilibrium with adjoining reaches.

9.1 Baseline monitoring

Baseline monitoring will ideally be conducted over a period of 24 months prior to construction to ensure a baseline dataset is developed. This accounts for the ephemeral nature of the creek and allows for sufficient data collection to capture a range of seasonal variations in flow regime. Baseline monitoring is required to assess the long-term performance requirements for operations and relinquishment monitoring of the diversion as discussed herein.

Baseline monitoring will be utilised to establish control reaches for the diversions to determine if changes in the diversion are a result of isolated processes or an event affecting the whole stream system. Monitoring will undertaken in the designated control reach, the reach to be diverted, and the designated downstream reach described above. The exact locations will be determined onsite and adequately marked/surveyed to ensure consistency in monitoring.

The Index of Diversion Condition (IDC) method of recording and monitoring creek diversions will be used for the baseline monitoring in accordance with the ACARP (2001) Criteria. The IDC is used to identify potential management issues rather than provide a scientific assessment of a diversion or stream. The IDC method utilises transects within the reaches with indicators for the geomorphic and riparian index assessed in each transect. The baseline monitoring requirements are outlined **Table 9-2**.

Table 9-2 Baseline monitoring requirements

Actions	Purpose
IDC	The IDC method will be undertaken at four transects at each of the control reaches and within the reaches to be diverted. Photographs will be taken to record the condition of the stream or river before works are initiated. Photographs will be taken of the control reach, the reach to be diverted and the downstream reach. It is recommended that photographs be taken from fixed points along the control and diversion reaches to allow future comparison.
Aerial Photographs	Aerial photos displaying the existing condition of the creeks and also the location of the new diversion will be taken before works begin. The scale of the aerial photo should be sufficient to allow accurate measurements of the diversion and adjoining river or stream.
Survey	A cross-section survey and long section survey of the stream or river upstream (Control reach) and downstream (Downstream reach) of the proposed diversion will be conducted as part of diversion detailed design. This information will be useful during relinquishment monitoring to demonstrate the diversion has had no adverse impacts on upstream and downstream reaches. In addition, SLR recommends repeat LiDAR be captured for the existing and diversion reach to record a baseline and monitor change.
Vegetation	The species, abundance and diversity of vegetation in the reach to be diverted will be recorded prior to diversion detailed design and construction. This information will also be used as part of the revegetation of the new diversion and used for comparison during relinquishment monitoring.
Flow Events	In the absence of flow data, information regarding the site and frequency of flow events will be approximated by validation of debris marks against hydraulic modelling undertaken in this report.



9.2 Construction and Establishment Monitoring

Construction and establishment monitoring will begin with construction of the diversion of Hail Creek and continue until the diversion becomes operational. A summary of the monitoring requirements to be undertaken in this phase are provided **Table 9-3**.

Table 9-3 Construction monitoring requirements

Actions	Purpose
Execution Outputs	An execution output database will be developed to record descriptions of the design activities completed. The date of activity and completion will be noted along with details of any accompanying photographs. Design activities not completed to specification are to be recorded through as constructed drawings with an explanation and details of the modified design.
Photographs	Photographs will be taken during and immediately after the construction work is finished. Photographs will be taken from fixed photo points where possible and details such as date, time and weather conditions should accompany the photographs.
Aerial Photographs	Aerial photographs will be taken immediately after diversion construction and establishment has been completed. These photos will accurately display the extent of change and provide a baseline reference for changes that may occur in the future. Additionally, a particular feature of the rehabilitation program may be modified and details of the modification may not be recorded in the database. An aerial photograph may record the modification.

9.3 Operational Monitoring

Operational monitoring will commence after commissioning of Hail Creek Diversion to assess the long-term performance of the system. A summary of the operational monitoring requirements is provided in **Table 9-4**.

A combination of fixed time and trigger event-based monitoring will be used throughout the life of the diversion. This combination represents the most effective strategy for assessing long term trends as well as the direct impacts associated with large defined flood events. The monitoring frequency for the diversions is summarised below:

- Monitoring should be undertaken directly after the wet season at pre-determined frequencies of 1, 2, 5, 7, 10, 15, 20, 25 and 30 years, and
- Trigger event based monitoring is recommended for floods greater than the 10 % AEP event. This is to be reassessed during the detailed design phase, and at any time when poor performance and/or potential failure of the diversion is observed.

Upon completion of each operational monitoring assessment, a performance report will be prepared for the Hail Creek Diversion by a registered RPEQ. The report will include the following:

- An assessment on Hail Creek Diversion performance in comparison to the approved design documentation, including Design Plans, specifications, and monitoring/maintenance strategies.
- An assessment of site surveys to identify and quantify any changes to the channel bed and permanent corridor width.
- Provide detail on any remedial works to be undertaken including a timetable for completion of proposed works.

- Provide any recommendations on measures to maintain the physical integrity of the works.

Table 9-4 Operational monitoring requirements

Actions	Purpose
Survival of Works	The survival of in stream works including scour protection, timber piling and vegetation should be assessed during this phase of monitoring. Early detection of failure is likely to increase the options for remedial action.
Photographs	Photographs will be taken from fixed photo points along the Control reach, Diversion reach and Downstream reach on an annual basis.
Aerial Photographs	Aerial photographs of the Control reach, Diversion reach and Downstream reach should be taken on an annual basis.
Index of Diversion Condition	The IDC method will be undertaken at four transects for each at each of the control reaches and within diversions. Photographs will be taken to record the condition of the stream within the control and diversion reaches. It is recommended that photographs be taken from fixed points along the control and downstream reaches to allow future comparisons.
Survey	Longitudinal section and cross section surveys should be conducted in the Control reach, Diversion reach and Downstream reach. These surveys should be repeated every 5-years or after a major flood event (39 % AEP).
Flow Events	Flow events should be monitored to determine the size of events the diversion has carried through installation of water level monitoring.

9.4 Relinquishment monitoring

Relinquishment monitoring will commence at the end of the mine life to demonstrate that Hail Creek Diversion is operating as a waterway in dynamic equilibrium and not having an adverse impact on adjoining reaches. A summary of the operational monitoring requirements is provided in **Table 9-5**.

Table 9-5 Relinquishment monitoring requirements

Actions	Purpose
Stage 1 Survey	Long-section and cross-section survey will be conducted during the first year of relinquishment monitoring. The survey should include the Control reach, Diversion reach and Downstream reach. This survey should be compared to the ‘as built’ long section to assess the change in bed elevation.
Stage 1 Evaluation	Survey data from baseline and operational monitoring should be compared with data during relinquishment monitoring. Rates of change for channel top width, cross-section area, horizontal displacement and vertical displacement for the control reach, diversion reach and downstream reach should be calculated.
Vegetation Assessment	Detailed vegetation assessment should be conducted during first year of relinquishment monitoring to determine key species absent from Diversion reach but present in Control reach.
Photographs	Photographs should be taken from fixed photo points in the Control, Diversion and Downstream reaches.
Aerial Photographs	Aerial photos of diversion and Control, Diversion and Downstream reaches should be taken on an annual basis.

Actions	Purpose
Stage 2 Survey	A final long-section and cross-section survey should be conducted prior to application for licence relinquishment.
Stage 2 Evaluation	All data should be evaluated and photographs collated for presentation to regulators.

10.0 Alignment with Key Outcomes of DNRME Guidelines

The proposed watercourse diversion meets all the five key outcomes of the DNRME (2019) Guidelines. A summary of the key outcome from the DNRME (2019) Guideline and commentary on how its met has been provided in **Table 10-1**.

Table 10-1 Summary of the proposed diversion meets the five key DNRME (2019) Guidelines

DNRME (2019) Guideline Key Outcome	Comment on Proposed Watercourse Diversion
Outcome 1: The permanent watercourse diversion incorporates natural features (including geomorphic and vegetation) present in the landscape and in local watercourses	A geomorphic study of the existing watercourse channel that is to be diverted and 1 km upstream and downstream of the proposed diversion has been undertaken **(Section 5.0**). A riparian assessment was undertaken for the existing watercourse channel to be diverted. Section 7.0 and Section 7.5 outlines the geomorphic and vegetation characteristics to be maintained for the diversion channel.
Option 2: The permanent watercourse diversion maintains the existing hydrologic characteristics of surface water and groundwater systems	Hydraulic geometry of the proposed diversion alignment (Section 7.3) is comparable to the existing alignment (Section 5.2). Section 8.0 outlines the hydrologic assessment of the proposed watercourse diversion, including a hydrologic model (Section 8.2).
Outcome 3: The hydraulic characteristics of the permanent watercourse diversion are both comparable with other local watercourses and suitable for the region in which the watercourse diversion is located	Section 8.0 outlines the hydrologic assessment of the proposed watercourse diversion, including a hydrologic model (Section 8.3).
Outcome 4: The permanent watercourse diversion maintains a sediment transport regime that allows the watercourse diversion to be self-sustaining, while minimising the impacts to upstream and downstream reaches	A sediment Transport model has been developed (Section 8.4). The 39 % AEP event increases in sediment load rate compared to the existing case. This is consistent with the soil erosion loss in the Mackay region.
Outcome 5: The permanent watercourse diversion and associated structures maintain equilibrium and functionality and are appropriate for all substrate conditions they encounter	Watercourse diversion design, construction, operation, and monitoring are appropriate to the substrate characteristics (Section 7.0 and Section 9.0) No hydraulic control structures (e.g. drop structures) were used within the diversion

11.0 Conclusion

This report provides the Functional Design for the Hail Creek Diversion and has been prepared in accordance with requirements of the (DNRME (2019) Guideline*: Works that interfere with water in a watercourse – watercourse diversions* (DNRME, 2019) and with the ACARP *Criteria for functioning river landscape units in mining and post mining landscapes* (ACARP, 2014). The report describes the basis of design for the Hail Creek Diversion, the design approach and modelling outcomes to demonstrate that a self-sustaining system can be achieved.

This report has been certified by a suitably qualified and experienced person. Signed statements of certification have been provided in **12.0**.

12.0 Statements of Certification

12.1 Form of Certification for Suitably Qualified and Experienced Person

I hereby state that I meet the requirements of the definition of 'suitably qualified and experienced person' for surface water expert as stated in the DNRME (2019) Guideline.

Statement of certification

I hereby certify that the hydrologic and hydraulic analyses undertaken as part Section 8.1, Section 8.2, Section 8.3 and Section 8.4 of the report entitled Hail Creek Diversion Functional Design Report and dated 25 November 2025 for the Hail Creek Diversion:

- Relates to watercourse diversion of Hail Creek from the western margin of Homevale Pit, trending from north to south before reconnecting to a downstream section of Hail Creek
- Includes all relevant material relied on by me
- Is in accordance with all relevant requirements of the DNRME (2019) Guideline
- Is in accordance with all relevant conditions of EA EPML00661913.

Limitations that apply to the surface water components, for which this certification is provided, are provided in Section 8.3.7, Section 8.4.4 and Section 13.0 of the Hail Creek Diversion Functional Design Report.

This certification does not include the following components as defined in the DNRME (2019) Guideline:

- Geomorphologist
- Geotechnical expert
- Vegetation expert
- Groundwater expert
- Engineer
- Soils expert

I, Hayden Munck, declare that the information and opinions provided as part of this certification is true to the best of my knowledge and belief. I acknowledge that it is an offence under section 480 of the Environmental Protection Act 1994 to give the administering authority a document containing information that I know is false, misleading or incomplete in a material particular.

Signed: ……

[Signature of certifier/including registered professional engineer reference number/s]

Date: 25 November 2025

13.0 References

ACARP, 2001, *Monitoring and Evaluation Program for Bowen Basin River Diversions*, Australian Coal Association Research Program, Program No. C9068.

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Appendix A Vegetation Assessments

Hail Creek Diversion

Replacement Functional Design Report

Hail Creek Coal Holdings Pty Limited

SLR Project No.: 623.030360.00001

25 November 2025

Appendix A Vegetation assessments for Homevale Pit

A.1.1 Vegetation assessments

Table A.1: Species in each vegetation community around Homevale Pit

RE	11.3.25	11.3.25a	11.3.4	11.9.9
Tree / shrub	*E. teretriconis,* Melaleuca bracteate *Ficus opposita* *Corymbia erythrophloia* *Casuraina cunninghamiana*	As 11.3.25, with the addition of *E. raveretiana*[1]	*E. teretriconis,* *Corymbia clarksoniana* *C. erythrophloia* *C. tessellaris* *Atalaya hemiglauca*	*E. crebra* *Corymbia clarksoniana* *C. tessellaris* *C. dallachiana* *Grevillea striata* *Atalaya hemiglauca*
Grasses	*Heteropogon contortus* *Heteropogon triticeus*		*Heteropogon contortus* *Heteropogon triticeus* *Themeda triandra* *Panicum spp.* *Aristida spp.* *Cymbopogon bombycinus*	*Heteropogon contortus* *Heteropogon triticeus* *Themeda triandra* *Panicum spp.* *Cymbopogon bombycinus*
Forbs	*Eustrephus latifolious* *Grewia savannicola* *Grewia latifolia*		*Grewia savannicola* *Grewia latifolia*	*Eustrephus latifolious* *Indigofera pratensis* *Grewia savannicola* *Grewia latifolia*

Table A.2: Existing vegetation communities in the area of disturbance

	11.3.4	11.9.9
Tree / shrub	*E. teretriconis,* *Corymbia clarksoniana* *C. erythrophloia* *C. tessellaris* *Atalaya hemiglauca*	*E. crebra* *Corymbia clarksoniana* *C. tessellaris* *C. dallachiana* *Grevillea striata* *Atalaya hemiglauca*
Grasses	*Heteropogon contortus* *Heteropogon triticeus* *Themeda triandra* *Panicum spp.* *Aristida spp.* *Cymbopogon bombycinus*	*Heteropogon contortus* *Heteropogon triticeus* *Themeda triandra* *Panicum spp.* *Cymbopogon bombycinus*
Forbs	*Grewia savannicola*	*Eustrephus latifolious*

[1] *E. raveretiana* is listed as vulnerable under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). RE 11.3.25a is outside the potential impact area. All efforts should be made to avoid impacting individuals of *E. raveretiana*.

	11.3.4	11.9.9
	Grewia latifolia	*Indigofera pratensis* *Grewia savannicola* *Grewia latifolia*

Table A.3: Reference photos of existing vegetation conditions

Existing Vegetation Conditions		
RE 11.3.25		
RE 11.3.25a		
RE 11.3.4		
RE 11.9.9		

Existing Vegetation Conditions		
Area of Disturbance		
RE 11.3.4		
RE 11.9.9		
Non-remnant		

Appendix B Design Drawings

Hail Creek Diversion

Replacement Functional Design Report

Hail Creek Coal Holdings Pty Limited

SLR Project No.: 623.030360.00001

25 November 2025

HAIL CREEK DIVERSION FUNCTIONAL DESIGN
HAIL CREEK COAL PTY LTD



LOCALITY PLAN
SCALE 1:25000

DRAWING SCHEDULE	
DRAWING NUMBER	DRAWING TITLE
623.030360-CI-1000	COVER SHEET, DRAWING SCHEDULE AND LOCALITY PLAN
623.030360-CI-1100	GENERAL ARRANGEMENT LAYOUT PLAN
623.030360-CI-1200	DIVERSION LONGSECTION
623.030360-CI-1300	TYPICAL CROSS SECTION

0.0 250 500 750 1000
METRES
SCALE 1:25000

IMAGERY PROVIDED BY NEARMAP.COM 2024

PLOT DATE: 23-Aug-2024 2:43:15 PM

REVISIONS				
A	23.08.2024	ISSUED FOR REVIEW	AM	
	DATE	DESCRIPTION	APPROVED	

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PROJECT: HAIL CREEK DIVERSION FUNCTIONAL DESIGN

DRAWING TITLE: COVER SHEET, DRAWING SCHEDULE AND LOCALITY PLAN

SIZE: A1

STATUS: FOR REVIEW

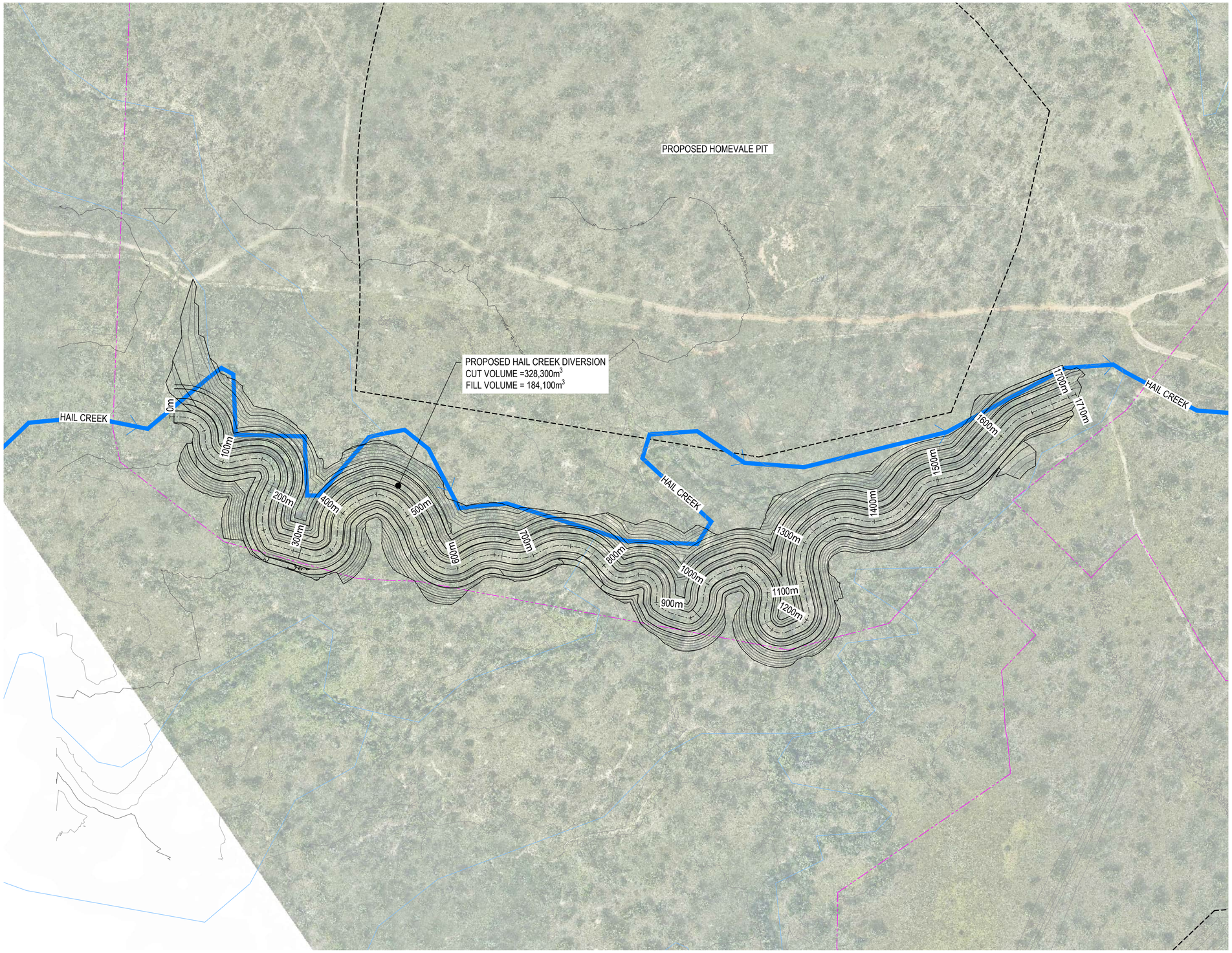
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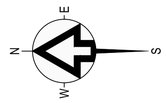
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DRAWING NUMBER: 623.030360-1000

REVISION: A

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGIS\CAD\Drawings\623.030360-CI-1000.dwg





LEGEND	
	EXISTING GROUND CONTOURS
	APPROVED DISTURBANCE BOUNDARY
	EXISTING DRAINAGE LINES (COUNCIL DATA)
	EXISTING HAIL CREEK ALIGNMENT
	DESIGN CONTOURS

0.0 25 50 75 100
METRES
SCALE 1:2500

GENERAL ARRANGMENT PLAN
SCALE 1:2500

IMAGERY PROVIDED BY NEARMAP.COM 2024

PLOT DATE: 23-Aug-2024 2:43:23 PM

REVISIONS				
A	23.08.2024	ISSUED FOR REVIEW	AM
	DATE	DESCRIPTION	APPROVED

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DESIGN:	TS	DATE:	23.08.2024
DWG. CHECK:	AM	DATE:	23.08.2024
DES. CHECK:	EDC	DATE:	23.08.2024
RESPONSIBLE PRINCIPAL SIGNATURE:		DATE:	

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CLIENT: HAIL CREEK COAL PTY LTD

PROJECT: HAIL CREEK DIVERSION FUNCTIONAL DESIGN

DRAWING TITLE: GENERAL ARRANGEMENT PLAN

SIZE: A1

STATUS: FOR REVIEW

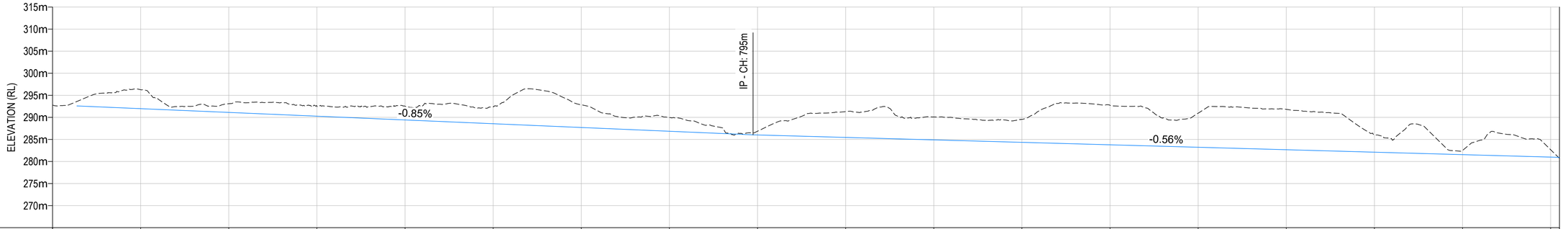
SCALE: 1:2500

DATUM:

DRAWING NUMBER: 623.030360-1100

REVISION: A

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DESIGN SURFACE (RLm)	291.98	291.12	290.27	289.41	288.56	287.71	286.85	286.01	285.46	284.90	284.34	283.79	283.23	282.67	282.12	281.56	281.00	280.95
EXISTING GROUND (RLm)	296.26	293.10	292.55	292.52	292.40	292.86	289.96	286.86	291.31	290.10	289.53	292.74	290.95	291.82	286.08	282.50	282.67	
EXCAVATION DEPTH (m)	-4.28	-1.97	-2.28	-3.10	-3.84	-5.15	-3.11	-0.85	-5.86	-5.20	-5.19	-8.95	-7.72	-9.15	-3.97	-0.94	-1.66	
CHAINAGE (m)	100.00	200.00	300.00	400.00	500.00	600.00	700.00	800.00	900.00	1000.00	1100.00	1200.00	1300.00	1400.00	1500.00	1600.00	1700.00	1710.00

HAIL CREEK ALIGNMENT - LONGSECTION

SCALE H 1:2500
V 1:500

0.0 25 50 75 100
METRES
SCALE 1:2500

IMAGERY PROVIDED BY NEARMAP.COM 2024

PLOT DATE 23-Aug-2024 2:43:24 PM

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	DATE	DESCRIPTION	APPROVED

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DWG. CHECK:	AM	DATE:	23.08.2024
DES. CHECK:	EDC	DATE:	23.08.2024
RESPONSIBLE PRINCIPAL SIGNATURE:		DATE:	

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CLIENT: HAIL CREEK COAL PTY LTD

PROJECT: HAIL CREEK DIVERSION FUNCTIONAL DESIGN

DRAWING TITLE: LONGSECTION

SIZE: A1

STATUS: FOR REVIEW

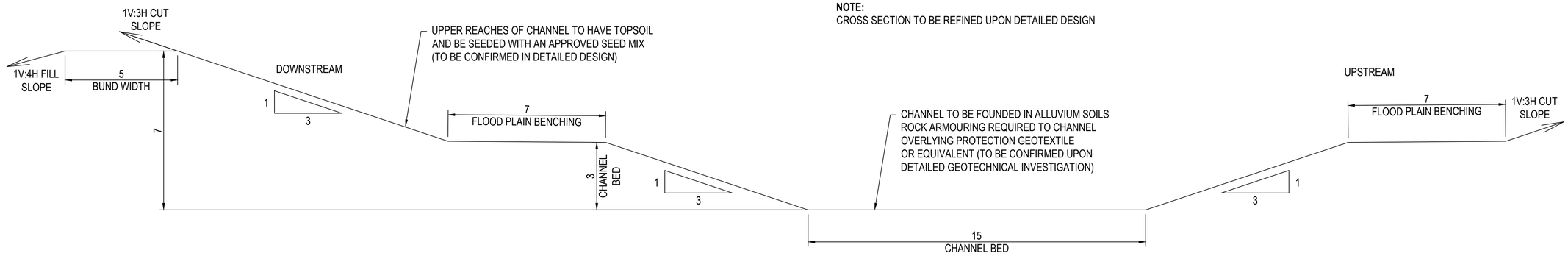
SCALE: 1:2500

DATUM:

DRAWING NUMBER: 623.030360-1200

REVISION: A

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NOTE:
CROSS SECTION TO BE REFINED UPON DETAILED DESIGN

HAIL CREEK DIVERSION TYPICAL CROSS SECTION

SCALE 1:100

0.0 100 200 300 400
MILLIMETRES
SCALE 1:10

REVISIONS				
A	23.08.2024	ISSUED FOR REVIEW	AM	
	DATE	DESCRIPTION	APPROVED	

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DESIGN:	TS	DATE:	23.08.2024
DWG. CHECK:	AM	DATE:	23.08.2024
DES. CHECK:	EDC	DATE:	23.08.2024
RESPONSIBLE PRINCIPAL SIGNATURE:		DATE:	

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CLIENT: HAIL CREEK COAL PTY LTD

PROJECT: HAIL CREEK DIVERSION FUNCTIONAL DESIGN

DRAWING TITLE: TYPICAL DETAILS

SIZE: A1

STATUS: FOR REVIEW

SCALE: 1:10

DATUM:

DRAWING NUMBER: 623.030360-1300

REVISION: A

PLOT DATE: 30-Aug-2024 10:35:33 AM IMAGERY PROVIDED BY NEARMAP.COM 2024

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Appendix C TUFLOW Results – Existing Scenario

Hail Creek Diversion

Replacement Functional Design Report

Hail Creek Coal Holdings Pty Limited

SLR Project No.: 623.030360.00001

25 November 2025

642000
643000
644000
7632000
7631000
7630000

Level (m AHD)
< 280
280 - 282
282 - 284
284 - 288
288 - 290
290 - 292
292 - 294
294 - 296
296 - 298
298 - 300
> 300

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
TUFLOW Model Extent
Hail Creek Mining Lease
Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Levels - 39% AEP

APPENDIX C1-1

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CADGISIGIS\Surface_Water\AutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX C1-1_EXG02_39p_h.mxd

642000
643000
644000
7632000
7631000
7630000

Level (m AHD)
- < 280
- 280 - 282
- 282 - 284
- 284 - 288
- 288 - 290
- 290 - 292
- 292 - 294
- 294 - 296
- 296 - 298
- 298 - 300
- > 300

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Levels - 2% AEP

APPENDIX C1-2

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Drive\06 SLR Data\01 CADG\SG\S\Surface_WaterAutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX C1-2_EXG02_02p_h.mxd

642000
643000
644000
7632000
7631000
7630000

Level (m AHD)
< 280
280 - 282
282 - 284
284 - 288
288 - 290
290 - 292
292 - 294
294 - 296
296 - 298
298 - 300
> 300

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
TUFLOW Model Extent
Hail Creek Mining Lease
Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

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HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Levels - 1% AEP

APPENDIX C1-3

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CAD\GIS\GIS\Surface_Water\AutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX C1-3_EXG02_01p_h.mxd

642000
643000
644000
7632000
7631000
7630000

Level (m AHD)
- < 280
- 280 - 282
- 282 - 284
- 284 - 288
- 288 - 290
- 290 - 292
- 292 - 294
- 294 - 296
- 296 - 298
- 298 - 300
- > 300

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

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HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Levels - 0.1% AEP

APPENDIX C1-4

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CADGISIGIS\Surface_Water\AutoMapping\v02\HailCik\Output\MXDs\623.030360.00001_APPENDIX C1-4_EXG02_1in1000_h.mxd

642000
643000
644000
7632000
7631000
7630000

Depth (m)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- Above 3.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

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HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Depths - 39% AEP

APPENDIX C2-1

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel06 SLR Data\01 CAD\GIS\GIS\Surface_Water\AutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX C2-1_EXG02_39p_d.mxd

642000
643000
644000
7632000
7631000
7630000

Depth (m)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- Above 3.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Depths - 2% AEP

APPENDIX C2-2

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CAD\GIS\GIS\Surface_WaterAutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX C2-2_EXG02_02p_d.mxd

642000
643000
644000
7632000
7631000
7630000

Depth (m)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- Above 3.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

N

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Depths - 1% AEP

APPENDIX C2-3

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CAD\GIS\GIS\Surface_Water\AutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX C2-3_EXG02_01p_d.mxd

642000
643000
644000
7632000
7631000
7630000

Depth (m)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- Above 3.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

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HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Depths - 0.1% AEP

APPENDIX C2-4

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CAD\GIS\GIS\Surface_Water\AutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX C2-4_EXG02_1in1000_d.mxd

642000
643000
644000
7632000
7631000
7630000

Velocity (m/s)
Below 0.5
0.5 - 1
1 - 1.5
1.5 - 2
2 - 2.5
Above 2.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

LEGEND

- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Velocities - 39% AEP

APPENDIX C3-1

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CADG\SIG\SI\Surface_Water\AutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX C3-1_EXG02_39p_v.mxd

642000
643000
644000
7632000
7631000
7630000

Velocity (m/s)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- Above 2.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Velocities - 2% AEP

APPENDIX C3-2

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGIS\GIS\Surface_Water\AutoMapping\v02\HailCkOutputMXDs\623.030360.00001_APPENDIX C3-2_EXG02_02p_v.mxd

642000
643000
644000
7632000
7631000
7630000

Velocity (m/s)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- Above 2.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Velocities - 1% AEP

APPENDIX C3-3

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGIS\GIS\Surface_Water\AutoMapping\v02\HailCkOutputMXDs\623.030360.00001_APPENDIX C3-3_EXG02_01p_v.mxd

642000
643000
644000
7632000
7631000
7630000

Velocity (m/s)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- Above 2.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

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HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Velocities - 0.1% AEP

APPENDIX C3-4

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Drivel\06 SLR Data\01 CADG\SIG\SIS\Surface_WaterAutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX C3-4_EXG02_1in1000_v.mxd

642000
643000
644000
7632000
7631000
7630000

Stream Power (W/m²)
Below 25
25 - 35
35 - 45
45 - 50
50 - 100
100 - 150
Above150

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Stream Power - 39% AEP

APPENDIX C4-1

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADG\SIG\S\Surface_WaterAutoMapping\v02\HailCkOutputMXDs\623.030360.00001_APPENDIX C4-1_EXG02_39p_SP.mxd

642000
643000
644000
7632000
7631000
7630000

Stream Power (W/m²)
- Below 25
- 25 - 35
- 35 - 45
- 45 - 50
- 50 - 100
- 100 - 150
- Above150

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Stream Power - 2% AEP

SLR

APPENDIX C4-2

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADG\SIG\SIS\Surface_WaterAutoMapping\v02\HailCkOutputMXDs\623.030360.00001_APPENDIX C4-2_EXG02_02p_SP.mxd

642000
643000
644000
7632000
7631000
7630000

Bed Shear Stress (N/m²)
- Below 20
- 20 - 40
- 40 - 60
- 60 - 80
- Above 80

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Bed Shear Stress - 39% AEP

SLR

APPENDIX C5-1

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel06 SLR Data\01 CAD\GIS\GIS\Surface_WaterAutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX C5-1_EXG02_39p_BSS.mxd

642000
643000
644000
7632000
7631000
7630000

Bed Shear Stress (N/m²)
- Below 20
- 20 - 40
- 40 - 60
- 60 - 80
- Above 80

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	07-Aug-2024
Drawn by:	TS

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Existing Conditions (EXG02)
Peak Flood Bed Shear Stress - 2% AEP

SLR

APPENDIX C5-2

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADG\SIG\SIS\Surface_WaterAutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX C5-2_EXG02_02p_BSS.mxd

Appendix D TUFLOW Results – Diversion Scenario

Hail Creek Diversion

Replacement Functional Design Report

Hail Creek Coal Holdings Pty Limited

SLR Project No.: 623.030360.00001

25 November 2025

642000
643000
644000
7632000
7631000
7630000

Level (m AHD)
< 280
280 - 282
282 - 284
284 - 288
288 - 290
290 - 292
292 - 294
294 - 296
296 - 298
298 - 300
> 300

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
TUFLOW Model Extent
Hail Creek Mining Lease
Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Levels - 39% AEP

APPENDIX D1-1

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CAD\GIS\GIS\Surface_Water\AutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX D1-1_FD14_39p_h.mxd

642000
643000
644000
7632000
7631000
7630000

Level (m AHD)
< 280
280 - 282
282 - 284
284 - 288
288 - 290
290 - 292
292 - 294
294 - 296
296 - 298
298 - 300
> 300

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
TUFLOW Model Extent
Hail Creek Mining Lease
Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Levels - 2% AEP

APPENDIX D1-2

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGIS\GIS\Surface_Water\AutoMapping\qv02\HailCkIO.output\MXDs\623.030360.00001_APPENDIX D1-2_FD14_02p_h.mxd

642000
643000
644000
7632000
7631000
7630000

Level (m AHD)
- < 280
- 280 - 282
- 282 - 284
- 284 - 288
- 288 - 290
- 290 - 292
- 292 - 294
- 294 - 296
- 296 - 298
- 298 - 300
- > 300

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Levels - 1% AEP

APPENDIX D1-3

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CAD\GIS\GIS\Surface_Water\AutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX D1-3_FD14_01p_h.mxd

642000
643000
644000
7632000
7631000
7630000

Level (m AHD)
- < 280
- 280 - 282
- 282 - 284
- 284 - 288
- 288 - 290
- 290 - 292
- 292 - 294
- 294 - 296
- 296 - 298
- 298 - 300
- > 300

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Levels - 0.1% AEP

APPENDIX D1-4

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CAD\GIS\GIS\Surface_Water\AutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX D1-4_FD14_1in1000_h.mxd

642000
643000
644000
7632000
7631000
7630000

Depth (m)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- Above 3.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Depths - 39% AEP

SLR

APPENDIX D2-1

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CADGIS\GIS\Surface_WaterAutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX D2-1_FD14_39p_d.mxd

642000
643000
644000
7632000
7631000
7630000

Depth (m)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- Above 3.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Depths - 2% AEP

SLR

APPENDIX D2-2

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CADGIS\GIS\Surface_WaterAutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX D2-2_FD14_02p_d.mxd

642000
643000
644000
7632000
7631000
7630000

Depth (m)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- Above 3.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Depths - 1% AEP

APPENDIX D2-3

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CAD\GIS\GIS\Surface_Water\AutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX D2-3_FD14_01p_d.mxd

642000
643000
644000
7632000
7631000
7630000

Depth (m)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- Above 3.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Depths - 0.1% AEP

SLR

APPENDIX D2-4

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CADGIS\GIS\Surface_WaterAutoMapping\v02\HailCkOutput\MXDs\623.030360.00001_APPENDIX D2-4_FD14_1in1000_d.mxd

642000
643000
644000
7632000
7631000
7630000

Velocity (m/s)
Below 0.5
0.5 - 1
1 - 1.5
1.5 - 2
2 - 2.5
Above 2.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND

- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Velocities - 39% AEP

APPENDIX D3-1

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGIS\GIS\Surface_WaterAutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX D3-1_FD14_39p_v.mxd

642000
643000
644000
7632000
7631000
7630000

Velocity (m/s)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- Above 2.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Velocities - 2% AEP

APPENDIX D3-2

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGIS\GIS\Surface_Water\AutoMapping\v02\HailCkIO.mxd

642000
643000
644000
7632000
7631000
7630000

Velocity (m/s)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- Above 2.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Velocities - 1% AEP

APPENDIX D3-3

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADG\GIS\Surface_WaterAutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX D3-3_FD14_01p_v.mxd

642000
643000
644000
7632000
7631000
7630000

Velocity (m/s)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- Above 2.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Velocities - 0.1% AEP

APPENDIX D3-4

H:\Projects-SLR\623-TS\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADG\GIS\Surface_WaterAutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX D3-4_FD14_1in1000_v.mxd

642000
643000
644000
7632000
7631000
7630000

Stream Power (W/m²)
Below 25
25 - 35
35 - 45
45 - 50
50 - 100
100 - 150
Above150

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND

- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Stream Power - 39% AEP

SLR

APPENDIX D4-1

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADG\SIG\SISurface_WaterAutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX D4-1_FD14_39p_SP.mxd

642000
643000
644000
7632000
7631000
7630000

Stream Power (W/m²)
- Below 25
- 25 - 35
- 35 - 45
- 45 - 50
- 50 - 100
- 100 - 150
- Above150

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Stream Power - 2% AEP

APPENDIX D4-2

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CAD\GIS\GIS\Surface_Water\AutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX D4-2_FD14_02p_SPmxd

642000
643000
644000
7632000
7631000
7630000

Bed Shear Stress (N/m²)
- Below 20
- 20 - 40
- 40 - 60
- 60 - 80
- Above 80

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Bed Shear Stress - 39% AEP

APPENDIX D5-1

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADG\SIG\SIS\Surface_WaterAutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX D5-1_FD14_39p_BSS.mxd

642000
643000
644000
7632000
7631000
7630000

Bed Shear Stress (N/m²)
- Below 20
- 20 - 40
- 40 - 60
- 60 - 80
- Above 80

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	06-Aug-2024
Drawn by:	TS

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Bed Shear Stress - 2% AEP

SLR

APPENDIX D5-2

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CAD\GIS\GIS\Surface_Water\AutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX D5-2_FD14_02p_BSS.mxd

Appendix E TUFLOW Results – Long Sections

Hail Creek Diversion

Replacement Functional Design Report

Hail Creek Coal Holdings Pty Limited

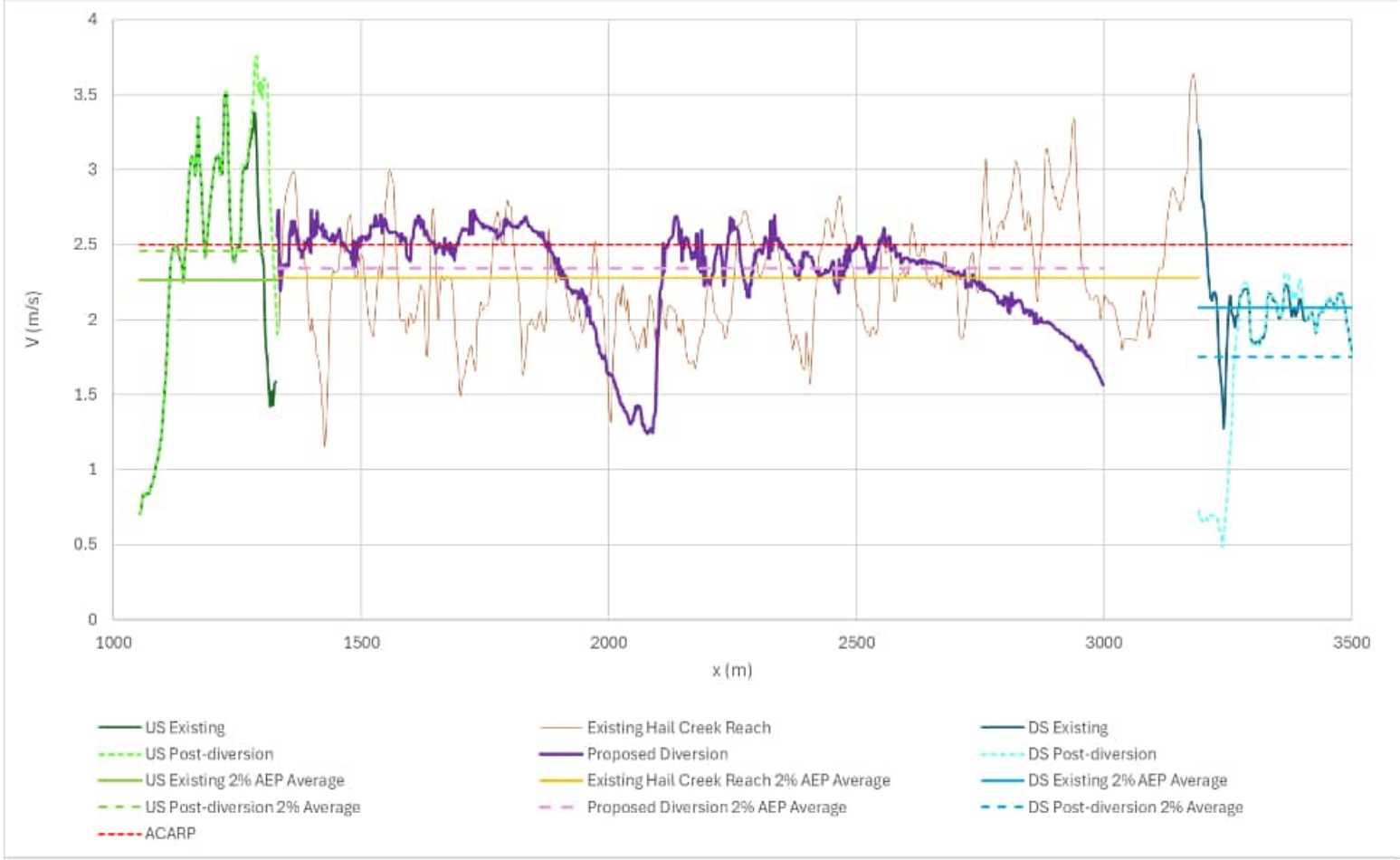
SLR Project No.: 623.030360.00001

25 November 2025

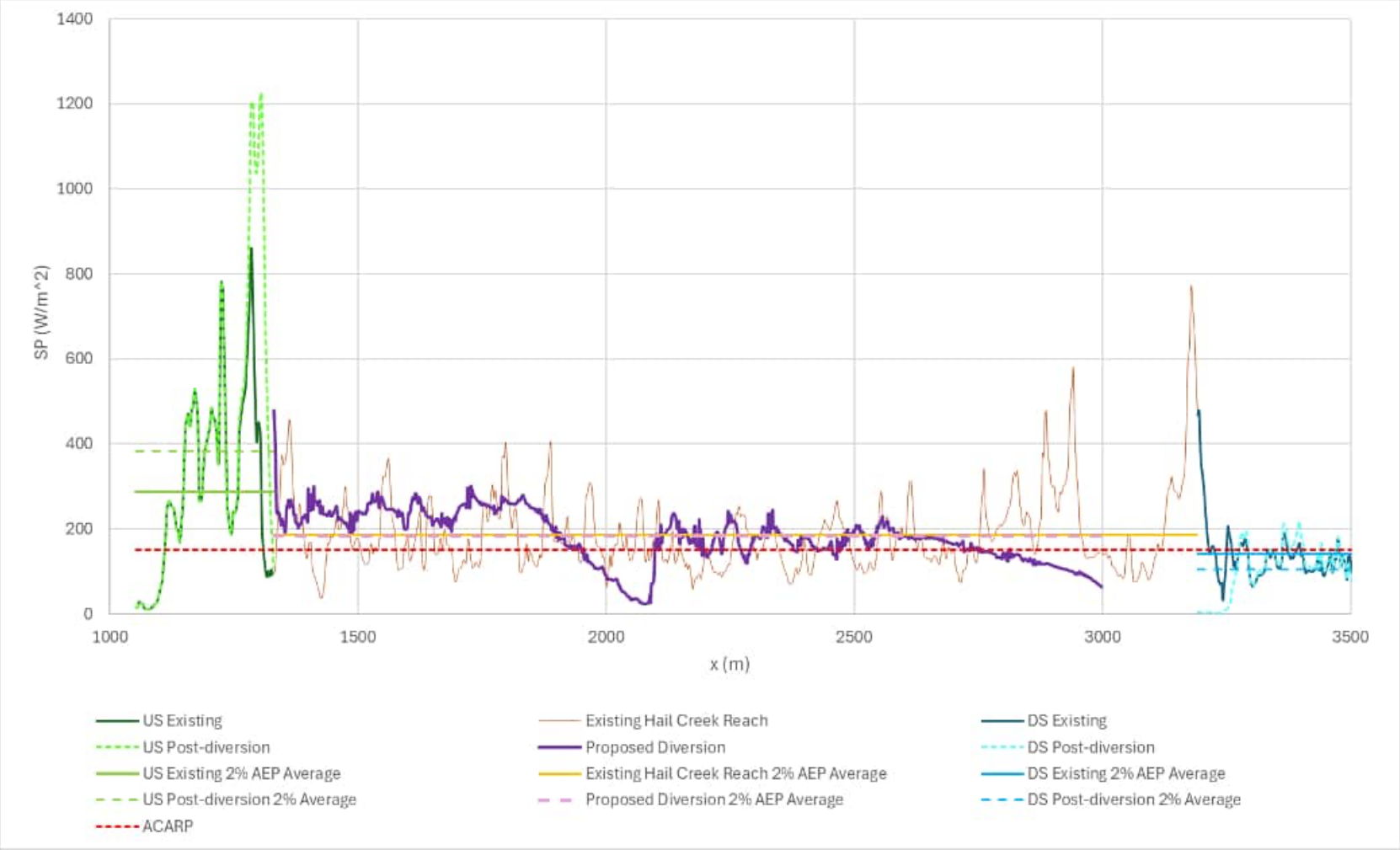
Appendix E TUFLOW Results – Long Sections

E.1 2% AEP Results Long Sections

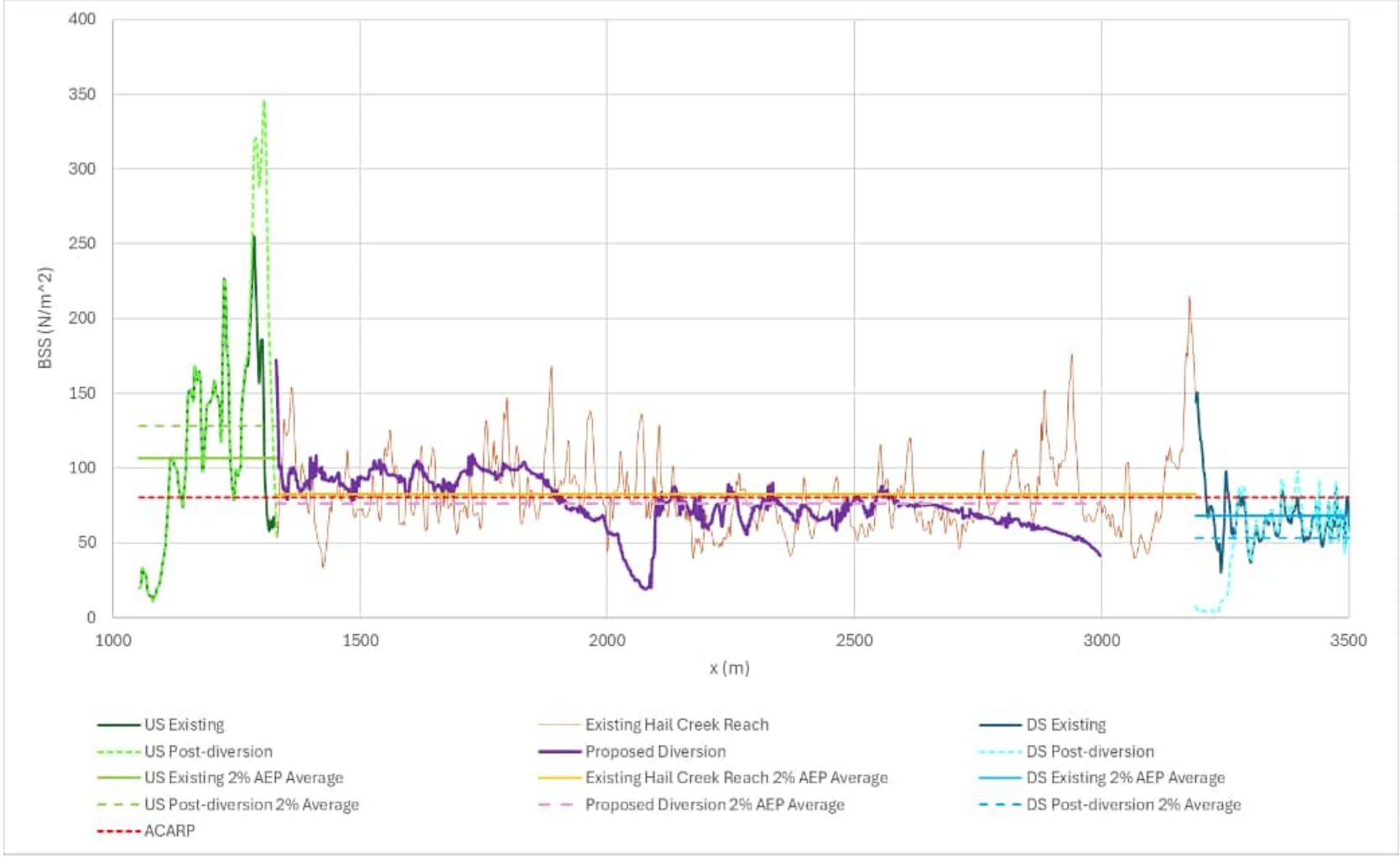
E.1.1 Velocity



E.1.2 Stream Power

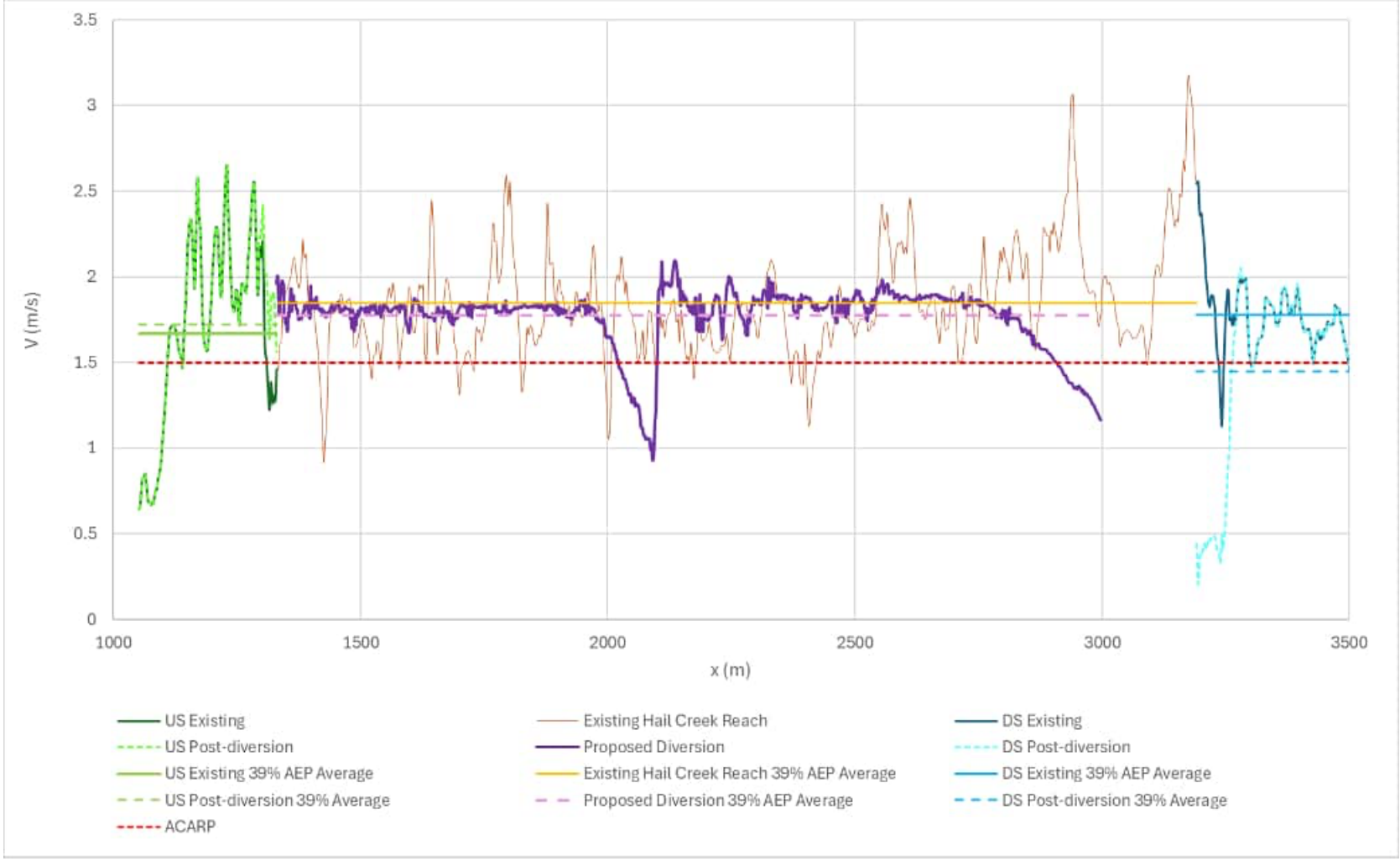


E.1.3 Bed Shear Stress

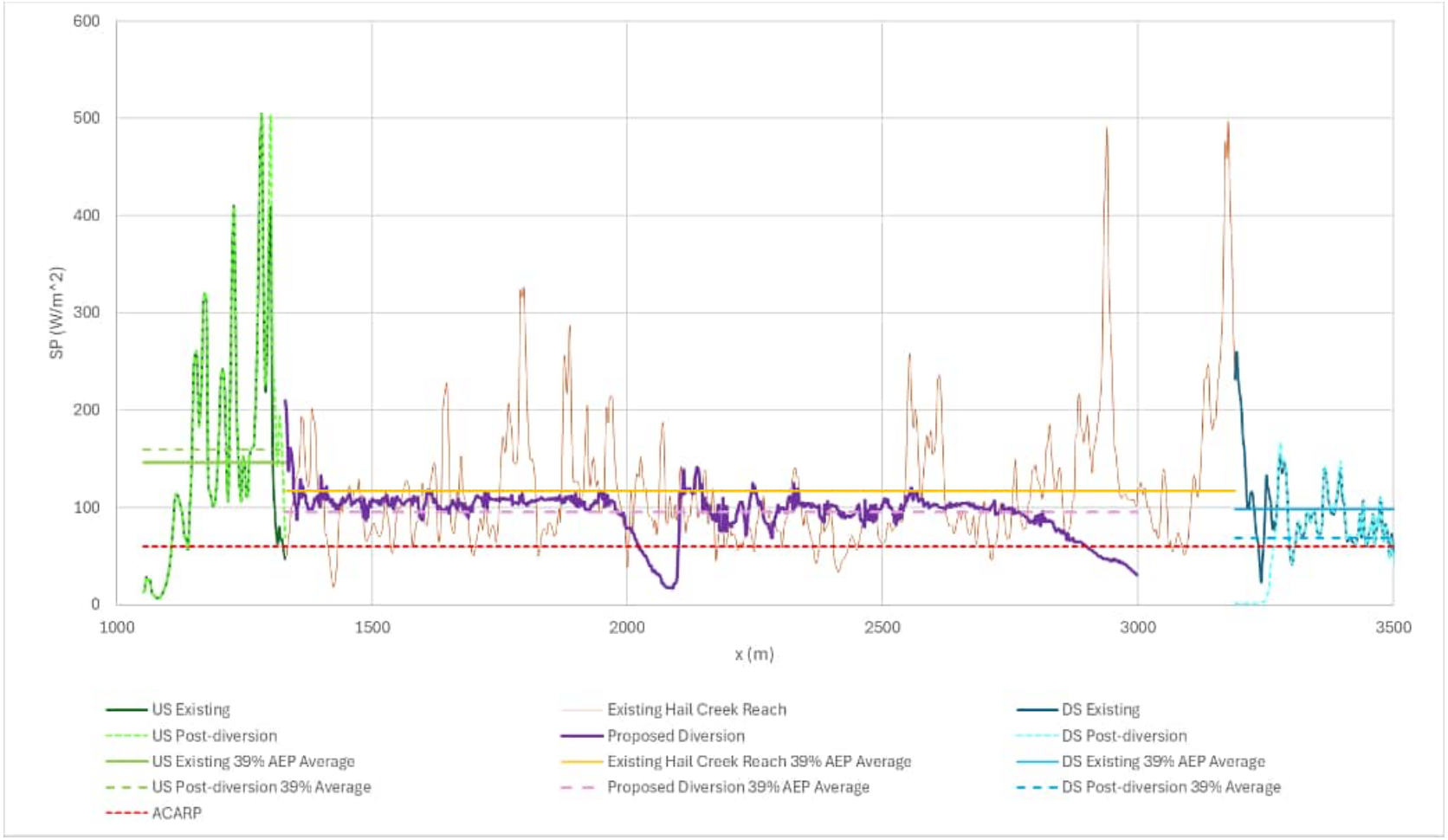


E.2 39% AEP Results Long Sections

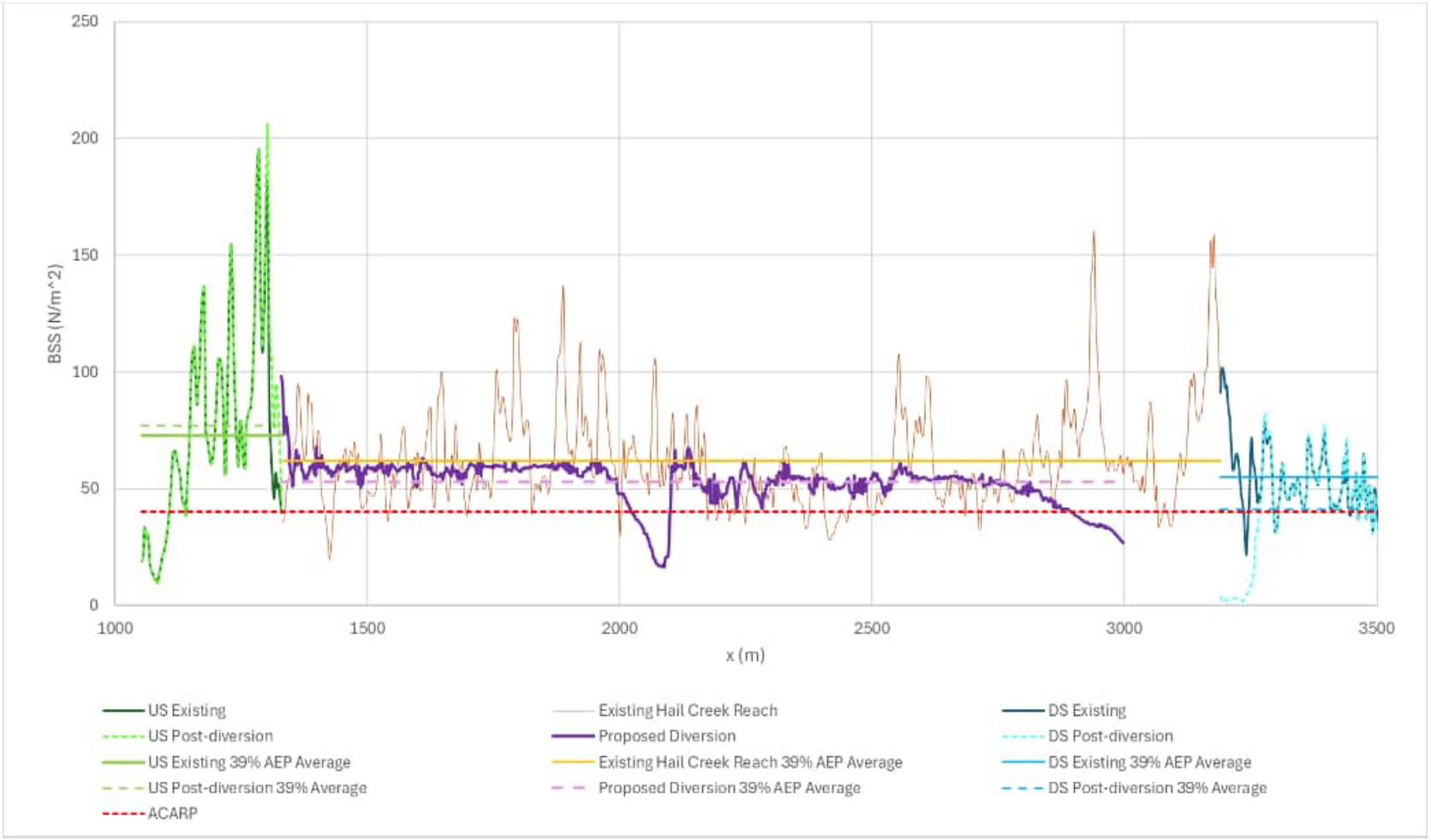
E.2.1 Velocity



E.2.2 Stream Power



E.2.3 Bed Shear Stress



Appendix F TUFLOW Results – 0.1% AEP Climate Change Scenario

Hail Creek Diversion

Replacement Functional Design Report

Hail Creek Coal Holdings Pty Limited

SLR Project No.: 623.030360.00001

25 November 2025

642000
643000
644000
7632000
7631000
7630000

Level (m AHD)
- < 280
- 280 - 282
- 282 - 284
- 284 - 288
- 288 - 290
- 290 - 292
- 292 - 294
- 294 - 296
- 296 - 298
- 298 - 300
- > 300

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	27-Aug-2025
Drawn by:	TS

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Levels - 0.1% AEP
Long-Term SSP5-8.5

SLR

APPENDIX F1-1

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGISIGIS\Surface_Water\AutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX F1-1_FD14_1in1000_h_Long-term_SSP5-8.5.mxd

642000
643000
644000
7632000
7631000
7630000

Depth (m)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- 2.5 - 3
- 3 - 3.5
- Above 3.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	27-Aug-2025
Drawn by:	TS

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Depths - 0.1% AEP
Long-Term SSP5-8.5

APPENDIX F1-2

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Divel\06 SLR Data\01 CADG\SIG\SIS\Surface_WaterAutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX F1-2_FD14_1in1000_d_Long-term_SSP5-8.5.mxd

642000
643000
644000
7632000
7631000
7630000

Velocity (m/s)
- Below 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.5
- Above 2.5

Image Sources: Esri, DigitalGlobe, GeoEye, i-cubed, USDA FSA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

0 0.05 0.1 0.2 km

LEGEND
- TUFLOW Model Extent
- Hail Creek Mining Lease
- Homevale Pit

Coordinate System:	GDA 1994 MGA Zone 55
Scale:	1:7,500 at A3
Project Number:	623.030360
Date:	27-Aug-2025
Drawn by:	TS

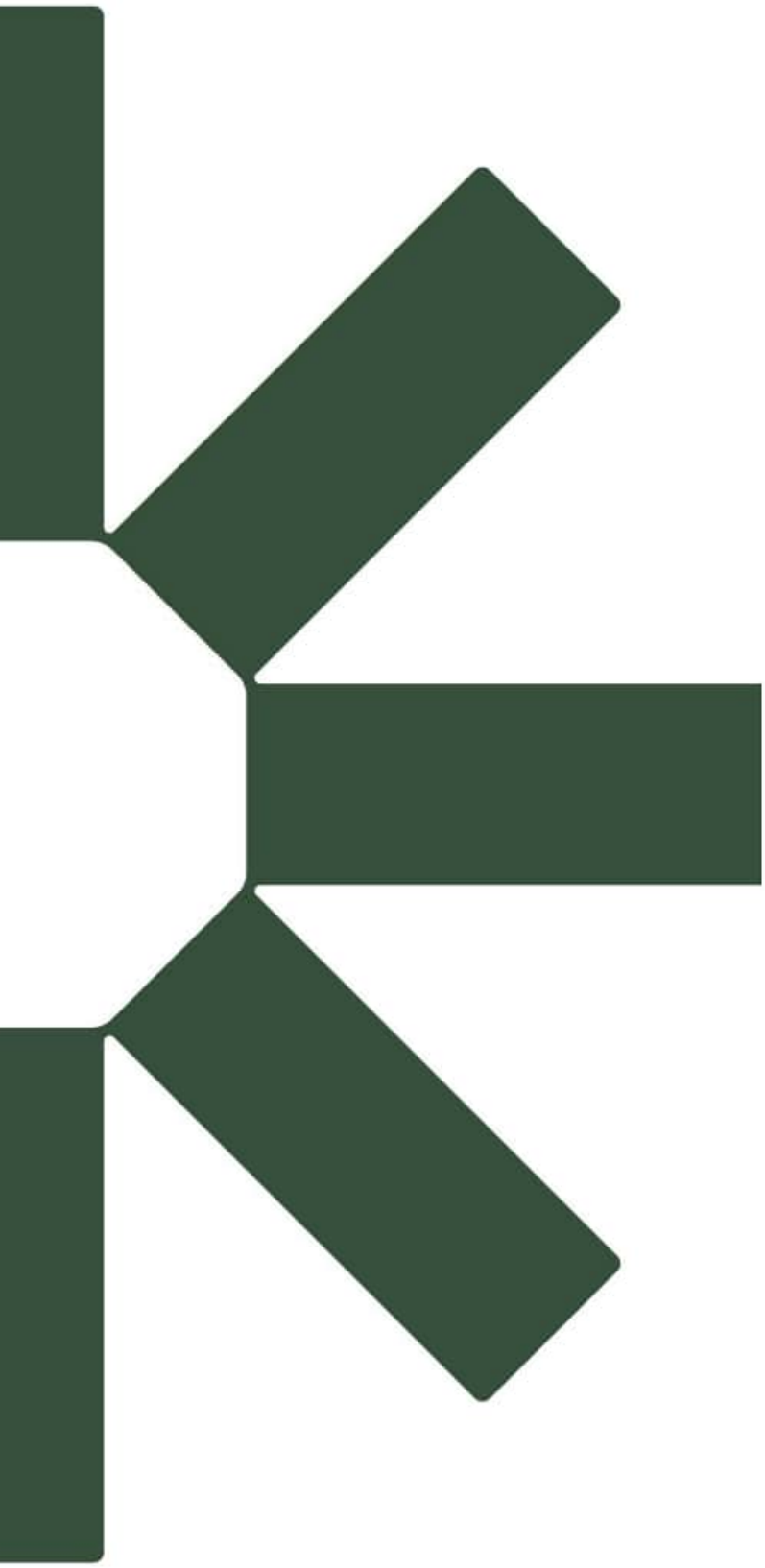
SLR

HAIL CREEK MINE
HAIL CREEK DIVERSION FUNCTIONAL DESIGN

Diversion Conditions (FD14)
Peak Flood Velocities - 0.1% AEP
Long-Term SSP5-8.5

APPENDIX F1-3

H:\Projects-SLR\623-TSV\623.030360.00001 Hail Creek Schammer Creek Dive\06 SLR Data\01 CADGIS\GIS\Surface_WaterAutoMapping\v02\HailCk\Output\MXDs\623.030360.00001_APPENDIX F1-3_FD14_1in1000_v_Long-term_SSP5-8.5.mxd



Making Sustainability Happen