BHP Mitsubishi Alliance

Appendix E

Surface Water Resources Assessment

Blackwater Mine

North Extension Project - Surface Water Resources Assessment

BM Alliance Coal Operations Pty Ltd

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SLR Project No.: 620.13452.00000

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Revision: 10

Making Sustainability Happen

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
02	14 September 2023	S McAuliffe, F Stark	N. Kunz, H.Munck	Draft
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08	15 November 2023	D Maxwell	F Stark	Final Draft
09	1 December 2023	F. Stark	P.Allen	Final Draft V2
10	8 December 2023	F.Stark	P.Allen	Final Draft V3

Basis of Report

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with BM Alliance Coal Operations Pty Ltd (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.

Executive Summary

The Blackwater Mine (BWM) is owned and operated by BM Alliance Coal Operations Pty Ltd (BMA). The BWM has been operational since 1967. Current operations at the BWM are carried under the conditions of Environmental Authority (EA) EPML00717813. The EA, as written, prohibits mining in Surface Area 7 (SA7) and Surface Area 10 (SA10) within ML 1762 and ML 1759, respectively. These two areas lie immediately to the east of the current mining area. BMA seek to extend their current mining operation at BWM into SA7 and SA10, this is referred to as the North Extension Project (the Project). This report investigates the potential impacts of the Project on surface water resources and proposes mitigation measures to reduce impacts.

The Project is located within the Blackwater Creek, Taurus Creek, Deep Creek, Sagittarius Creek, and Two Mile Gully catchments. To prevent the inundation of the proposed pits from Two Mile Gully, Deep Creek and Taurus Creek, protection measures are proposed at six locations and include:

- Flood protection during operation. Operational flood protection will include levees and/or flood protection landforms.
- Where flood protection is required post-mining, the final landform design will provide an appropriate level of protection.
- Delineation and management of areas where minimum ground levels need to be maintained to prevent ingress of the flood events into mine pits and infrastructure areas.

Flood modelling was undertaken to examine the effectiveness and impact of the proposed flood protection levees/landforms. The modelling indicated that the proposed levees/landforms will provide appropriate flood protection to the Project during operations. The modelling indicated that impacts from these measures on the flood and flow regime were expected to be minimal and confined to the immediate vicinity of the Project. The flood characteristics with the proposed infrastructure in place, were also found to be typical of the area under existing flood conditions.

Water Balance Modelling was undertaken to demonstrate the ability of the existing water management system to manage Mine Affected Water (MAW) and the water supply needs of the Project. The modelling included consideration of climate change factors for six changed climate scenarios. The Water Balance Modelling indicated the following:

- The Project is able to satisfy the mine water demands through planned water supply allocations in 2026 and 2027 as well as use of the stored Mine Affected Water inventory.
- The Project will continue to comply with the BWMs existing EA including release conditions based on downstream water quality criteria.

Final landform modelling of the Project indicates that the final landform will be stable and flood flows will be free draining. At the conclusion of mining, four (4) final voids will remain. These voids will be groundwater sinks with all water contained in the voids. The void water quality is predicted to become hypersaline over time.

The Project is not expected to have a material impact on streamflow or flood flows and no downstream water users were identified that would be impacted by the Project. The Project will largely utilise surface water management measures implemented at BWM. The management and mitigation measures are conditioned in the existing BWM EA through elements such as the Water Management Plan, (Fitzroy Regional) Receiving Environment Monitoring Program (FRREMP), Sediment and Erosion Control Plan and Regulated Structures Design and Inspection Conditions, where required levees which provide flood

protection during operations will be considered regulated structures. These plans will be expanded to cover the Project area and are considered to be suitable to mitigate potential water quality impacts.

The Project does not require amendments to the conditions outlined in Schedule F – Water EA conditions (EPML00717813) and Schedule G – Structures.

The Project will have a minimal impact on the hydrological characteristics of the surface water resources in the area. The flow regime is unlikely to change significantly, and the quantity of flow is unlikely to reduce the current or future utility of the resource for other users. As such the project is expected to have negligible impacts as per the criteria outlined in the *Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments—Impacts on water resources (Commonwealth of Australia, 2022).*

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Appendices

1.0 Introduction

The Blackwater Mine (BWM) is located approximately 20 kilometres (km) south-west of Blackwater in the Bowen Basin, Queensland (**Figure 1-1**). BWM's Mining Leases (MLs) include ML1759, ML1760, ML1761, ML1762, ML1767, ML1771, ML1772, ML1773, ML1792, ML1800, ML1812, ML1829, ML1860, ML1862, ML1907, ML70091, ML70103, ML70104, ML70139, ML70167 and ML70329 (**Figure 1-1)**.

The BWM has been in operation since 1967 and operates in accordance with, amongst other authorisations, Environmental Authority (EA) EPML00717813, granted under the *Environmental Protection Act 1994* (Qld) (EP Act). The BWM produces up to 16 million tonnes per annum (Mtpa) of product coal.

1.1 Project Overview

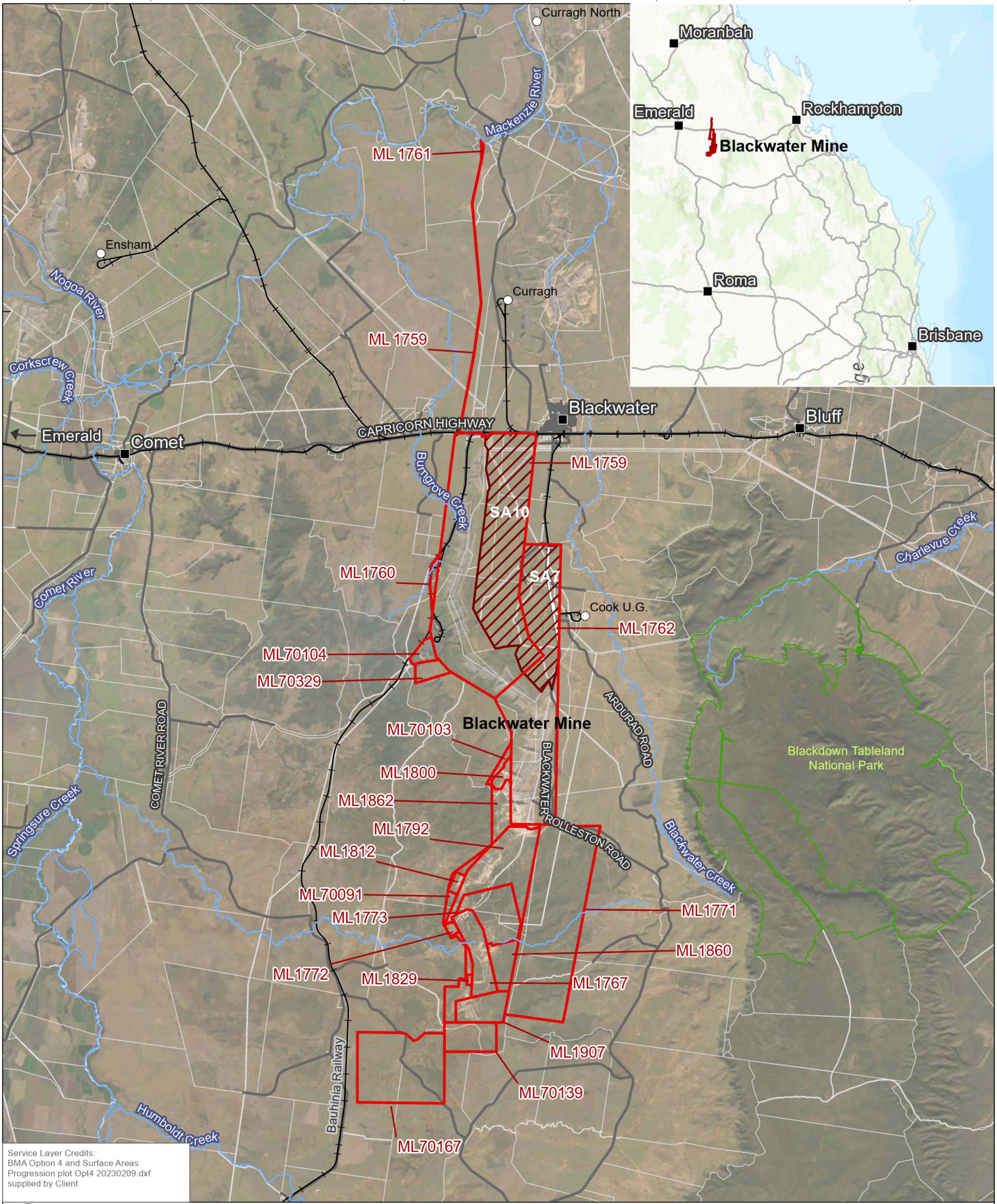
BM Alliance Coal Operations Pty Ltd (BMA) seek relevant State and Federal approvals to extend the current mining operation through the BWM – North Extension Project (the Project). The Project would extend the mining area of the existing BWM to within Surface Area (SA)10 on ML1759 and SA7 on ML1762 (**Figure 1-1** and **Figure 1-2)** and increase BWM production to up to 17.6 Mtpa (product coal). Importantly, the Project should be viewed in the context that it is an extension and continuation of ongoing mining operations on a portion of the significantly larger BWM mining operation.

The key elements of the Project include, but are not limited to, the following:

- Vegetation clearing, the removal and stockpiling of topsoil material, drilling and blasting of overburden and interburden material.
- Removal of overburden and interburden material (dragline and truck and shovel/excavator methods) to uncover coal, which is placed as back fill in the mined-out pit voids (in-pit spoil dumps) as mining advances.
- Open cut mining (truck and shovel/excavator methods) of RoM coal from the coal measures in SA10 on ML1759 and SA7 on ML1762.
- Continued use of BWM infrastructure (e.g. Coal Handling and Preparation Plant [CHPP], Thermal Coal Plant [TCP], RoM and product stockpiles, train load-out, water management system and other supporting infrastructure).
- Continued disposal of rejects and tailings in accordance with the EA.
- Construction and operation of new or relocated infrastructure within SA10 on ML1759 and SA7 on ML1762 to facilitate and/or support the open cut mining extension such as back access roads, access tracks, water management infrastructure and powerlines, laydown areas and build pads.
- A new dragline crossing across Deep Creek.
- Ongoing exploration activities within ML1759 and ML1762.
- Progressive rehabilitation of the mine site.

Specifically of relevance to this report, the construction and operation of new or relocated water management infrastructure outlined above includes:

- Construction of new Erosion and Sediment Control (ESC) structures as required.
- Flood protection at six locations to prevent inundation of the proposed pits.



Service Layer Credits:
BMA Option 4 and Surface Areas
Progression plot Opt4 20230209.dxf
supplied by Client

0 5 10 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:400,000 at A4
Project Number:	620.014601
Date Drawn:	07-Dec-2023
Drawn by:	NT

LEGEND

- City/Town
- Coal Mine
- Railway
- Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- National Park
- Cadastre

BLACKWATER MINE - NORTH EXTENSION PROJECT

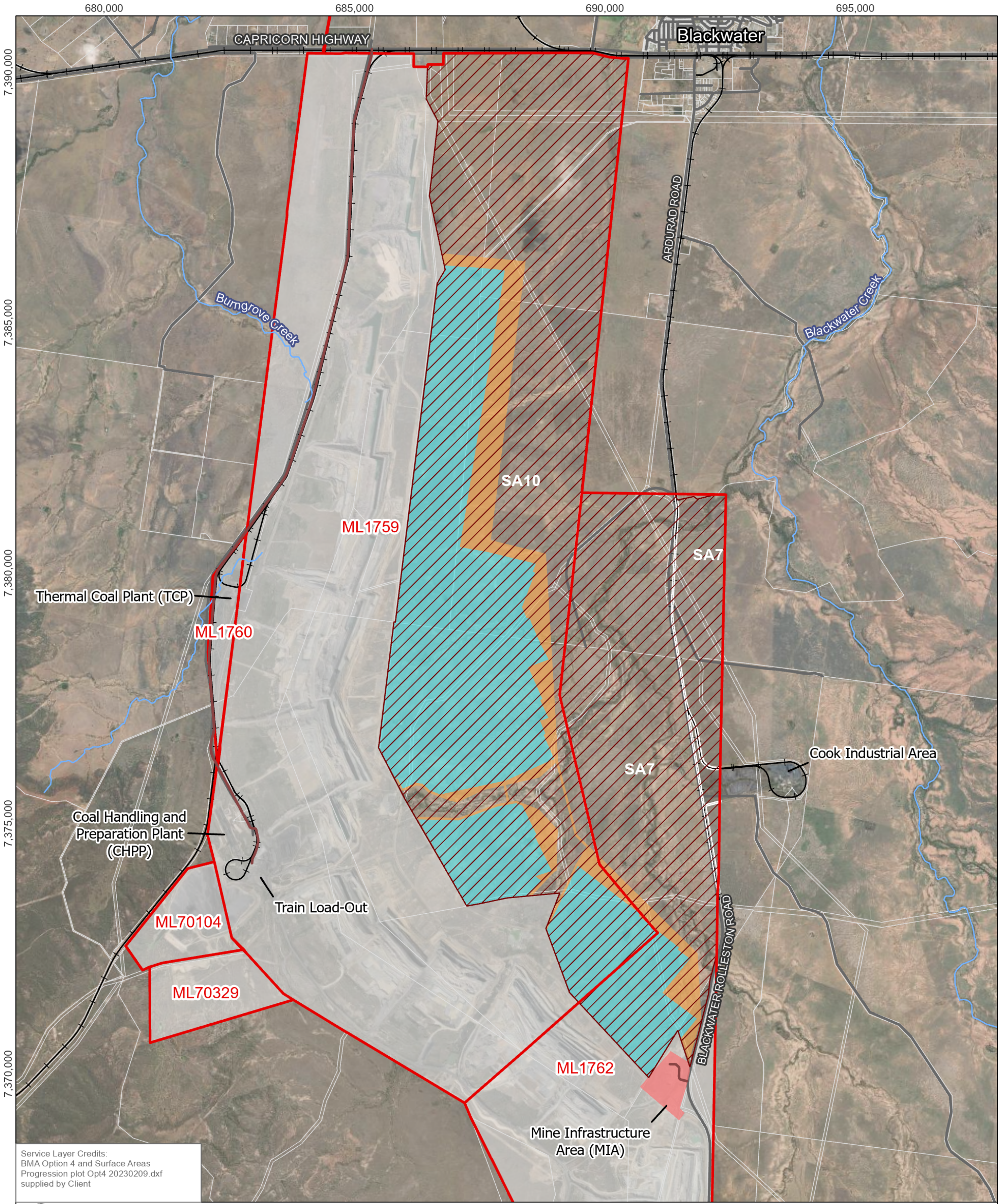
PROJECT LOCATION

SLR

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 1-1

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_SW_F01_1_Site_Location



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	07-Dec-2023
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LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Cadastre
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

PROJECT OVERVIEW

SLR

FIGURE 1-2

Surface Area SA7 on ML1762 and SA10 on ML1759 cover a total area of approximately 9,010 hectares (ha). The extent of the proposed Project open cut mining area and out of pit disturbance areas is approximately 3,761 ha. If approved, and subject to customer demand, the extension is projected to extend mining at the BWM to within SA7 on ML1762 and SA10 on ML1759 from 2025 to 2085.

This Report outlines the details of the surface water resources associated with the Project..

1.1.1 Project Objectives

The key surface water objectives for the Project are:

- Maintaining the Environmental Values (EVs) for surface water in the region and mitigating potential impacts of the Project on the downstream environment and downstream users.
- Management of surface water flows and flooding, in particular through Blackwater Creek.
- Maintaining the condition and natural functions of water bodies, and watercourses—including the stability of beds and banks of watercourses from construction through to closure.

The report structure is provided as follows:

- **Surface water context:** Describes the local, regional and legislative context for the site and existing surface water EVs.
- **Surface water management:** Describes the proposed water management strategy and infrastructure for the site.
- **Hydrologic and hydraulic modelling:** Presents the existing flood characteristics and summarises the flood modelling approach.
- **Mine water management:** Details the performance assessment of the proposed infrastructure through use of the water balance model.
- **Impact assessment and mitigation:** Summarises the findings of the assessment, potential impacts and the proposed mitigation measures, as well as the final landform conditions.

2.0 Surface Water Context

2.1 Regional Catchment

The Project site is located within the catchment of Blackwater Creek, which is a tributary of the Mackenzie River. The Mackenzie River catchment drains to the Fitzroy River, which ultimately terminates at the Coral Sea south-east of Rockhampton, near Port Alma.

Land uses within the Fitzroy River basin include mining, agriculture, bushland and regional centres. The Project area covers an area of approximately 90 km^2, which equates to approximately 0.7% of the 13,000 km^2 Mackenzie River catchment, and 0.07% of the 140,000 km^2 Fitzroy River basin.

2.2 Local Waterways

The catchments of the following local waterways are located within, or in close proximity to, the Project site:

- Blackwater Creek.
- Taurus Creek.
- Two Mile Gully.
- Deep Creek.
- Sagittarius Creek.

Details on the local waterways are provided below and illustrated in **Figure 2-1**.

2.2.1 Taurus Creek

Taurus Creek is a tributary of Blackwater Creek, with a catchment area of approximately 300 km^2 encompassing Deep Creek and Two Mile Gully. The Taurus Creek watercourse drains in a northerly direction, originating south of the Project site and passing between Stewarton Pit and Deep Creek Pit. Ramp 42 Fill Point Dam and New Taurus Creek Dam are Mine Affected Water (MAW) dams located on Taurus Creek, situated between Deep Creek Pit and Stewarton Pit. Taurus Creek discharges into Blackwater Creek some 15 km downstream of the New Taurus Creek Dam.

2.2.2 Deep Creek

Deep Creek is a tributary of Taurus Creek with a catchment area of approximately 35 km^2, which includes the Northern Coal Handling and Preparation Plant located west of Besgrove Pit. The Deep Creek watercourse traverses between Besgrove Pit and Deep Creek Pit via the Deep Creek Diversion which conveys flows to the New Deep Creek Dam. The New Deep Creek Dam is an on-line structure and flows discharging from the Dam continue in an easterly direction for approximately 3.5 km before terminating at the confluence with Taurus Creek.

2.2.3 Two Mile Gully

Two Mile Gully is a tributary of Taurus Creek with a catchment area of approximately 160 km^2. The primary watercourse of Two Mile Gully runs in a northerly direction, generally parallel with the alignment of North Ballamoo, Blackdown, Wilpeena and Tannyfoil Pits. The primary watercourse originates in the vicinity of Ballamoo Pit, and discharges into Taurus Creek approximately 25 km downstream. The Two Mile Gully catchment contains two major tributaries of the primary watercourse, located to the east and west respectively.

The eastern tributary has a catchment area of 56 km^2 to the confluence with Two Mile Gully which occurs some 15 km along the primary watercourse. The land use within the eastern tributary consists primarily of grazing land.

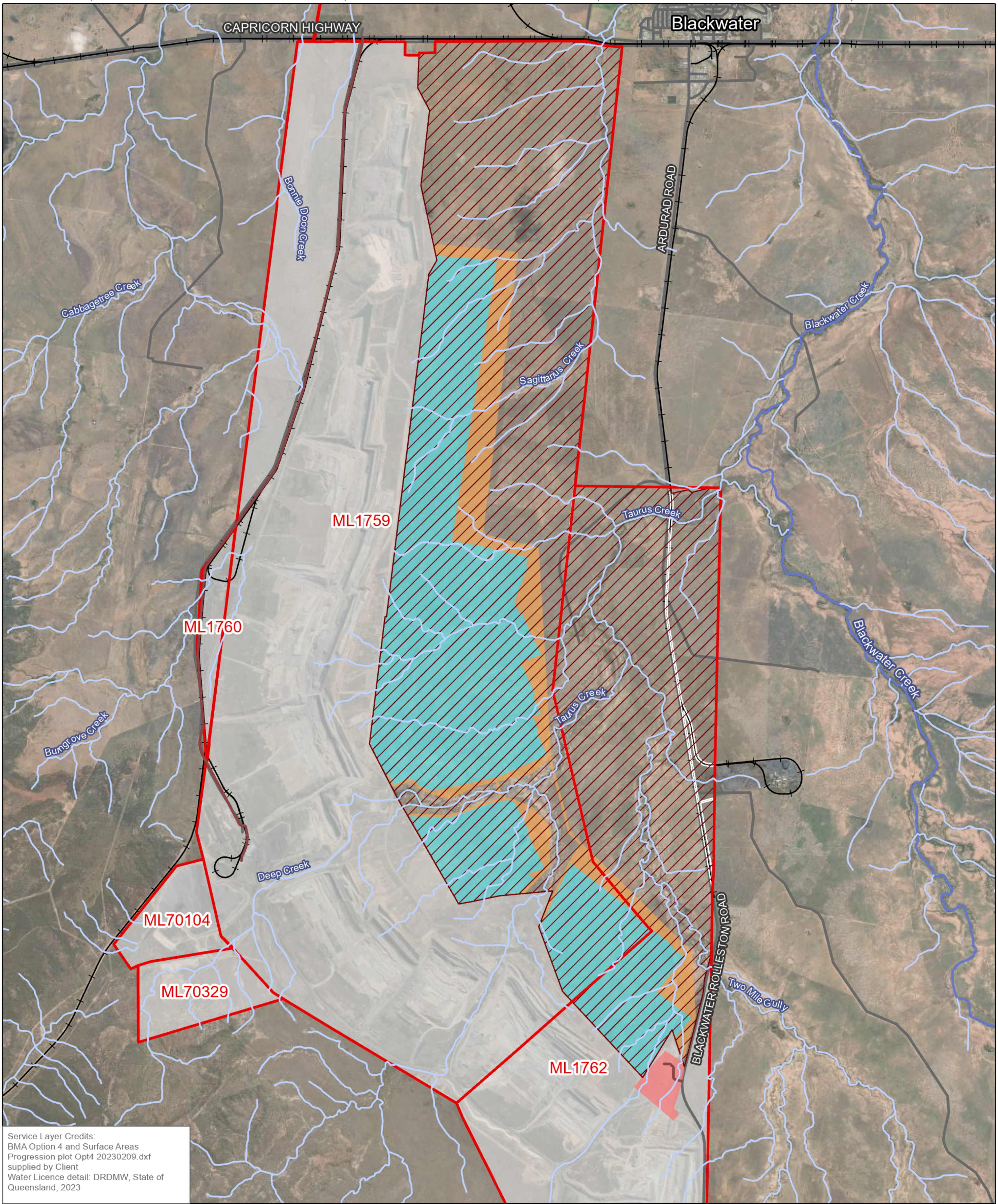
The western tributary of Two Mile Gully originates on the north of Haul Road 46, between Stewarton Pit and Tannyfoil Pit. Approximately 16 km^2 of the natural catchment of the western tributary is diverted to Taurus Creek via the existing diversion channel which runs parallel to Haul Road 46 immediately to the south. The existing catchment encompasses approximately 10 km^2 and contains the Blackwater Administration Area. The tributary runs for 7 km before discharging into Two Mile Gully.

2.2.4 Blackwater Creek

Blackwater Creek is located to the immediate east of Two Mile Gully, encompassing a catchment area of 280 km^2 draining to the confluence with Taurus Creek. The main tributary of Blackwater Creek will not be impacted by the Project's mining activities. The land use consists of general grazing and light vegetation. Major tributaries of Blackwater Creek other than Taurus Creek include Spring Creek and Stony Creek. The primary watercourse of Blackwater Creek runs in a northerly direction for approximately 40 km before its junction with Taurus Creek, subsequently continuing for another 45 km before discharging into the Mackenzie River.

2.2.5 Sagittarius Creek

Sagittarius Creek is located to the north of Deep Creek, draining in a northerly direction, discharging from the Project site via existing culverts under the Blackwater Siding Railway some 13 km along the primary watercourse. Sagittarius Creek then continues for a further 7.5 km, running along the western extent of the town of Blackwater before discharging into Blackwater Creek 2 km upstream of Curragh East mine. The total catchment area of Sagittarius Creek is approximately 70 km^2, 43 km^2 of which is contained within the Project site.



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
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SLR

LEGEND

- Railway
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- Major Watercourse
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- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

LOCAL WATERWAYS

FIGURE 2-1

2.3 Climate and Flows

2.3.1 Rainfall

The Bureau of Meteorology (BoM) operates rainfall gauges for several locations in the vicinity of the Project site. The historical rainfall and evaporation records for gauge locations shown in **Table 2-1** were analysed to determine the climate at the Project site.

Table 2-1 Rainfall Gauge Data

Gauge Number	BoM Name	Period operational	Number of Years of Data & Completeness	Elevation	Location (Lat/Long)	Distance/Direction from Site (km)[1]
035134	Blackwater Airport	2013 - present	10 yrs (98% complete)	193	-23.6015, 148.8074	2.2 W
035132	New Caledonia	1968 - present	55 yrs (100% complete)	152	-23.4292 148.9272	18.5 NNE
035021	Comet Post Office	1895-2017	123 yrs (98% complete)	170	-23.6046 148.5447	30 W
035276	Springsure Creek Junction AL	2010-2019	9 yrs (100% complete)	167	-23.8564 148.5036	36 SW
035264	Emerald Airport	1992 – present	31 yrs (30% complete)	189	23.57 148.18	70 NNW
035027	Emerald Post Office	1883 – 1992	109 yrs (96% complete)	179	23.53 148.16	70 NNW

Note: [1] Measured from closest point of SA7 or SA10

The closest BoM gauging location is Blackwater Airport, which is situated approximately 2.2 km west of SA10. However, the Blackwater Airport gauging location also has the shortest record while the Comet Post Office gauging location (situated approximately 36 km SW of SA10) has the longest record (**Table 2-1**). Longer records are desirable as they provide a more accurate representation of the climate of a particular area.

Data from the Scientific Information for Land Owners (SILO) database hosted by the Science Delivery Division of the Department of Environment and Science (DES) were also obtained for the Project. SILO provides rainfall data as both Patched Point (historical data whereby missing data are infilled from interpolated estimates from surrounding gauges) and/or gridded data sets, which provide an interpolated grid of 5 x 5 km over the whole of Australia.

Figure 2-2 illustrates the average rainfall data from the New Caledonia gauge and the SILO data. The graph shows a good correlation between the SILO data and the nearest gauge with the most extensive and complete record.

The graph illustrates the dry winters and wet summers with approximately 71 percent of the annual rainfall occurring over the wet season between November and April. It also indicates that the SILO data provides a good estimate of regional rainfall.

Annual average rainfall totals for the gauges were similar with 481 mm recorded at Blackwater Airport, 550 mm at New Caledonia, 574 mm at Comet Post Office, and 592 mm at Springsure Creek Junction AL and 556 mm from the SILO data set.

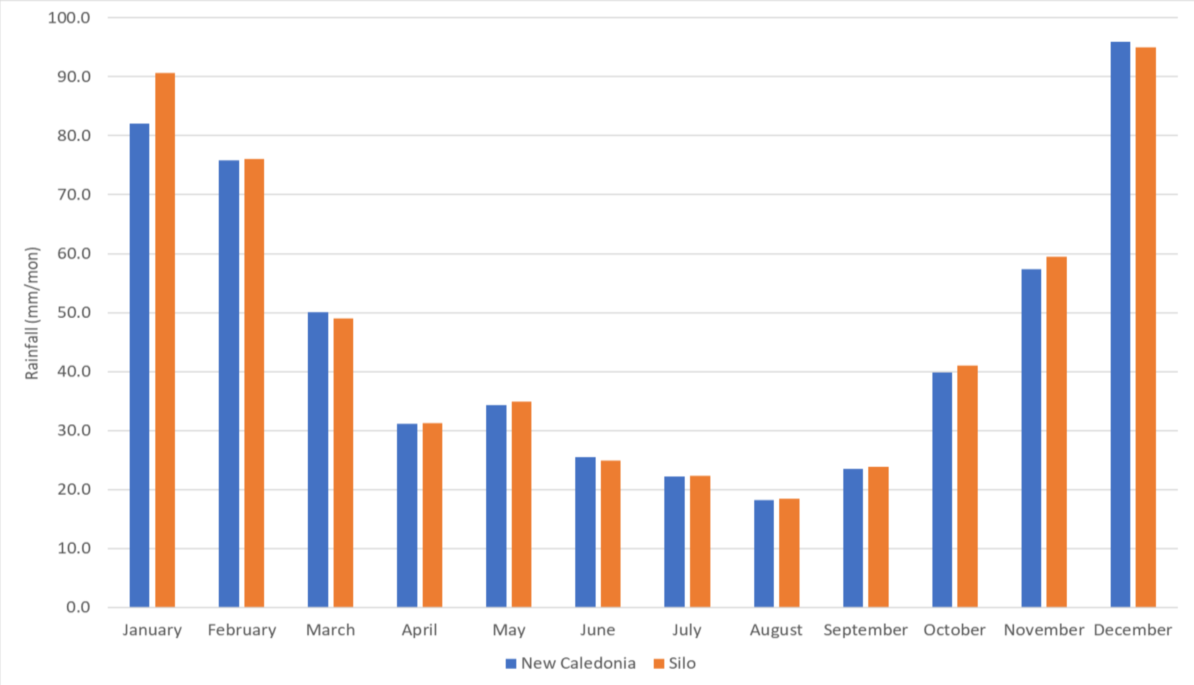


Figure 2-2 Average Monthly Rainfall (January 1968 to July 2023)

2.3.2 Evaporation

Evaporation data was available for the SILO data mentioned above. Daily data were available between 1 January 1968 and July 2023. Monthly averages from the SILO data are provided in **Figure 2-3**. **Figure 2-3** illustrates that the highest evaporation rates occur over the wet season between October and March, and potential evaporation consistently far exceeds rainfall during all seasons.

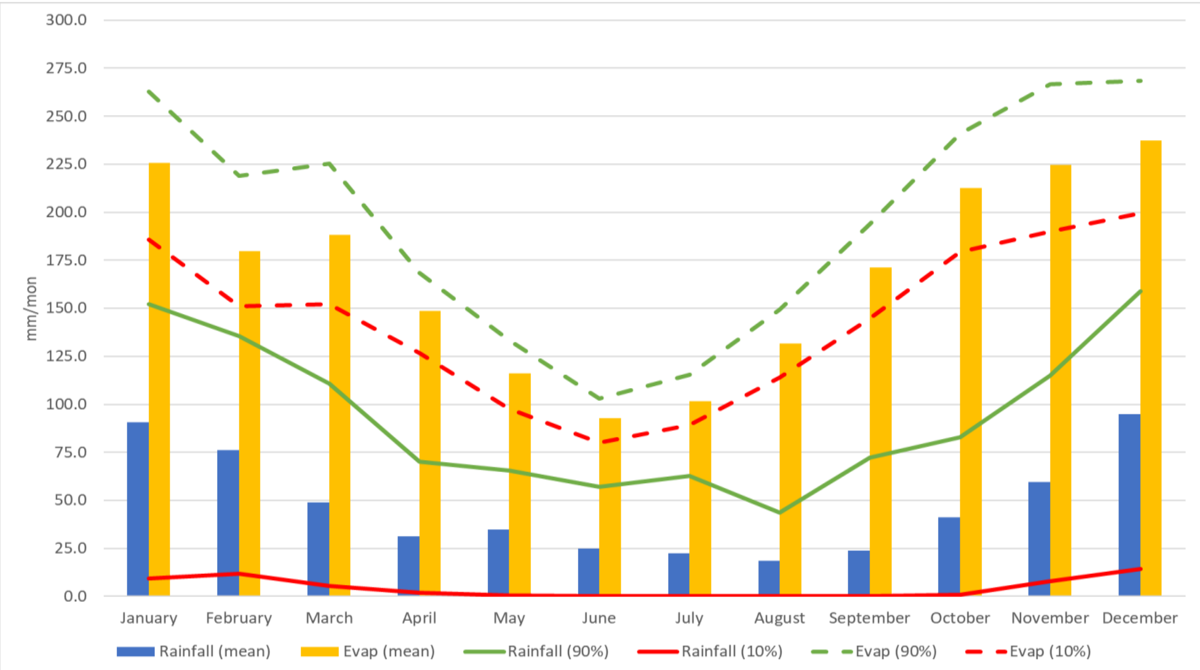


Figure 2-3 Evaporation relative to Rainfall

2.3.3 Streamflow Characteristics

The Department of Regional Development, Manufacturing and Water (DRDMW) operates stream gauges within close proximity to the Project site. **Table 2-2** outlines the streamflow gauge details. The nearest open streamflow gauge with the most significant record of 50 years is located on the Mackenzie River at Bingegang, approximately 70 km northeast of Blackwater. Closed gauge records for Blackwater Creek at Curragh also provide a combined 37 years of data for the smaller Blackwater Creek. Daily streamflow data for flow and water level (minimum, mean and maximum) were downloaded for the gauging stations listed in **Table 2-2** with the flow exceedance curve for Bingegang presented in **Figure 2-4**. This figure illustrates the ephemeral nature of surface water bodies at the BWM.

In addition to DRDMW gauges BMA have also installed flow monitors at several local watercourses including Blackwater Creek, Burngrove Creek, Deep Creek, New Deep Creek Dam, Taurus Creek and Two Mile Gully. These gauges have been monitoring flow in these creeks for approximately 10 years since February 2013. Flow at the Blackwater Creek gauges both DRDMW and BMA gauges is illustrated in **Figure 2-5**. This local flow data indicates the relatively small proportion of the total Blackwater catchment within the Project area and the ephemeral nature of this watercourse.

Table 2-2 Streamflow Gauge Details

Gauge Number	River Name	Catchment Area (km^2)	Open - Closed	Location (Degrees South)	Location (Degrees West)
130106A	Mackenzie River at Bingegang	50,860	1971 - Present	-23.04	149.01
130113A	Mackenzie River at Rileys Crossing	45,040,	2004- Present	-23.54	148.605
130105B	Mackenzie River at Coolmaringa	76,715	2017 - Present	-23.32	149.52
130108A	Blackwater Creek at Curragh	777	1972-1989	-23.49	148.873
130108B	Blackwater Creek at Curragh	776	1990-2009	-23.49	148.873

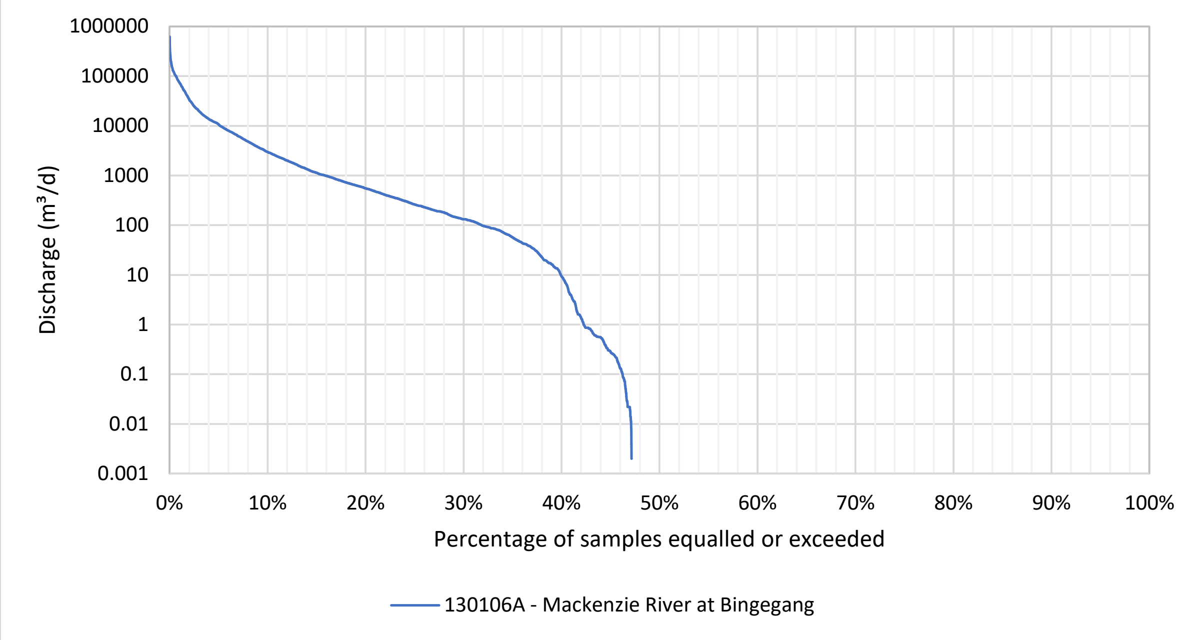


Figure 2-4 Daily Discharge Exceedance Curve Mackenzie River (1971-2023)

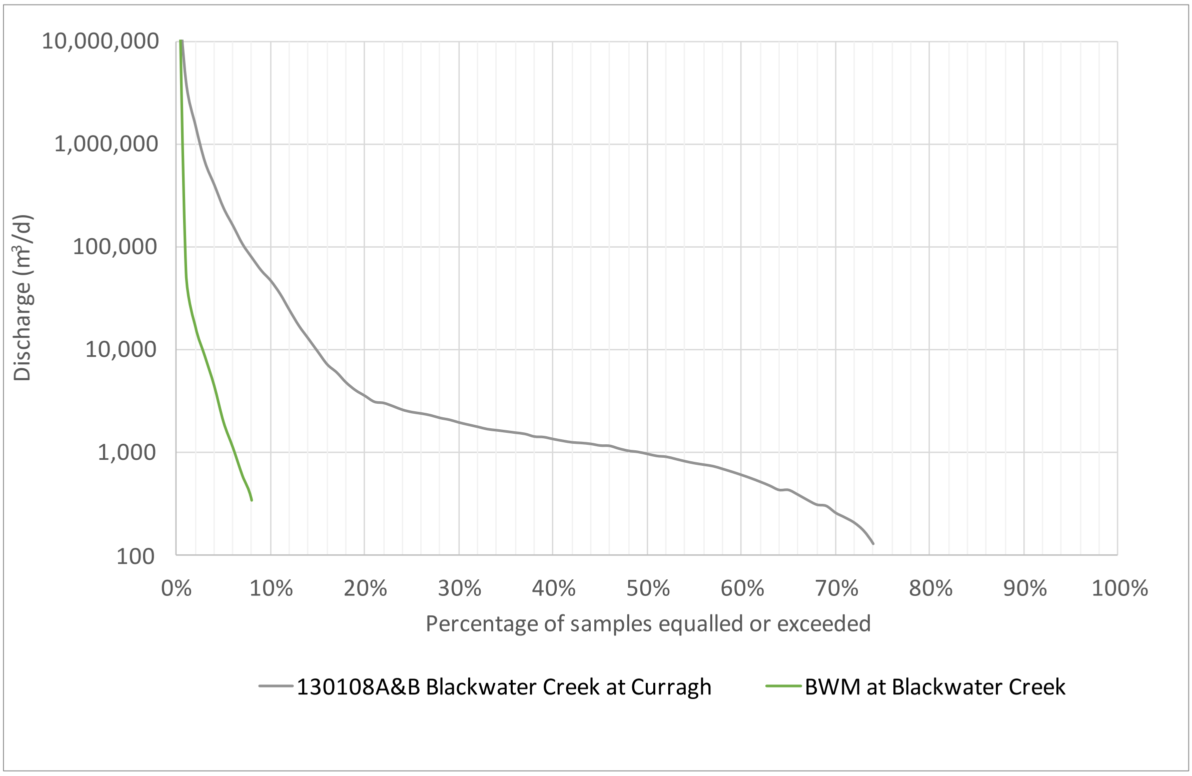


Figure 2-5 Daily Discharge Exceedance Curve

2.4 Legislative Framework

The relevant legislation in relation to surface water resources for the Project includes:

- *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) including the water trigger.
- *Water Act 2000 (QLD)* (the Water Act).
- *Water Reform and Other Legislation Amendment Act 2014* (WROLA Act).
- Water Plan (Fitzroy Basin) 2011.
- *Environmental Protection Act 1994* (the EP Act).
- Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP Water and Wetland Biodiversity).
- Environmental Protection (Water) Policy 2009 Mackenzie River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Mackenzie River Sub-basin September 2011.
- *Fisheries Act 1994*.
- *Environmental Protection (Great Barrier Reef Protection Measures) and Other Legislation Amendment Act 2019*.

2.4.1 Commonwealth Legislation

The Project has the potential to prompt the water trigger. Under the EPBC Act, an action involving a ‘CSG development’ or ‘large coal mining development’ will require approval from the Commonwealth Environment Minister if the action has, will have, or is likely to have, a significant impact on a water resource. The *Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments— impacts on water resources* (the Guideline) provides a self-assessment framework and exemptions to determine if a referral under the EPBC Act is required. An assessment of whether the Project is likely to have a significant impact on surface water resources in accordance with the *Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments—Impacts on water resources* (Commonwealth of Australia, 2022) is provided in Section 6.5.

The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC) is a statutory committee established under the EPBC Act that provides scientific advice to the Commonwealth Environment Minister and relevant State ministers. Guidelines have been developed in order to assist the IESC in reviewing CSG or large coal mining development proposals that are likely to have significant impacts on water resources. The IESC information requirements checklist is presented in the Blackwater Mine - North Extension Project Groundwater Impact Assessment (SLR, 2023b). For completeness, details on where aspects of this checklist relating to surface water impacts have been addressed and are documented within this report are outlined in **Table 2-3**.

Table 2-3 IESC Information Requirements Checklist* – Surface Water Resources

Assessment Item - Description of Proposal	
Assessment Item – Water and salt balance, and water quality	**Section in Report**
Provide a quantitative site water balance model describing the total water supply and demand under a range of rainfall conditions and allocation of water for mining activities (e.g. dust suppression, coal washing etc.), including all sources and uses.	**Section 5.0**

Assessment Item - Description of Proposal	
Provide estimates of the quality and quantity of operational discharges under dry, median and wet conditions, potential emergency discharges due to unusual events and the likely impacts on water-dependent assets.	**Section 5.10**
Describe the water requirements and on-site water management infrastructure, including modelling to demonstrate adequacy under a range of potential climatic conditions.	**Section 5.0 and Section 3.4**
Provide salt balance modelling that includes stores and the movement of salt between stores and takes into account seasonal and long-term variation.	**Section 5.9 and Section 5.10**
Assessment Item – Final landform and voids – coal mines	**Section in Report**
Identify and consider landscape modifications (e.g. voids, on-site earthworks, and roadway and pipeline networks) and their potential effects on surface water flow, erosion, sedimentation and habitat fragmentation of water-dependent species and communities.	**Section 7.1** & **Appendix A – Land Resources**
Evaluate mitigating inflows of saline groundwater by planning for partial backfilling of final voids.	**Section 7.2.**

*The checklist items presented here are the checklist items addressed in this report. Please refer to Blackwater Mine - North Extension Project Groundwater Impact Assessment (SLR, 2023b) Table 1 for the full checklist.

2.4.2 State Legislation

The Mackenzie River is a declared water course under the *Water Act 2000* (the Water Act). Queensland Globe Spatial Data identifies Blackwater Creek and the lower section of Taurus Creek (downstream of the Two Mile Gully confluence) as watercourses while the remaining local waterways referred to in **Section 2.2** are currently unmapped under the definitions of the Water Act. It is considered that these unmapped waterways would be classified as drainage features.

Under the Water Act, a Water Licence is required for taking or interfering with surface water, overland flow water or underground water. Changes to a number of provisions in the Water Act came into effect on 6 December 2016 through the *Water Reform and Other Legislation Amendment Act 2014* (WROLA Act). These changes included a simplification of the water licensing process and a number of exemptions. Under Section 97 and 98 of the Water Act, diversions associated with an EA (Section 97) or resource activity (Section 98) are approved through the EA process. The EA process applies to the extent that the water course diversion is on tenure associated with the EA. In the case of the Project, all proposed works are located within ML 1759 and ML 1762

The Fitzroy Basin Water Resource Plan 2011 and Fitzroy Basin Water Resource Operations Plan (DNRM, 2016) outline the use of water within the basin under the Water Act[1]. The plan defines the availability of water and provides a framework for sustainable management such as targets for environmental flow objectives and regulating the taking of overland flow. The Project falls within the Upper Mackenzie Sub Basin area of the Fitzroy Basin Water Resources Plan, with no specific objectives set for this sub basin area in the vicinity of the Project.

The EPP (Water) outlines the objectives of the EP Act with regards to water. In particular, the EPP (Water) Upper Mackenzie River Sub Basin Plan outlines the EVs and Water Quality Objectives (WQOs) for the region. These are discussed further in **Section 2.5**.

[1] The plan was amended in 2021. The Project is outside the water amendment plan area and thus this is not discussed further in this report.

The *Fisheries Act 1994* regulates waterway barrier works within watercourses and drainage features. Mapping for waterway barrier works classifies waterways based on their risk of impact to fish passage. The waterways within the Project area are classified in **Table 2-4**.

Table 2-4 Waterway Classification – Risk of Impact to Fish Passage

Waterway	Classification
Blackwater Creek and its unnamed tributaries	low/moderate/high/major
Taurus Creek	major
Unnamed Tributaries of Taurus Creek	low/moderate/high
Two Mile Gully	high/major
Unnamed Tributaries of Two Mile Gully	low/moderate/high
Deep Creek	low/moderate/high
Unnamed Tributaries of Deep Creek	low/moderate
Sagittarius Creek	moderate/high
Unnamed tributaries of Sagittarius Creek	low/moderate

The classification of the waterway barrier works changes along the creek. In the Project site the classification is typically low to moderate with high or major classification for the main channels of Taurus and Two Mile Creeks. This is illustrated in **Figure 2-6**. Although, waterway barrier works within these watercourses on lease are exempt from the Fisheries Act, their classification is included to support assessment of broader mitigation measures in line with the identified risk of impact classification.

In 2019, the EP Act was amended to include Section 41AA of the Environmental Protection Regulation 2019. The aim of Section 41AA is to achieve no net decline in water quality in the surface water basins that feed into the Great Barrier Reef (GBR). Since June 2021, all new or expanding projects that potentially impact the waters for the Great Barrier Reef (GBR) are required to provide information about their Dissolved Inorganic Nitrogen (DIN) and Total Suspended Solids (TSS) load.

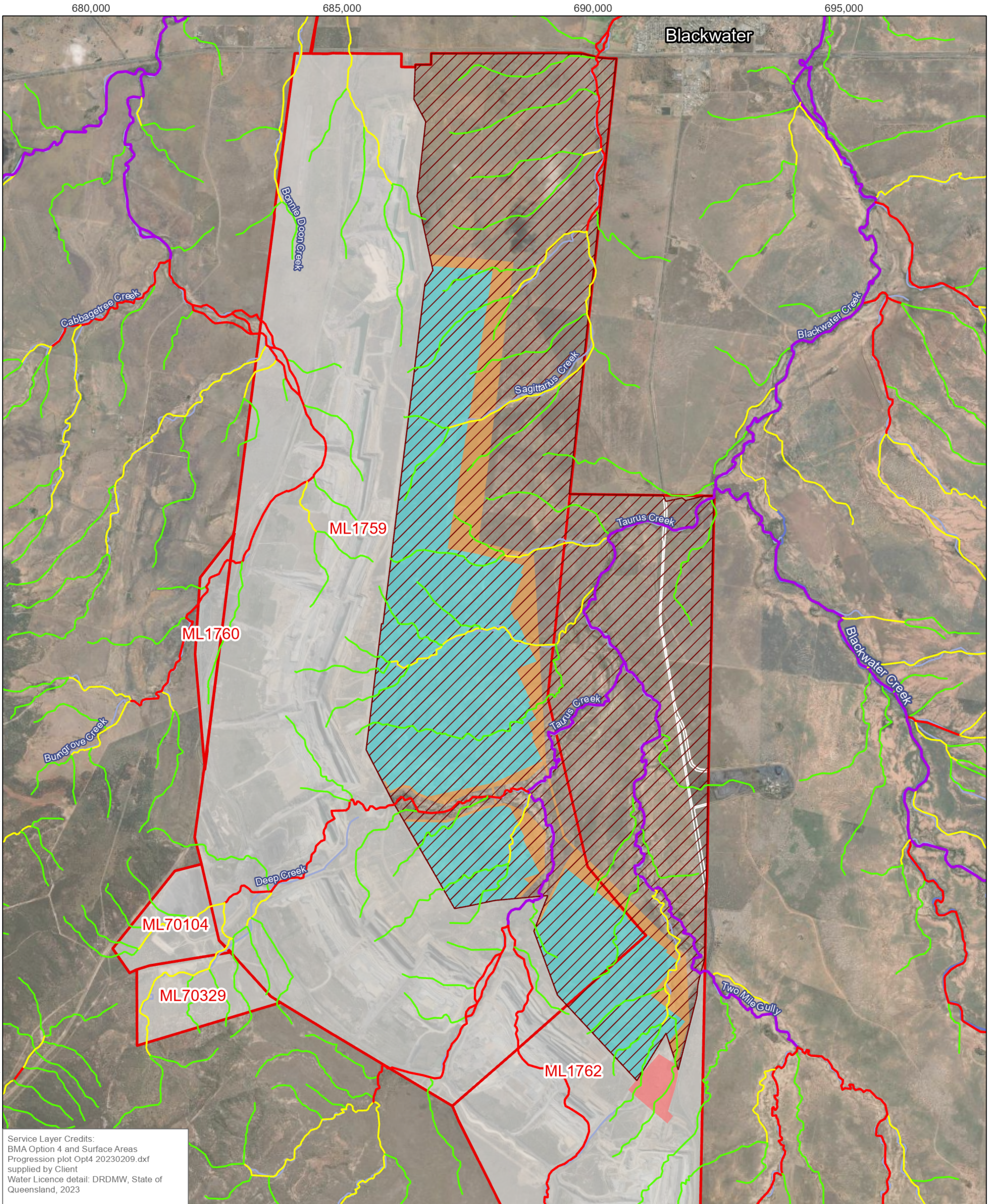
This report documents the assessment against the "*Guideline – Environmental Protection Act 1994: Reef discharge standards for industrial activities*" (DES, 2022) based on relevant information required for this EA amendment application to address Section 41AA of the Environmental Protection Regulation 2019.

The assessment relevant to the Great Barrier Reef legislation is described in **Section 6.3.1**

Table 2-5 Requirements for Section 41AA for EA Amendment applications

Item as per Guidelines (DES, 2022), Section 3.2.1	Assessment
A description of the location of a release and indicate whether it is within the GBR catchment waters, and the applicable river basin. A site map which can be provided in hardcopy or digital format.	Location of the Project and related discharge points are shown in **Figure 2-9**.
If the release is from a point source, provide the location of the end of pipe.	There are three authorised surface water release points defined in the Environmental Authority EPML00717813. No changes are proposed to these points.

Item as per Guidelines (DES, 2022), Section 3.2.1	Assessment
	Location of discharge points is shown in **Figure 2-9**.
A description of the potential source of the DIN/TSS to be released and whether the waste water is a result of the relevant activity	Treated sewage effluent produced on-site from the sewage treatment plant, represents a potential DIN/TSS source. However, this can only be released in accordance with relevant conditions of the EA as explained in **Section 5.2.3**. Under Condition H2 of the EA this is not released to the environment. Runoff from disturbed areas and the potential load of DIN/TSS is discussed in **Section 6.3.1**.
A description of any waste water releases that may not be included in the Section 41AA such as any predicted unplanned/uncontrolled releases, watercourse diversions, clean stormwater diverted around disturbed areas or stormwater that contains only sediment	As outlined in **Section 3.1**, there will be stormwater diversions around disturbed areas which do not require assessment under Section 41AA requirements. The impact of controlled and uncontrolled release from the Mine Water Management system are discussed in **Section 6.3.1**.
For an amendment application, the characteristics of the waste water to be released from the relevant activity subject of the amendment application (e.g., load, concentration, volume, release rate, timing and duration of release). It should be provided to allow for an assessment on an annual basis for the life of the project.	Load: the annual load is the annual volume multiplied by the concentration, these are in accordance with the sites current EA conditions. The predicted load for the Project is discussed further in **Section 5.8**, **Section 5.10** and **Section 6.2.**
The characteristics of the receiving environment (e.g., water type (freshwater, marine, tidal), environmental values, sensitive receptors).	**Section 2.5** discusses the environmental values. **Section 5.8** provides a description of receiving environment water quality.
The spatial and temporal extent of potential changes in stream hydrology or estuarine hydraulics and water quality (regarding an increase in DIN/TSS).	The Project does not propose any changes to the current EA conditions, information on downstream water quality from the existing REMP is provided in **Section 2.5.2** and discussed further in **Section 6.3.1.**
The mitigation measures proposed (see section 3.2.3).	As outlined in **Section 3.1**, the Project will adopt a surface water management strategy consistent with the current BWM, which includes diverting stormwater runoff from undisturbed areas, capturing disturbed area runoff in sediment/environmental dams for preferential reuse onsite rather than offsite discharge.



Service Layer Credits:
BMA Option 4 and Surface Areas Progression plot Opt4 20230209.dxf supplied by Client
Water Licence detail: DRDMW, State of Queensland, 2023

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Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	07-Dec-2023
Drawn by:	NT

SLR

LEGEND

Waterway Barrier Works

- 1 - Low
- 2 - Moderate
- 3 - High
- 4 - Major

- BWM North Extension Project Area
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

WATERWAY BARRIER WORKS

FIGURE 2-6

2.5 Environmental Values and Water Quality

The Project site is located within the Southern Tributaries of the Mackenzie River Sub-basin waters. The EVs for the Project are listed in the Environmental Protection (Water) Policy 2009 – Mackenzie River Sub-basin Environmental Values and WQO (EHP, 2013). New Draft Guidelines for the Fitzroy WQOs were also published in 2017 (DSITI, 2017) for consultation but have not been adopted. These draft guidelines also discussed where applicable below.

The purpose of this policy is to achieve ecological sustainable development in relation to Queensland waters. It sets a framework for managing environmental impacts on water, the identification of environmental values and the guidelines needed to protect the water environment. The Australian and New Zealand Water Quality Guidelines (ANZECC 2018) are an example of guidelines which may be used to assess water quality in the existing environment and assist in the setting of EVs and WQO.

A review of the WQ1304 surface waters plan that accompanies the EPP Mackenzie River Sub-Basin EV and WQO indicates that Burngrove Creek, Taurus Creek, Deep Creek and Emu Creek are waters included in the Mackenzie River Southern Tributaries – Developed Areas. The EVs identified by the plan are the same across all creeks and are summarised in **Table 2-6**.

Table 2-6 EV's for Mackenzie River Sub-basin Southern Tributaries (EHP, 2013)

Environmental Value	Mackenzie Southern Tributaries – Developed Areas
Aquatic Ecosystems	✓
Irrigation	-
Farm supply/use	✓
Stock water	✓
Aquaculture	-
Human consumption of aquatic foods	✓ (refer notes)
Primary recreation	x
Secondary recreation	x
Visual recreation	✓
Drinking water	x
Industrial use	x
Cultural and spiritual values	✓
✓ Indicates EV selected for protection, relevant X Indicates EV selected for protection, not relevant to the Project - Indicates EV not selected for protection under the EPP	

Although the EV for human consumption is noted for this area of the sub-basin, it is not considered relevant for the Project area due to the ephemeral nature of the creeks and lack of any water supply infrastructure in close proximity to the Project. The closest water supply location is Bingegang Weir which is located over 100 kilometres downstream of the Project. The Project represents less than 0.002% of the total catchment area to Bingegang Weir and drinking water is treated prior to its distribution for consumption. Similarly, due to the ephemeral nature of the watercourses and their location, it is considered unlikely that waterways will be used for primary or secondary recreation.

All relevant EVs need to be considered when evaluating a water body. The level of environmental and water quality protection must be determined to maintain each of the EVs. Management goals that are established to protect the environmental values should reflect the specific problems and/or threats to the values, desired levels of protection and key attributes that must be protected (ANZECC & ARMCANZ, 2000).

The existing BWM extends into the Comet River sub -basin, however, this part of the existing BWM is not part of the Project site and as such the Comet River sub-basin is not discussed in this assessment.

2.5.1 Guideline Values

Where more than one EV applies to receiving waters, the most stringent Water Quality Objective (WQO) is adopted to protect all identified EVs. Aquatic ecosystem WQOs therefore form the basis of the WQO for this Project. **Table 2-4** outlines the guideline WQO identified for the Protection of Aquatic Ecosystems.

Table 2-7 Guideline Values for the Protection of Aquatic Ecosystems

Management Intent (Level of Protection)	Southern Tributaries Mackenzie River Sub-basin waters (refer plans WQ130, WQ1304)		
	Parameter	WQO 2013	WQO 2017 DRAFT[d]
Aquatic Ecosystems, Moderately Disturbed	Ammonia N	<20 µg/L[a]	<10-10-25 µg/L
	Oxidised N	<60 µg/L[a]	<10-10-130 µg/L (base) 20-50-160 µg/L (event)
	Organic N	<420 µg/ L[a]	-
	Total nitrogen	<775 µg/ L[b]	<250-400-680 µg/L (base) 400-755-1300 µg/L (event)
	Filterable reactive phosphorus (FRP)	<20 µg/L[a]	<11-20-44 µg/L[a]
	Total phosphorus	<160 µg/L[b]	<50-75-150 µg/L (base) 210-230-350 µg/L (event)
	Chlorophyll a	<5.0 µg/L[a]	As per 2013 WQO
	Dissolved oxygen	85%–110% saturation[a]	As per 2013 WQO
	Turbidity	<50 NTU[a]	15-70-688 NTU 90-190-450 NTU
	Suspended solids	<110 mg/L[b]	11-75-1280 mg/L 30-90-315 mg/L
	pH	6.5–8.5 [b]	As per 2013 WQO
	Electrical conductivity (EC) baseflow	<310 µS/cm[b]	430-620-870 µS/cm (low) 220-320-390 µS/cm (high)
	Electrical conductivity (EC) high flow	<210 µS/cm[b]	
	sulfate	<10 mg/L[b]	<20-<20-25 mg/L (base) <20-<20-33 mg/L (event)
	Macroinvertebrates[c]	Taxa richness (composite): 12–21 Taxa richness (edge habitat): 23–33 PET taxa richness (composite): 2–5 PET taxa richness (edge habitat): 2–5 SIGNAL index (composite): 3.33–3.85	As per 2013 WQO

Management Intent (Level of Protection)	Southern Tributaries Mackenzie River Sub-basin waters (refer plans WQ130, WQ1304)		
	Parameter	WQO 2013	WQO 2017 DRAFT[d]
		SIGNAL index (edge habitat): 3.31–4.20 % tolerant taxa (composite): 25–50% % tolerant taxa (edge habitat): 44–56% % tolerant taxa (edge habitat): 44–56%	

Notes N = nitrogen, EC = electrical conductivity (EC), ND = no data, µg/ L = micrograms per litre, mg/L = milligrams per litre, NTU = Nephelometric Turbidity Units, µS/cm = microSiemens per centimetre

[a] The values for these indicators are based on the QWQG Central Coast regional water quality guidelines

[b] The values for these indicators are based on sub-regional low flow water quality guidelines derived by the department as part of the process to establish EVs and WQOs in the Fitzroy Basin. Refer to 'sources' below for more details.

[c] The values for these macroinvertebrate biological indicators are based on the QWQG Central Coast regional water quality guidelines. They apply to support waters at a moderately disturbed level of protection. Values are provided for 20th and 80th percentiles. The median value of biological indicators at test sites is to be compared and assessed against these values. More details on indicators and derivation of values are in the QWQG. Refer to 'sources' below. Values are provided for two habitat types: edge (along the streambank) and composite (a mixture of all bed habitats). Taxa richness refers to the number of macroinvertebrate taxa collected in a sample. PET taxa richness refers to the total number of families from three orders of aquatic insects considered to be sensitive to changes in their environment (Plecoptera, Ephemeroptera, Trichoptera). SIGNAL index (stream invertebrate grade number—average level) gives an indication of water quality in the river from which the sample was collected, based on the sensitivity of taxa to water quality change. A higher number indicates greater sensitivity. The % tolerant taxa index was developed to assist in identifying taxa sensitivity to pollution. If a site is experiencing an impact from pollution it is expected that there would be a reduction in the percentage of sensitive taxa collected, and an increase in the percentage of tolerant taxa collected.

[d.] WQGs for indicators are shown as a range of 20th, 50th and 80th percentiles to be achieved (e.g.3-4-5), lower and upper limits (e.g. pH: 7.2-8.2) or as a single value.

BWM have an annual Receiving Environment Monitoring Program (REMP) for the BWM. The REMP has been active for multiple years and the associated sampling has been used to derive local water quality guidelines for Blackwater, Taurus and Deep Creeks. The REMP notes the aquatic ecosystem protection guideline (2000 µS/cm) identified by Prasad et al. (2012) for the protection of 95% of species within the Fitzroy Basin. This limit is also the guideline upon which the current EA condition F21, Table F5 is based. Table F5 of the EA requires a salinity of 2,000 µS/cm for the 80th percentile of readings for the downstream receiving environment.

WQO and EVs are discussed further in Blackwater Mine North Extension Project - Aquatic Ecology Assessment (ESP, 2023).

2.5.2 Water Quality Monitoring

Water quality sampling has been regularly undertaken at 11 locations upstream and downstream of the Project site as part of the REMP. The REMP has been undertaken in accordance with condition F22 of the EA and includes water quality, sediment and macro invertebrate sampling. **Figure 2-9** illustrates the sampling locations.

In the most recent REMP (2020/21), water quality results indicated most analytes were within guidelines, and where concentrations were above guideline they mainly occurred both upstream and downstream of mining. With a few exceptions, downstream median concentrations for all analytes across the entire REMP study (since 2010) remained within the upstream 80th percentile which is considered acceptable for slightly-to-moderately disturbed ecosystems (Gauge, 2022). These exceptions were reported as mainly confined to creeks outside the Project area[2]. The REMP also examined streamflow, habitat condition, sediment quality, and biological indicators. It was concluded the data indicates changes in water quality after mining are within acceptable limits and/or downstream medians were within guideline values, suggesting the current EA limits are protecting the environment (Gauge, 2022).

The results of this monitoring are discussed further in Blackwater North Extension Project Aquatic Ecology (ESP, 2023).

Water quality data for pH and Electrical Conductivity (EC) are regularly sampled during periods of flow at key upstream and downstream flow monitoring locations. This monitoring has been undertaken over ten years since 2013. The recorded pH and EC at key locations relevant to the Project are presented in **Figure 2-7** and **Figure 2-8,** respectively. **Figure 2-7** indicates that the pH is generally within guideline values. **Figure 2-8** indicates that EC is generally below the 80th percentile 2000 µS/cm downstream requirements under the EA. It also indicates that, with the exception of Taurus Creek upstream, the majority of the readings are within the WQO 2017 80th percentile guidelines.

The BWM EA was amended on 29 June 2023 to authorise BWM participating in the Fitzroy Regional Receiving Environmental Monitoring Program (FRREMP). The EA amendments remove the application of EA Conditions F22 to F24 while BWM is a participant in the FRREMP. Condition F21 Table F5 is unaffected by the EA amendment.

[2] One exception to this is the median total aluminium in downstream Taurus Creek which was higher than the upstream 80th percentile, although dissolved aluminium is lower downstream. Total aluminium medians were below the upstream 80th percentile for the overall catchment of Blackwater Creek.

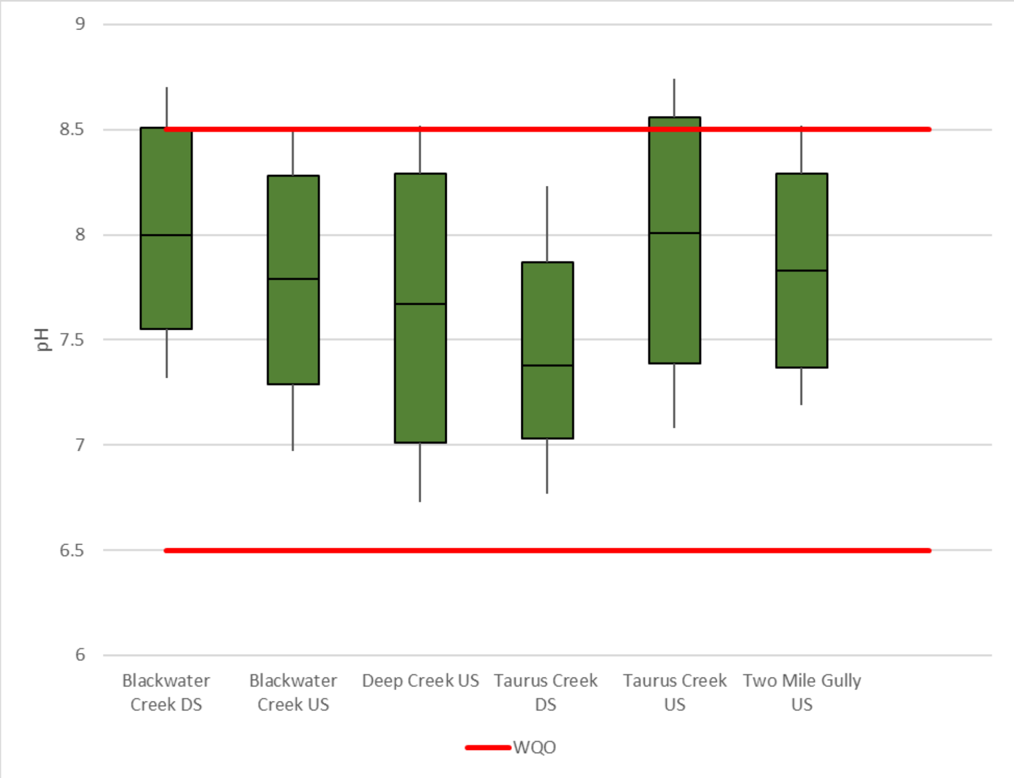


Figure 2-7 Recorded pH at Upstream and Downstream Gauges

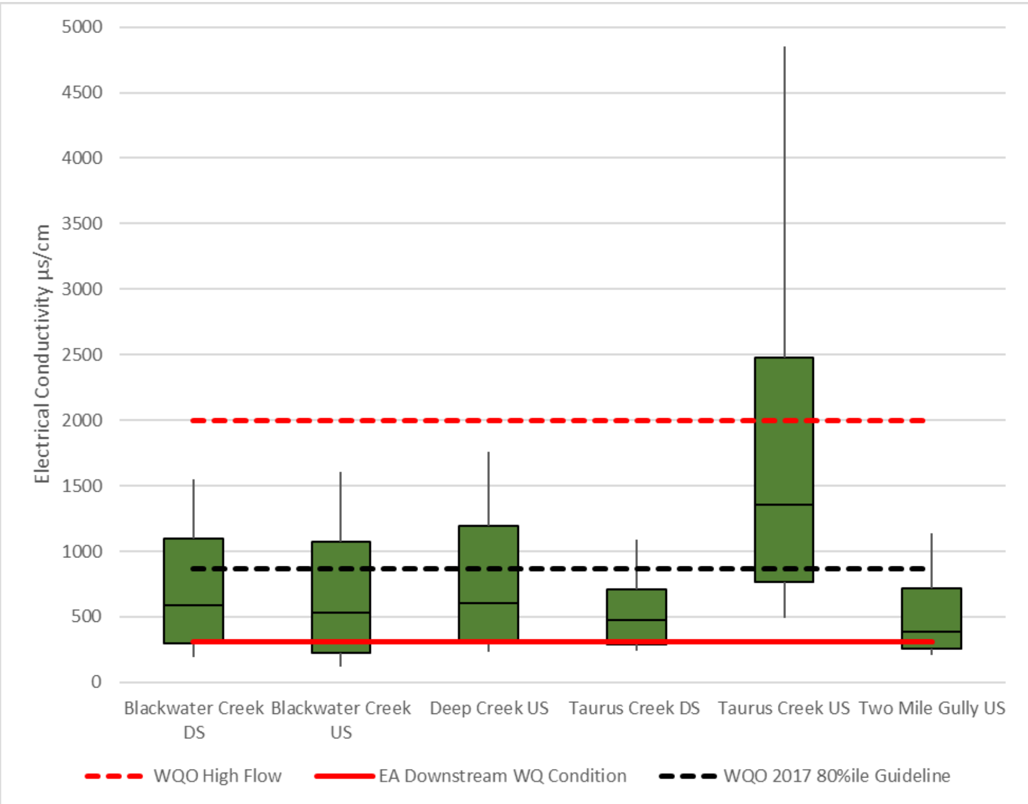


Figure 2-8 Recorded EC at Upstream and Downstream Gauges

2.5.3 Water Quality in MAW Storages

Water quality in key MAW storages on site is regularly monitored. The water quality values for pH and EC in sampled mine storages are presented in **Table 2-8** and **Table 2-9**. Importantly it is noted that these results are those recorded in the storages over all sample points not when water is being released from the storages. The observed pH levels are within the pH limits for the 10th percentile in all storages, with some exceedances at 20th and 50th percentiles. Exceedances are observed in all storages for the 80th and 90th percentiles. The maximum pH level observed in the MAW storages ranges from pH 9.4 to 11.6.

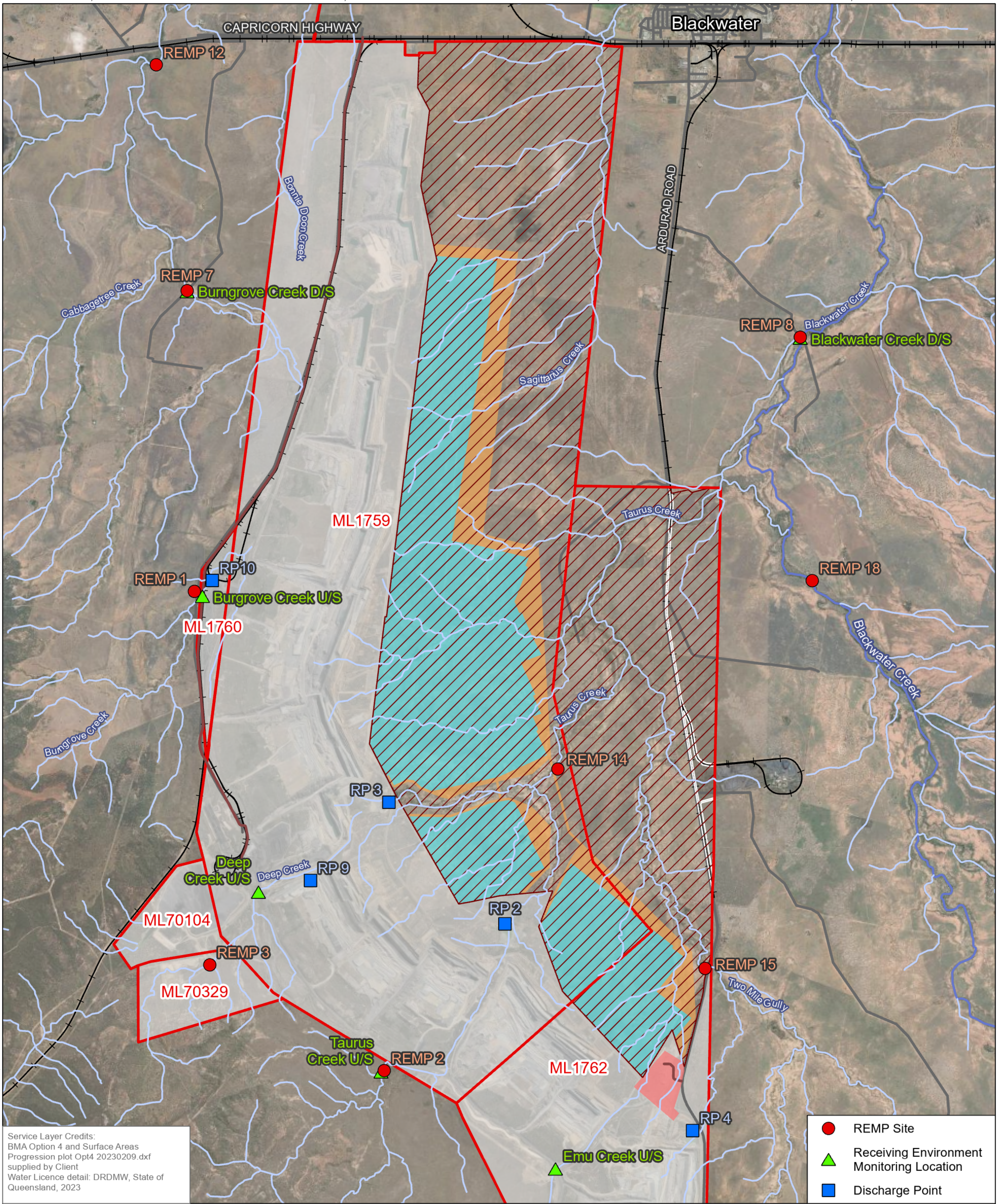
EC concentrations for the MAW storages are within the release limit of 10,000 (µS/cm) for the 10th to 90th percentiles for all the storages except for the TCP Dam which was slightly above the EC limit at the 90th percentile.

Table 2-8 Levels of pH in Mine Storages (pH units)

Statistical Variable	CHPP Sed Dam	New Deep Creek Dam	Ramp 34 Storage Dam	Reject Drainage Sump	Tannyfoil Dam	Taurus Dam	TCP Dam
Min	7.2	6.8	6.7	6.9	6.6	6.4	8.3
10%	7.9	8.3	7.2	7.4	7.5	8.4	8.7
20%	8.3	8.5	7.3	7.6	7.6	8.7	8.7
50%	8.6	8.6	8.3	8.3	8.3	9.0	8.8
80%	8.8	8.8	9.3	8.9	8.9	9.2	8.9
90%	8.9	8.9	9.5	9.3	9.2	9.5	9.0
Max	9.4	9.6	10.8	10.5	10.8	10.7	11.6

Table 2-9 EC Concentration in Mine Storages (µS/cm)

Statistical Variable	CHPP Sed Dam	New Deep Creek Dam	Ramp 34 Storage Dam	Reject Drainage Sump	Tannyfoil Dam	Taurus Dam	TCP Dam
Min	473	897	400	350	173	59	158
10%	1394	3571	808	1720	2929	1926	6064
20%	1773	4191	988	2178	3320	2595	6342
50%	2888	5286	1441	3687	3913	5011	8139
80%	3829	7100	2773	5082	4717	7677	9569
90%	4464	8306	3476	5924	5154	9354	10149
Max	6192	11345	5193	7465	10785	57073	11726



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	07-Dec-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Mine Acces Road
- Minor Watercourse
- Major Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

WATER QUALITY MONITORING LOCATIONS

SLR

FIGURE 2-9

2.6 Existing Water Users

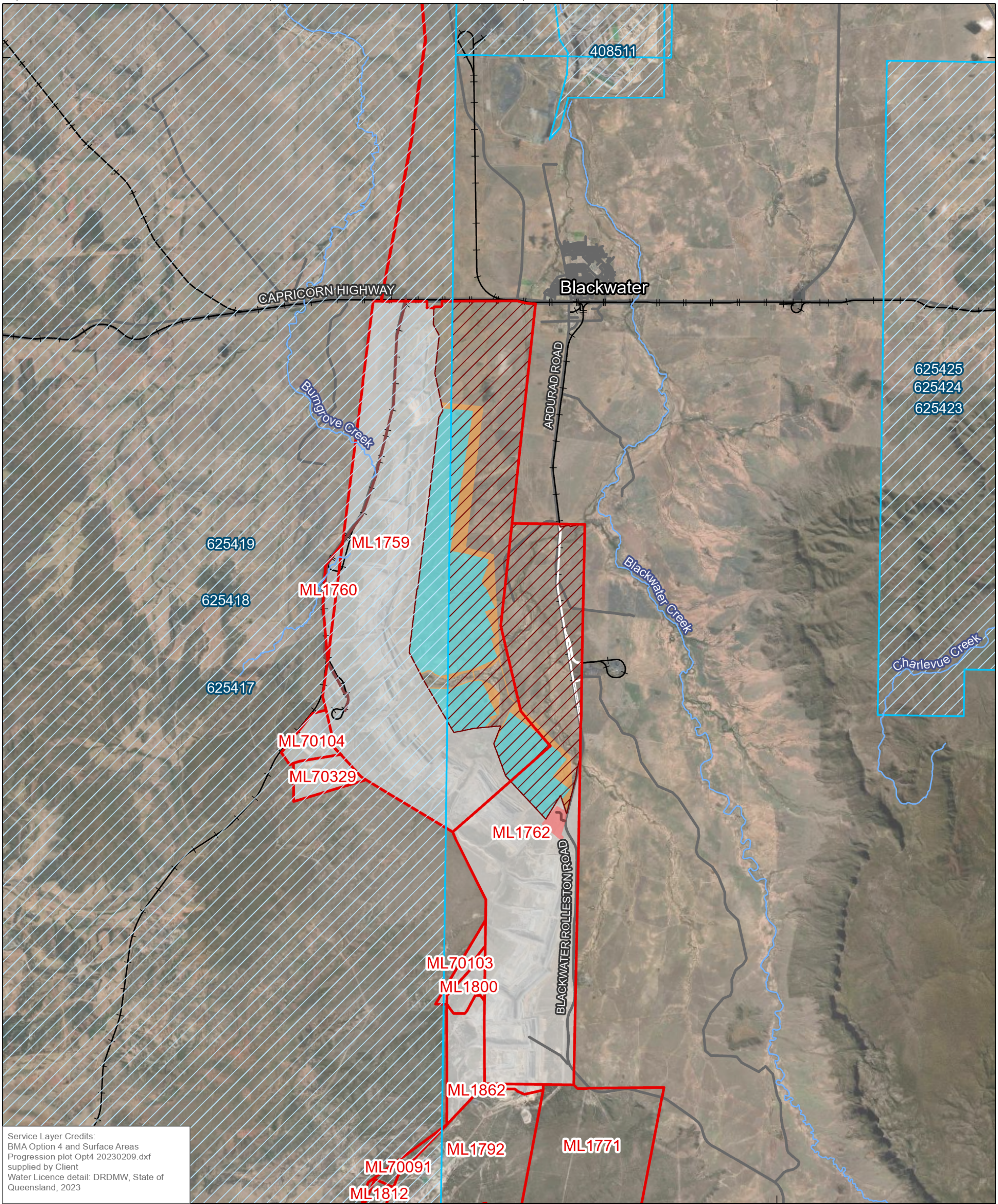
2.6.1 Licensed Water Users

A search of the Queensland Government database for licenced water users was undertaken on 19 June 2023. Licenced surface water users downstream of the Project site are listed in **Table 2-10** and presented in **Figure 2-10**. Three of the four licenses are associated with a license to take water for Petroleum and Gas; these licenses cover a large area around BWM. The only other license that overlaps the area is for Coronado's operations at Curragh Mine and is for diverting or interfering with the Blackwater Creek channel not to take water from the watercourse. Any other licenses in the vicinity of the Project are not directly impacted by the Project.

Table 2-10 Water Users

Licence No	Location	Licence Type	Purpose	Watercourse
408511	ML80086	Licence to interfere by diversion-Channel	Divert the Course of Flow	Blackwater Creek
625417	ATP684	Licence to Take Water	Petroleum and Gas - Non Associated Water	Quaternary - Undefined
625418	ATP684	Licence to Take Water	Petroleum and Gas - Non Associated Water	Rewan Formation
625419	ATP684	Licence to Take Water	Petroleum and Gas - Non Associated Water	Betts Creek Beds

Aerial photography was also reviewed, and it was observed that a number of what appear to be farm dams, exist along the watercourses north of BWM. No water licences have been identified for these structures.



Service Layer Credits:
BMA Option 4 and Surface Areas Progression plot Opt4 20230209.dxf supplied by Client
Water Licence detail: DRDMW, State of Queensland, 2023

0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:200,000 at A4
Project Number:	620.014601
Date Drawn:	07-Dec-2023
Drawn by:	NT

LEGEND

- Railway
- Road
- Mine Acces Road
- Watercourse
- Water Licence
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

WATER USERS

SLR

FIGURE 2-10

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_SW_F02_10_WaterLicence

2.7 Receiving Environment – Potential Sensitive Receptors

The potential for sensitive receptors in the receiving environment were reviewed based on a review of Commonwealth mapped Matters of National Environmental Significance (MNES) and state mapped Matters of State Environmental Significance (MSES).

An initial review of MNES within 20 km of the Project Area using the Protected Matters Search Tool (PMST) indicates that there are six threatened ecological communities, 33 threatened species and 14 migratory species (which are known to occur, likely to occur, or may occur, or habitats are known to / likely / may occur) within the PMST search area. The results were then reviewed against government mapped regional ecosystems and MSES. The review, discussed further below, indicates that most remnant regional ecosystems are located upstream of the BWM to the west of the mine and will not be impacted the Project.

It is noted that this information is based on government mapped data only and no ground truthing of these areas has been carried out as part of surface water impact assessment per se but has been undertaken as part of the broader Project. Further information on MNES and MSES is provided in Blackwater North Extension Project Aquatic Ecology (ESP, 2023), Terrestrial Ecology MSES Assessment (EMM 2023a) and Terrestrial Ecology MNES (EMM 2023b).

A review of the Biodiversity status mapping by the QLD government indicated the following:

- Endangered – Sub-dominant area (11.3.2/11.2.25/11/3.1 - Acacia open forest & Eucalyptus woodland) along a 1km small section of Taurus creek, within the northern extent of SA7 approximately 5 kms downstream of the Project area and existing EA release points.
- Of Concern – Dominant area (11.3.2/11.3.3/11.3.3c – Eucalyptus woodland and Coolabah Woodland) along Blackwater Creek, 10 km downstream of the Project disturbance footprint, outside of SA7 and SA10.
- Threatened (endangered or vulnerable) wildlife habitat for Denisonia maculata (Ornamental Snake). A review of the mapping up to 20 km downstream of the study area showed small areas along Taurus and Blackwater Creeks between 4 km and 8 km downstream of the Project disturbance footprint.
- Regulated Vegetation mapping of Endangered / Of Concern Category C (regrowth) identified areas within SA7 approximately 6 km downstream of the Project disturbance area.

Overall, the potential for sensitive receptors in the downstream environment was reviewed and found to be minimal within the areas immediately downstream of the surface water release points. The locations identified as Threatened (endangered or vulnerable) wildlife habitat is also classified as Regulated Vegetation essential habitat. This largely consists of a small 1km section of Taurus Creek downstream of the Project disturbance area.

Although all creeks downstream of the Project are mapped for MSES regulated vegetation none are mapped as MSES declared high ecological value waters (watercourse). There are no High Ecological Significance (HES) wetlands downstream of the Project area with the closest trigger area being over 70 km downstream.

2.8 Creek Geomorphology

As described above, the Project area includes tributary streams of the Mackenzie River in the headwaters of the Fitzroy River Basin. The area is divided by a relatively indistinct ridgeline dividing two watersheds within the Project site:

- The western watershed includes Sagittarius Creek and tributaries.

- The eastern watershed includes Blackwater Creek, Taurus Creek, Two Mile Gully, Deep Creek, Stony Creek, Spring Creek and tributaries.

Within the Project site, both Two Mile Gully and Deep Creek join Taurus Creek. Upstream of the Project site, Spring Creek joins Stony Creek, and Stony Creek joins Blackwater Creek. To the east of the Project site, Taurus Creek joins Blackwater Creek. Downstream of the Project site, Sagittarius Creek joins Blackwater Creek.

The watercourses in and around the Project site are ephemeral and are dry for prolonged periods. After these prolonged dry periods, a significant rainfall event is typically required in order for the streams to flow.

Typical cross-sections for two of the main ephemeral surface water bodies within the Project Area – Sagittarius Creek and Taurus Creek – are provided in **Figure 2-11** and **Figure 2-12**. The Sagittarius Creek cross-section shows a single confined channel whereas the Taurus Creek cross-section shows confined low-flow channels and a broader high-flow channel.

Figure 2-13 and **Figure 2-14** illustrate typical vegetation in the tributaries for an undefined tributary and Taurus Creek respectively.

Existing waterways running through the Project area are prone to erosion, particularly as a result of grazing activities.

The stream beds contain mostly sand and gravel on a clay base, except Deep Creek upstream which contains a majority of silt and clay. As the creek progresses downstream away from the mining lease, the substrate shows little change in morphology, with small amounts of silt or sediment observed in areas of former remnant pools (BMA, 2020).

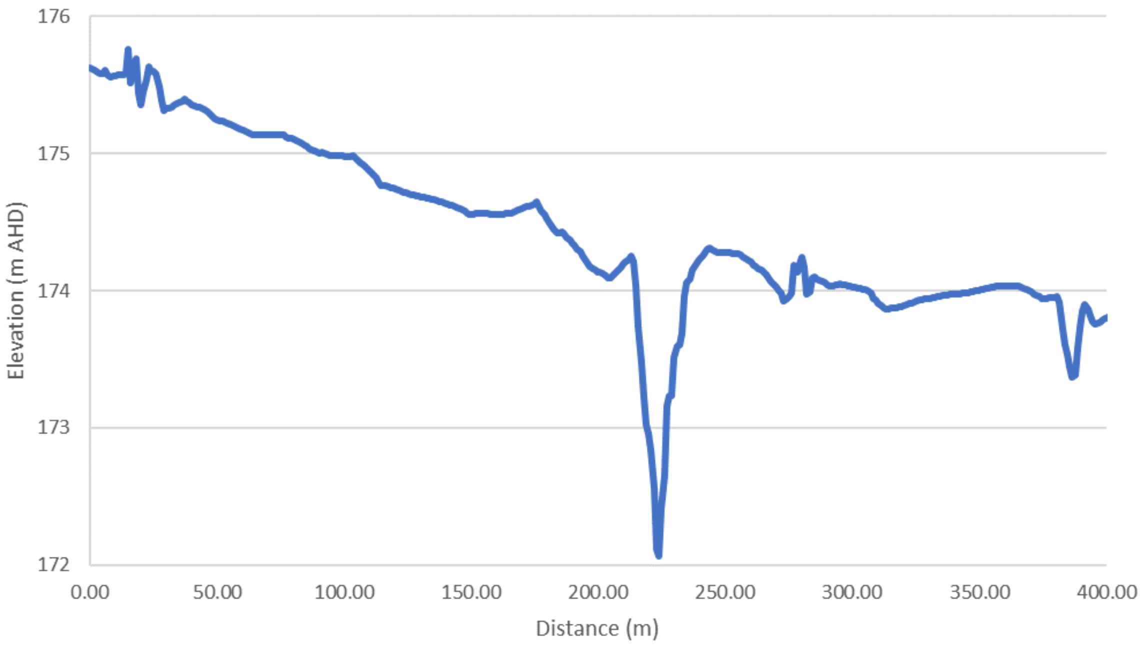


Figure 2-11 Typical cross-section of Sagittarius Creek

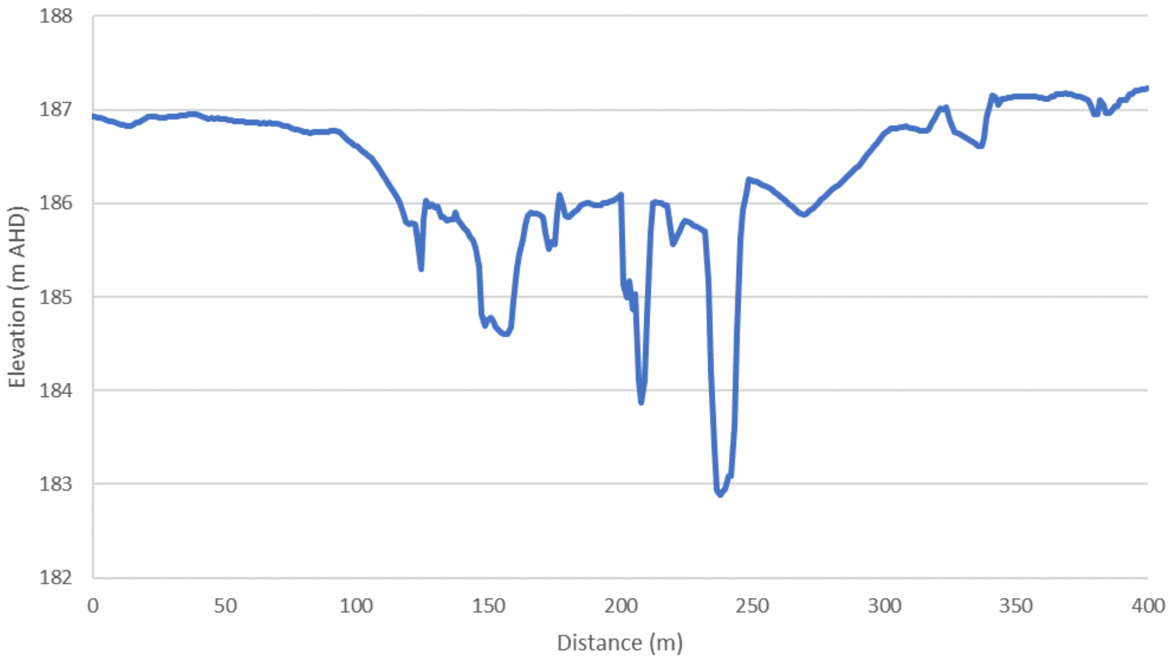


Figure 2-12 Typical cross-section of Taurus Creek

Figure 2-13 Eucalypt fringing drainage line which indicates typical vegetation (refer EMM, 2023a, Photograph 6.17)

Figure 2-14 Riparian vegetation on Taurus Creek which indicates typical vegetation (refer EMM, 2023a, Photograph 6.1)

3.0 Surface Water Management

3.1 Overview of Surface Water Management Principles

BWM will review and update, as required its Water Management Plan to incorporate the Project. The current surface water management strategy (illustrated in **Figure 3-1**) will be applied to the new areas for the Project and will involve the following management actions:

- Where possible, stormwater runoff from undisturbed areas both on and surrounding the mine is diverted away from disturbed areas into adjacent waterways (i.e., Taurus Creek, Two Mile Gully, Deep Creek and Sagittarius Creek).
- Disturbed area runoff is captured and treated in sediment/environmental dams and used preferentially for dust suppression and coal processing to minimise the likelihood of offsite water discharges.
- Mine-affected water is captured and treated in the Mine water management system where it is then transferred to be preferentially used for process water or dust suppression. If required, it is discharged off-site in compliance with the Mine's EA EPML00717813.
- Infrastructure and mining areas will be protected from flooding from surrounding surface water courses (i.e., Taurus Creek, Two Mile Gully and Deep Creek) using a flood levee and/or flood protection landforms.
- All significant quantities of hydrocarbon and chemical products stored on site are stored in temporary or permanent bunding.
- Sediment transport to be reduced through progressive rehabilitation.
- The continued implementation of the BWM's Environmental Management System will ensure that roles and responsibilities for mining activities that may affect surface water are clearly defined and that appropriate management actions are developed and implemented for these mining activities to provide a commensurate level of environmental protection.
- All water management structures will be designed and constructed using practical hydraulic parameters based on an appropriate risk-based rainfall event, catchment size, slopes, discharge design and soil types.
- Spill capture and retention devices are used for refuelling and similar areas.
- Runoff from oily water areas is treated using an oil-water separator.
- Disturbance is kept to an operational minimum for safe operation to reduce the area exposed.

There are several controls that inherently form part of the water management system through both planning, design and procedure. These are presented graphically in **Figure 3-1**. Overall, the controls are informed by a risk-based approach to water management, where there is a balance between capturing and treating water running off disturbed areas and providing for good quality water to continue to flow downstream for users and the environment. Achieving this balance, particularly allowing good quality water to flow downstream, is critical to reducing the risk of contributing to environmental harm if water is unnecessarily retained (potentially deteriorating it through evaporation and creating legacy water inventory). This risk-based approach has been adopted since the introduction of the DES model mining conditions in 2008 following the capture of water at Ensham and the following research into river health by Dr Barry Hart (Hart, 2008).

The selection of a design immunity for water management infrastructure is based on industry guidelines and research including but not limited to:

- BMA Standard Erosion and Sediment Control (ESC) and Mine Affected Water (MAW) Standard BMAs Erosion and Sedimentation Control Standard 30 (BMA, 2020)
- Risk ratings based on recommendations from Australian Soils and Landscapes Handbook (CSIRO, 2004);
- Best Practice Erosion and Sediment Control by the International Erosion Control Association (IECA), (IECA, 2008);
- Structures which are dams or levee as of part of environmentally relevant activities (DES, 2019); and
- The Manual for Assessing Consequence Categories and Hydraulic Performance of Structures (DEHP, 2016) (the Manual).

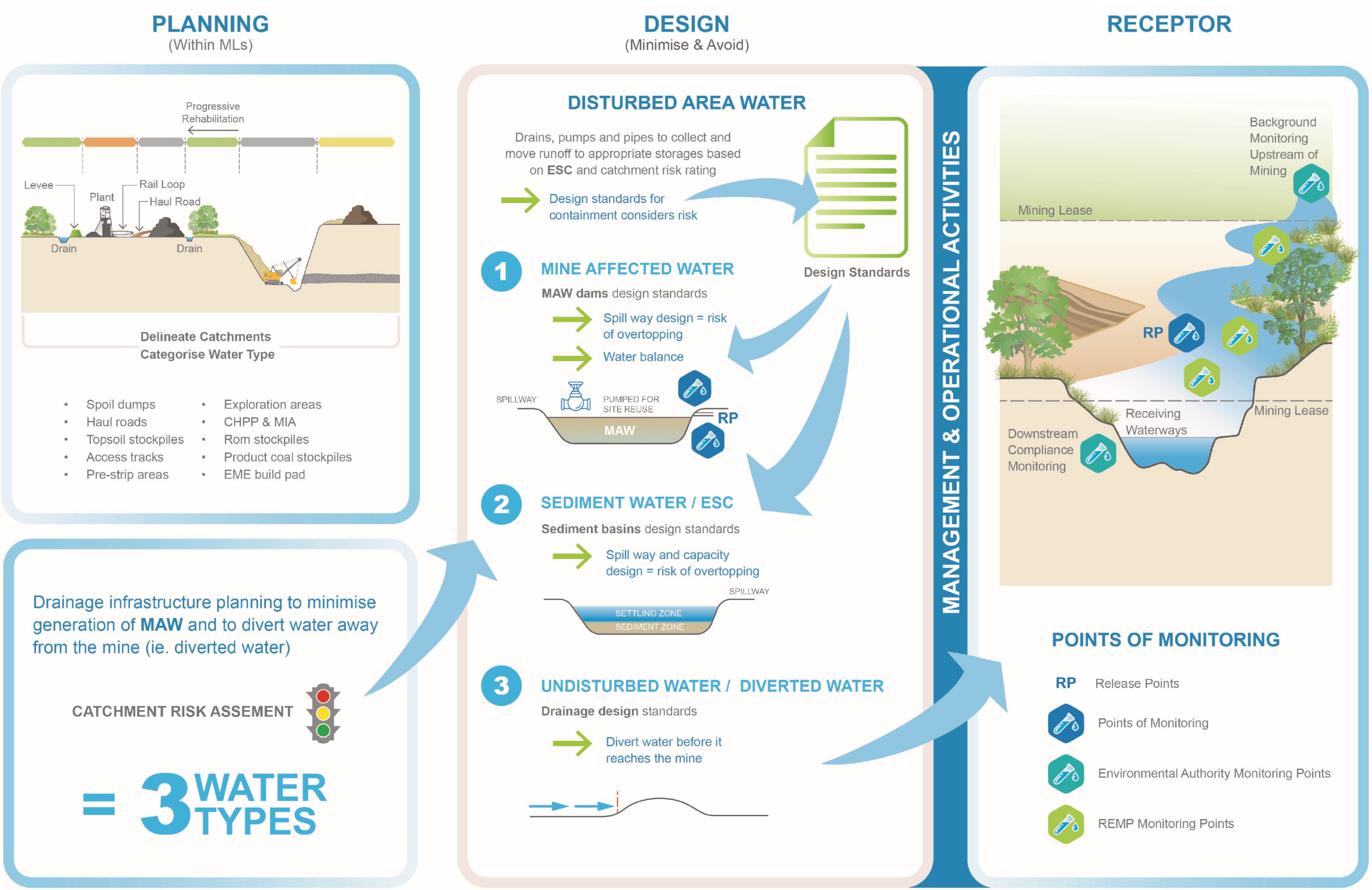
Figure 3-1 illustrates how catchment planning and separation of water types is undertaken as part of the mine design. As the mine develops this process reoccurs as the changing footprint and progressive rehabilitation changes the area of potential disturbance. Water is classified as ‘having the potential to be sediment-laden” (ESC), MAW or undisturbed and is then routed through the water management structures accordingly. Elements essential for the operation of the system, such as a sediment storage allowance in an ESC structure that is appropriate for the proposed maintenance regime of that structure, are also designed. The structures are sized through calculation of a single intense event as well as through water balance modelling which considers the potential for cumulative events as well as bottlenecks in the overall system as water is transferred between storages.

Following risk assessment and design, the system is supported through a number of active management controls, many of these are legislated through the Project’s EA and include but are not limited to:

- A site-specific ESC Plan and Water Management Plan (WMP);
- Trigger Action Response Plan (TARP) for the system and key structures;
- Release rules, procedures and telemetry;
- Inspections and water level management;
- Maintenance procedures including dewatering, desilting, and inspections;
- Monitoring of water quality; and
- Wet season preparedness, including predictive water balance modelling and subsequent planning.

Figure 3-1 also shows the monitoring which occurs through compliance activities associated with the EA, BWM’s internal operational monitoring and the REMP.

This water management system has been designed in accordance with BMA and BWM Standards. These standards are based on industry standards formed by research and proposed by regulatory agencies such as DES. The system is designed on a risk basis with consideration for avoiding and minimising the risk of environmental harm.



Project Number:	620.13593
Date:	13-Jul-2023
Drawn by:	NT

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BLACKWATER MINE - NORTH EXPANSION PROJECT

WATER MANAGMENT DIAGRAM

FIGURE 3-1

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3.2 Activities Requiring Management

The key components of the Project with potential to impact on surface water resources include:

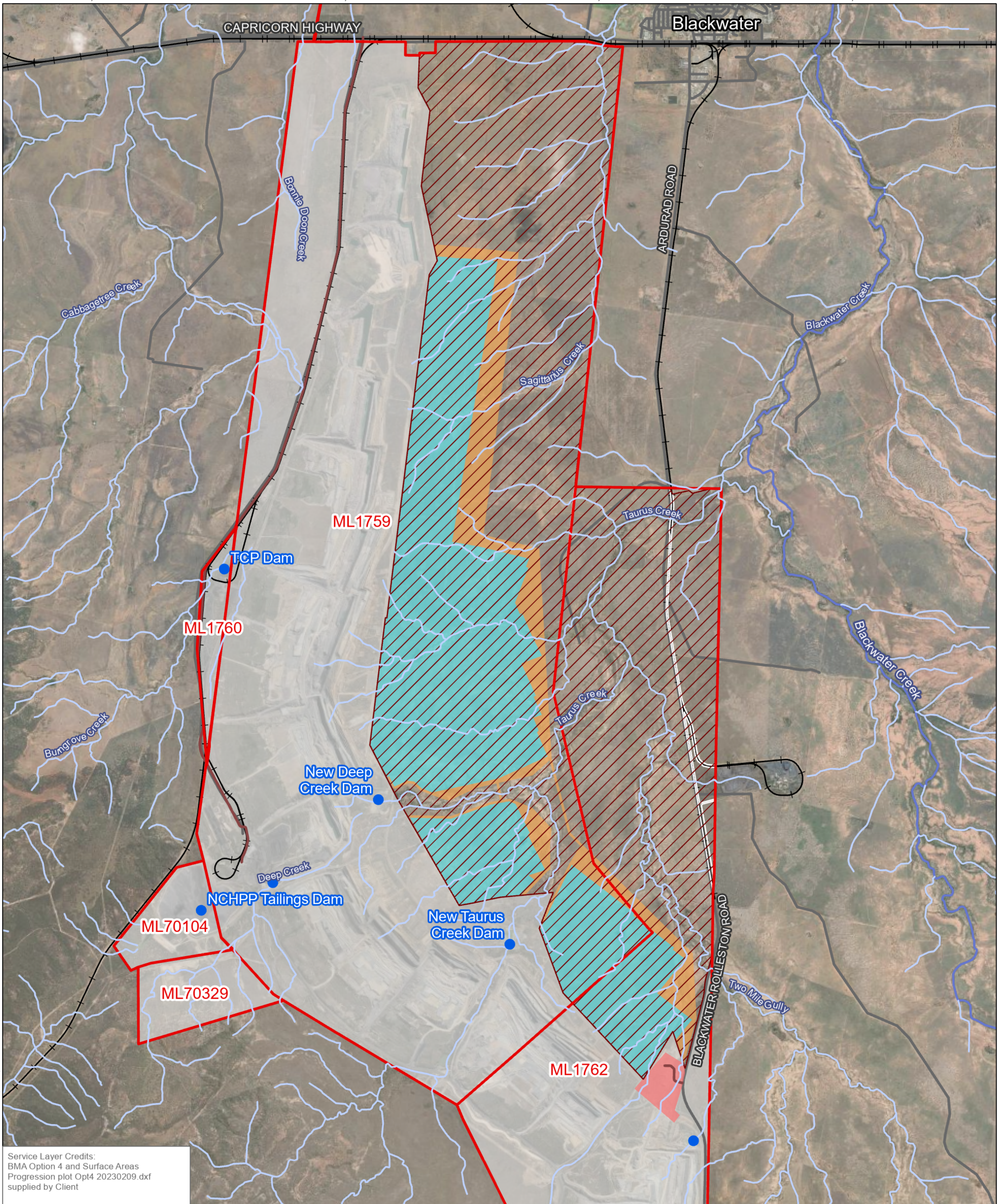
- Extension of open cut mining at the BWM into SA10 and SA7.
- Relocation of mine water dams, ESC structures and pipelines as required by the progress of mining.

3.3 Existing Surface Water Management

The existing water management strategy involves the use of clean water dams, MAW dams and ESC structures such as sediment dams. MAW will continue to be sent to inactive pits for storage where it is called on to meet the various site demands as required. MAW is also stored across the site in dust suppression fill points, environmental dams, tailings dams and MAW release dams including New Deep Creek Dam and New Taurus Creek Dam. **Figure 3-2** and **Figure 3-3** illustrates the key infrastructure and existing surface water management system for the BWM north site respectively. A detailed schematic of all transfers is provided in **Appendix D**.

The Bedford East and Bedford West pipelines supply water to BWM from BMA water allocations.

MAW pipelines are also used to transfer water during dewatering and between storages. The pipelines used for dewatering will require relocation as the pits progress.



0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:100,000 at A4
Project Number:	620.014601
Date Drawn:	11-Dec-2023
Drawn by:	NT

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LEGEND

- Water Storage Dam
- Railway
- Road
- Mine Acces Road
- Minor Watercourse
- Major Watercourse
- BWM Mining Lease
- BWM North Extension Project Area
- Existing Blackwater Mine
- Existing Mine Infrastructure Area

Indicative Project Footprint

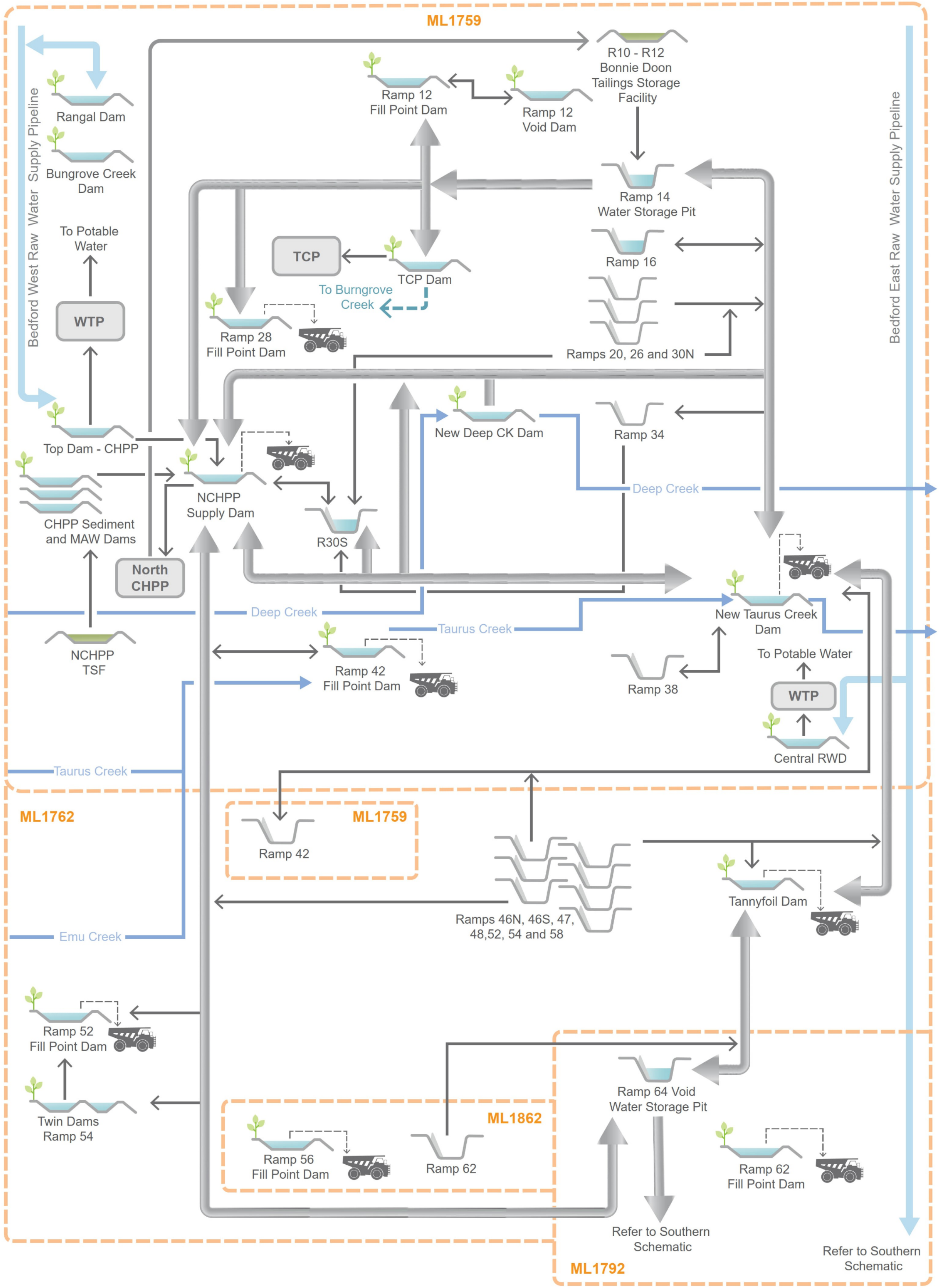
- Proposed Out of Pit Disturbance
- Proposed Pit Extent

BLACKWATER MINE - NORTH EXTENSION PROJECT

KEY WATER MANAGEMENT INFRASTRUCTURE

FIGURE 3-2

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro v1.aprx\620014601_SW_F03_2_SW_Infrastructure



BLACKWATER MINE - NORTH EXTENSION PROJECT

BWM MINE WATER MANAGEMENT SYSTEM SCHEMATIC

FIGURE 3-3

Path: H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\08 GIS\BWM NEP Pro\BWM NEP Pro.aprx\620014601_PD_F03_3_BWM Mine Water Management System Schematic

3.3.1 Flood Protection

Existing flood protection such as those associated with the Deep Creek and Taurus Creek Diversion will not be altered as part of the Project.

3.4 Proposed Surface Water Management Infrastructure

The Project will integrate with and utilise existing water management infrastructure. As the pit progresses, modifications to the locations of water management infrastructure will occur. Details of the proposed works are outlined in the following subsections.

3.4.1 Dams

New ESC structures will be constructed for the proposed Pit extensions. These storages will be designed to capture sediment laden runoff from disturbed areas such as those cleared prior to mining. ESC structures will be designed in accordance with the BWM Erosion and Sediment Control Plan and BWM Water Management Plan and managed in accordance with Schedule G of the BWM EA. The management plan specifies different types of ESC and the different requirements for each control type being Erosion, Drainage and Sediment. The regulated structures require a certified operational plan to be developed which will include management methods for high rainfall and flood events.

ESC structures will be placed at the natural low point within the disturbance footprint, with undisturbed surface water catchments diverted around and away from disturbed areas using bunds and gravity diversion drains. Some small diversion drains may be required to capture all disturbed catchment and discharge to the proposed sediment dams. Catchment risk assessments will be undertaken and used to define sediment control structure design, in particular the sizing. Sediment control measures are designed and constructed in accordance with the Best Practice Erosion and Sediment Control Guideline (IECA, 2018).

There are no proposed changes to the MAW structures as part of the Project. MAW is proposed to be managed in the existing MAW system, with additional pumps and pipeline infrastructure utilised to manage transfer of this water from the expanded Project site. MAW structures will be relocated if required as the mining footprint extends due to the Project.

Structures will be assessed in accordance with the Manual which includes an assessment for: failure to contain overtopping, failure to contain seepage and failure to contain dam break. High or significant structures will be managed in accordance with Schedule G of the EA and designed, constructed and managed in accordance with the Manual and associated dam specific documents required therein.

ESC structures and MAW dams are inspected pre- and post-wet season (at a minimum) and operational controls require dewatering to reset to the desired operational level and provide the required settling storage for rainfall events. The spillway capacity of the dams is designed specific to the consequence category and catchment risk.

The BWM's Water Management Plan (WMP) and ESC plan will be used to provide continued monitoring and management of the system and will be updated annually by a suitably qualified person under conditions F25 and F26 of the EA.

3.4.2 Flood Protection

To prevent the inundation of proposed pits from Two Mile Gully, Deep Creek and Taurus Creek, protection measures have been proposed including:

- Flood protection during operation. Operational flood protection will include levees and/or flood protection landforms.
- Where flood protection is required post-mining, the final landform design will provide an appropriate level of protection.
- Delineation and management of areas where minimum ground levels need to be maintained to prevent ingress of the flood events into mine pits and infrastructure areas.

Flood protection components and locations are shown on

Figure 3-4 and detailed in **Table 3-1**.

Table 3-1 Flood Protection Locations

Name	Required During	Details
FP1	Operations Only	Protection of the Besgrove Pit extension from Deep Creek flooding up to 0.1% AEP + 0.5 m freeboard. Estimated length 1 km. Estimated height 1.5m – 2.0 m.
FP2	Operations and Closure	Protection of the Besgrove Pit extension from Deep Creek flooding up to 0.1% AEP + 0.5 m freeboard. Estimated length 1 km. Estimated height 0.7 m – 2.4 m.
FP3	Operations and Closure	Protection of the Deep Creek Pit extension from Taurus Creek flooding up to 0.1% AEP + 0.5 m freeboard. Estimated length 650 m. Estimated height 1 m – 2.5 m.
FP4	Operations and Closure	Protection of the Stewarton Pit extension from Taurus Creek flooding up to 0.1% AEP + 0.5 m freeboard. Estimated length 1.3 km. Estimated height 0.8 m – 2.5 m.
FP5	Operations and Closure	Protection of the Stewarton Pit extension from Taurus Creek flooding up to 0.1% AEP + 0.5 m freeboard. Estimated length 250 m. Estimated height 0.6 m – 1.4 m.
FP6	Operations and Closure	Protection of the Stewarton Pit extension from Two Mile Gully flooding up to 0.1% AEP + 0.5 m freeboard. Estimated length 1 km. Estimated height 0.5 m – 1.5 m.

A flood protection levee (located at FP1 on

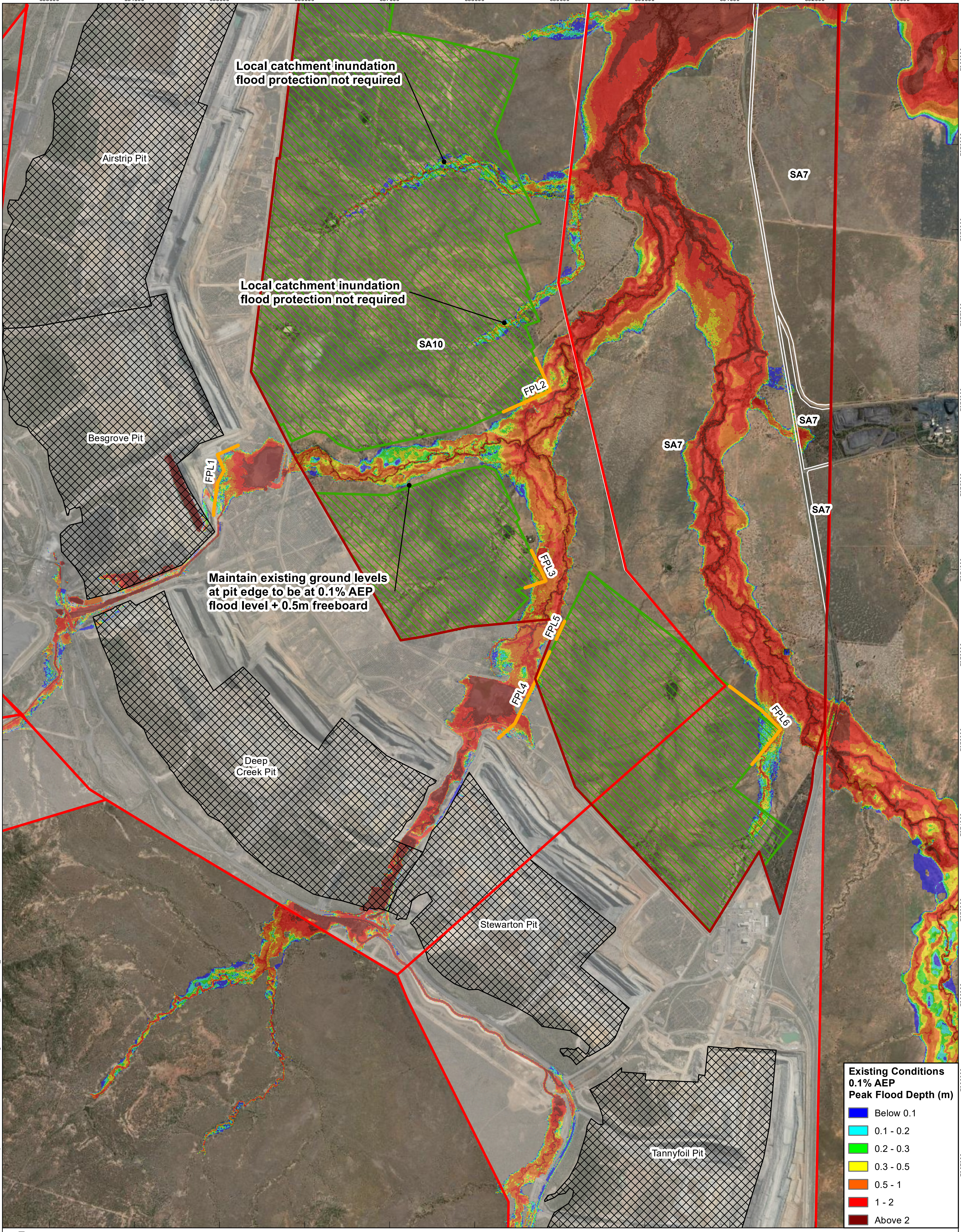
Figure 3-4**)** is required to prevent flood waters from Deep Creek inundating Besgrove pit west of New Deep Creek Dam. The levee will extend on the existing flood pit protection and be approximately 1 km long with a crest level at or above the 0.1% AEP flood level +0.5 m freeboard. The levee will have an average height of 1.5 m. This levee will only be required during operations.

Flood protection at locations FP2 to FP6 will be required during both operations and closure to protect the extension of Stewarton Pit, Deep Creek Pit and Besgrove Pit. Flood protection at these five locations may take the form of a flood protection levee during operations and be recontoured in the final landform. Alternatively, the flood protection may be provided through a flood protection landform designed to function during both operations and closure. At all five locations the final landform will provide flood protection during closure. These landforms will be generally trapezoidal in shape, top soiled and grass covered to minimise the potential for erosion. Ultimate design details including lengths, heights, top widths and batter slopes will be developed based on appropriate guidelines during detailed closure design.

The proposed flood protection at each location is expected to have a length of approximately 250 m to 1.3 km. The flood protection will prevent inundation up to a 0.1% AEP flood event + 0.5 m freeboard. They are estimated to have an average height of 1.5 to 2.0 m above natural ground levels, along the length. The locations are shown in

Figure 3-4 with details provided in **Table 3-1**.

Any flood protection levees will be constructed with an appropriate width based on the levee height and designed and constructed in accordance with the Department of Environment and Science (DES) *Manual for Assessing Hazard Categories and Hydraulic Performance of Dams and the DEHP guideline Structures which are dams or levees constructed as part of environmentally relevant activities*.



Coordinate System: AGD 1966 AMG Zone 55
Scale: 1:40,000 at A3
Project Number: 620.014601
Date: 15-Nov-2023
Drawn by: SM

0 500 1,000 Meters

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

SLR

H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\03 Technical Disciplines\03 Surface Water\GIS\Flood Figures\620.014601_FIGURE 3-4_Levees.mxd

BLACKWATER MINE -
NORTH EXTENSION PROJECT

PROPOSED FLOOD PROTECTION LOCATIONS

FIGURE 3-4

3.4.3 Waterway Crossings

Creek Infrastructure Crossing

The infrastructure crossing of Taurus Creek will include a Back Access Road crossing of Taurus Creek (as well as other infrastructure such as electricity transmission lines). The Back Access Road will be designed as a low level culvert crossing in accordance with the Accepted Development Requirements for high (red) risk waterway barrier works (DAF 2020) and will be consistent with the Department of Transport and Main Roads Drainage Manual (TMR, 2023). The pipes that convey flow will be installed at existing creek invert levels to allow fish passage and will be stabilised by rock protection. The flood design event (1 in 20 AEP) for the Back Access Road is such that in rarer events the crossing structure is overtopped.

Dragline Crossing

The dragline crossing of Deep Creek is designed to allow the machine to walk down into, across and out of the creek bed. The crossing will be at creek bed level and will not impede flow. No culvert pipes will be installed and the upstream and downstream edges of the crossings will be protected by rock. All flows will flow through the DRE crossing and hence fish passage is unimpeded. Draglines crossing events do not occur on a frequent basis and when they do, they are not scheduled to occur during wet weather or stream flow.

4.0 Hydrologic and Hydraulic Modelling

4.1 Terminology

This report uses the terminology Annual Exceedance Probability (AEP) to define the likelihood of design flood events occurring, that is the probability of an event occurring or being exceeded within a year. Average Recurrence Interval (ARI) was a term used previously to define the probability of design flood events (IEAust, 1987) and was defined as the average period between occurrences equalling or exceeding a given value.

In the Australian Rainfall and Runoff: A Guide to Flood Estimation (AR&R) (Geoscience Australia, 2019), the adopted terminology to define design flood probabilities has been changed to AEP. The BoM has similarly adopted this terminology in publishing the revised rainfall Intensity-Frequency-Duration (IFD) curves for Australia (BoM, 2016). It is noted that the 50% and 20% AEP do not directly correspond to the 2 year and 5 year ARI. However, this terminology has been adopted for this report and for ease of conversion. This is considered appropriate given the limitations and uncertainty associated with the hydrology for these frequent events presented in this report.

For clarity, the adopted and previously used terminology is both shown in **Table 4-1**.

Table 4-1 Design Flood Events - Terminology

ARI*	AEP**	Terminology used in this report
2 years	~39%	50% AEP
5 years	~18%	20% AEP
10 years	10%	10% AEP
20 years	5%	5% AEP
50 years	2%	2% AEP
100 years	1%	1% AEP
1000 years	0.05%	0.1% AEP

**Average Recurrence Interval ** Annual Exceedance Probability.*

4.2 Previous Modelling

Hydrologic and hydraulic modelling of BWM was previously undertaken by GHD, as detailed in the report *'Blackwater Mine Flood Study'*, February 2021 (BWMFS). The hydrologic and hydraulic models were reviewed with minor updates made to the provided models to ensure the models were fit for the purposes of this assessment. Details of the modelling are provided in **Section 4.3** and **Section 4.5**.

4.3 Hydrologic modelling

As part of the BWMFS, XP-RAFTS hydrologic models of the catchments in the vicinity of BWM were developed including:

- Blackwater Creek
- Rockland Creek
- Two Mile Gully

- Sagittarius Creek
- Bonnie Doon Creek
- Burngrove Creek
- An unnamed waterway[3]
- Sirius Creek
- Taurus Creek

The BWMFS (GHD, 2021) included calibration of the Burngrove Creek and Speculation Creek models was undertaken using historical rainfall and streamflow data. The model parameters including Mannings roughness, losses and channel routing adopted for the calibration assessment were applied to the remaining models.

The following XP-RAFTS models were utilised for this assessment:

- Taurus Creek (includes Deep Creek)
- Two Mile Gully
- Blackwater Creek

To verify the model performance, the results of the models were compared to the results of Rational Method, Regional Flood Frequency Estimation (RFFE) model and Quantile Regression Technique (QRT) analyses. The results of the analyses showed that the models generally produced peak flows in the order of the Rational Method and Quantile Regression Technique estimates. The comparison of results for Taurus Creek is illustrated in **Figure 4-1**.

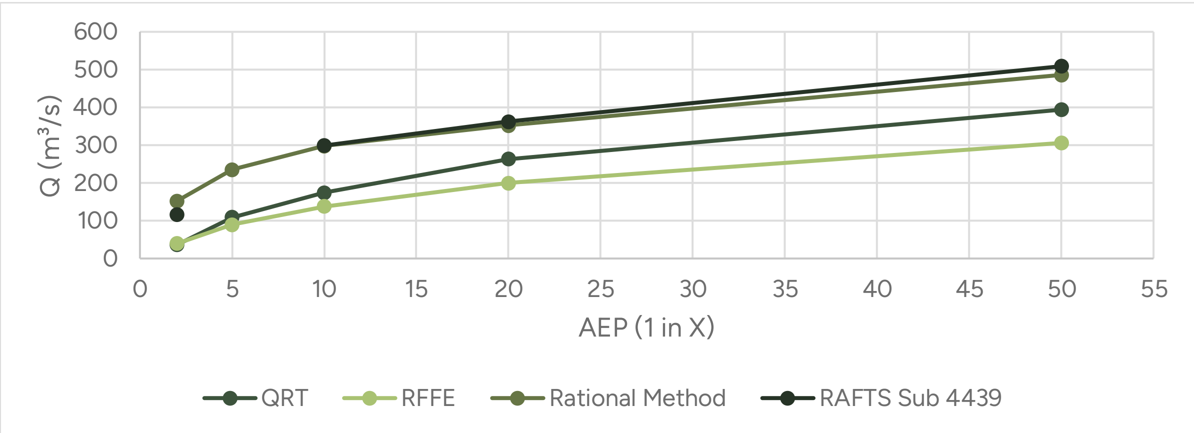


Figure 4-1 Hydrologic Model Verification Results – Taurus Creek

Based on the outcomes illustrated in **Figure 4-1**, and the model development and calibration methodology undertaken by GHD, the XP-RAFTS model was considered fit for the purpose of the assessment.

[3] Referred to in the GHD Flood Study documentation as Speculation Creek. It is noted that Speculation Creek has been used as nomenclature consistent with previous flood studies. However this creek is unnamed on all government waterway mapping.

The model was used to simulate the 0.1%, 2% and 50% AEP storm events. Storm durations and temporal patterns were selected based on the critical event analysis undertaken as part of the BWMFS.

Critical durations for each of the AEP events were identified from the hydrologic model results based on peak flow rates predicted at key locations for the Project. To account for peak flow rates in other areas of the Project site, the next event durations longer and shorter than each of the critical duration events were also modelled. For each AEP and duration event, temporal patterns which produced the median peak flow rates at key locations for the Project were adopted. Flow hydrographs produced by the XP-RAFTS model were extracted and utilised in the hydraulic model as inflow boundary conditions.

4.4 Probable Maximum Precipitation Flood

In addition to the 0.1%, 2% and 50% AEP storm events, the probable maximum flood (PMF) events for each of the hydrologic model catchments were developed and simulated using the XP-RAFTS model. The probable maximum precipitation (PMP) depths developed by GHD as part of the BWMFS were adopted for this assessment and Generalised Short Duration Method (GSDM) and Revised Generalised Tropical Storm Method (GTSMR) temporal patterns were applied as appropriate to the event durations.

No data was available for the Blackwater Creek PMP depths, therefore these were conservatively estimated based on the greatest estimates provided for each duration across the other catchments. As shown in **Table 4-2**, the Blackwater Creek PMP depths were adopted from the maximum from each of the other domains for each duration. While this may result in slight overestimations in flows generated by the XP-RAFTS model, there was no residual impact to the outcome of the assessment as the confluence of Taurus Creek with Blackwater Creek is approximately 5.2 km downstream of the proposed pit locations. At this location water levels are 13 m below the ground surface levels within the Project footprint. Therefore, there is no hydraulic influence from Blackwater Creek flows (at this confluence) on the flood levels in the Project footprint.

The PMP events were applied to the hydrologic model and flow hydrographs produced were extracted and utilised in the hydraulic model as inflow boundary conditions.

Table 4-2 PMP Rainfall Depths (mm)

Model Domain	Duration (hours)					
	1	6	12	18	24	72
Taurus Creek	310	590	780	870	960	1730
Two Mile Gully	410	800	880	920	950	1700
Blackwater Creek	**410**	**800**	**880**	**920**	**990**	**1790**

4.5 Hydraulic Modelling

4.5.1 Model Setup

Hydraulic modelling of the area was conducted using the TUFLOW 1D/2D linked fluvial hydrodynamic model, which was developed by GHD as part of the BWMFS. The TUFLOW model covers the catchments of Deep Creek, Taurus Creek, Two Mile Gully, Blackwater Creek and Sagittarius Creek.

The model was reviewed and deemed to be generally appropriate for use in the assessment, with minor updates made to inflow locations, boundary conditions and sources.

4.5.2 Model Scenarios

The following model scenarios were developed:

- **Existing Scenario** – representing the current conditions based on the modelling undertaken by GHD. The scenario was developed based on the assumption that the existing pits maintain immunity from flooding ingress in the 0.1% AEP event. Discrete modifications to the base model terrain were made in some locations to simulate this. Refer **Appendix A**.
- **Future Scenario** – representing conditions during the expansion of mining operations into SA7 and SA10. The model terrain was adjusted to incorporate the proposed flood protection levee and landforms. Model inflows were adjusted to account for the reduction in catchment areas due to the proposed mining progression programme (refer **Section 6.1** for results). Refer **Appendix B**.
- **End of Life Scenario** – representing conditions following the completion of mining of SA7 and SA10 (refer **Section 7.1** for results). Refer **Appendix C.**

The model was utilised to simulate a range of storm events for each model scenario, including the 0.1%, 2% and 50% AEP events. Storm durations and temporal patterns were selected based on the critical storm analysis detailed in the BWMFS.

The Probable Maximum Precipitation Flood (PMPF) event was also simulated for the End of Life model scenario. The PMPF is the representative flood event caused by the occurrence of the PMP storm event.

4.5.3 Model Results

The results of the TUFLOW model simulations were used to illustrate the extent of flooding for the simulated flood events. Peak flood levels, depths and velocities produced by the TUFLOW model for the existing scenario are illustrated in **Appendix A.**

4.5.4 Existing Flood Characteristics

The results of the TUFLOW model were reviewed in the context of the project under existing conditions. This information provides the base case information for future assessment of potential impacts as a result of the proposed expansion of mining activities.

The results showed that under existing flooding conditions without the proposed flood management structures in place, operational areas of the project would be subject to inundation from Deep Creek, Taurus Creek and Two Mile Gully in the 0.1% AEP event.

The existing flood characteristics are summarised below for Deep Creek, Taurus Creek (upstream of the junction with Deep Creek) and Two Mile Gully. The flood characteristics are illustrated relative to the recommended industry standard ACARP design criteria for the design of stream diversions (ACARP, 2002), which relate to stream power, velocities and shear stresses. Peak stream power, bed shear stress, and velocities were extracted from the TUFLOW model.

While these criteria relate only to diversions, application to existing conditions indicate the nature of the existing flow regime. The analysis, presented in **Table 4-3**, indicates the flow behaviour for the existing Deep Creek, Taurus Creek and Two Mile Gully generally exceeds the ACARP design criteria. This is discussed further in the flood impact assessment **Section 6.1**.

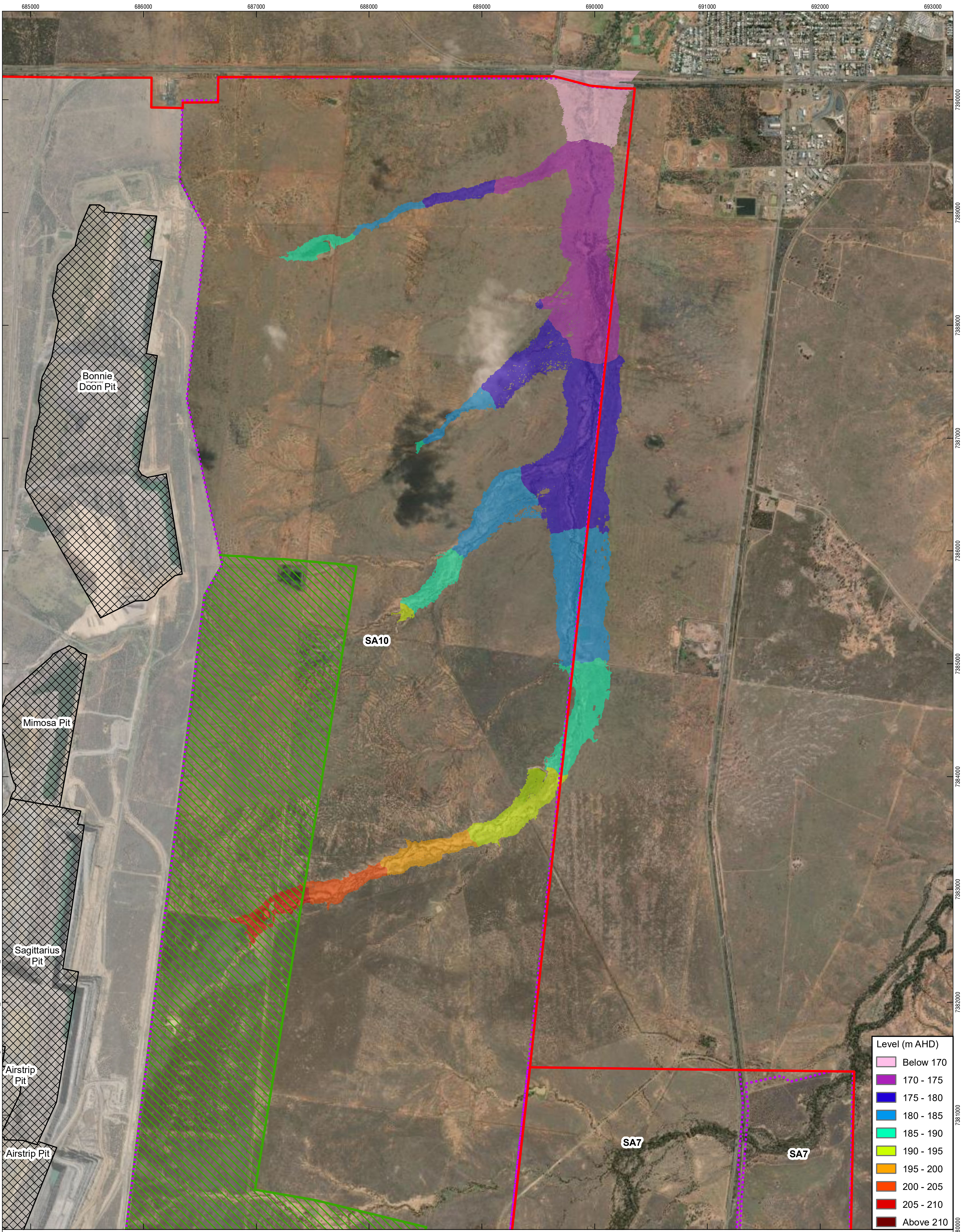
Appendix A provides mapping of these model results.

Table 4-3 ACARP Diversion Channel Design Criteria and Existing Flood Behaviour

Scenario		ACARP Criteria	Deep Creek	Taurus Creek	Two Mile Gully
50% AEP event	Stream Power (W/m^2)	**< 60**	< 60 generally, stretches of main channel > 150	< 60 generally, stretches of main channel > 150	< 60 generally, stretches of main channel > 150
	Velocity (m/s)	**< 1.5**	< 1.5 generally, localised areas of main channel > 2.5	< 1.5 generally, localised areas of main channel > 2.5	< 1.5 generally, localised areas of main channel > 2.5
	Shear Stress (N/m^2)	**< 40**	< 40 generally, stretches of main channel > 80	< 40 generally, stretches of main channel > 80	< 40 generally, stretches of main channel > 80
2% AEP event	Stream Power (W/m^2)	**< 150**	> 150 in stretches of main channel	> 150 in stretches of main channel	> 150 in main channel
	Velocity (m/s)	**< 2.5**	< 1.5 generally, localised areas of main channel > 2.5	< 1.5 generally, localised areas of main channel > 2.5	< 1.5 generally, localised areas of main channel > 2.5
	Shear Stress (N/m^2)	**< 80**	> 80 in stretches of main channel	> 80 in stretches of main channel	> 80 in main channel

It is noted that the hydraulic model results for velocity, bed shear stress and stream power are calculated using a depth-averaged approach within each model grid cell; the results are therefore appropriate for use as indicative information only. Peak values of each parameter were extracted from the model results, which provides a conservative assessment of results, given these values are not necessarily sustained over extended periods of time.

Sagittarius Creek is within the SA7 and SA10 surface areas. Existing flood modelling indicates that the proposed mine plan would only intersect the upper portions of the Sagittarius Creek catchment. The existing flood extent for Sagittarius Creek is illustrated in **Figure 4-2**. This shows that the Project is predominately outside the flood extent. The flood extent, particularly the upper reaches, will reduce as the mining extension footprint reduces the catchment area reporting to the creek. By 2085, the small area of flood extent that overlaps the extension footprint will not exist, as the extension footprint is associated with complete removal of the catchment area reporting to this point. The minor reduction in catchment area would only result in minor decreases in flood levels and flows. These minor reductions are considered to have negligible impacts. As such no further flood modelling of Sagittarius Creek was undertaken.



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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:30,000 at A3
Project Number:	620.014601
Date:	23-Oct-2023
Drawn by:	SM

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Extension Footprint 2085
- BWM Mining Areas
- Existing Blackwater Mine

SLR

BLACKWATER MINE
NORTH EXTENSION PROJECT

SAGITTARIUS CREEK - EXISTING CONDITIONS
PEAK FLOOD LEVELS - 0.1% AEP

FIGURE 4-2

5.0 Mine Water Management

The Project will largely utilise the existing water management system at BWM. Additional water management infrastructure in the form of pipelines, pumps and new ESC structures will also be required to facilitate the Project. The water management system at BWM and proposed updates to water management for the Project are outlined in the following subsections.

5.1 Mine Water Balance Modelling

The BWM Water Balance Model (WBM) titled BWM_WBM_V4.2 dated March 2023 was supplied by BMA on the 25 July 2023. This model is a daily WBM developed using the GoldSim Software and represents the existing BWM operations as illustrated in **Figure 3-2**. This model is assumed to represent the current mine operations it also includes disposal of tailings into the Bonnie Doon Pit, which is expected to be operational in conjunction with this Project. The model is assumed fit for purpose to form the base case for expansion of the Project. Unless otherwise specified no other changes were made to this model.

5.2 Mine Water Sources and Demands

5.2.1 Water Supply and Demands

Water supply for the Project will be provided via the existing water supply network supplying BWM, supplemented by the capture of rainfall runoff which forms part of the site's MAW inventory as well as utilisation of the existing water inventory on site. Water is supplied from the Fitzroy River catchment via Fairbairn Dam and the Bedford weir on the Mackenzie River. BWM has allocations to draw a maximum of 678 ML and 1603 ML per annum of water from the Bedford East and West pipelines respectively. BWM is seeking an additional water supply option which will consist of an additional 1000 ML on 1 July 2026 and a further 1000 ML on 1 July 2027. This will bring the total water supply option for the Project to 4281 ML per annum by 2027.

As part of the Project, as a result of the increase in production, the average CHPP water demand for BWM is predicted to increase from a current rate of 3.4 GL/year to 4 GL/year[4] in approximately 2032 (an increase of ~0.6 GL/year). Although the average CHPP demand is maintained at similar levels to existing until 2045. After this time, CHPP demands gradually decrease until end of mining in 2085, when the demand is predicted to be approximately 0.5 GL/year.

5.2.2 Potable Water

Water for potable purposes is sourced via pipeline and treated on site at separate treatment facilities for the Central, Southern and CHPP areas of the mine. The raw water for potable purposes is sourced from the Mackenzie River at the Bedford Weir pumping station. No changes are proposed to the potable water supply as a result of the Project.

5.2.3 Treated Sewage Effluent

The Project will not require changes to sewage treatment management at BWM. Treated sewage effluent produced on-site must only be released in accordance with the relevant conditions of the EA. In particular, under Condition H2 Treated Sewage effluent must not be

[4] Based on P50 climatic assumption.

directly released from the sewage treatment plant/s to any waters[5]. If treated sewage water is used directly for dust suppression, it needs to pass the quality values specified in the EA, which sets limits for BOD, pH, total suspended solids, nitrogen, phosphorus and E coli. The quality monitoring for this is covered in the Environmental Monitoring Program and is conducted by a NATA registered, external provider under an Environmental Monitoring Service Contract.

5.2.4 Pit Dewatering

The existing water management strategy for pit dewatering will continue for the Project with pumps and pipeline infrastructure extended and relocated as required with the pit progression.

5.3 Climate

The BWM WBM is based on probabilistic rainfall. The probabilistic rainfall allows examination of a range of climate sequences based on the recorded historical rainfall data. The probabilistic data maintains the climate statistics of the historical rainfall record but also examines the robustness of the system. This is achieved by modelling of events that are statistically likely to occur (based on the historical series) but may be more extreme or occur in a different sequence to the historical record. The use of probabilistic data allows for the presentation of the modelling results with a probability of occurring, which helps inform the management strategies and mitigation measures.

The Project's climate data has incorporated climate change predictions as the climate data set for the assessment of the Project.

Daily rainfall predictions at BWM from 3 Regional Climate Models (RCMs)[6] for 2 RCPs (i.e., RCP 4.5 and RCP 8.5) was provided by BMA for the 2020-2085 period. Probabilistic rainfall data was generated for the assessment methodology in accordance with BMAs guideline (refer **Figure 5-1**) but extended for the Project assessment horizon. The methodology stitches together the six 65 year climate sequences into a combined single climate sequence. Stochastic climate data is then generated for 500 x 65 year climate sequences using the eWater CRC Stochastic Climate Library.

The process aims to capture variability in rainfall from the three RCMs considered most appliable to these locations under two different warming scenarios (RCP4.5: moderate and RCP8.5: high). This is captured through an ensemble of the rainfall inputs to the model.

The existing WBM applied monthly evaporation data. Changed climate factors were also incorporated as per the BMA guideline, refer **Figure 5-1.** The percentage change in daily evaporation for each of the three pivotal years was determined for the six changed climate scenarios, the resulting average was applied to the monthly data in the WBM to represent the impact of climate change on evaporation, as presented in **Table 5-1.**

[5] It is noted that waters do not include structures associated with the mine affected water management system. The volume of treated sewage effluent at a capacity of 1500 equivalent persons represents a very small proportion of the BWM mine affected water management system (less than 0.00001%).

[6] RCMs represented were nominated by BMA in accordance with their corporate policy and included ACCESS1, GFDL-CM and MPI-ESM-LRQ.

Table 5-1 Percentage (%) Change in Daily Evaporation under Changed Climate.

Pivotal Year	% Increase
2050	13
2070	18
2090	22

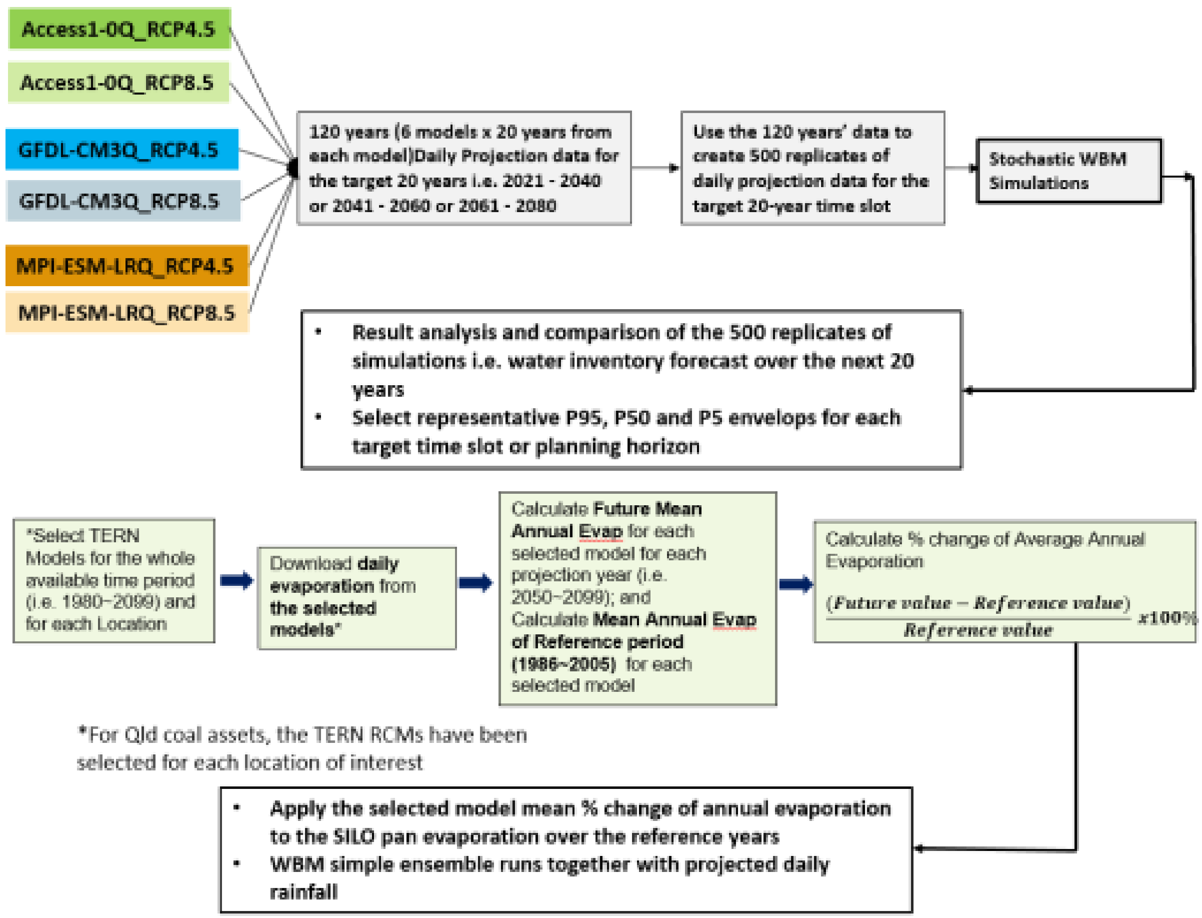


Figure 5-1 BMA Guideline – Changed Climate

Table 5-2 provides a comparison of the mean monthly rainfall result from the stochastic rainfall compared to the historical rainfall. The comparison indicates a lower amount of rainfall during winter and a higher amount of rainfall during summer. This is consistent with climate change projections for the region[7].

[7] https://www.longpaddock.qld.gov.au/qld-future-climate/dashboard

Table 5-2 Comparison between mean monthly rainfall for historic (1900-2019) and ensembled (2020-2065) rainfall (mm).

Month	Historic Rainfall	Ensembled Rainfall	% change
January	132	110	-17
February	105	100	-5
March	68	76	12
April	36	32	-11
May	20	28	40
June	16	30	88
July	8	20	150
August	5	17	240
September	6	15	150
October	27	28	4
November	60	54	-10
December	107	85	-21

5.4 Contributing Catchments and Land use

Catchment contributing areas are altered as the mine pit progresses and therefore require delineation in yearly and 5-year intervals over the life of mine. Catchment areas are shown in **Appendix E**.

Catchment areas for each land use for each storage or pit were determined from the mine plans and GIS analysis. This was undertaken yearly for the first ten years, then every five years thereafter. Treatment of existing areas of spoil and partial rehabilitation were discussed with BMA and a similar schedule adopted. Land use for the mine progression was assumed from the GIS pit progression layers to be as follows:

- Natural – any time before clearing.
- Cleared – one year prior to mining.
- Pit – three years from first being mined.
- Spoil not rehabilitated (reporting to pit) – three to seven years post mining.
- Spoil commencing rehabilitation (reporting away from pit to ESC structures) – seven to twelve years post mining.
- Spoil undergoing rehabilitation classification (reporting to ESC structures) – seven to fifteen years post mining.

The ramp numbering of the progression extents was based on information provided by BMA. A description of each catchment type is provided in **Appendix E**, along with a summary of the total pit catchment area for the northern area.

The modelling was conducted assuming progression of north BWM in approved areas to the south of SA7 and SA10 in addition to the Project in SA7 and SA10.

5.5 Rainfall Runoff

The Australian Water Balance Model (AWBM) was used to relate daily rainfall and evapotranspiration to soil moisture and runoff. The AWBM parameters within the BWM WBM are maintained as per the existing BMA operational model. These parameters have been adopted for different land use types based on calibration. The AWBM parameters are provided in **Table 5-3**.

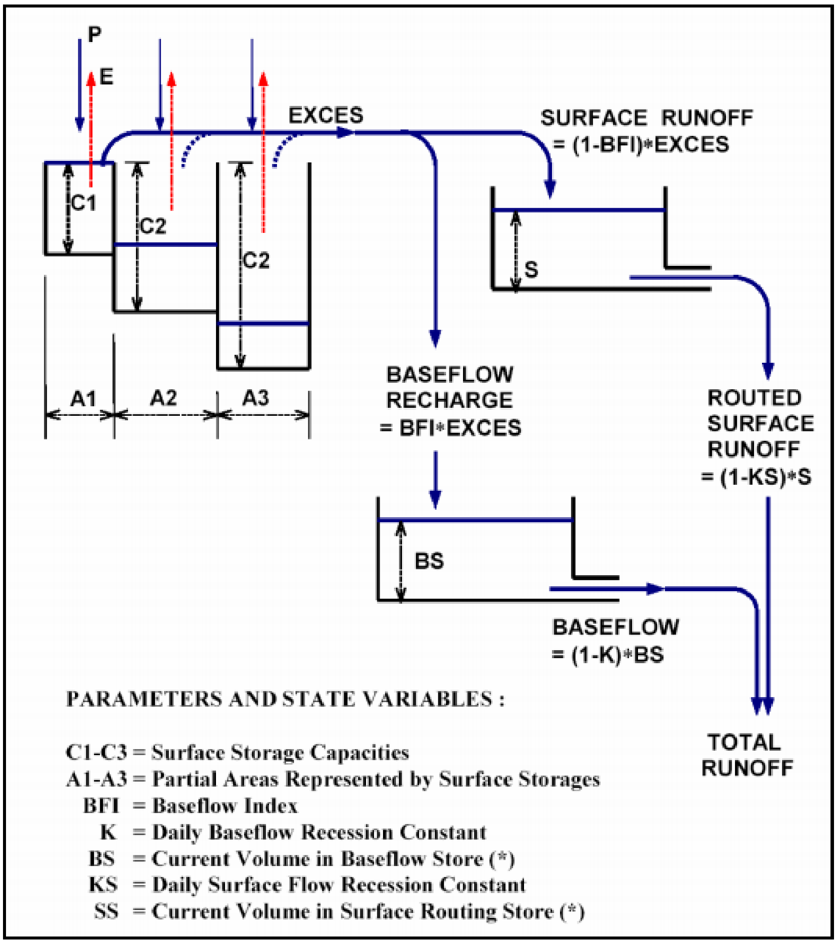


Figure 5-2 Structure of the AWBM Model (eWater CRC, 2004)

Table 5-3 Adopted AWBM Parameters

Parameter	Natural	Disturbed	Mining Pit / Industrial Road	Tailings	Spoil	Rehab
Small storage capacity (mm)	20	10	7	7	20	20
Medium storage capacity (mm)	90	50	27	17	100	90
Large storage capacity (mm)	200	100	37	27	160	200
Small partial area portion	0.134	0.134	0.134	0.134	0.134	0.134
Medium partial area portion	0.433	0.433	0.433	0.433	0.433	0.433
Large partial area portion	0.433	0.433	0.433	0.433	0.433	0.433

Parameter	Natural	Disturbed	Mining Pit / Industrial Road	Tailings	Spoil	Rehab
Baseflow index	0.35	0.1	0.1	0.1	0.8	0.35
Baseflow recession	0.7	0.7	0.7	0.7	0.7	0.7
Daily streamflow recession	0.1	0.1	0.1	0.1	0.1	0.1
Initial soil store levels (mm)	0	0	0	0	0	0
Initial baseflow level	0	0	0	0	0	0

5.6 Groundwater

Groundwater inflows to the pits were provided by groundwater modelling outlined as documented in the Blackwater North Extension Project Groundwater Impact Assessment (SLR, 2023b). These were provided over six zones which were then assigned to Pits. A summary of these inflows is provided in **Table 5-4**. Groundwater inflows to the surface water management system are small relative to surface water flows.

Table 5-4 Groundwater Inflows

Zone	Ramps	Groundwater Inflow		
		Median	Min	Max
Zone A	Ramp 14	0.53	0.0	1.15
Zone B	Ramp 16	0.31	0.0	1.72
Zone C	Ramp 18	0.28	0.0	1.24
Zone D	Ramp 20, 26, 30N, 30S	0.81	0.29	2.56
Zone E	Ramp 34, 38	0.21	0.0	0.97
Zone F	Ramp 42, 46N, 46S, 47	0.38	0.0	1.03

Ramp 14 is maintained as a water storage pit in the model as such Ramp 14 inflows, tonnages and catchment have been added to Ramp 16/18. Flows in Zone A for the first 5 years were found to be high due to the influence of the Ramp 14 water storage pit. After discussion with the groundwater modellers, these were replaced with the long term average on the assumption that levels in this water storage pit would be reduced or maintained to minimise this potential seepage for structural integrity of the future mine pit.

5.7 Water Balance Operating Rules and Assumptions

The WBM includes consideration for:

- Limitations on transfers to and from storages based on pump and pipeline capacity including consideration for limitations of backbone pipelines which receive inflows from multiple storages.
- Objectives to maximise pit operability by transferring water which collects in the pit catchment to out of pit storages.
- Management of storages used to support the BWM water demands (dust and plant) so that shortfalls do not occur impacting operations.
- Typical operating rules and relationships governing the priorities on the transfer or water to and from storages.

- Water quality, with salinity used to represent general water quality and modelled as TDS and releases according to water quality conditions as outlined in the EA.

The following assumptions were made when adapting the existing WBM to represent the Project:

- Active pits were derived from the mine plan shapefile undertaken yearly for the first ten years (2021-2030), then every five years thereafter.
- Demands were updated based on the run-of-mine coal and yield percentage values (wash and bypass feed) were updated as per the Project description.
- The modelling included the Bonnie Doon Pit as a new Tailings Storage Facility (TSF).

5.8 Controlled Release Conditions

The BWM WBM includes the representation of the EA conditions for releases at the site. The current EA (EPML00717813) allows for discharge from Tannyfoil Dam, New Taurus Creek Dam and New Deep Creek Dam subject to minimum flow rates being achieved in the receiving waters and water quality limits being achieved at the release points. Two of these storages, New Deep Creek and New Taurus Creek storages are on stream storages with large natural catchments and the storages are typically overflowing when the downstream release conditions are triggered. As such the majority of water removed from the system via these storages is through the spillway rather than pumped releases. This controlled release is important to prevent undesired accumulation of water onsite.

The release limits at the point of release and receiving waterway are outlined in **Table 5-5** and **Table 5-6**, respectively. The EA requires a minimum flow of 1 m^3/s in the receiving waterway of Burngrove Creek or Blackwater Creek in order to support release in accordance with the EA conditions.

Current release limits do not require consideration of TSS and nitrogen, and site water quality monitoring data for water releases from March 2021 – January 2023 do not monitor for TSS nor total nitrogen. However, water quality monitoring data from site storages taken from March 2021 – January 2023 indicates an average total nitrogen concentration (N) of 2.44 mg/L with a maximum of 8.1 mg/L. This indicates that the Dissolved Inorganic Nitrogen (DIN) load from the system associated with releases either controlled or uncontrolled is expected to be minimal.

Table 5-5 EA Table F2 Mine Affected Water Release Limits

Quality Characteristic	Release Limit	Monitoring Frequency
Electrical Conductivity (µS/cm)	10,000	Real time telemetry for EC and pH with grab samples at commencement and weekly thereafter when safe to do so and access permits. Daily grab samples if telemetry not available (the first sample must be taken as soon as practicable).
pH (pH units)	6.5 (minimum) 9.0 (maximum)	
Sulphate (SO_4^{2-})	To be correlated with EC	

Table 5-6 EA Table F5 Receiving Waters Contaminant Trigger Levels

Quality Characteristic	Release Limit	Monitoring Frequency
pH (pH units)	6.5-8.5	Grab samples shall be taken only when safe to do so and in day light hours
Electrical Conductivity (µS/cm)	2,000-80th percentile	
Sulphate (SO_4^{2-})	N/A - be correlated with EC	

As outlined in **Section 2.5.2**. The BWM REMP and monitoring data obtained for releases indicates that the water quality variables (EC and pH) are within acceptable EA release limits in all monitoring locations. The water quality results are presented in **Table 5-7**.

Table 5-7 Receiving Environment Water Quality

Sample Location	Station Name	EC (µS/cm)	pH (pH units)
MP1/REMP1	Burngrove Creek US	114	7.7
MP7/REMP7	Burngrove Creek DS	313	8.0
MP3/REMP3	Deep Creek Dam US	112	7.3
RP3	Deep Creek Dam	1071	8.1
RP2	Taurus Dam	929	8.0
MP8/REMP8	Blackwater Creek DS	140	7.7
RP11	NCHPP Sediment Dam	1270	7.7
RP12	Rejects Stockpile Dam	1300	7.6
RP13	Ramp 34 Storage Dam	645	7.6

5.9 Site Surface Water Quality

The water balance model was developed to include a high-level salt balance to track both the quantity and quality of water onsite. The salt balance tracks the water quality associated with all of the inflows to the sediment dams, MAW dams and pits and subsequent effects from evaporation and releases on the storage water quality. The water quality values are presented in **Table 5-8**. These adopted values are consistent with those adopted for other Queensland mine sites.

Table 5-8 Assumed Salinity

Source	Assumed Salinity (µS/cm)
Natural catchments / undisturbed*	300
Cleared	500
Groundwater* / Pit	3000
Spoil	1000
Tailings	3000
Rehabilitated	300

*based on average data from monitoring

The above salinity values are converted to a concentration in milligrams per litre using an average multiplication factor of 0.67 (Measuring Salinity DERM, June 2007) to quantify the mass of salt transferred in the model. The salt balance is used as an indicator of water quality. Actual releases will be made based on sampling and monitoring of a number of water quality parameters.

5.10 Mine Water Balance Results

The following provides a summary of the water management results for the Project. The results of the modelling are influenced by a number of factors. These are summarised below:

- Decreased annual rainfall and increased evaporation due to climate change factors.

- Changes to catchments due to the Project footprint. However, it is noted that the proportion of MAW remains relatively constant as the mine progresses with pit areas, becoming spoil and progressively rehabilitated.
- Changes to water demands for dust and the CHPP, this is initially a minor increase followed by a decreased demand.

Figure 5-3 illustrates the total storage inventory predicted over the Project, under different climatic conditions. The results indicate that under median (P50) climatic conditions stored water inventory is predicted to be between 2,500 ML to 10,000 ML. Under median (P50) climatic conditions the water inventory is predicted to decline over the next 10 years. This is due to the increased consumption from production, reduced average rainfall and increased evaporation due to climate change. In dry conditions this has the potential to decrease to approximately 1,300 ML. The water storage inventory is then predicted to increase from 2045 as production demands decrease, with the total site water inventory under median climatic conditions returning to approximately 7,000 ML (similar to the current inventory). Wet climate conditions could see increase in water storage volumes up to 19,000 ML.

The graph indicates there is predicted to be sufficient capacity within the designated storages (~2,300 ML for MAW dam storage and in excess of 40,000 ML including designated in-pit storage) to manage the climate extremes of the Project. From 2070 the inventory begins to be influenced by the final landform, conservative assumptions have been made in the modelling for rehabilitated areas to continue to report to the pit or ESC structures, it is likely that this will be able to be diverted offsite further reducing the stored inventory. Further information on the final void water balance modelling is provided in **Section 7.2**.

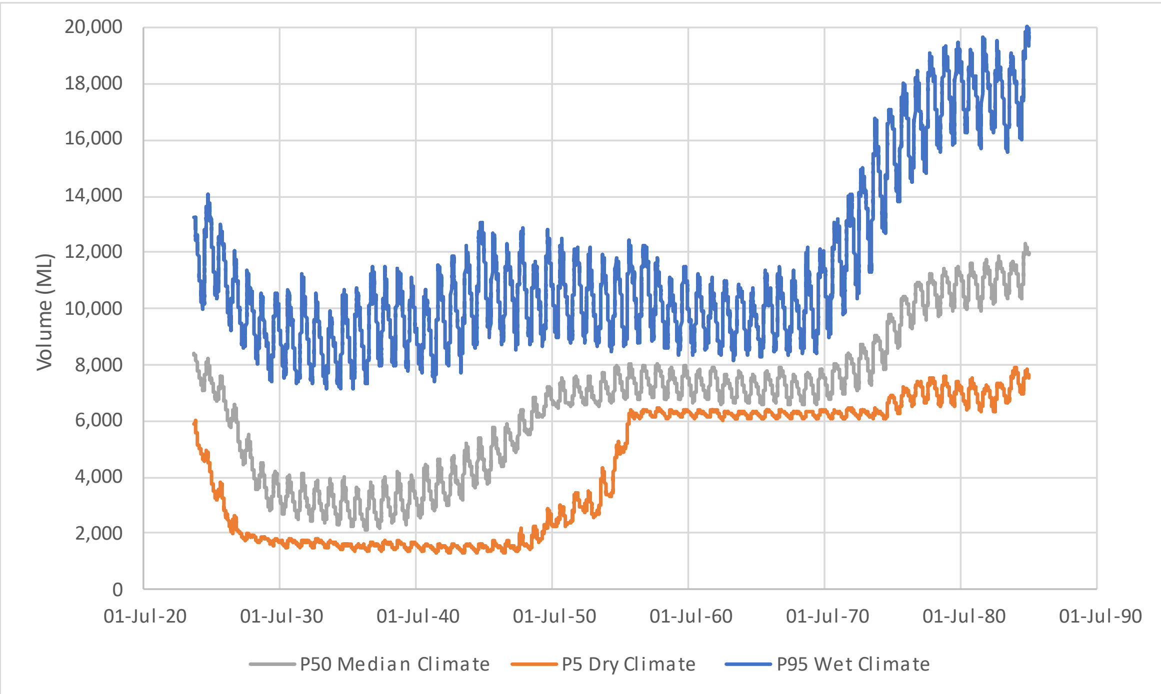


Figure 5-3 Predicted Site Inventory

To assess the adequacy of the water balance to meet the Project's operational requirements, the likelihood of pit inundation was assessed. The water balance modelling indicated that the pits would not exceed the sump capacity of 20 ML in moderate to high rainfall conditions. For very high rainfall conditions, pit inundation could be on average one to two months per annum, refer **Table 5-9.** The inundation days presented in **Table 5-9** are more frequent later in the mine life when production demand decreases, and the pit catchment increases. As discussed above, conservative assumptions have been made about rehabilitation which is likely to reduce the water reporting to the pit from the volumes predicted in the model.

The BWM is also investigating upgrades to the pump and pipeline infrastructure to continue to optimise use of MAW and reduce impacts on production. It is likely that pit inundation will have less impacts on the operation of the mine from 2070 when production decreases to 25% of the 2032 peak.

Table 5-9 Pit Inundation Statistics per Annum

Climate	Average No of Days of Pit Inundation per annum							
	R16	R20	R26	R30N	R34	R38	R42	R46
Very High Rainfall (95% exceedance)	3	15	111	95	14	13	0	17

The BWM WBM predicts the ability of the Project to meet water supply demands. **Figure 5-4** illustrates the water supply deficit predicted by the model for the CHPP. This result indicates relatively minor shortfalls in moderate climatic conditions, in the order of 400 ML and up to 1600 ML in dry conditions, with no shortfalls predicted under wet climate conditions. Noting that BWM is seeking an additional water supply allocation (refer **Section 5.2.2**). The predicted shortfalls are significantly less than the available water storage inventory under all climate conditions and within the additional water supply volumes BWM are currently seeking for the site totalling 2,000 ML by 2027, refer **Section 5.2.1**. A similar result is presented for dust suppression demands, refer **Figure 5-5**.

Current bottlenecks in the onsite water management system also limit the site's ability to satisfy demands. The WBM operational rules do not represent the full complexity of the system operations and ability for localised changes when required to manage risk. In the event that the mine is predicted to be in deficit, BWM will utilise the water supply within the existing MAW (this is likely to provide a further 2000 ML to 4000 ML) to supplement the Project's water demands (e.g. filling up a water truck directly from a pit water storage through a temporary pump), considering these the potential shortfall would be 0 ML/annum in a P50.

There remains a risk of deficit across dust and CHPP demand in the very dry P5, with the predicted storage inventory and additional demand only just satisfying the identified shortfall. This risk of this deficit is over the period from 2030 to 2037 and would only occur should a P5 dry climatic period occur. This dry period considered predicted changed climate which results in a decrease in annual rainfall. During dry periods the site initiates water conserving measures through the sites TARPs. The requirement and timings of the additional water supply options are reviewed annually against the inventory to manage the risk of water shortfall.

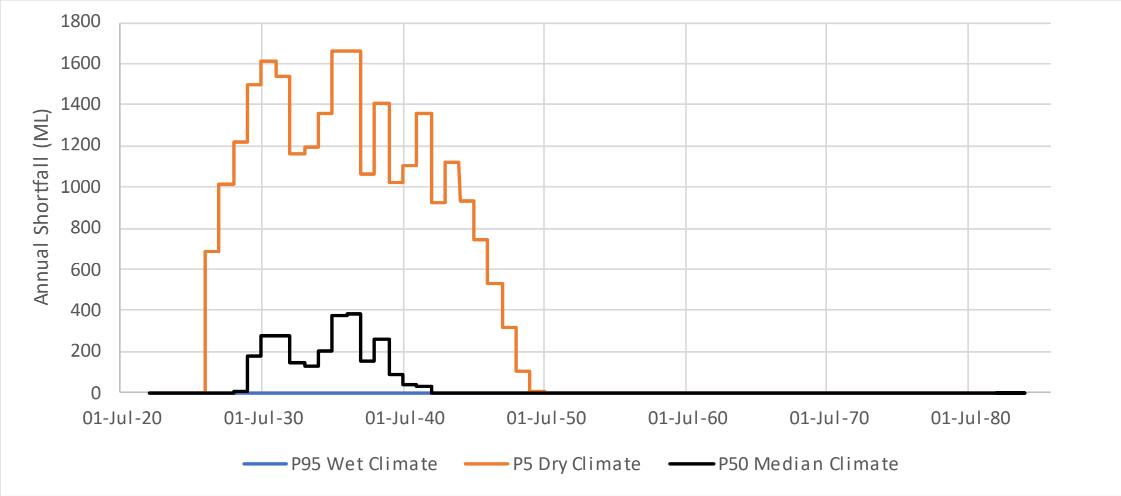


Figure 5-4 CHPP Shortfall Results

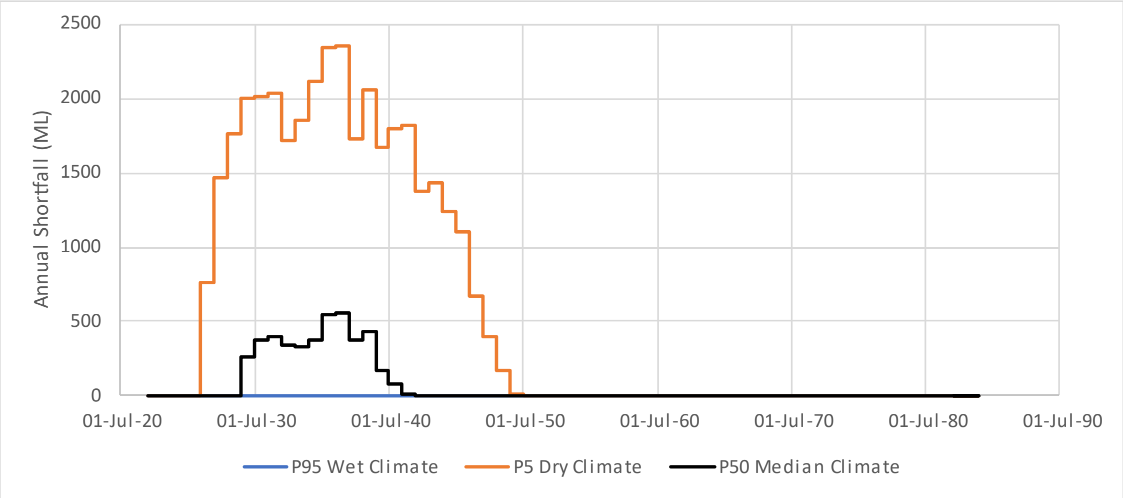


Figure 5-5 Dust Suppression Shortfall Results

The modelling predicts that with releases downstream, EC in the receiving waterways will consistently be less than 2,000 µS/cm and on average less than 300 µS/cm. The ongoing releases in accordance with the EA are considered important as they allow for good quality water to be released off site following periods of significant rainfall. This prevents good quality water increasing in salinity through evaporation and maximises the available storage within the mine site to manage climate extremes. This release of water also assists in maintaining the availability of water to downstream users at an appropriate water quality and reducing the uncontrolled releases from site.

The predicted annual controlled release volumes are small, in the order of 100 ML/year. This is due to the site retaining water to satisfy mine water demands under moderate and dry conditions. The potential releases through controlled release and overflows are in the order of 4 GL/year in a P50 moderate climate and up to 9 GL/year in a P95 wet climate. This is due to a number of the storages being on stream storages where water is released via the spillway and comprises of a large proportion of water that is flowing through the site from upstream undisturbed catchments. The predicted water quality (based on EC) of overflows prior to dilution is generally good with 50th percentile 810 µS/cm and 80th percentile 1310 µS/cm.

It should be noted that during the Project's operations, the mine site will be progressively rehabilitated. As such water quality within the storages is expected to improve.

The results of the water balance modelling illustrate the ability of the water storages to manage the predicted climate extremes in rainfall. The predicted probability over the Project's life was based on the stochastic rainfall data (500 replicates x 65 years = 32,500 years modelled), which considers changed climate condition.

The BWM WBM has an internal quality assurance process to ensure the robustness of the model. The WBM calculates a mass balance for all water quantity and quality elements on a daily basis. The WBM net balance was zero for the WBM for both water quantity and quality.

6.0 Impact Assessment and Mitigation

The proposed water infrastructure achieves compliance with regulatory requirements and guidelines such as the Manual and the BWM Water Management Plan and BWM Erosion and Sediment Control Plan. The performance of the system has been examined through flood and water balance modelling.

6.1 Flooding Impact Assessment and Mitigation

As outlined in **Section 3.4.2,** protecting the pits from flood ingress will require the construction of proposed flood protection levees and/or landforms. The TUFLOW model results illustrating the flood extent for the 0.1% AEP following inclusion of the infrastructure are illustrated in **Figure 6-1**. The TUFLOW model results showing the impact on mine expansion on peak flood levels is illustrated in **Figure 6-2**.

Flood modelling results for all AEPs for the existing[8] ('BWM mining areas' shown on **Figure 6-1** and **Figure 6-2**) and future (mine expansion beyond the 'BWM mining areas') scenarios are mapped and provided in **Appendix A** and **Appendix B**. The results show that in the 0.1% AEP event, peak flood levels in Taurus Creek downstream of SA7 and SA10 are generally reduced in the future scenario in comparison to the existing scenario. In Blackwater Creek, downstream of the junction with Taurus Creek, peak flood levels are approximately 70 mm lower than in the existing scenario. The reduction in flood levels can be attributed to the reduction in catchment area caused by the proposed mining progression.

The results show local increases in peak flood levels occur within Deep Creek and Taurus Creek as a result of the flood protection during operations, particularly FP1, FP2 and FP3. These increases range from 10 mm to 500 mm, although are generally less than 100 mm. Isolated increases are also shown at the junction of Deep Creek and Taurus Creek adjacent to FP2. The increases are localised and wholly contained within ML 1759 and ML 1762.

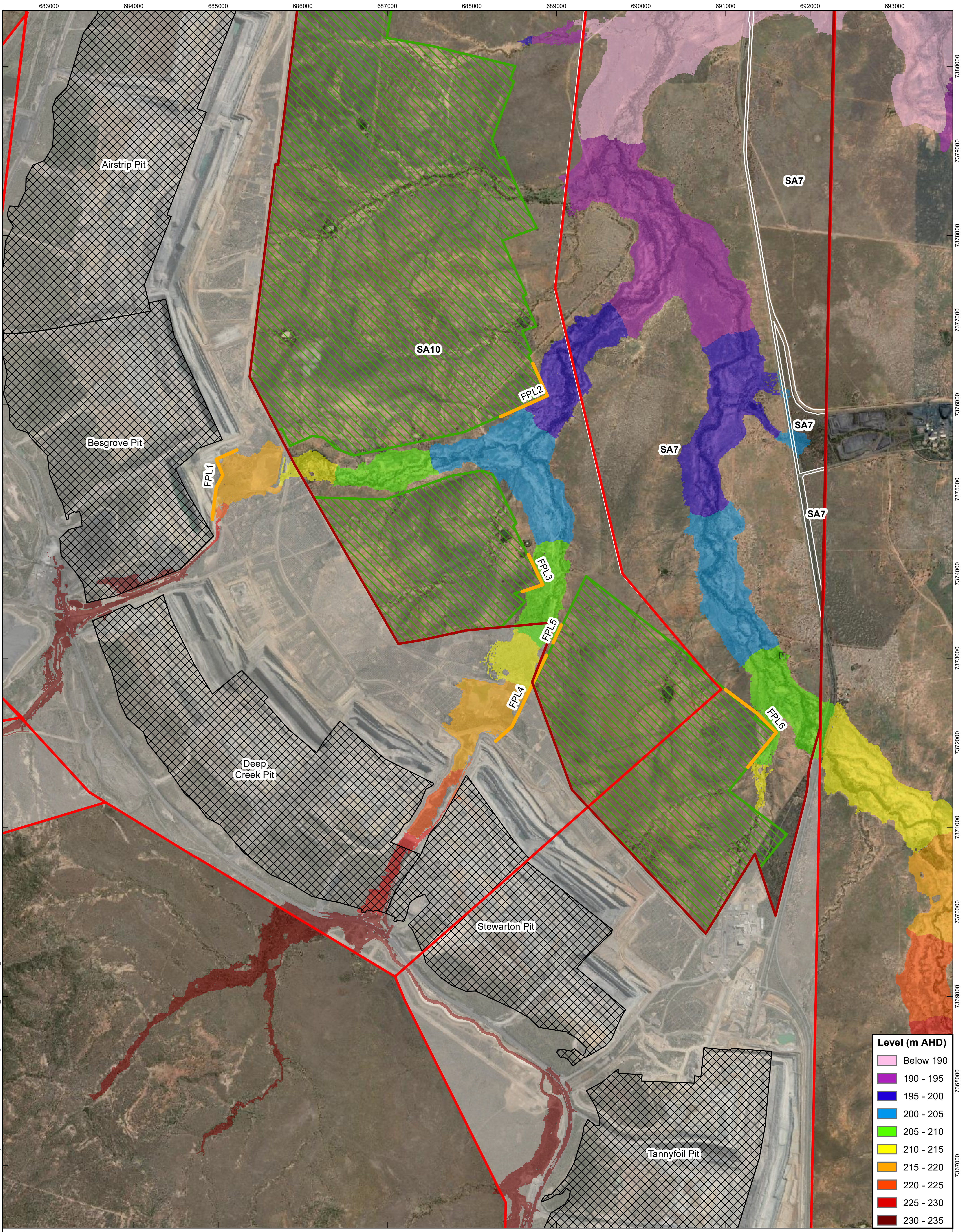
The flood characteristics for the future scenario and existing conditions are summarised below for Deep Creek, Taurus Creek (upstream of junction with Deep Creek) and Two Mile Gully. The flood characteristics are illustrated relative to the recommended industry standard ACARP design criteria for the design of stream diversions (ACARP, 2002), which relate to stream power, velocities and shear stresses. While these criteria relate only to diversions, comparisons to existing conditions indicate the nature of the existing flow regime which often exceeds the ACARP criteria.

The comparison indicates the expected flow/flood behaviour resulting from the Project is generally unchanged from the existing conditions during the 2% and 50% AEP events. This is a result of the proposed flood protection and the alterations to surface water catchments having minimal impacts to the flow regimes for these events. Therefore, the anticipated flow velocity, bed shear stress and stream power results are similar to the existing conditions. It is noted that flooding impacts from the Project will be less as a conservative approach was taken to model the existing conditions as the BWM mining areas and future as beyond the BWM mining areas (including expansion of the existing approved mine).

[8] Flood modelling compares existing (BWM mining areas) and future (mine expansion at the final operational year). Impacts are assessed as the relative change between these two scenarios. This is a conservative assessment as it also includes the impact from the extension of the existing approved mine as part of the change from existing conditions. The impacts of the Project are therefore less that what is reported.

A sensitivity assessment was undertaken to examine the potential impact of changed climate on flood levels in the 0.1% AEP event. The changed climate was applied as an IFD factor of 1.20. This was based on BMA's Guideline for Climate Change Adaptation in Mine Water Planning and Hydrologic Assessments (CTSV-GLD-006, Doc No. 014050701), which assumes P90, an RCP of 4.5 (or equivalently P50 RCP8.5), and 2061~2099 time horizon. **Figure 6-3** illustrates the sensitivity of the flood levels to changed climate. The results indicate that 0.1% AEP flood level increases due to change climate could be up to 320 mm adjacent to the flood protection at FP1 and thus within the 500 mm freeboard of the final landform flood protection. Across the model domain, climate change results indicate an increase in 0.1% AEP flood levels of up to 900 mm, but are generally less than 250 mm.

There are no downstream water users and only isolated areas that are potentially sensitive environmental receptors. The magnitude and frequency of change to flood behaviour in these areas is predicted to be minimal. Therefore, any changes to the flood risk are unlikely to impact sensitive receptors in the vicinity of the Project.



0 500 1,000 Meters

Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	07-Dec-2023
Drawn by:	SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE - NORTH EXTENSION PROJECT

EXTENSION CONDITIONS PEAK FLOOD LEVELS - 0.1% AEP

FIGURE 6-1

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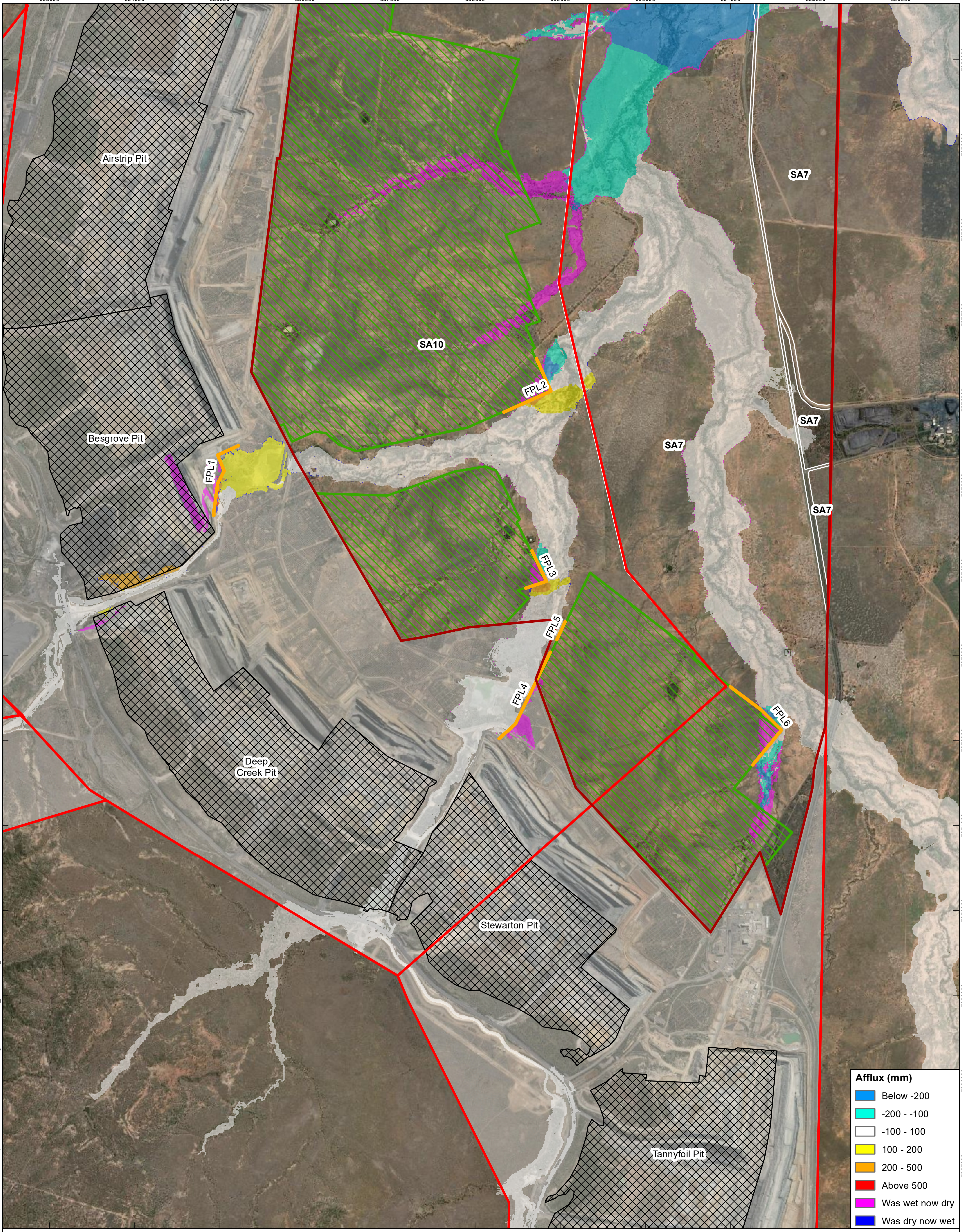

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SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
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- Existing Blackwater Mine
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BLACKWATER MINE - NORTH EXTENSION PROJECT

EXTENSION CONDITIONS PEAK FLOOD AFFLUX - 0.1% AEP

FIGURE 6-2

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Figure 6-3 Extension Conditions Climate Change Peak Flood Afflux 0.1% AEP

6.2 Changes to Flow Regime

The Project has the potential to impact on streamflow due to loss of catchment area draining to local waterways. Catchment area to these waterways is reduced through the Project's activities as disturbed catchment areas are directed to the MAW management or ESC system for capture, treatment, and reuse. The captured catchment will change as the mine develops and has the potential to influence flows in downstream sections of Sagittarius Creek, Taurus Creek, Deep Creek and Blackwater Creek.

Table 6-1 provides information on the total catchment area for each creek and the proportion of the catchment captured by the Project. This is based on the maximum disturbance area and is conservative in that it does not consider any treatment and release of water in accordance with the sites EA. **Table 6-1** indicates that the greatest potential impact is at Sagittarius Creek where a greater proportion of the total catchment area ~11% is captured by the Project. The reduction in catchment area at Blackwater township is 2%.

The translation of this loss of catchment area to potential change in streamflow was estimated based on gauged flow data (refer **Section 2.3.3**), whereby the flow was estimated based on recorded flows in the catchment and scaled for any differences in catchment area between the gauge location and point of interest. For Sagittarius Creek, which is ungauged, flow was based on the Taurus Creek gauge scaled by relative catchment area at both locations. This is reported in **Table 6-1** as a potential change to the estimated flow exceedance at the 50th, 80th and 95th percentiles. This change in flow is also illustrated in **Figure 6-4** which shows the change in the flow exceedance curve due to the change in daily discharge exceedance. Due to the ephemeral nature of the creeks, flows are minimal and infrequent. The change in flow due to the loss of catchment area is minimal. The potential impact on water quantity, in Blackwater Creek at the confluence with Taurus Creek and further downstream at the town of Blackwater is likely to be undetectable.

Table 6-1 Estimated Changes to Catchment and Flow

Creek	Total Catchment Area (ha)	Catchment Captured by Project (ha)	% Change	Estimated Flows (ML/d)					
				50%ile		85%ile		90%ile	
				Base	Project	Base	Project	Base	Project
Sagittarius Creek at the ML Boundary	6680	720	-11%	0	0	0	0	2.26	2.01
Deep Creek[9]	8940	650	-7%	0.64	0.59	7.26	6.73	21.41	19.85
Taurus Creek	17100	490	-3%	0	0	0	0	10.15	9.85
Taurus and Deep Creek Confluence	29995	1330	-4%	0	0	0	0	13.65	13.04
Blackwater Creek at Blackwater Town	66280	1330	-2%	0	0	0	0	31.71	31.08
Blackwater and Sagittarius Creek Confluence	69420	2050	-3%	0	0	0	0	31.71	30.77

[9] Flows at Deep Creek are influenced by gauging location relative to New Deep Creek Dam which is on stream and a release point under the existing BWM EA. The gauged record indicates flows on 63% of days with all other gauges flowing 10-18% of days. This flow behaviour is not seen at the Taurus and Deep Creek confluence despite Deep Creek representing a significant proportion of the catchment to this point and is therefore considered to potentially be influenced by the gauges location relative to New Deep Creek Dam, rather than the gauge being representative of Deep Creek Flows.

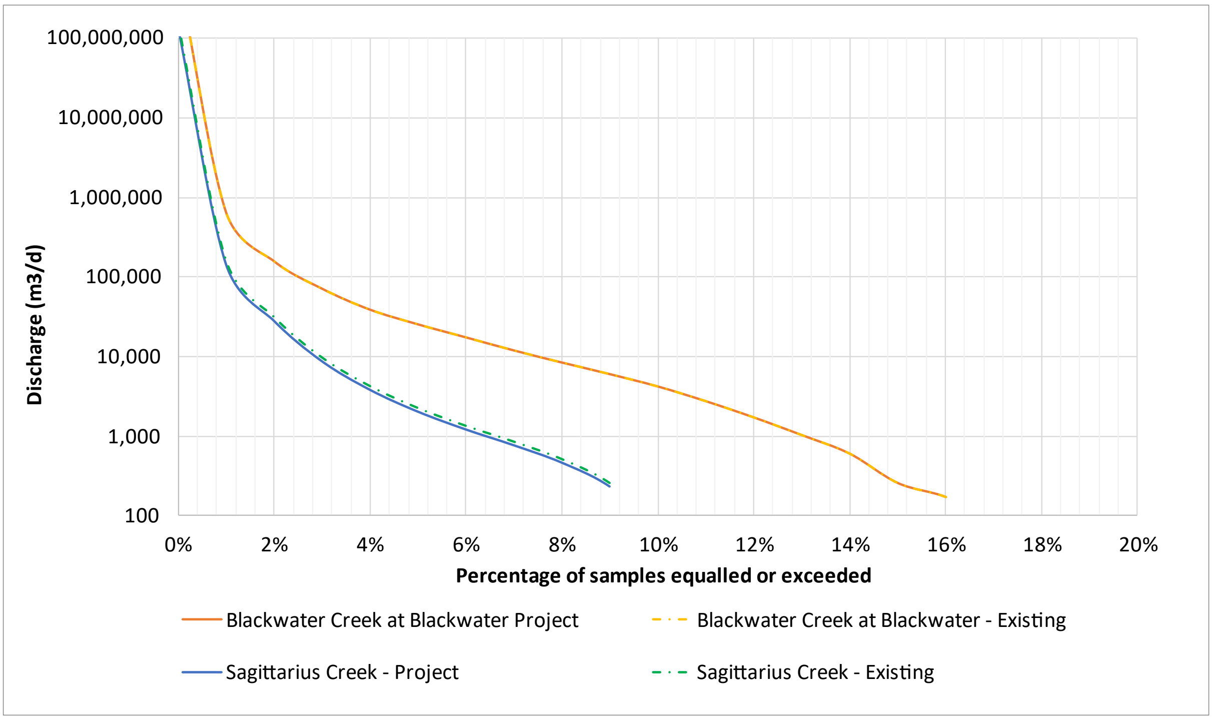

Figure 6-4 Potential Change in Flow

The Groundwater Impact Assessment report (SLR, 2023) discusses potential surface groundwater interactions and impacts on these. These were found to be negligible.

The potential changes to surface and groundwater interaction are documented in the Blackwater North Extension Project Groundwater Impact Assessment (SLR, 2023b). The change in groundwater flow to rivers and creeks due to the Project was calculated by comparing the river flow budgets for Blackwater Creek in the Cumulative scenario (i.e., with Project) against the Approved scenario (i.e., Without the Project). This calculation showed that over the life of mine, the change of baseflow is 0.01 ML/day. Given the Blackwater Creek is highly ephemeral, the alluvium is not contributing large amounts of water and this reduction due to the Project is deemed insignificant.

6.3 Mine Water Releases and Downstream Impacts Mitigation

As part of the Project, the average water demand for BWM is predicted to increase from a current rate of 3.7 GL/year to 4.9 GL/year[10] (increase of ~3.3 ML/day). Determining options to meet this demand through additional water supply as well as management of surplus water capture during wet seasons is a critical component of the Project's water strategy. The water management strategy developed for the Project provides a continuation of existing water management practices albeit with various water supply upgrades.

[10] Based on P50 climatic assumption

The performance of the existing water management system for the Project has been examined through both flood modelling and water balance modelling for a range of scenarios with the modelling indicating that the system is able to meet the design criteria stated for the relevant structure. The performance of the system will be continuously reviewed as part of the sites ESC Plan and WMP.

Key findings from the water balance assessment include the following.

- As the Project life extends to 2085, the Project's climate data incorporates climate change predictions. The predictions estimate decreased average annual rainfall in the future.
- Release conditions have negligible impacts on key results. This is due to these storages being on-stream storages with large natural catchments. These storages would typically be overflowing or close to overflowing when the downstream flow gauges enable controlled release conditions to be triggered. The majority of water removed from the system via these storages is through uncontrolled releases rather than controlled releases, noting that on-stream storage overflows are largely from the undisturbed catchment flowing from upstream of the BWM.
- Based on the mine plan and land use assumptions, catchment areas increase from the baseline assumptions which is maintained until closure.
- The Project increases the water demands for dust suppression and CHPP, and these demands are predicted to be reliably met in the P50 scenario through the use of additional allocations as well as the on-site MAW inventory. The requirement and timings of the additional water supply options are reviewed annually to manage the risk of water shortfall.
- In very wet climates the site will have a surplus of water. Pit inundation occurrences are more likely after approximately 2070 when the catchment area increases and production decreases, BWM will manage the risks as part of the sites transition to closure and through prioritisation of pumping from the remaining active mine pits.
- To prevent the inundation of proposed pits from Two Mile Gully, Deep Creek and Taurus Creek, the following protection measures are proposed.
    - Flood protection during operation. Operational flood protection will include levees and/or flood protection landforms.
    - Where flood protection is required post-mining, the final landform design will provide an appropriate level of protection.
    - Delineation and management of areas where minimum ground levels need to be maintained to prevent ingress of the flood events into mine pits and infrastructure areas.

6.3.1 Great Barrier Reef (GBR) Considerations

The Project site is located within the Fitzroy Basin and is therefore required to address the Reef discharge standards for industrial activities as per section 41AA of the Environmental Protection Regulation 2019. Under the Guideline, consideration under section 41AA will apply where the relevant activity will release DIN/fine sediment as part of its day-to-day operations during dry weather days or where the activity may release DIN/fine sediment during wet weather days that would ordinarily be conditioned as part of the EA.

As noted in **Section 5.8**, current release limits for the approved operations do not require consideration of TSS and nitrogen for planned water releases. Therefore, neither suspended solids nor total nitrogen is currently measured as part of regular water quality monitoring data for water releases. Water quality monitoring data from site storages taken from March

2021 – January 2023 indicate an average total nitrogen concentration (N) of 2.44 mg/L with a maximum of 8.1 mg/L. This is below the environmental guidelines for total nitrogen in rivers and streams (100-750 mg/L) as per the ANZECC guidelines[11]. Water balance modelling results for the Project (**Section 5.10**) suggest that planned releases would be minimal, less than 100 ML/year across all site storages. This is less than current release volumes as the project is predicted to utilise more of the site stored water inventory to satisfy mine demands as production increases and the climate dries under the changed climate projections. As discussed in **Section 5.8**, the results of the water balance modelling indicate downstream water quality is predicted to be good, consistent with the requirements of the EA and generally below downstream WQOs for salinity.

BWM releases for current approved mining operations, are detailed in **Section 5.8**. The Project will utilise the same infrastructure and processes as is being used for the approved operations. The potential for increased DIN and fine sediment resulting in impacts to the GBR as a result of the Project are therefore considered to be minimal.

6.4 Water Quality Impacts and Mitigation Measures

The Project has the potential to impact on water quality and subsequently the downstream environment. Impacts on aquatic ecology are discussed in the Blackwater North Extension Project Aquatic Ecology Impact Assessment (ESP, 2023). Impacts due to construction activities are expected to be minimal given the Project is a continuation of existing mining into SA7 and SA10, with the Project largely utilising existing infrastructure. To manage the potential for decreased water quality from Project construction activities the following mitigation measures will be implemented:

- Appropriate sediment control measures (e.g., sediment fences and sediment filters) will be established as required to reduce the amount of runoff from disturbed areas in accordance with the BWM Erosion and Sediment Control Plan and BWM Water Management Plan.
- Bunding and appropriate storage of fuels and other hazardous and flammable materials will be undertaken in accordance with AS1940:2004.
- Fuels and chemicals will not be stored or handled within 200 m of waterbodies.
- Personnel will receive appropriate spill clean-up training.
- Construction of any temporary waterway crossings will occur over the dry season to minimise soil disturbance on adjacent waterways.
- As soon as practical, disturbed areas will be rehabilitated to reduce the amount of exposed soils.

The following management strategies will be implemented by the Project to protect surface water quality and the downstream receiving environment from operations:

- The existing BWM Water Management Plan (WMP) will be reviewed and updated, as required to incorporate the Project.
- Sediment dams, pit water storage and other water management structures (e.g. bunds and drains) will be used appropriately in accordance with the current framework specified in the BWM WMP.
- The Project's water management will be based on the separation and management of clean and MAW/sediment-laden water catchments.

[11] Total Nitrogen - DCCEEW

- Water captured within the Project’s clean areas will be diverted around operational areas and where practical, allowed to discharge off site as part of normal overland flow.
- Disturbed areas within the Project site will be diverted to sediment and MAW dams for treatment and possible reuse for dust suppression and process water requirements. This will maximise their storage capacity to reduce the risk of off-site discharges.

- The current REMP or FRREMP and associated water quality monitoring program will continue for the Project in accordance with the EA. The program is designed to ensure the WMP is effective, to demonstrate compliance with the Mine’s strict discharge limits, and to ensure the downstream water quality is not being adversely impacted.
- Progressive rehabilitation will be undertaken as the Project’s operational areas become available to reduce the amount of disturbed area.
- Fuel, dangerous goods and hazardous chemicals will be managed as outlined by current standards, guidelines and in compliance with statutory requirements.
- The existing BWM spills and emergency response procedures will be implemented for the Project. Spill recovery and containment equipment will be available when working adjacent to sensitive drainage paths and within other areas, such as workshops.

Through implementing the above management strategies for surface water management, the risk of adverse impacts to the water quality of watercourses downstream of the Project is minimal.

6.4.1 Water Quality Monitoring

Monitoring is an essential part of the BWM environmental systems and WMP and includes monitoring required by the EA. Monitoring is conducted against local WQO defined through the REMP sampling (REMP, Gauge 2021). Water Quality monitoring will continue to be conducted in accordance with the Project’s EA conditions and the BWM REMP or the FRREEMP.

6.5 Significant Impact Assessment

As outlined in **Section 2.4.1**, this report assesses the projects impacts on surface water resources and includes assessment against the requirements of the *Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments—Impacts on water resources (Commonwealth of Australia, 2022).* The above indicates the Project will have a minimal impact on the hydrological characteristics of the surface water resources in the area. The flow regime is unlikely to change significantly, and the quantity of flow is unlikely to reduce the current or future utility of the resource for other users.

6.6 Cumulative Impact Assessment

The existing BWM has been integrated into the surface water assessment for the Project described in this report. Therefore, the cumulative impacts due to the Project and the BWM have been accounted for in this assessment.

The results from this assessment indicate that the Project is able to manage surface water impacts such as flooding and mine water management in accordance with DEHP standards and guidelines. These guidelines set out conditions and thresholds such as downstream receiving water quality conditions which are based on research undertaken into species tolerance and the potential for cumulative impacts from multiple mining releases.

6.7 Climate Change

As the Project has a 60-year mine production plan, the Project's climate data used in water balance modelling incorporated climate change predictions. The climate change scenario estimates a lower amount of average annual rainfall and increased annual evaporation in the future (see also **Section 5.3**). Thus, the Project's proposed water management strategy recommended as a result of the water balance modelling undertaken herein inherently caters for potential influence of climate change.

6.8 Impact and Mitigation Assessment Summary

The impact assessment indicates that impacts associated with the Project are expected to be insignificant and or contained within the Project area. The impacts of the Project are expected to be managed through the BWM current EA and associated management plans which will be reviewed and updated, as required to include the Project.

7.0 Rehabilitation and Final Void Assessment

7.1 Flooding

Assessment of flood behaviour for the final landform was undertaken for the 0.1% AEP event and is illustrated in **Figure 7-1** with full results in **Appendix C**. As shown, results of the modelling indicate that the proposed final landform will provide flood immunity for the final void up to the 0.1% AEP event.

The final landform shows the removal of any levees including the Deep Creek Levee (FP1), and final stable landforms FP2 through to FP6 (refer **Section 3.4.2**). The final landform includes areas of raised ground which protect the final void from the 0.1% AEP event. The final landforms at the flood protection locations are less than 2.5 m in height (above the natural ground level) and provide flood mitigation for a length of up to 1.3 km. The landforms will be vegetated which will assist in preventing erosion and mitigate the potential for increased sediment load downstream.

As outlined in **Section 6.1** a sensitivity assessment was undertaken to examine the potential impact of climate change on flood levels in the 0.1% AEP. The final landform footprint is similar to that of the operational model at 2085 and thus similar impacts to flooding would be expected in the final landform. That is flood level increases due to climate change could be up to 320 mm and thus within the 500 mm freeboard of the final landform flood protection.

The final landform will be assessed further and redesigned as part of the detailed closure planning. This will include assessment of the structural integrity of the final landform and monitoring of erosion and water quality. The mining lease will not be relinquished until the final landform is deemed to be stable and suitable for relinquishment.

0 500 1,000 Meters

Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	15-Nov-2023
Drawn by:	SM

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

SLR

BLACKWATER MINE - NORTH EXTENSION PROJECT

FINAL LANDFORM PEAK FLOOD DEPTHS - 0.1% AEP

FIGURE 7-1

H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\03 Technical Disciplines\03 Surface Water\GIS\Flood Figures\620.014601_FIGURE 7-1_Extent.mxd

7.2 Final Voids

The primary objective of the spoil dumping strategy for the Project is to backfill the mined-out pits where practical, to reduce the final void area remaining at end of the Project life. At the end of the Project life four (4) final voids will remain in perpetuity within the Project area. The key characteristics of these voids in relation to water are summarised in **Table 7-1**Table 7-1 below.

Table 7-1 Final Voids – Parameters

Component	Location	Catchment Area (ha)	Surface Area (ha)	Invert RL (m AHD)	Max Depth (m)	Capacity (GL)
Void 1	Ramp 16	1,030	261	19.49	125	110
Void 2	Ramps 20, 26, 30N and 30S	1,726	288	-10.4	125	136
Void 3	Ramps 34S, 38N and 38S	1049	280	49.5	201	134
Void 4	Ramps 42N, 46N and 46S	978	518	-10.5	206	416

A daily time step water balance model was developed for each void to predict the final void water quality and volume. The modelling involved an iterative process between ground and surface water modelling. Groundwater inflows to the GoldSim void water balance model were determined from the groundwater flux curve, provided from the Groundwater Impact Study (refer Blackwater North Extension Project Groundwater Impact Assessment (SLR, 2023b)). All four void areas will act as groundwater sinks, which means that groundwater will flow into the voids driven by ongoing evaporative discharge from the void lakes. As the final voids would act as a sink, evaporation from the final void water bodies would overtime concentrate salts in the final void water bodies.

The model was simulated for six changed climate sequences. These sequences are consistent with those used as inputs to develop probabilistic data for the operational WBM as outline in **Section 5.3**. The six changed climate sequences were modelled individually for a 100 year period with the median, maximum and minimum resulting water levels calculated.

The groundwater model was then simulated for the resulting pit lake levels and updated inflows modelled in the GoldSim WBM to confirm convergence.

The equilibrated predicted final void water levels are listed in **Table 7-2**. The equilibrated water levels change by 1m to 3m for the four voids. If drier or wetter conditions should prevail, the voids would still remain sinks to the groundwater. **Figure 7-2** illustrates the final void water levels and volumes for the moderate climate respectively.

Table 7-2 Final Voids – Equilibrium Water Levels – Climate Extremes

Component	Lowest Equilibrium Pit Water Level (m AHD)	Median Equilibrium Pit Water Level (m AHD)	Highest Equilibrium Pit Water Level (m AHD)
Void 1	54.8	58.1	65.3
Void 2	62.0	64.9	70.4
Void 3	119.1	121.2	125.1
Void 4	65.8	69.6	75.0

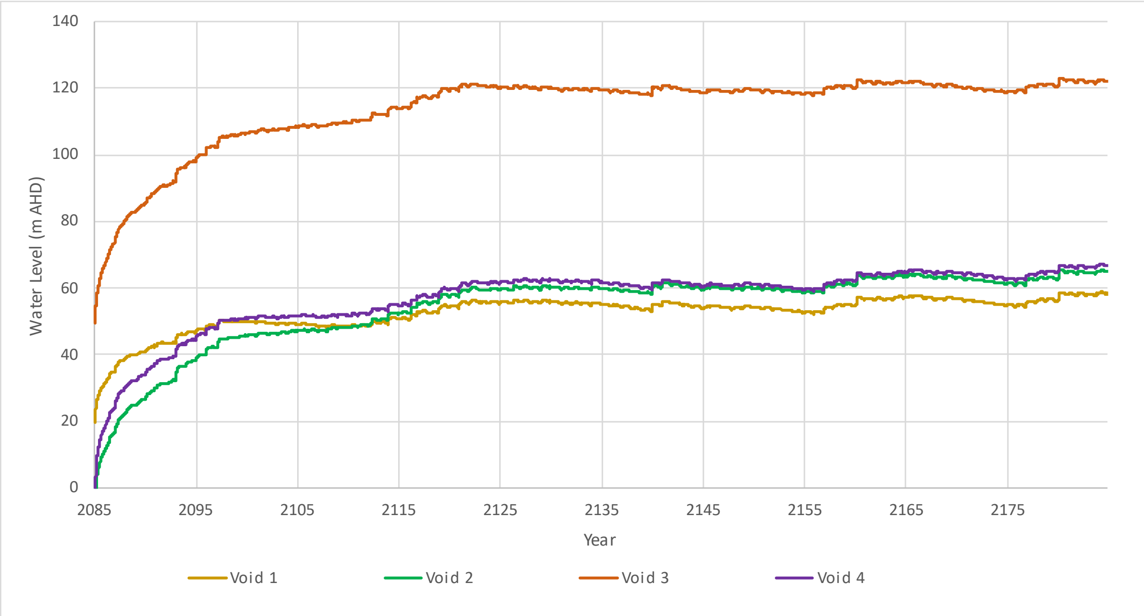

Figure 7-2 Final Void Predicted Water Level

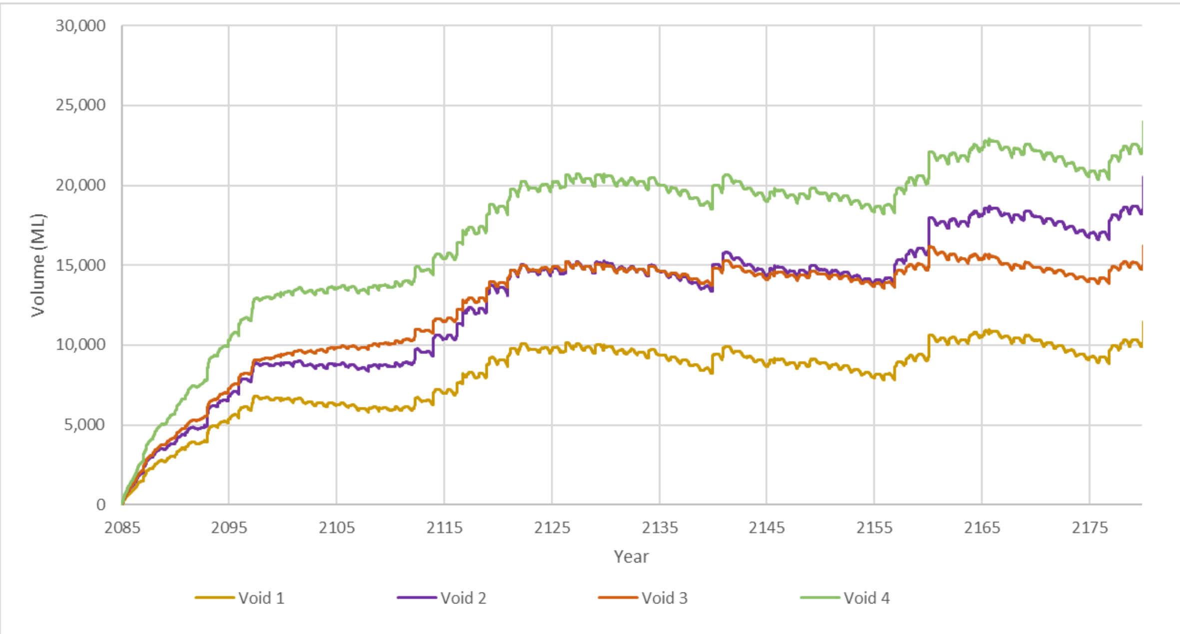

Figure 7-3 Final Void Predicted Volume

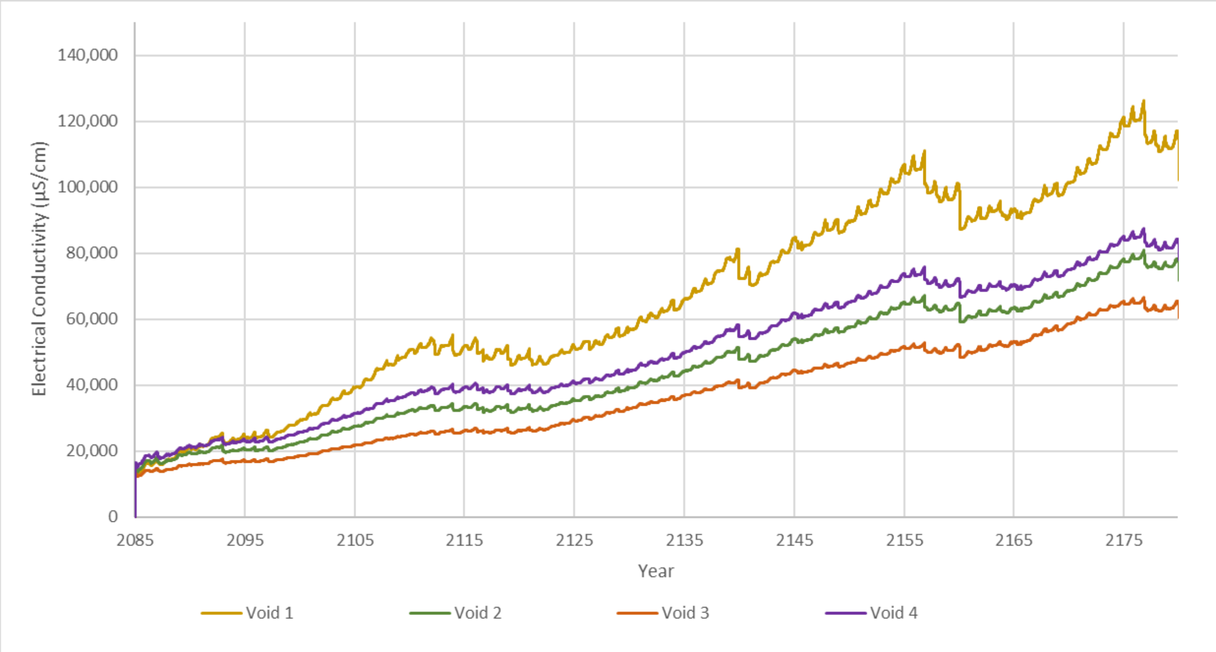

Figure 7-4 Final Void Predicted Water Quality

The salinity of the final voids was also modelled to examine the impacts of the effects of evaporation and groundwater inflows on void water quality. The salinity of the final voids is predicted to increase significantly post closure due to the constant inflow from highly saline groundwater ranging from 12,200 to 16,200 µS/cm. The predicted salinity values increase in excess of 50,000 µS/cm and the resulting water quality is predicted to be hypersaline (refer **Figure 7-4**). It is noted that the WBM does not represent all of the process and that precipitation of some salts is likely to occur along with an upper threshold on the volume of salts in the soil that can leach into the void, thus the predicted concentrations are likely conservative. However, the void is predicted to become hypersaline and this water predicted to be contained in the void. The BWM Progressive Rehabilitation Closure Plan (PRCP) will incorporate management measures to reduce the impacts of the final void water quality on the environment and any potential water users.

8.0 Surface Water Resources Summary

The key surface water issues for the Project are the potential impacts on:

- Flooding, flows from the flood protection infrastructure which will protect the pits within the Project area from the ingress of water during a flood event.
- Receiving water quality through the capture, use and release of water captured within the mining lease as part of the site water management system.
- Flooding and flows from the proposed final landform.

The surface water impact assessment identified the following:

- The proposed infrastructure achieves the 0.1% AEP flood immunity as required by industry guidelines to protect the mine from ingress from Deep Creek, Taurus Creek, and Two Mile Gully. This flood immunity is able to be achieved with minimal impacts on flood behaviour. Impacts are limited to the immediate project vicinity and flood behaviour is similar to existing conditions.
- The results of the water balance modelling demonstrate the ability of the Project's proposed water management infrastructure to manage mine water. The results indicate the water management system's ability to manage water in accordance with the current EA conditions as well as support the Project's water requirements.
- Post-closure, the final voids are immune to flood inundation in flood events of magnitude up to and including the 0.1% AEP event (considering climate change).
- The modelling of the final landform predicts that the final voids will be sinks and are not predicted to overflow into the environment. Water quality in these voids is predicted to be hypersaline.

The existing BWM surface water management measures are suitable to mitigate potential water quality impacts. New flood protection infrastructure during operations will include levees and/or flood protection landforms. If assessed as regulated structures these will be and designed, constructed and operated in accordance with the relevant guidelines.

The management and mitigation measures are currently conditioned in the existing BWM EA or managed through elements such as the Water Management Plan, REMP/FRREMP, Erosion and Sediment Control Plan and Regulated Structures Design and Inspection Conditions. These plans will be updated to incorporate the Project.

The Project does not require amendments to the conditions outlined in Schedule F – Water EA conditions (EPML00717813) and Schedule G – Structures.

The Project will have a minimal impact on the hydrological characteristics of the surface water resources in the area. The flow regime is unlikely to change significantly, and the quantity of flow is unlikely to reduce the current or future utility of the resource for other users. As such the project is expected to have negligible impacts as per the criteria outlined in the *Significant Impact Guidelines 1.3: Coal seam gas and large coal mining developments—Impacts on water resources (Commonwealth of Australia, 2022).*

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Appendix A Existing Flood Modelling Results

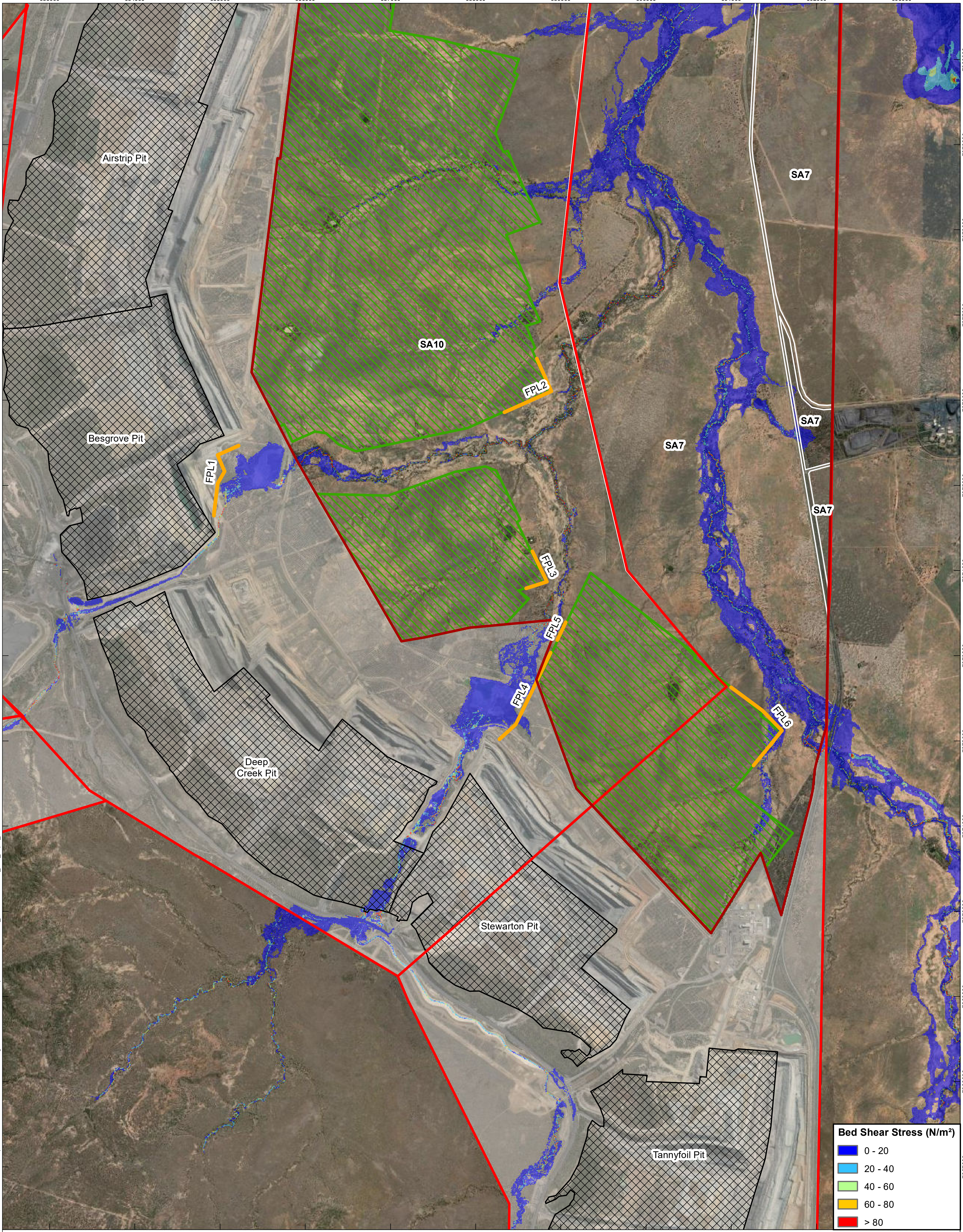
Blackwater Mine

North Extension Project - Surface Water Resources Assessment

BM Alliance Coal Operations Pty Ltd

SLR Project No.: 620.13452.00000

8 December 2023



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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

SLR

BLACKWATER MINE
NORTH EXTENSION PROJECT

Existing Conditions (E02)
Peak Flood Bed Shear Stress - 50% AEP

APPENDIX A-1-1

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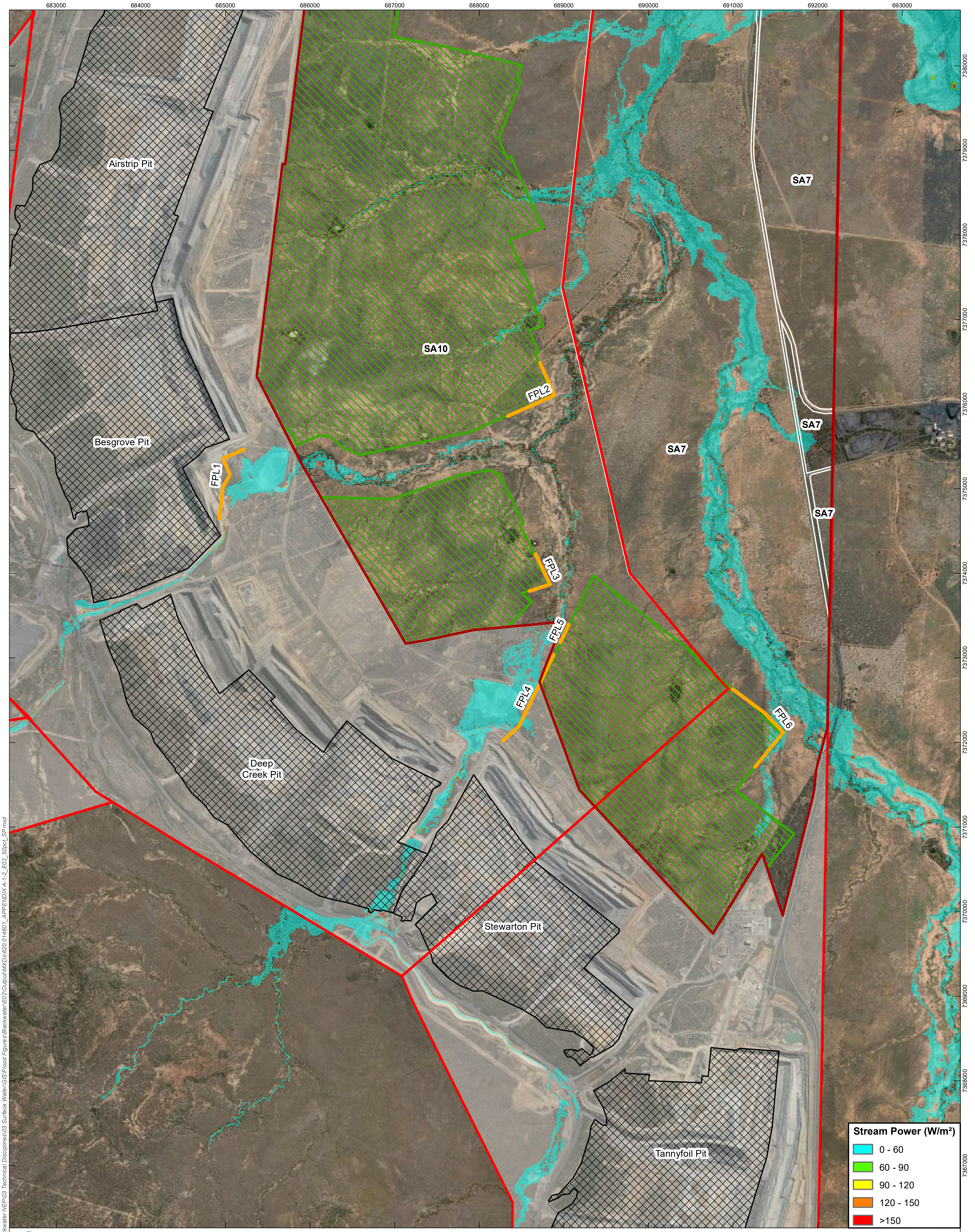

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Coordinate System: AGD 1966 AMG Zone 55
Scale: 1:40,000 at A3
Project Number: 620.014601
Date: 8/12/2023
Drawn by: SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Existing Conditions (E02)
Peak Flood Stream Power - 50% AEP

APPENDIX A-1-2

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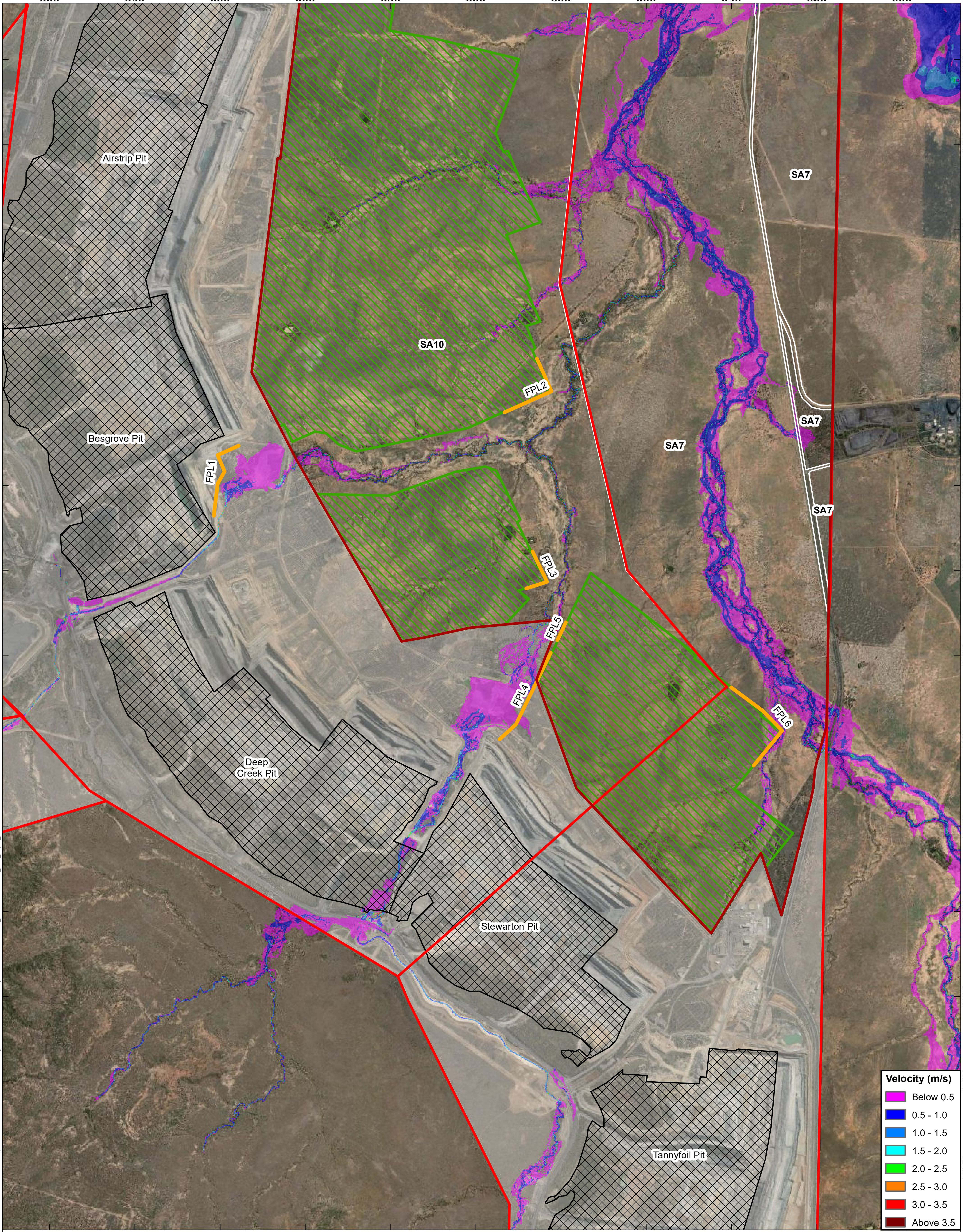

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Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

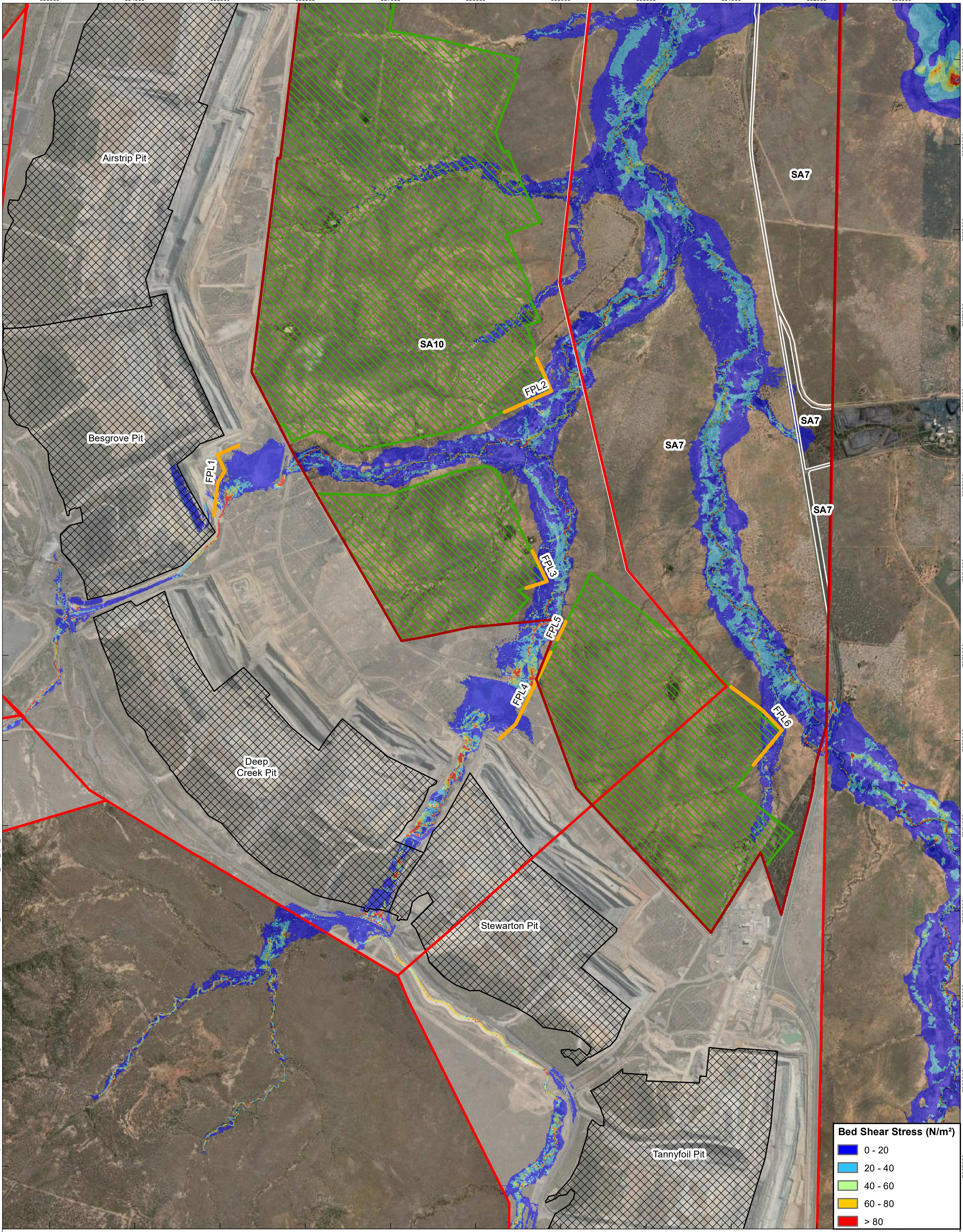
LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Existing Conditions (E02)
Peak Flood Velocities - 50% AEP

APPENDIX A-1-3



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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

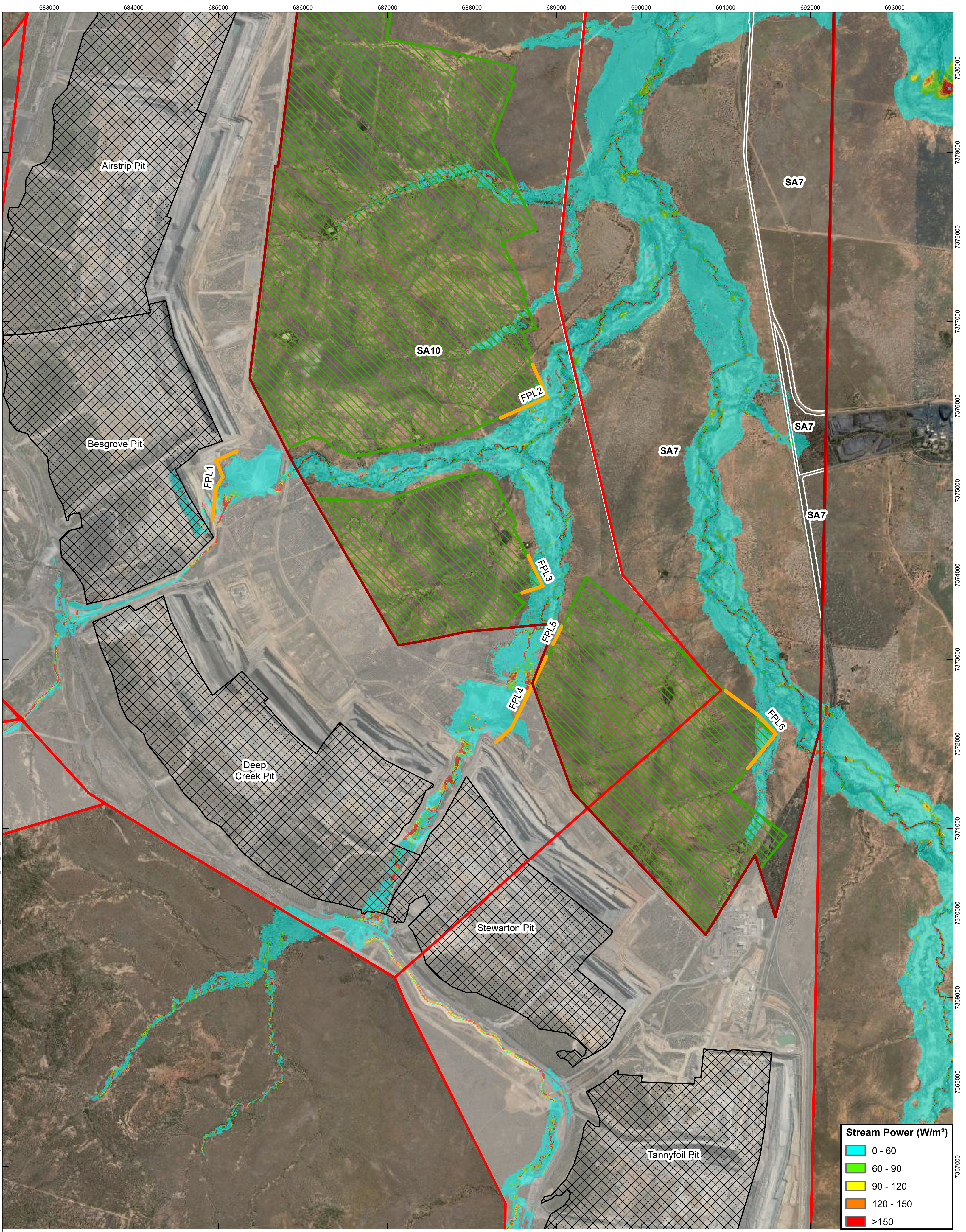
LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Existing Conditions (E02)
Peak Flood Bed Shear Stress - 2% AEP

APPENDIX A-1-4



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Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Existing Conditions (E02)
Peak Flood Stream Power - 2% AEP

APPENDIX A-1-5

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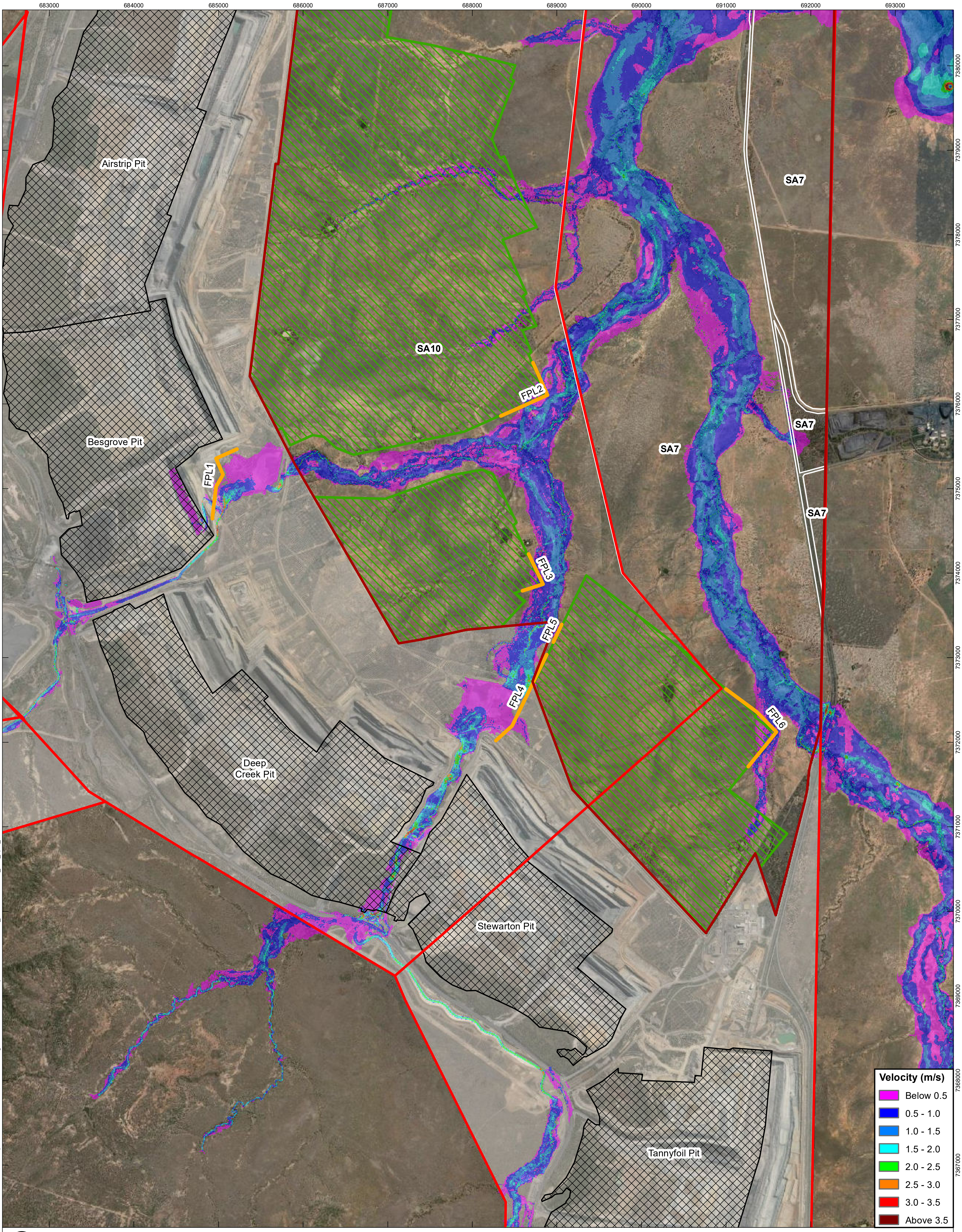

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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Existing Conditions (E02)
Peak Flood Velocities - 2% AEP

APPENDIX A-1-6

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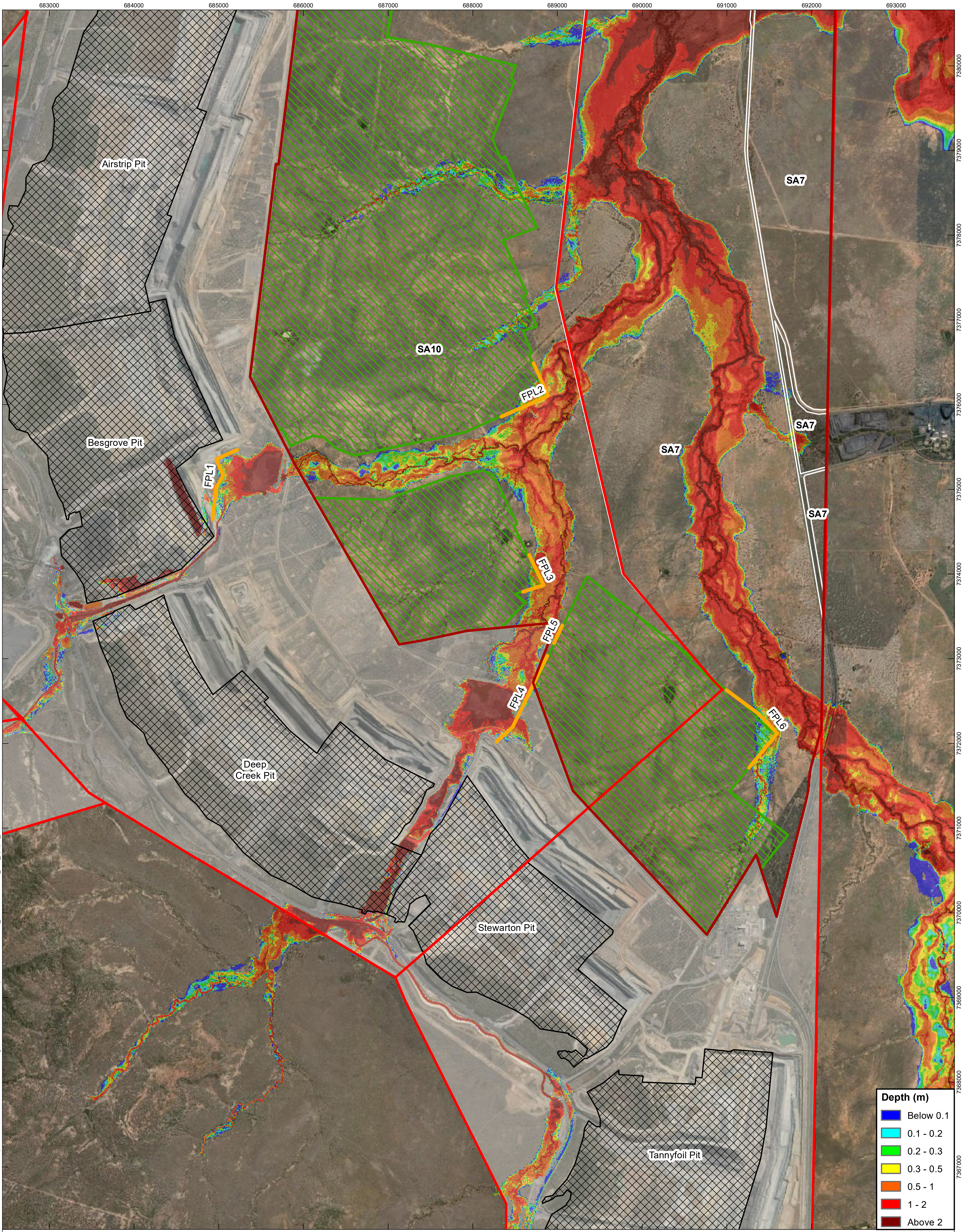

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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

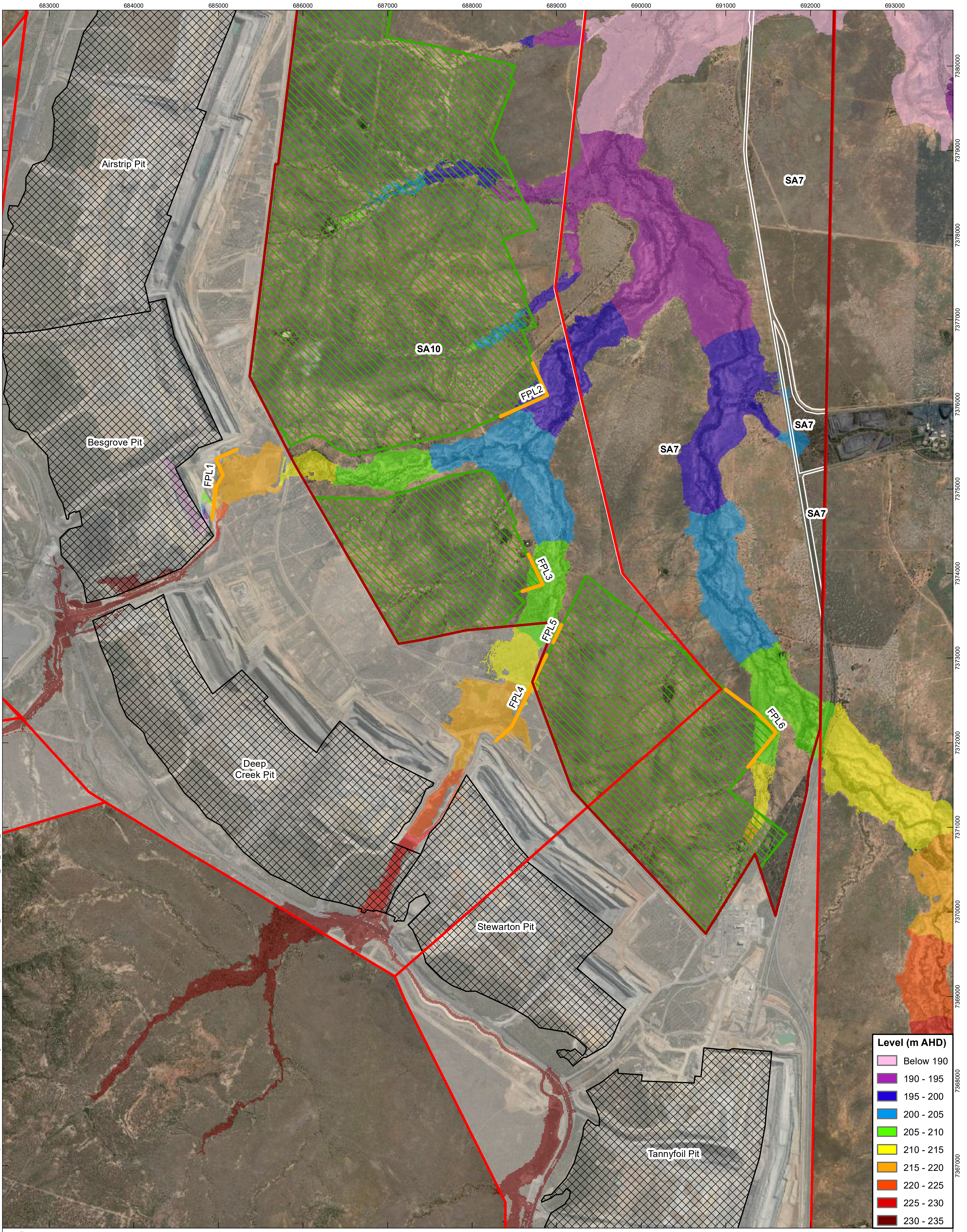
LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Existing Conditions (E03)
Peak Flood Depths - 0.1% AEP

APPENDIX A-1-7



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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

SLR

BLACKWATER MINE
NORTH EXTENSION PROJECT

Existing Conditions (E03)
Peak Flood Levels - 0.1% AEP

APPENDIX A-1-8

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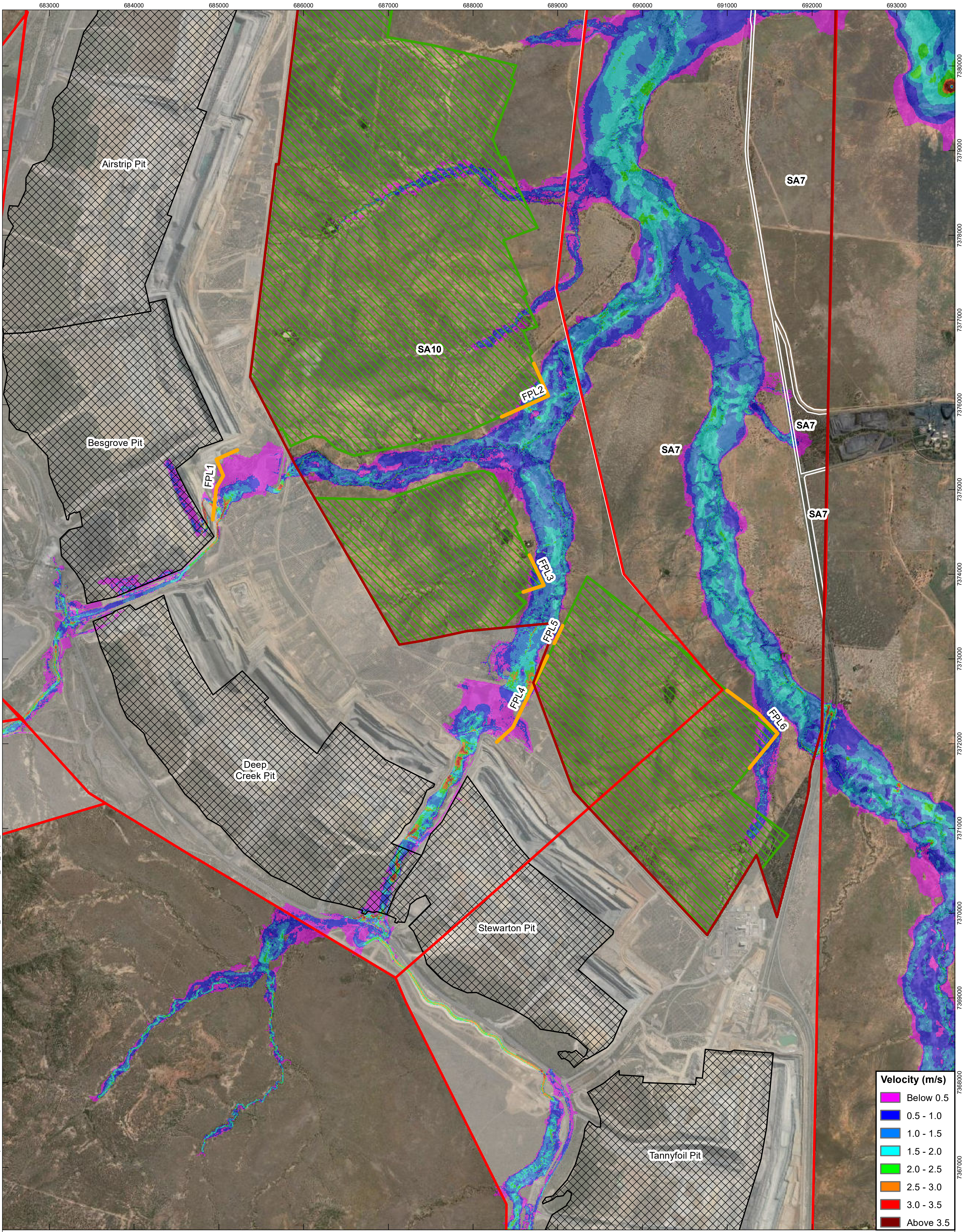

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Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Existing Conditions (E03)
Peak Flood Velocities - 0.1% AEP

APPENDIX A-1-9

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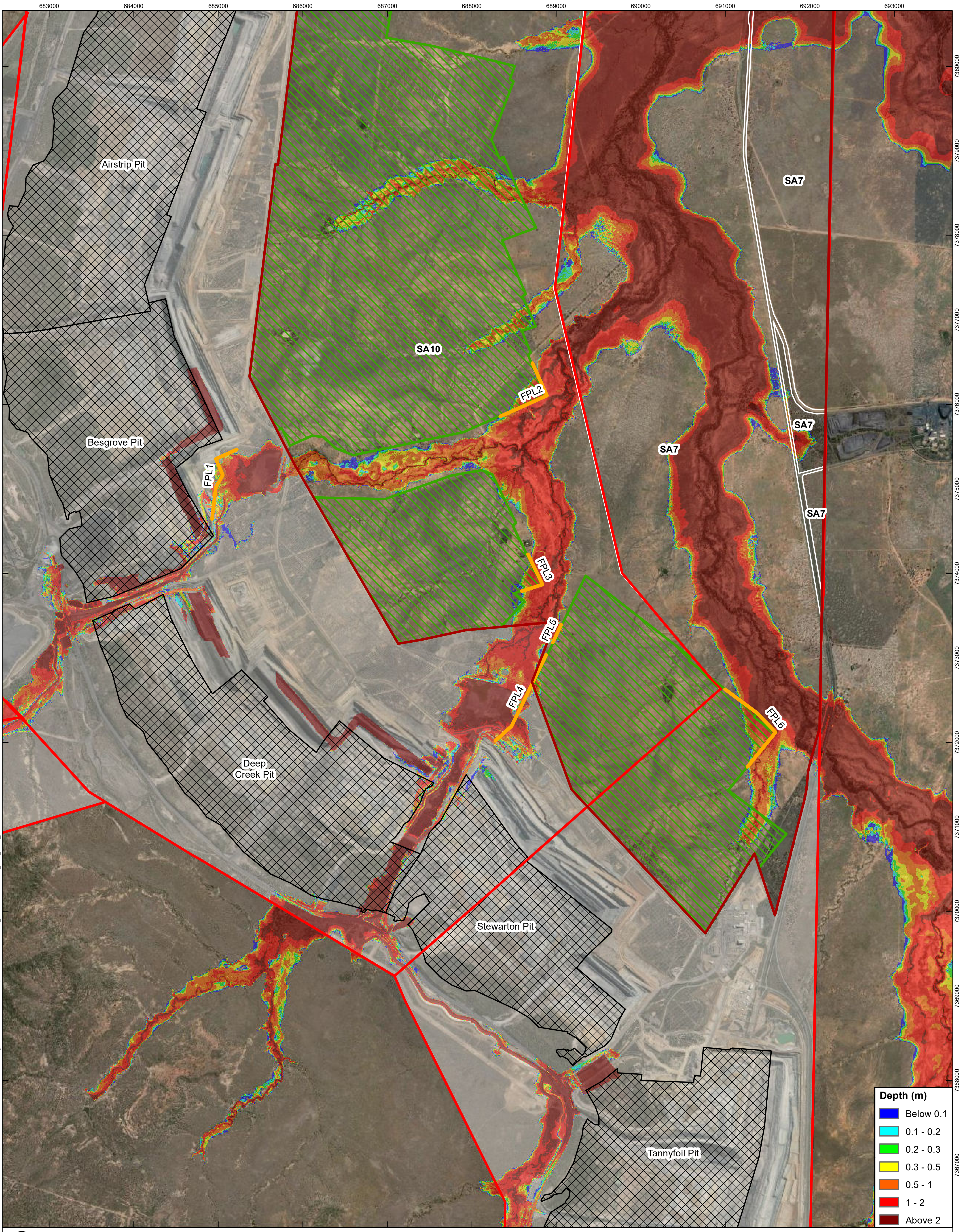

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Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

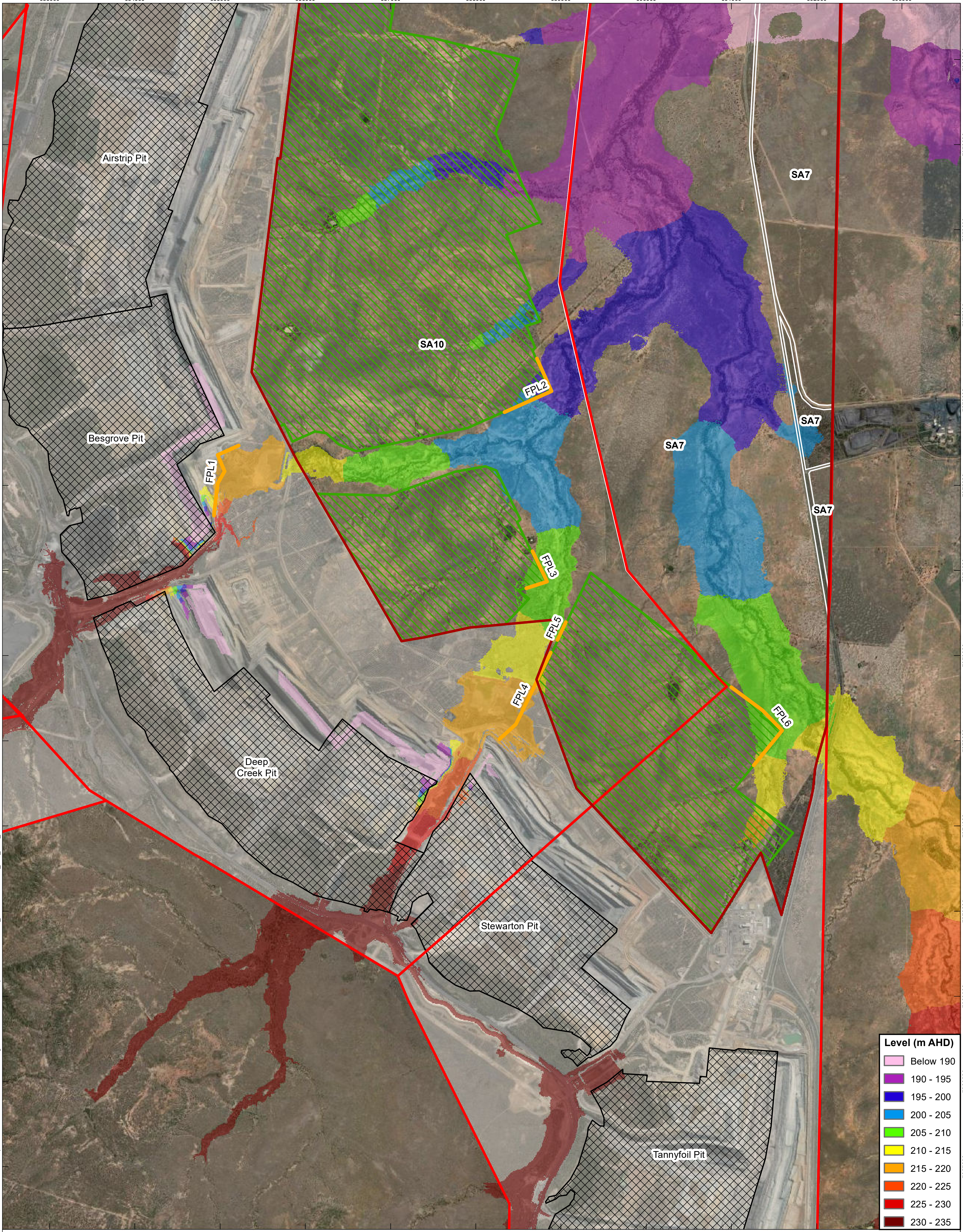
LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Existing Conditions (E02)
Peak Flood Depths - PMP

APPENDIX A-1-10



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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

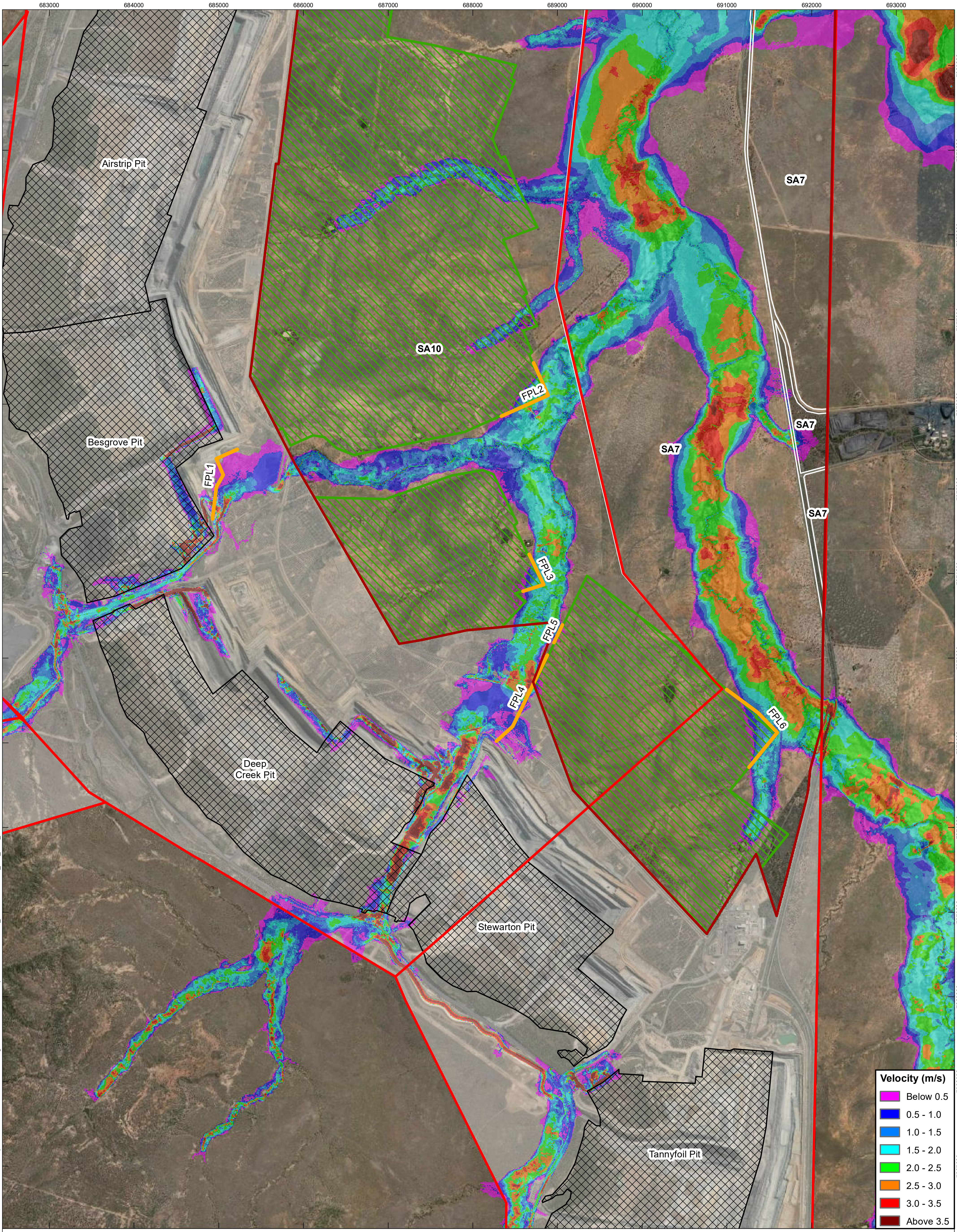
SLR

BLACKWATER MINE
NORTH EXTENSION PROJECT

Existing Conditions (E02)
Peak Flood Levels - PMP

APPENDIX A-1-11

H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\03 Technical Disciplines\03 Surface Water\GIS\Flood Figures\Blackwater\E02\Output\MXDs\620.014601_APPENDIX A-1-11_E02_PMP_h.mxd



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Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Existing Conditions (E02)
Peak Flood Velocities - PMP

APPENDIX A-1-12

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Appendix B Project Flood Modelling Results

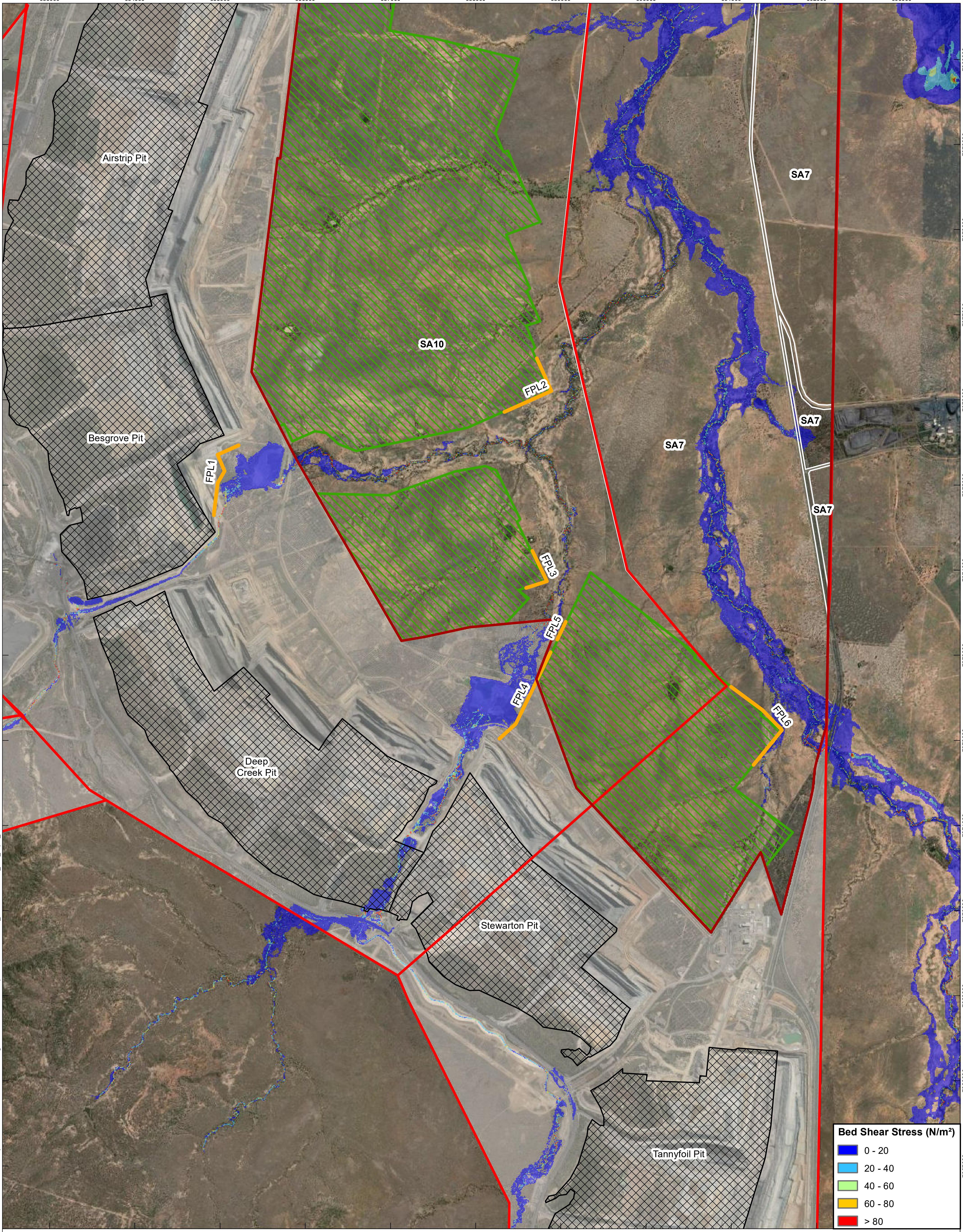
Blackwater Mine

North Extension Project - Surface Water Resources Assessment

BM Alliance Coal Operations Pty Ltd

SLR Project No.: 620.13452.00000

8 December 2023



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Date:	8/12/2023
Drawn by:	SM

LEGEND

- BWM North Extension Project Area
- Mining Leases
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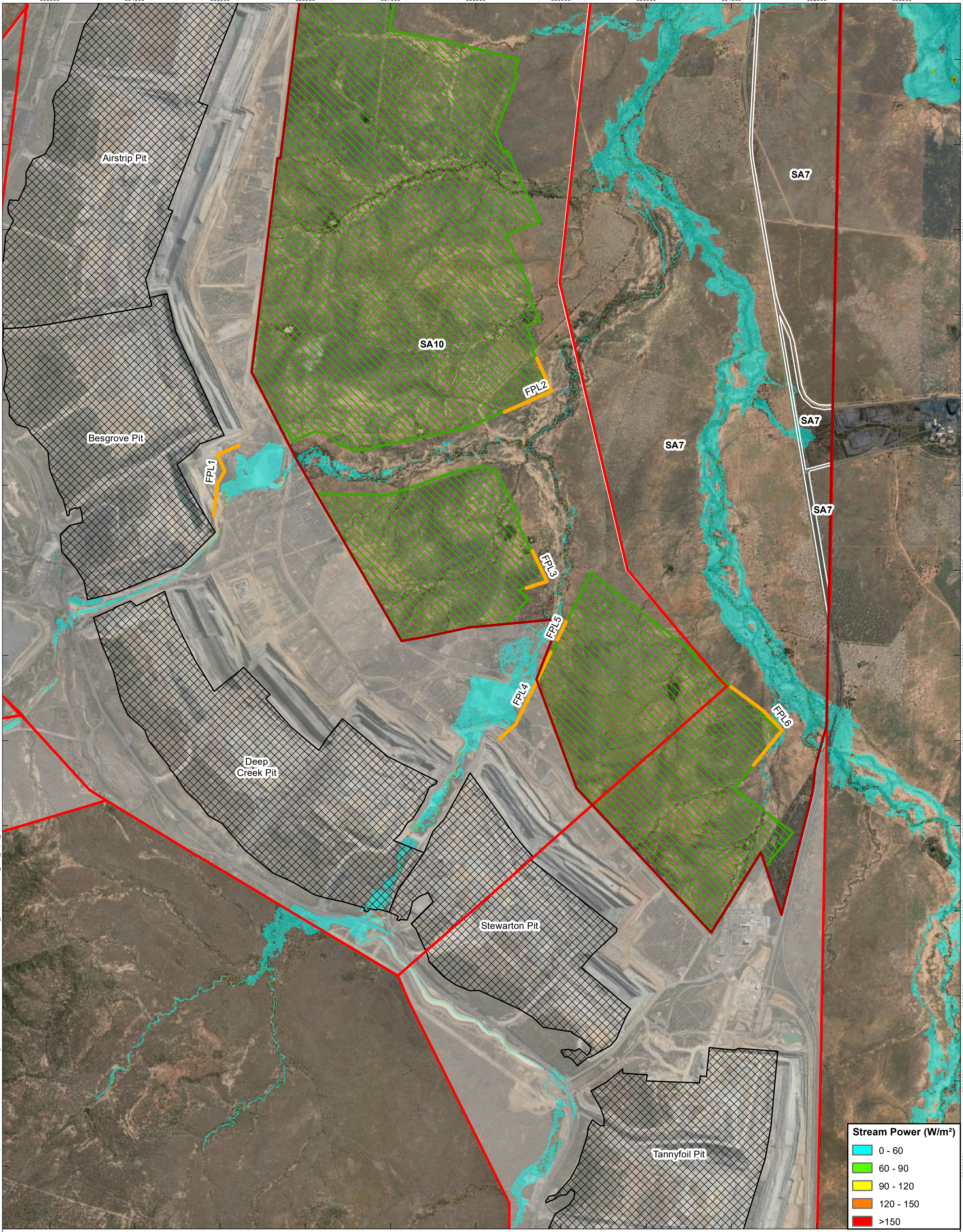
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

SLR

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D02)
Peak Flood Bed Shear Stress - 50% AEP

APPENDIX B-1-1



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Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

SLR

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D02)
Peak Flood Stream Power - 50% AEP

APPENDIX B-1-2

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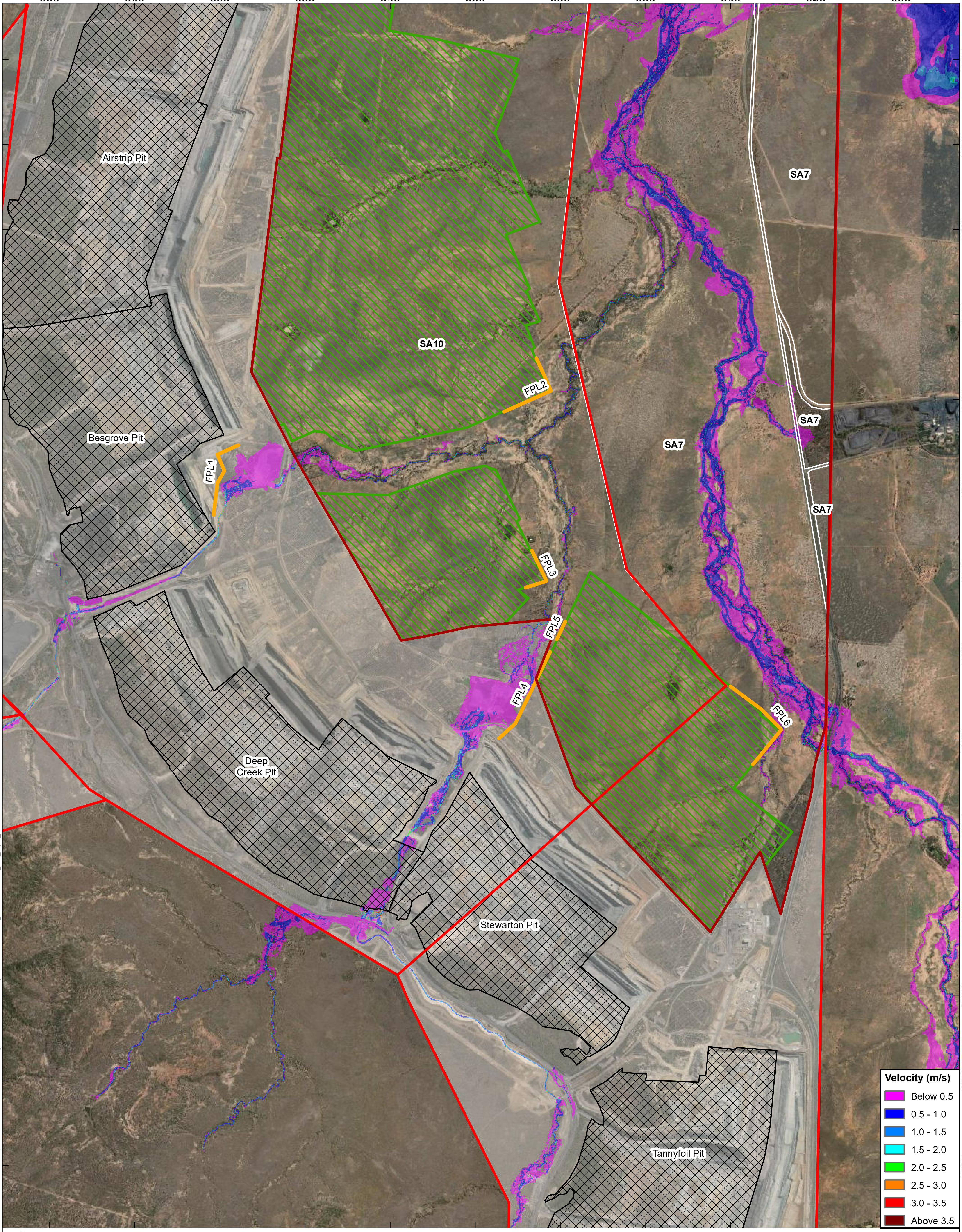

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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D02)
Peak Flood Velocities - 50% AEP

APPENDIX B-1-3

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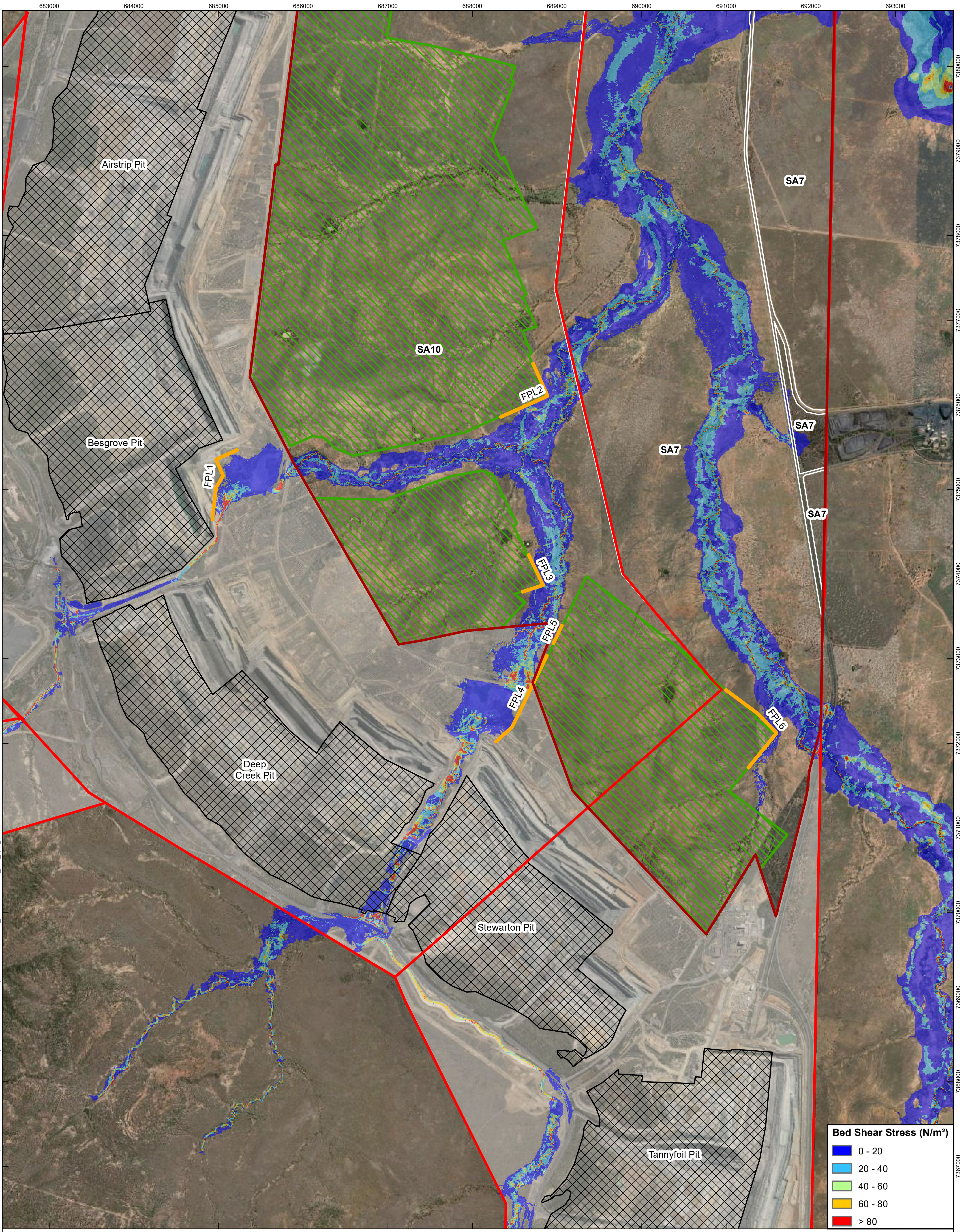

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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D02)
Peak Flood Bed Shear Stress - 2% AEP

APPENDIX B-1-4

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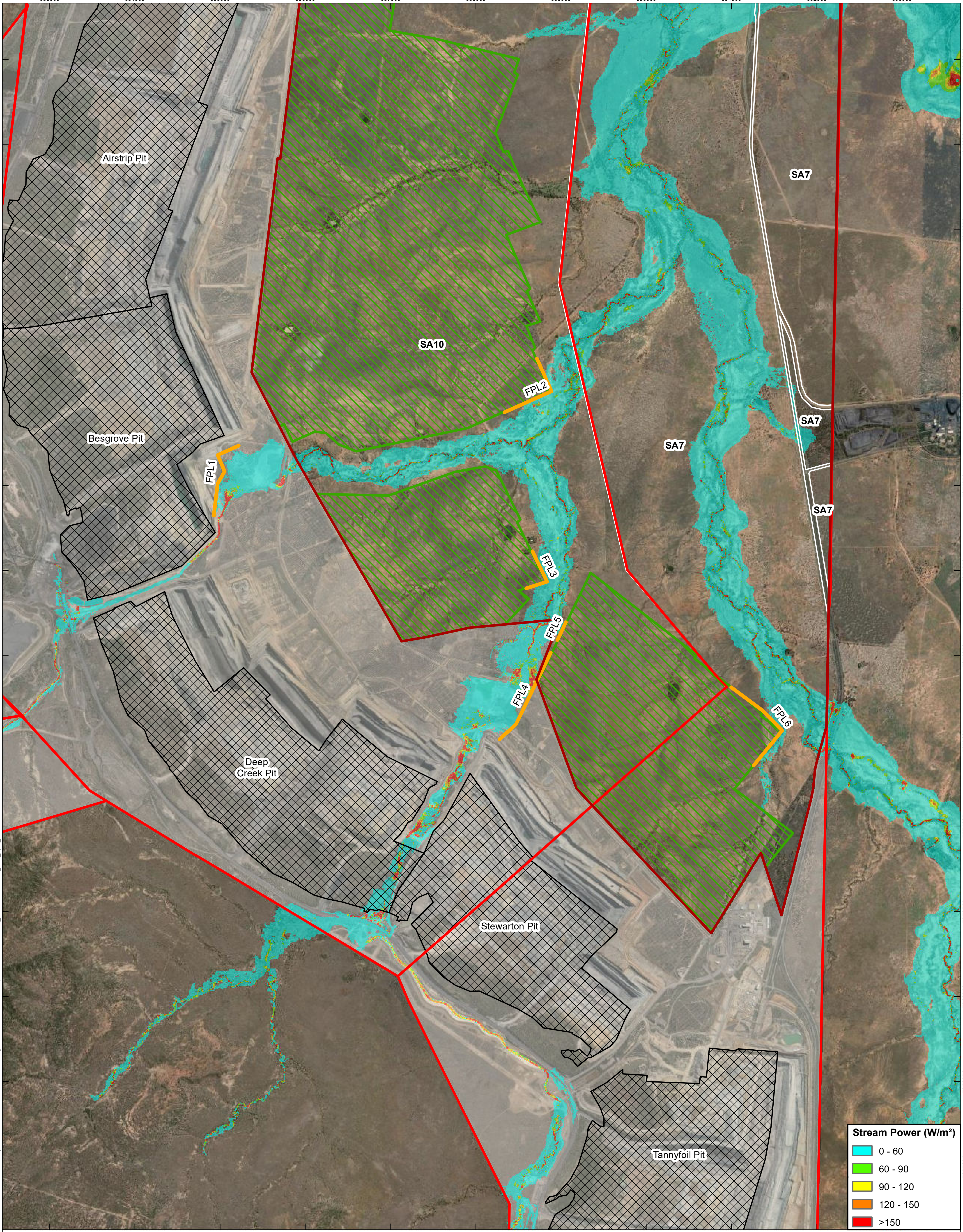

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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

SLR

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D02)
Peak Flood Stream Power - 2% AEP

APPENDIX B-1-5

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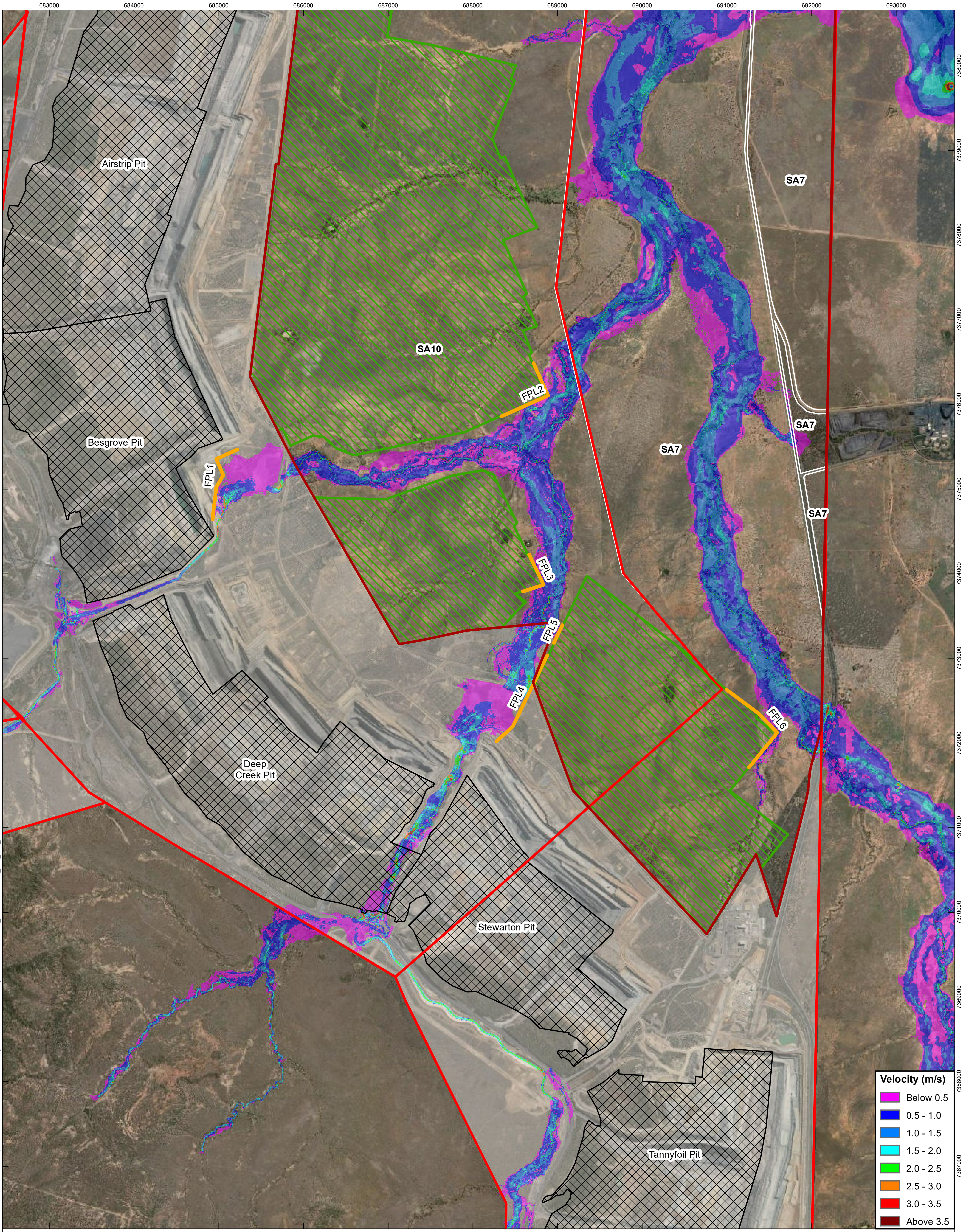

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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D02)
Peak Flood Velocities - 2% AEP

APPENDIX B-1-6

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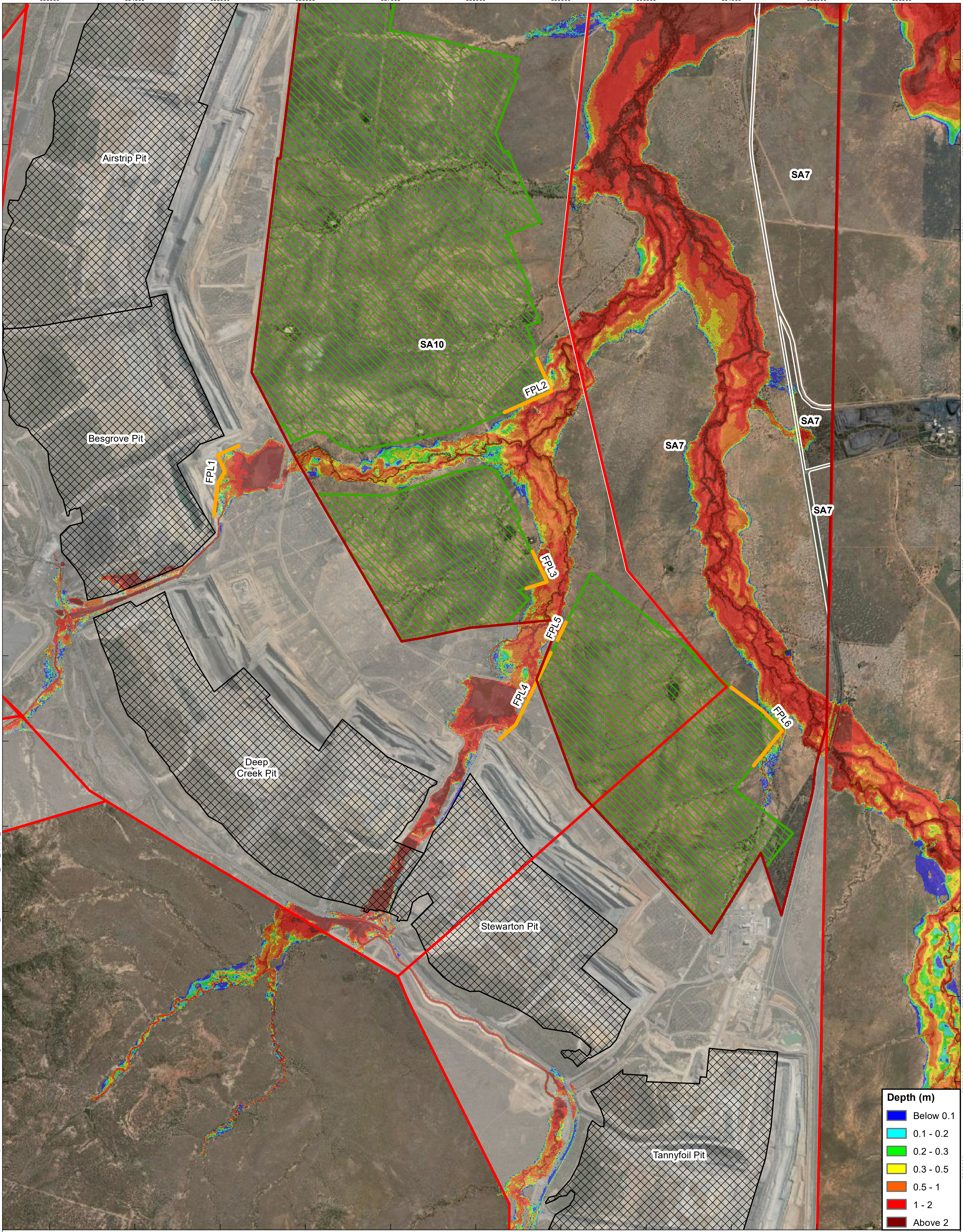

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Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D02)
Peak Flood Depths - 0.1% AEP

APPENDIX B-1-7

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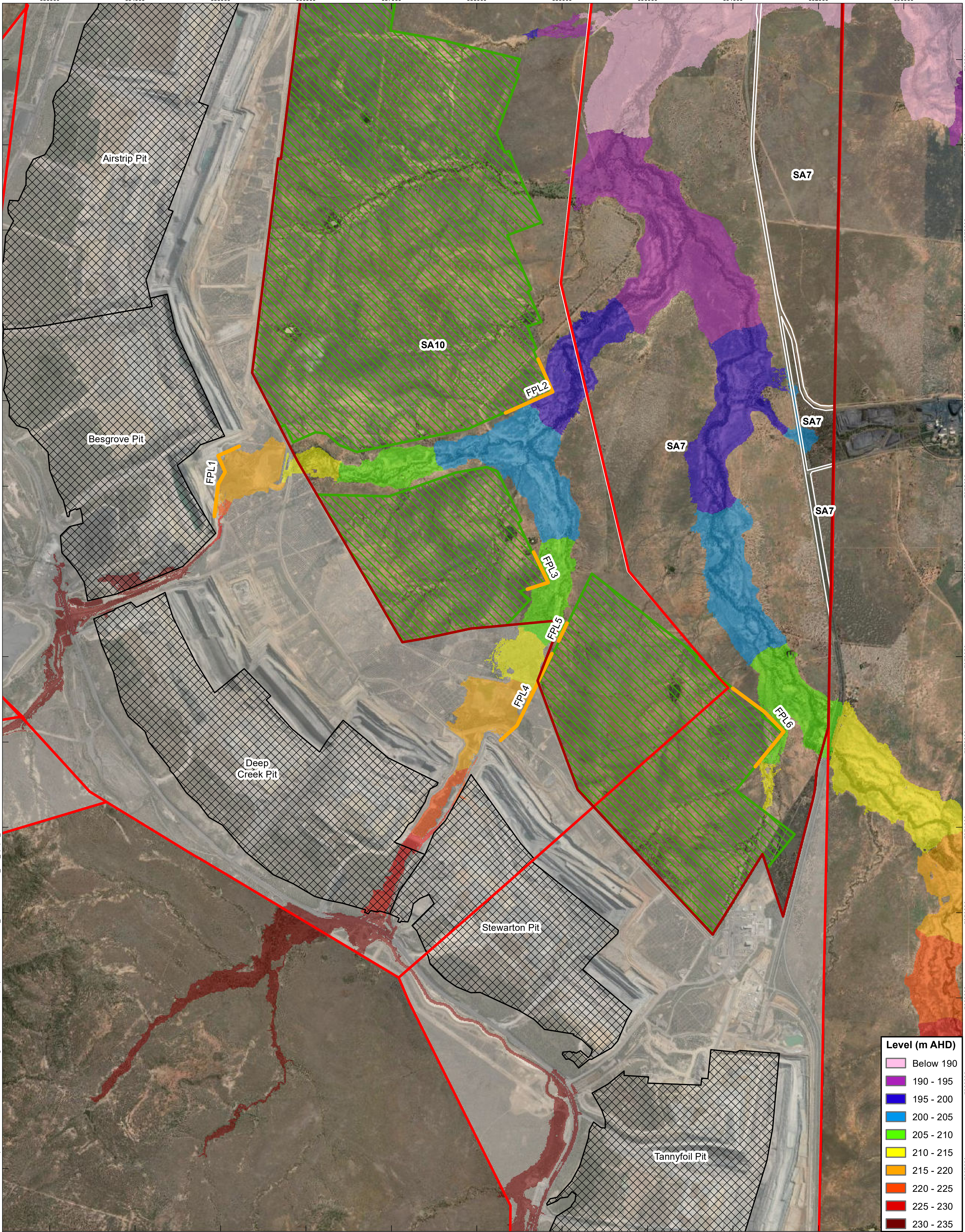

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Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

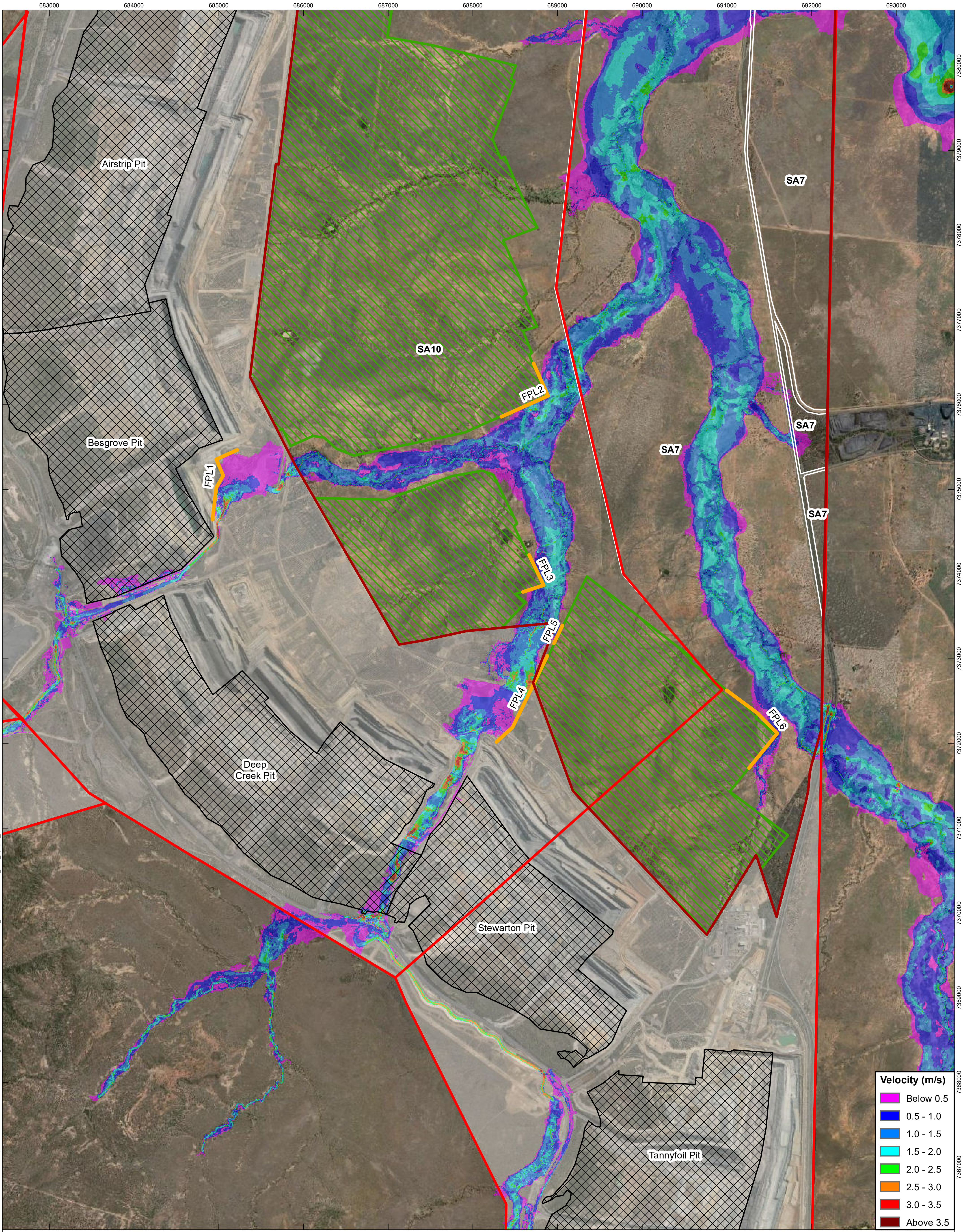
LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D02)
Peak Flood Levels - 0.1% AEP

APPENDIX B-1-8



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Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D02)
Peak Flood Velocities - 0.1% AEP

APPENDIX B-1-9

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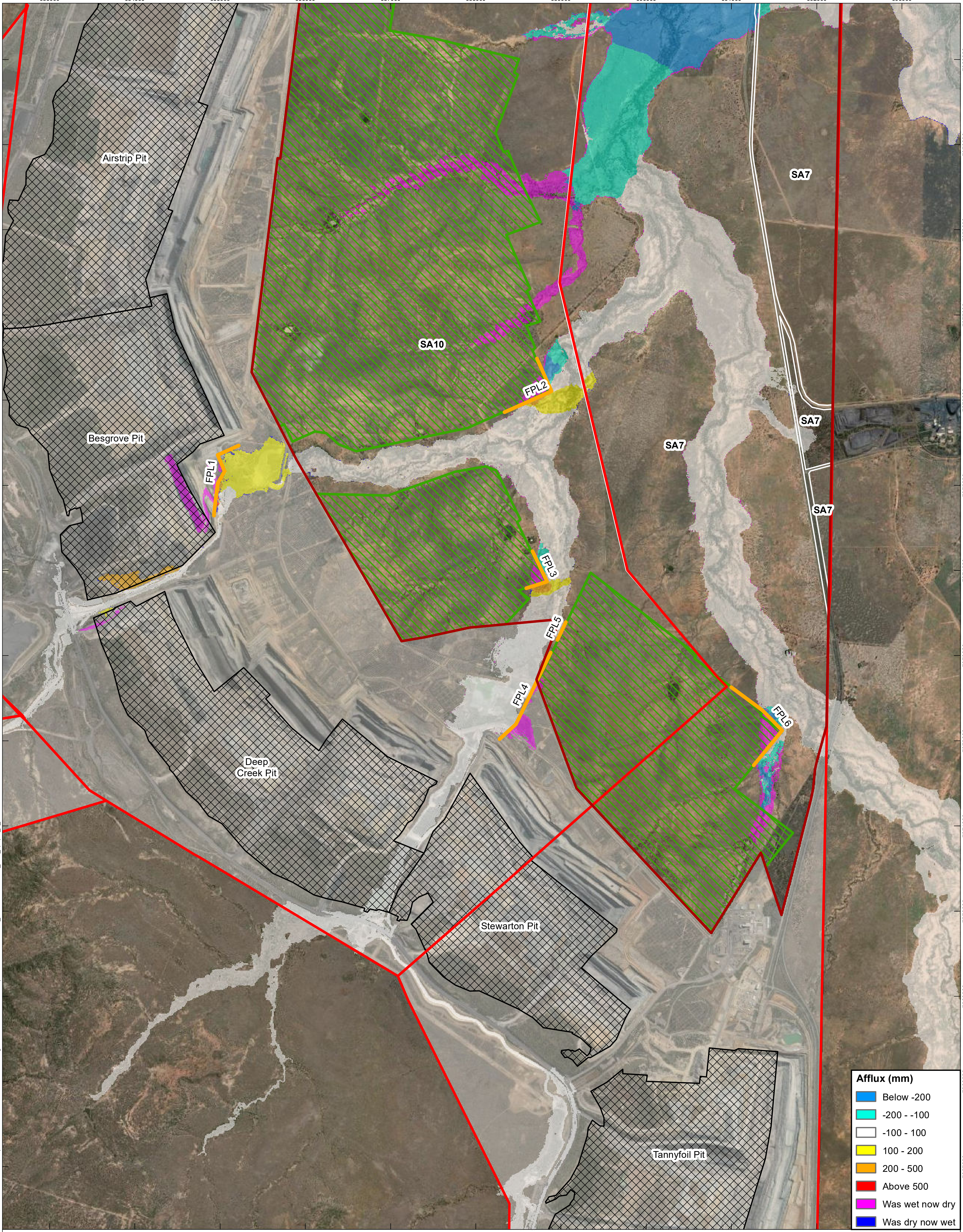

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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D02)
Peak Flood Afflux - 0.1% AEP

APPENDIX B-1-10

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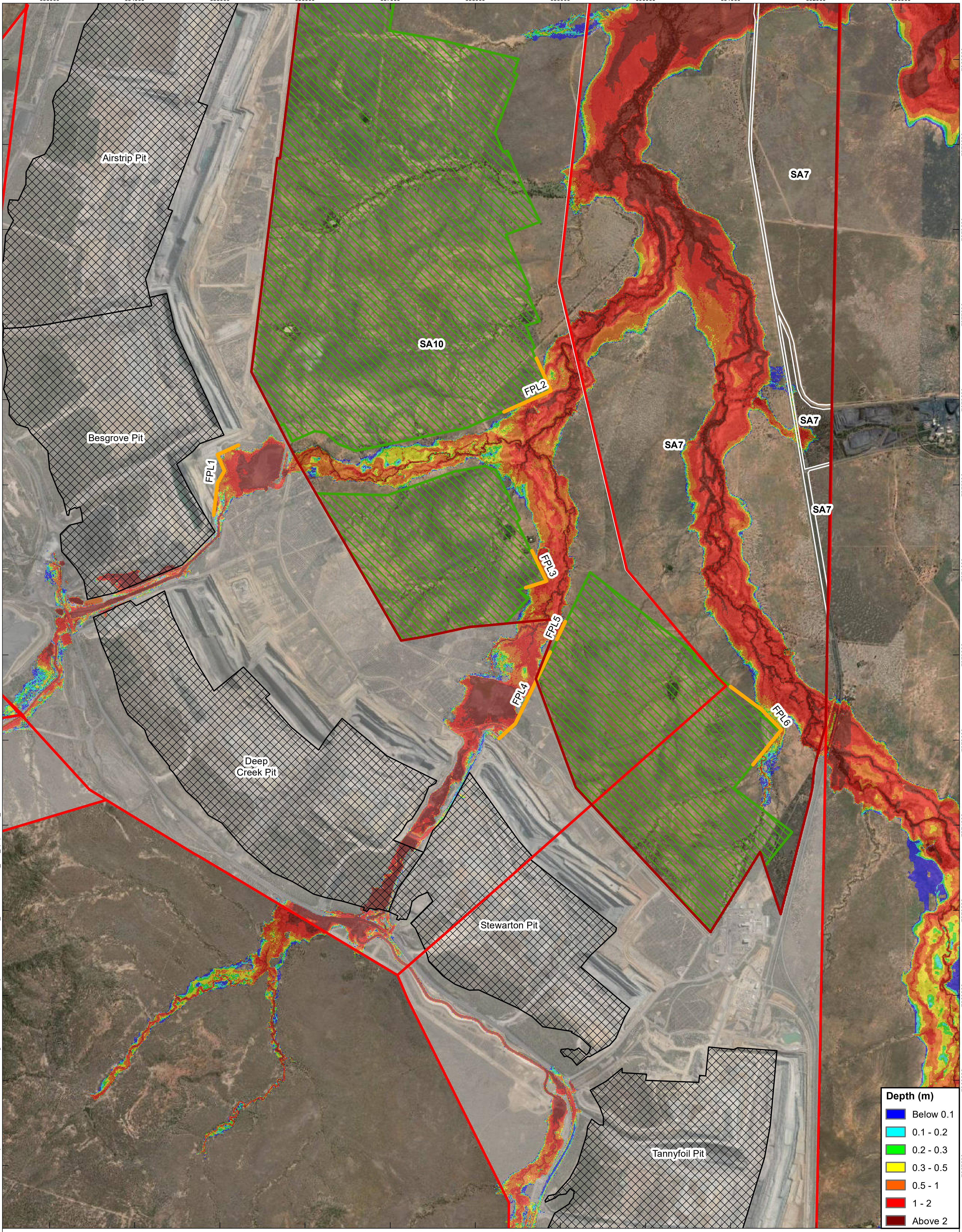

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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D04)
Peak Flood Depths - 0.1% AEP + Climate Change

APPENDIX B-1-11

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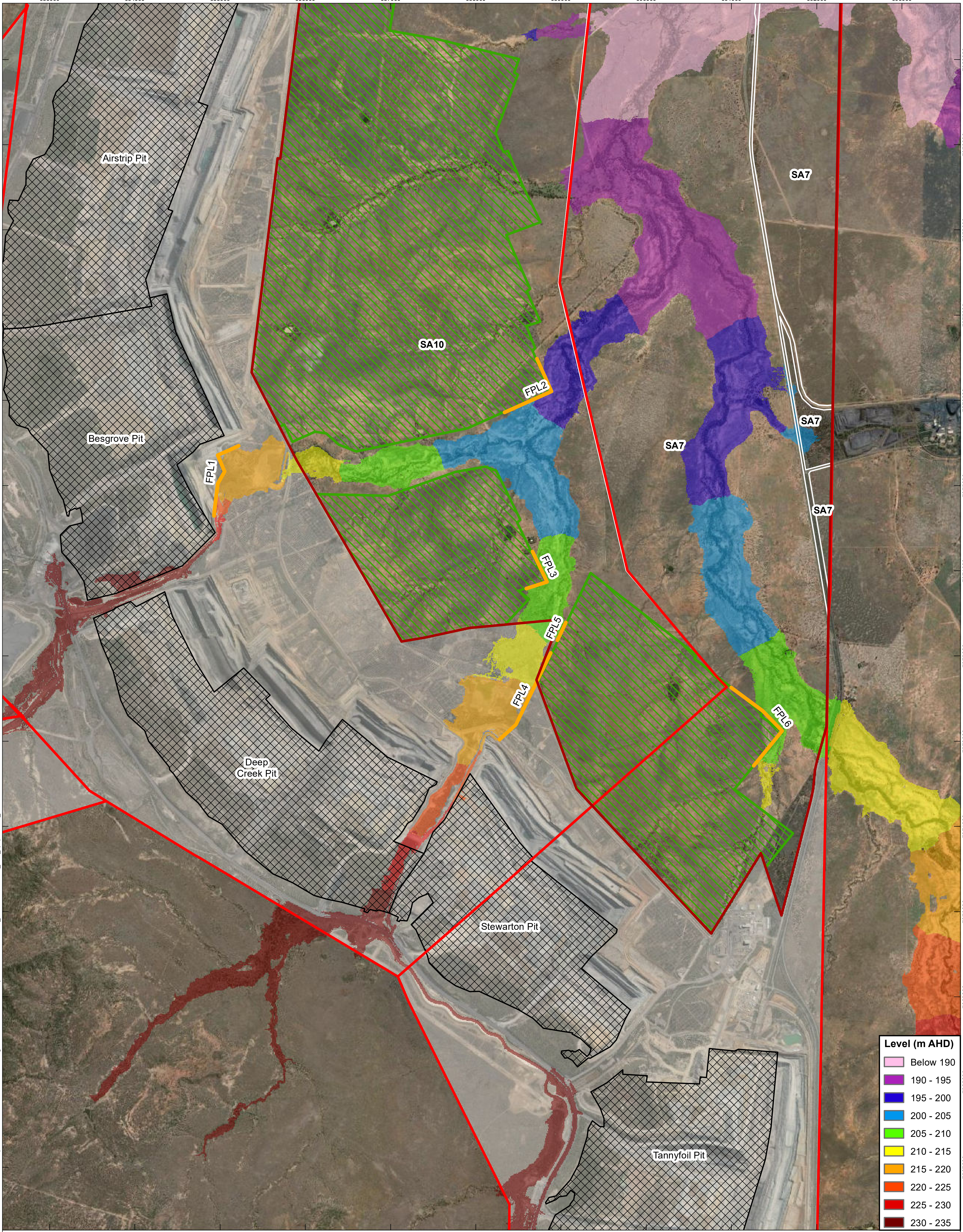

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Coordinate System:	AGD 1966 AMG Zone 55
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Date:	8/12/2023
Drawn by:	SM

LEGEND

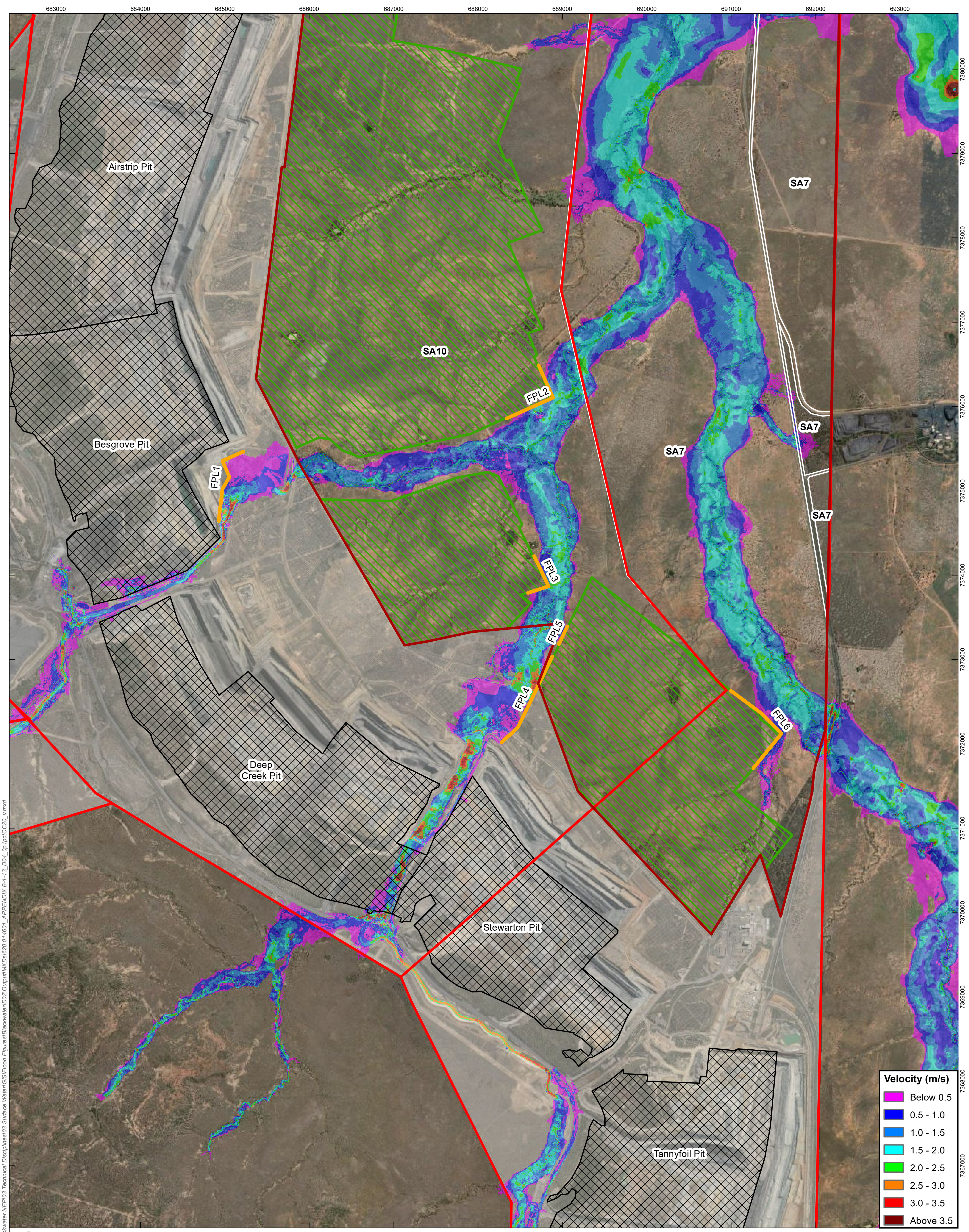
- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

SLR

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D04)
Peak Flood Levels - 0.1% AEP + Climate Change

APPENDIX B-1-12



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Date:	8/12/2023
Drawn by:	SM

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D04)
Peak Flood Velocities - 0.1% AEP + Climate Change

APPENDIX B-1-13

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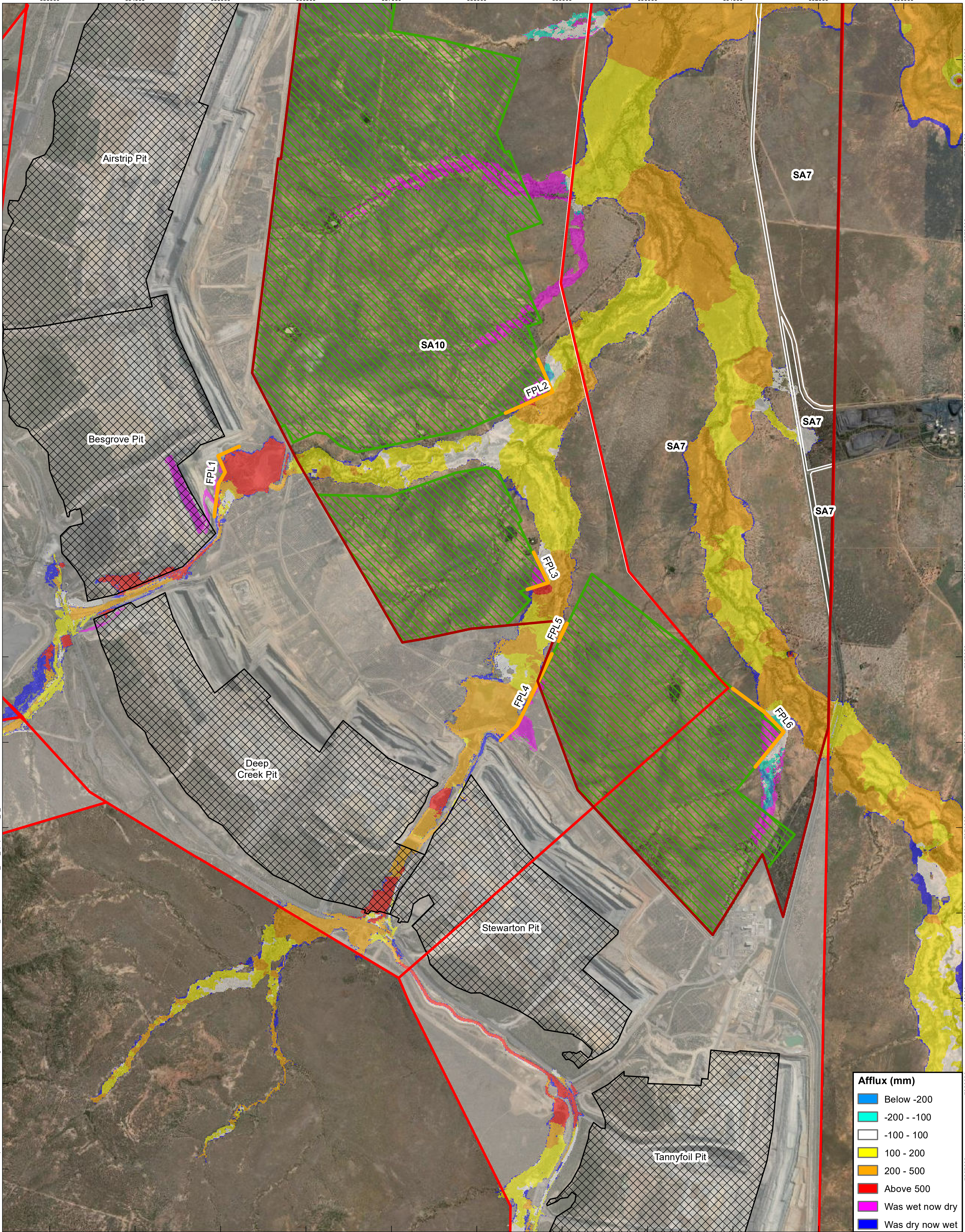

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Coordinate System:	AGD 1966 AMG Zone 55
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Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

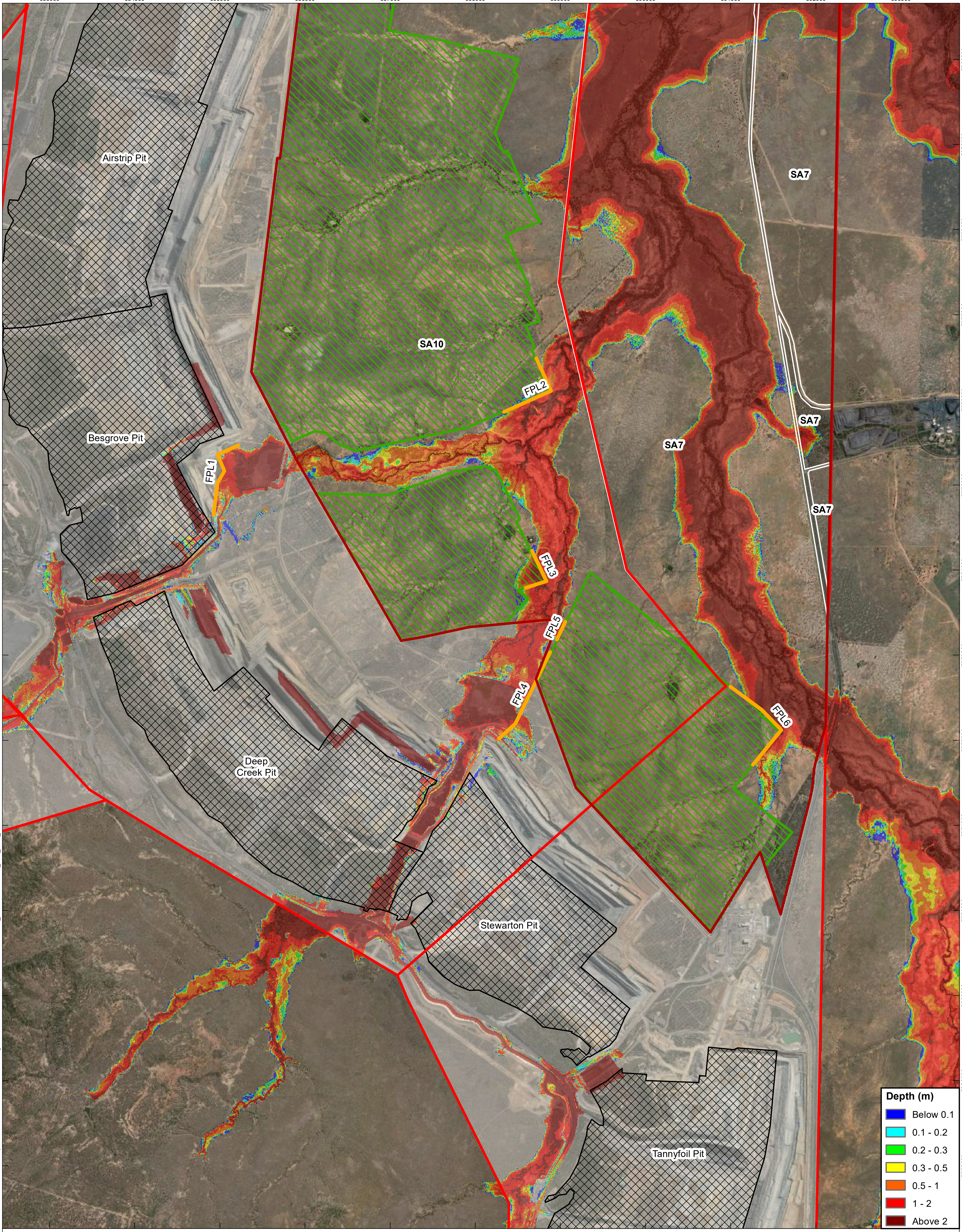
LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D04)
Peak Flood Afflux - 0.1% AEP + Climate Change

APPENDIX B-1-14



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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D02)
Peak Flood Depths - PMP

APPENDIX B-1-15

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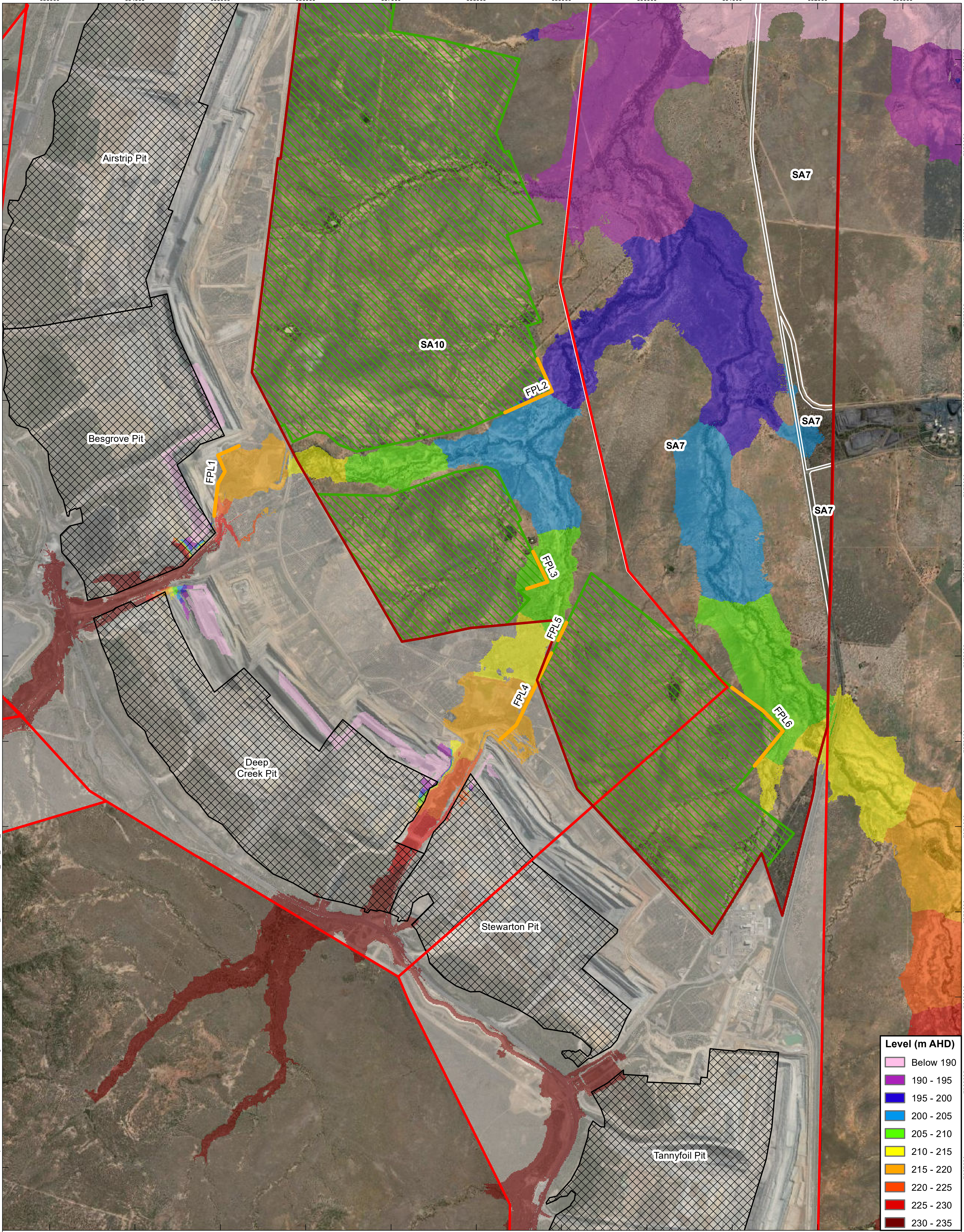

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Scale: 1:40,000 at A3
Project Number: 620.014601
Date: 8/12/2023
Drawn by: SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D02)
Peak Flood Levels - PMP

APPENDIX B-1-16

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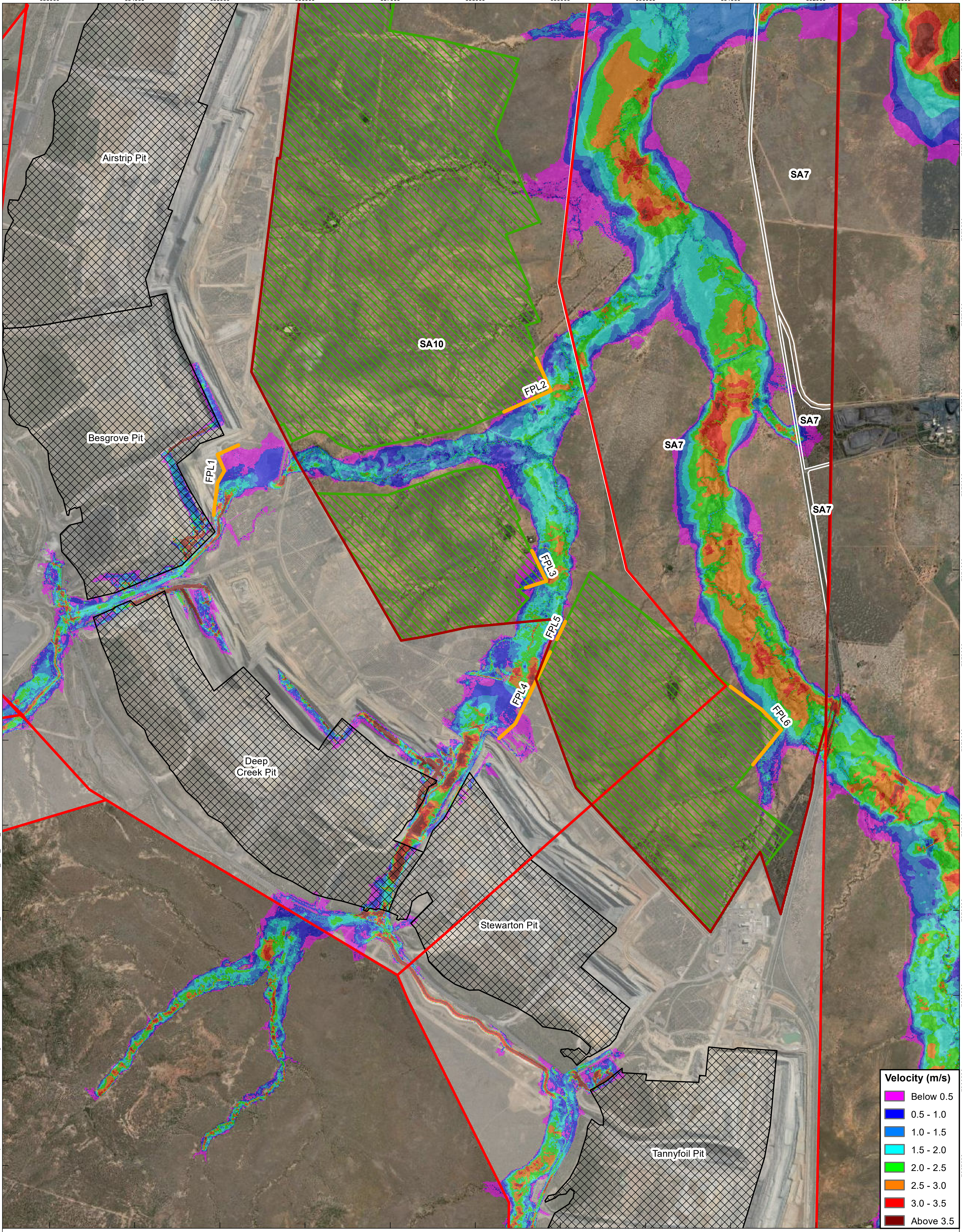

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Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D02)
Peak Flood Velocities - PMP

APPENDIX B-1-17

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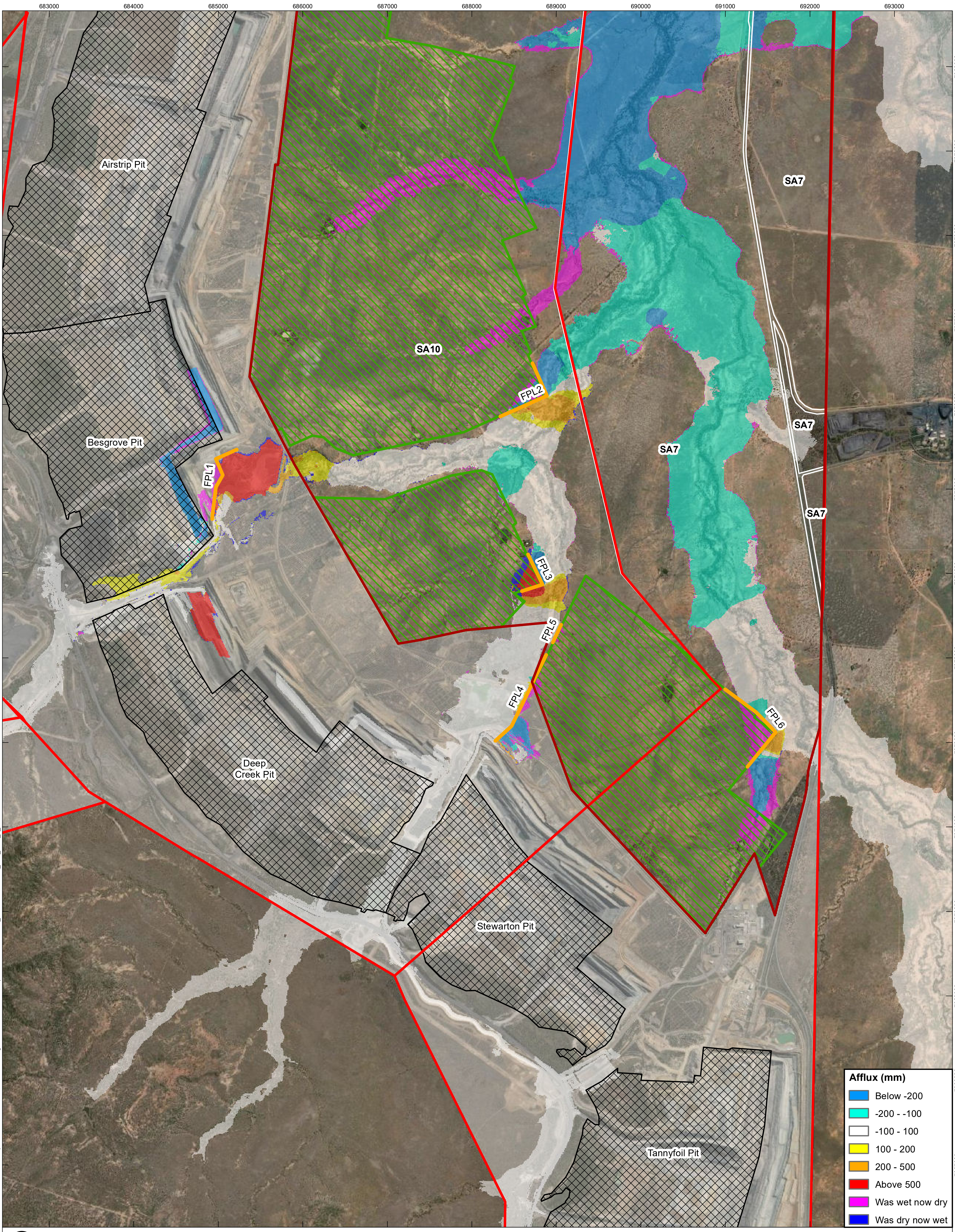

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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	8/12/2023
Drawn by:	SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

Extension Conditions (D02)
Peak Flood Afflux - PMP

APPENDIX B-1-18

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Appendix C Final Landform Flood Modelling Results

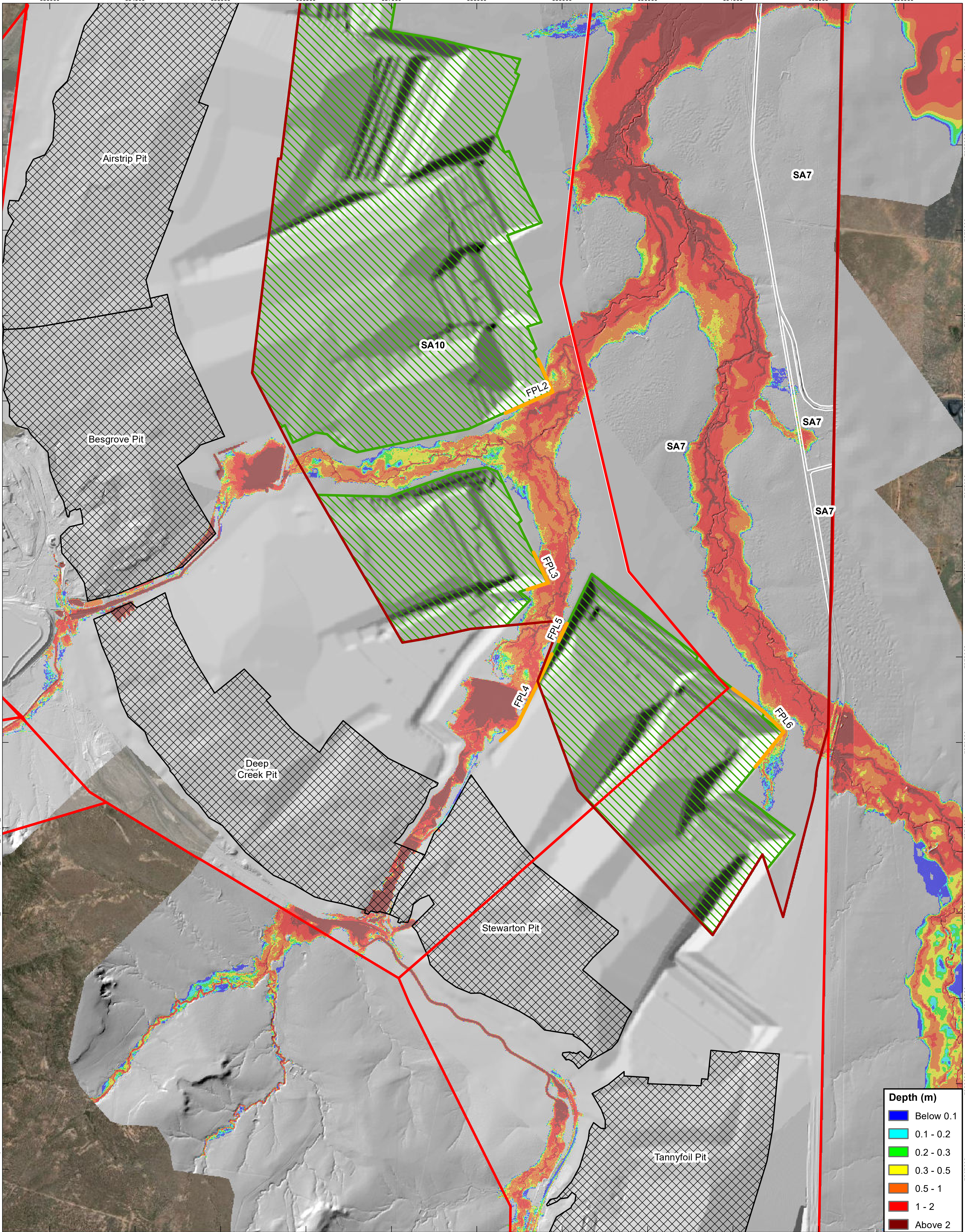
Blackwater Mine

North Extension Project - Surface Water Resources Assessment

BM Alliance Coal Operations Pty Ltd

SLR Project No.: 620.13452.00000

8 December 2023



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Coordinate System: AGD 1966 AMG Zone 55
Scale: 1:40,000 at A3
Project Number: 620.014601
Date: 08-Dec-2023
Drawn by: SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

End of Life Scenario (EOL02)
Peak Flood Depths - 0.1% AEP

APPENDIX C-1-1

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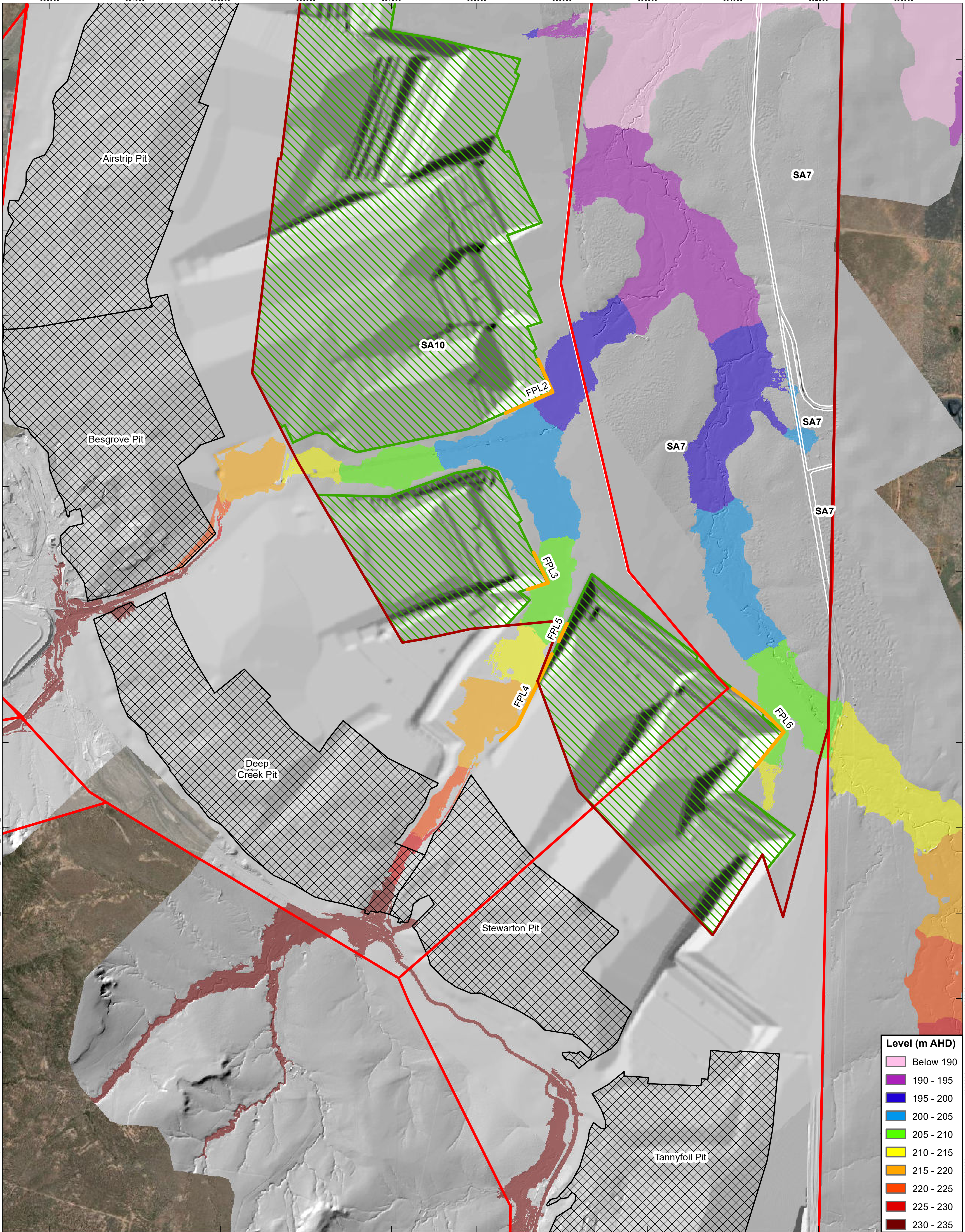

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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	08-Dec-2023
Drawn by:	SM

SLR

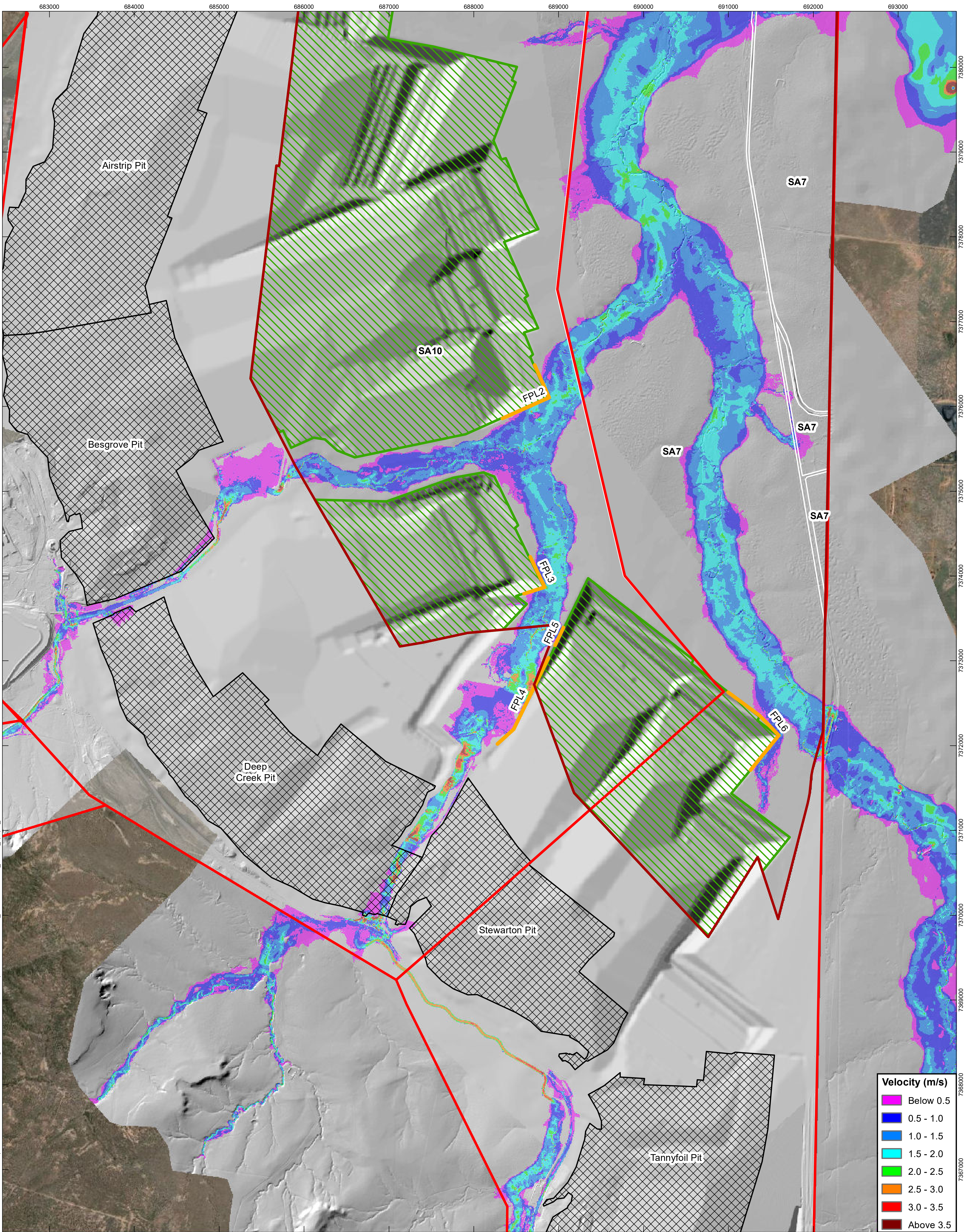
LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

End of Life Scenario (EOL02)
Peak Flood Levels - 0.1% AEP

APPENDIX C-1-2



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Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	08-Dec-2023
Drawn by:	SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

End of Life Scenario (EOL02)
Peak Flood Velocities - 0.1% AEP

APPENDIX C-1-3

0 500 1,000 Meters

Coordinate System:	AGD 1966 AMG Zone 55
Scale:	1:40,000 at A3
Project Number:	620.014601
Date:	08-Dec-2023
Drawn by:	SM

SLR

LEGEND

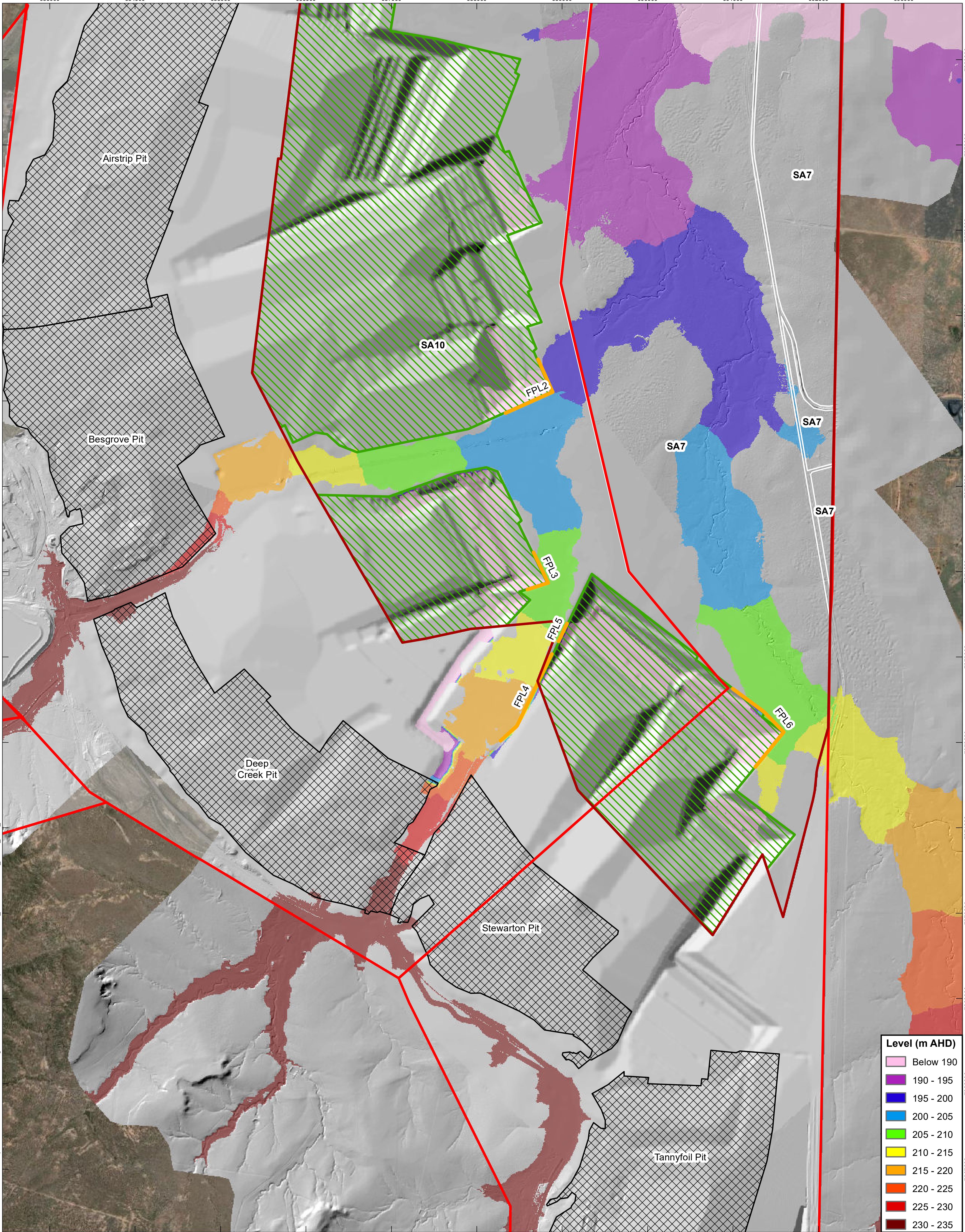
- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

End of Life Scenario (EOL02)
Peak Flood Depths - PMP

APPENDIX C-1-4

H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\03 Technical Disciplines\03 Surface Water\GIS\Flood Figures\Blackwater\EOL02\Output\MXDs\620.014601_APPENDIX C-1-4_EOL02_PMP_d.mxd



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Coordinate System: AGD 1966 AMG Zone 55
Scale: 1:40,000 at A3
Project Number: 620.014601
Date: 08-Dec-2023
Drawn by: SM

LEGEND
BWM North Extension Project Area
Mining Leases
Proposed Pit Extent
BWM Mining Areas
Existing Blackwater Mine
Flood Protection Location

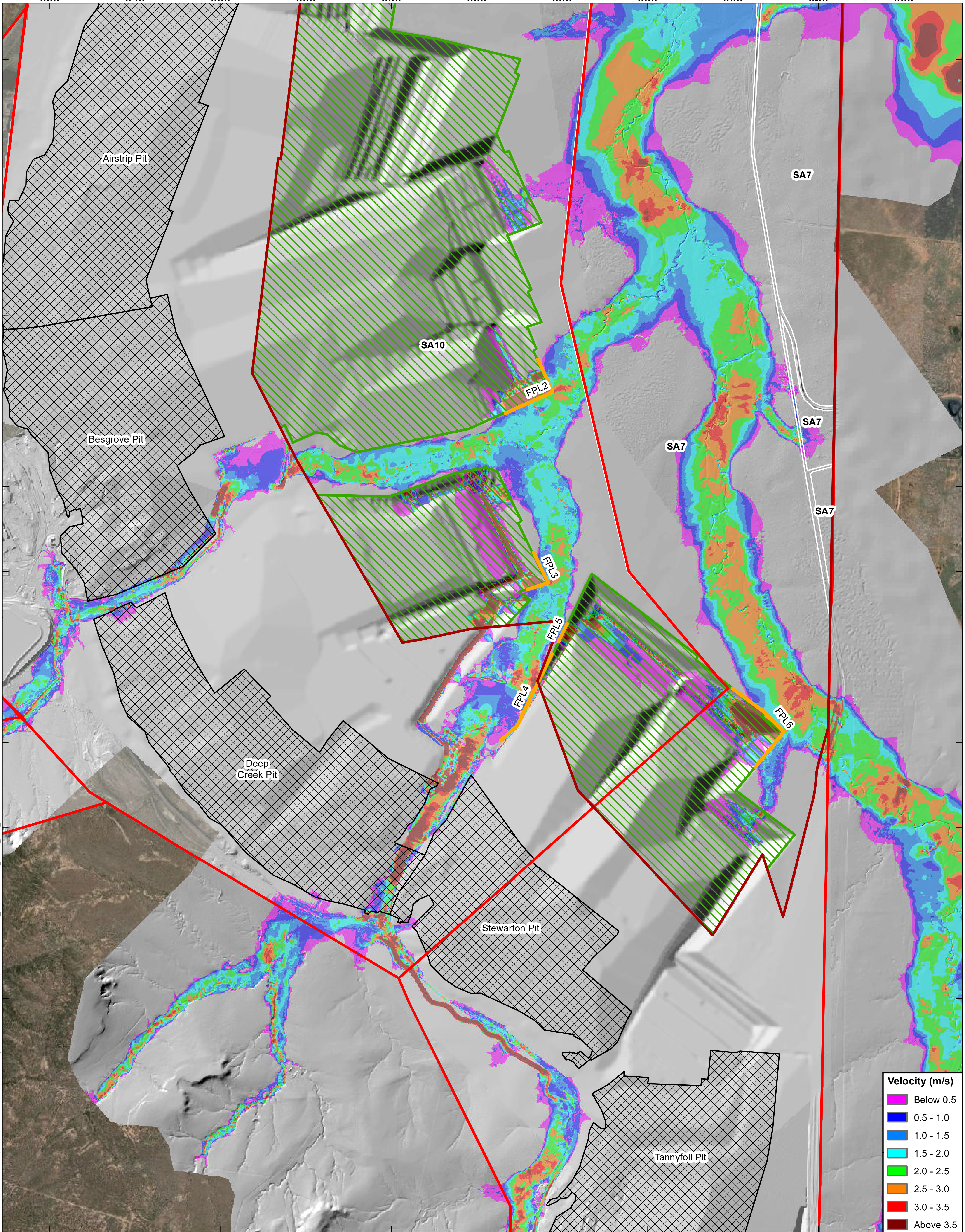
SLR

BLACKWATER MINE NORTH EXTENSION PROJECT

End of Life Scenario (EOL02) Peak Flood Levels - PMP

APPENDIX C-1-5

H:\Projects-SLR\620-BNE\620-BNE\620.014601.00001 Blackwater NEP\03 Technical Disciplines\03 Surface Water\GIS\Flood Figures\Blackwater\EOL02\Output\MXDs\620.014601_APPENDIX C-1-5_EOL02_PMP_h.mxd



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Coordinate System: AGD 1966 AMG Zone 55
Scale: 1:40,000 at A3
Project Number: 620.014601
Date: 08-Dec-2023
Drawn by: SM

SLR

LEGEND

- BWM North Extension Project Area
- Mining Leases
- Proposed Pit Extent
- BWM Mining Areas
- Existing Blackwater Mine
- Flood Protection Location

BLACKWATER MINE
NORTH EXTENSION PROJECT

End of Life Scenario (EOL02)
Peak Flood Velocities - PMP

APPENDIX C-1-6

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Appendix D Detailed Mine Water Management System

Blackwater Mine

North Extension Project - Surface Water Resources Assessment

BM Alliance Coal Operations Pty Ltd

SLR Project No.: 620.13452.00000

8 December 2023

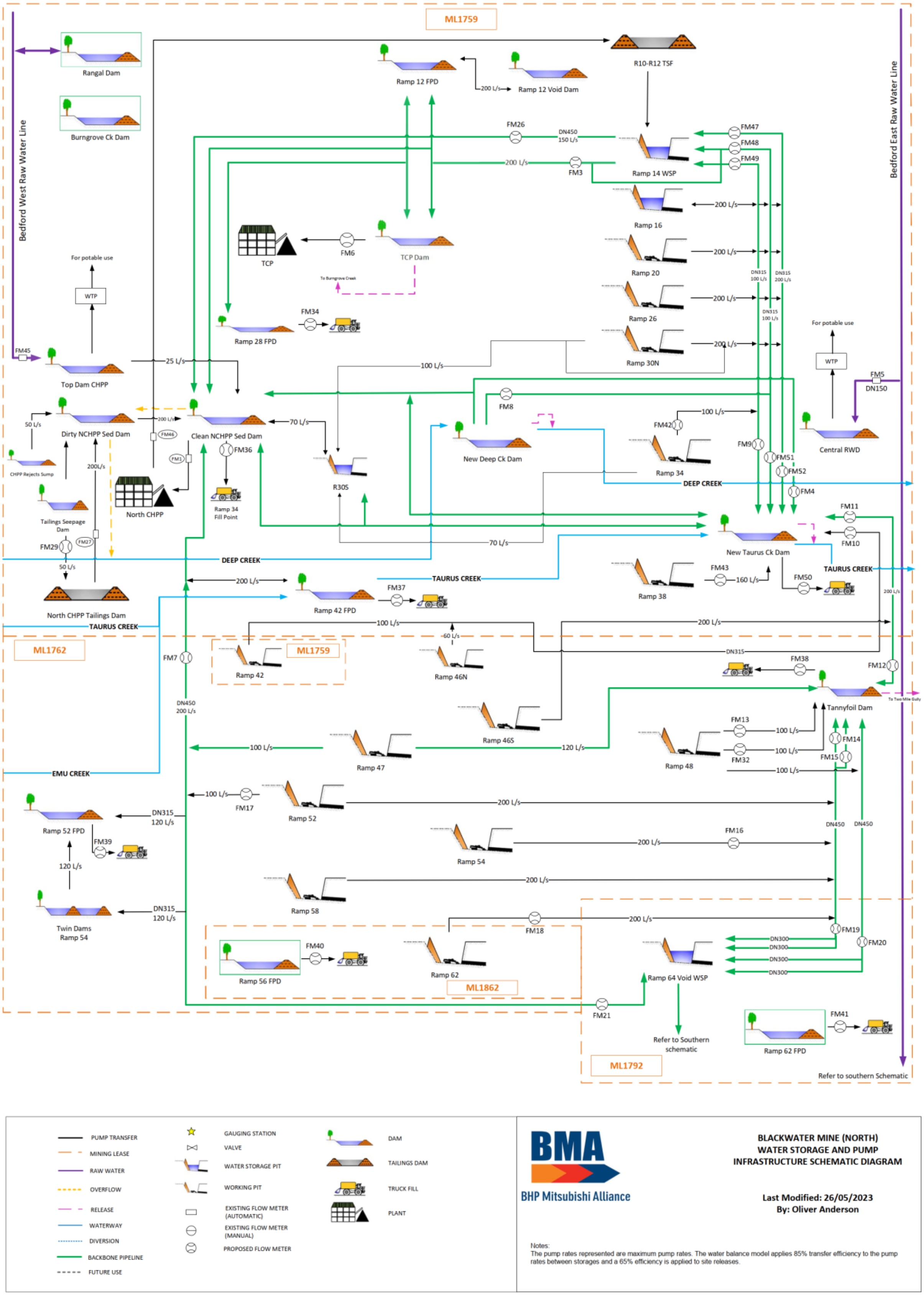

Figure D-9-1 Blackwater Mine North Water Storage and Pump Infrastructure Diagram

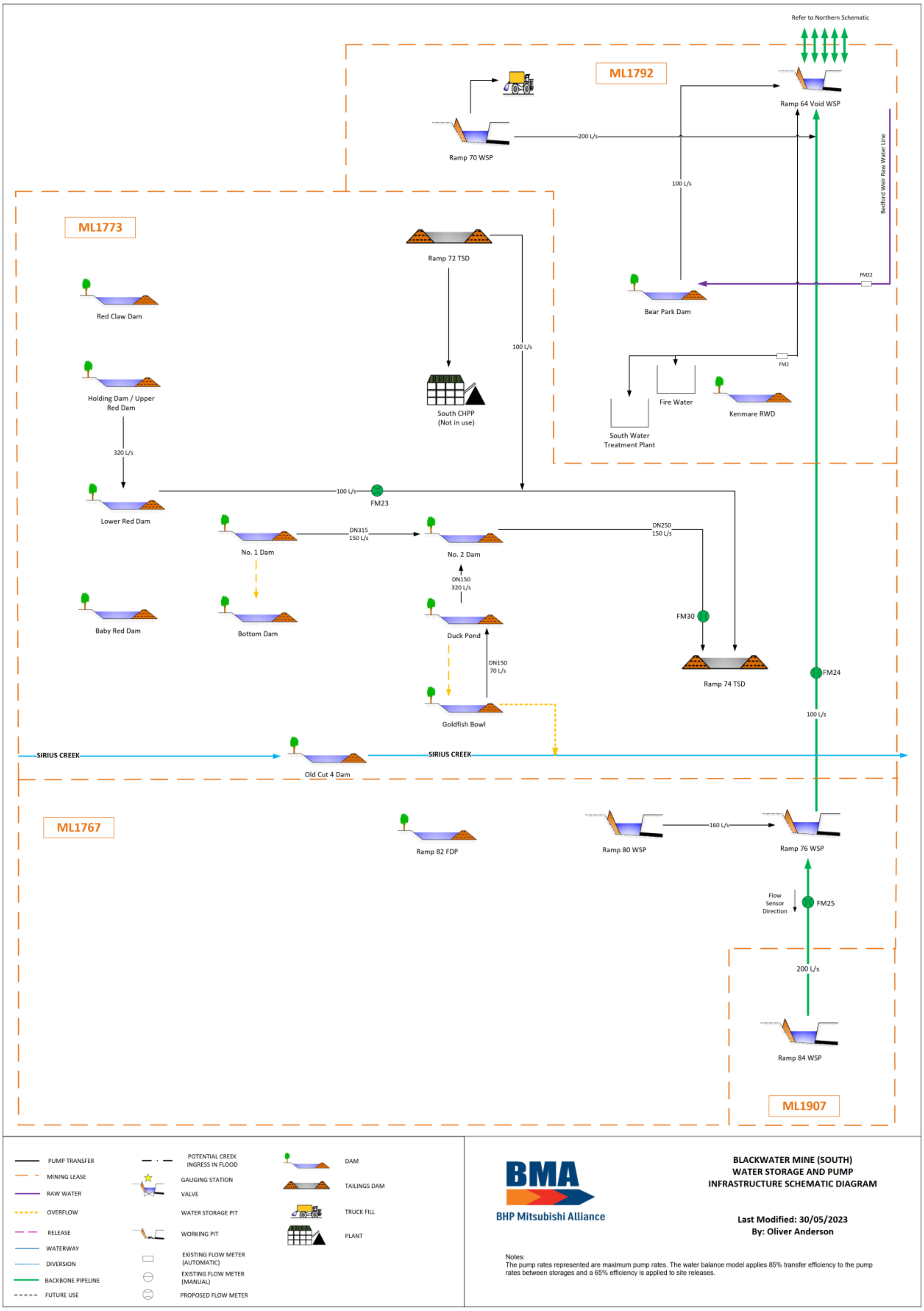

Figure D-9-2 Blackwater Mine South Water Storage and Pump Infrastructure Diagram

Appendix E Catchment Area Summary

Blackwater Mine

North Extension Project - Surface Water Resources Assessment

BM Alliance Coal Operations Pty Ltd

SLR Project No.: 620.13452.00000

8 December 2023

CATCHMENT AREA DESCRIPTIONS

- **Cleared/Disturbed –** This area represents the area that has been disturbed prior to mining through clearing of vegetation, topsoil removal and / or pre-strip. Runoff from this area must be captured in the mine water management system due to its potential to be sediment laden. Cleared areas will report to either out of pit ESC structures or flow back into the pit depending on the topography and the extent to which pre-stripping has occurred;
- **Mining Area/Pit –** This area represents the active mining area and mine pit floor. All runoff within this catchment reports to the respective mine pit;
- **Spoil –** This area represents the dump of spoil overburden material. This is typically behind the active mining area and usually consists of unconsolidated dump which has not yet reached natural surface;
- **Rehabilitated –** This area will become seeded and grassed. Runoff from this area will report to either ESC structures or back to the pit depending on the topography and rehabilitation;
- **Haul Roads –** haul roads represent areas of compacted fill which, although not impervious, will have minimal soil water stores and result in a larger percentage conversion of rainfall to runoff; and
- **Undisturbed/Natural –** Undisturbed areas are generally diverted away from disturbed areas and as such are not captured in the mine water management system. However, in some instances the topography and progression of the pit or the location of the flood levee is such that a proportion of the total catchment is undisturbed and reports to the water management system.

BWM North Area Pits Catchment Area

Year	Land use Catchment Area (ha)					Total Catchment Area (ha)
	Natural	Disturbed	Spoil	Pit	Rehab	
FY23	117	170	1767	170	0	2598
FY24	116	149	1926	149	0	2702
FY25	114	115	1705	115	0	2450
FY26	114	115	1705	115	0	2450
FY27	71	121	918	121	0	1520
FY28	67	121	955	121	0	1510
FY29	67	139	962	139	0	1565
FY30	62	145	1035	145	0	1625
FY35	70	193	1320	193	0	2196
FY40	91	181	816	181	615	2788
FY45	170	188	986	188	1179	3864
FY50	111	132	955	132	35	1738
FY55	111	132	955	132	35	1738
FY60	67	121	955	121	0	1510
FY65	67	121	955	121	0	1510
FY70	67	121	955	121	0	1510

Year	Land use Catchment Area (ha)					Total Catchment Area (ha)
	Natural	Disturbed	Spoil	Pit	Rehab	
FY75	302	71		71	1320	4409
FY80	271	8		8	1329	3331

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