

**INTEGRATED WATER AND WASTE
MANAGEMENT PLAN**

FOR

**KANGRA COAL (PTY) LTD:
Ballengeich Colliery**



M²ENCO



Title:

Integrated Water and Waste Management Plan for Kangra Coal (Pty) Ltd: Ballengeich Colliery, in support of a Water Use License Application on the farm Ballengeich 3299 located in the district of Newcastle, KwaZulu-Natal Province

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Report No: 2025/IWWMP/KANGRA_BALLEN

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Date: June 2026

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EXECUTIVE SUMMARY

The Ballengeich Colliery, owned by Kangra Coal (Pty) Ltd, is a defunct coal mine situated at the confluence of the Horn River (Quaternary Catchment V31F) and the Ngagane River (V31K), approximately 15 km south of Newcastle, KwaZulu-Natal, within the Pongola-Mtamvuna Water Management Area (WMA 4). Following several decades of underground bord-and-pillar and opencast coal mining, groundwater resources within and surrounding the Ballengeich Colliery have become significantly contaminated, leading to the generation of Acid Mine Drainage (AMD) with poor water quality characteristics, particularly with respect to sulphates, iron (Fe), manganese (Mn), calcium (Ca), magnesium (Mg), and sodium (Na). Contaminated groundwater decants artesianly from the old underground workings at a rate of approximately 1,000 m³/day (pH <4.5; SO₄ >4,000 mg/L; Fe 189 mg/L; Mn 4.0 mg/L) at a point on the western bank of the Horn River near the N11 bridge, ultimately discharging into the Horn and Ngagane River systems.

The site has been subject to a Section 19 Directive issued by the Department of Water and Sanitation (DWS) in August 2013 (Ref: 16/2/7/V301/A/1), directing Kangra Coal to take all reasonable measures to prevent, control, abate, and remedy water pollution originating from the site. The Directive remains in force. DWS conducted a formal site inspection on 3 July 2023 and issued a letter on 24 August 2023 (Ref: 16/2/7V301/C/4) directing expedited submission of the Water Use License Application (WULA) and specifically approving the passive constructed wetland approach as the preferred treatment strategy.

A previous WULA submitted in 2015 by GCS Water and Environmental Consultants, based on a phytoremediation approach using Eucalyptus tree plantations to intercept and evaporate decant waters, was formally declined by DWS on 29 April 2019. The existing Eucalyptus plantation on Portion 19 will be decommissioned to make space for the construction of the passive wetland treatment infrastructure, with felled material composted on site for use as organic carbon in the Successive Alkaline Producing System (SAPS). As part of the rehabilitation and AMD mitigation programme, a new 3.57 ha Eucalyptus plantation (Item 23; S21(d) Streamflow Reduction Activity) will be established adjacent to the West Decant Sump on Portion 19. This plantation forms an integral part of the AMD impact reduction strategy, functioning to reduce streamflow contributions to the Horn River from the western decant area while the passive treatment system reaches full operational capacity.

Following the decline of the 2015 application, Kangra Coal engaged extensively with DWS and appointed a multidisciplinary specialist team to develop a technically defensible, cost-effective, and sustainable long-term AMD treatment strategy. Various specialist investigations were conducted, including aquatic ecological assessments, wetland delineations, hydrogeological and hydrogeological assessments, hydrological modelling, assimilative capacity determinations, and full civil engineering design of the passive treatment system and stormwater management infrastructure. The current application (DWS Ref: WU33839; 60 definitive water use entries across five Section 21 categories) represents the most comprehensive and technically robust submission to date.



The proposed rehabilitation programme is centered on the implementation of a passive AMD treatment train designed by Bhekhani (Pty) Ltd to a capacity of 1,000 m³/day, comprising two Anoxic Limestone Drains (ALD 1 and ALD 2), a Successive Alkaline Producing System (SAPS), a Sedimentation/Oxidation Pond, and two Aerobic Wetland units across two treatment areas. Treatment Area 1 (western, Portions 25 and 19) addresses AMD from the underground workings. Treatment Area 2 (eastern, Portion 19) functions as a cut-off system intercepting seepage from the opencast spoil areas and discard dump. Together the two treatment areas address all three identified AMD sources, the underground workings (~30% contribution), opencast spoils (~55%), and discard dump (~15%).

In addition to the passive treatment system, the proposed project includes the rehabilitation of the existing discard dump, the upgrading and HDPE-lining of four existing Pollution Control Dams (PCDs 3, 4, 7, and 8) to Class C standard (GNR 636); the construction of a new Quantum PCD (8,600 m³); a comprehensive stormwater management system designed by GFK Consulting Engineers (Report G2025/06/338(1), 24 March 2026) achieving full GN 704 compliance; and the refurbishment and operation of the Ballengeich Siding as a coal screening and storage facility for a period of 15 years at a capacity of 95,000 tonnes per month. A flood protection berm along the Ngagane and Horn Rivers, designed to the 1:100-year flood event, protects all lined PCDs and treatment infrastructure from flood inundation.

The Water Use Licence Application covers 60 definitive water use entries across five Section 21 categories: S21(c) & (i) (32 entries), S21(d) (1 entry), S21(f) (3 entries), S21(g) (25 entries), and S21(j) (1 entry). Section 21(a) does not apply to this application as no groundwater abstraction takes place on the Ballengeich site. All Quantum operational water and wash bay water is sourced externally from NCCA (Northern Coal Alliance) by pipe and water tanker, as confirmed in writing by the Quantum.

All specialist assessments have provided a reasoned opinion that the proposed activities should be authorised. It is respectfully requested that DWS issue the Water Use Licence for the Ballengeich Colliery for a period of 20 years, comprising the 15-year operational and rehabilitation implementation period and a 5-year post-implementation monitoring and compliance verification period to confirm sustained achievement of the GN 1873 (March 2022) Resource Quality Objectives before formal closure of WUL conditions.



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Appendix 1	Integrated Water and Waste Water Management Plan	Completed - 2026
Appendix 2	Certified Copy of ID of applicant	Included
Appendix 3	Company Registration	Included
Appendix 4	Title Deeds	Included
Appendix 5	Property Zoning Certificate	Included
Appendix 6	Land Clearance Letter	Included
Appendix 7	BBEEE Certification	Included
Appendix 8	Online DW Forms	to be completed
Appendix 9	Topographic Map	Included
Appendix 10	Master Layout Plan	Included
Appendix 11	Alternatives Report	Included
Appendix 12	Environmental Authorisation	N/A
Appendix 13	EMP	Old EMP, 1996
Appendix 14	Wetland Assessment	Included
Appendix 15	Geotechnical Report	GCS Report – 2015, 2016
Appendix 16	WULAR	Included
Appendix 17	Aquatic Assessment	Included
Appendix 18	Geohydrological Report	EWS, 2025
Appendix 19	Hydrological Assessment	EWS, 2025
Appendix 20	Water Balance	EWS, 2025
Appendix 21	Method Statement	Included
Appendix 22	Stormwater Management Plan	GFK, 2026
Appendix 23	Civil Design: Constructed Wetland	Included
Appendix 24	Compliance Monitoring Report	Included
Appendix 25	Contingency Plan	Part of Action Plan -2026
Appendix 26	Public Participation	to be conducted
Appendix 27	Financial Provisioning – Letter	FP Updated 2025
Appendix 28	GN 704 Exemption Motivation	Completed
Appendix 29	Mining Permit, Signed SLP	N/A
Appendix 30	Service Level Agreement	Included, not signed
Appendix 31	Waste Load Allocation Study	Completed – 2025



List of Acronyms

ALD	Anoxic Limestone Drain
AMD	Acid Mine Drainage
BH	Borehole
BPG	Best Practice Guideline
CMA	Catchment Management Agency
DWS	Department of Water and Sanitation
EIA	Environmental Impact Assessment
ELU	Existing Lawful Use
EPA	Environmental Performance Audit
ERA	Environmental Risk Assessment
FEPA	Freshwater Ecosystem Priority Area
GN	Government Notice
IFR	In-stream Flow Requirement
ISP	Interim stockpile
IWWMP	Integrated Water and Waste Management Plan
KZN	KwaZulu-Natal
MAE	Mean annual evaporation
MAR	Mean annual runoff
MPRDA	Mineral Resource Development Act, 2002 (Act 28 of 2002)
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NWA	National Water Act, 1998 (Act 36 of 1998)
PCD	Pollution Control Dam
PES	Present Ecological State
RQO	Resource Quality Objective
SAPS	Successive Alkaline Producing System
SAWQG	South African Water Quality Guidelines
SAWS	South Africa Weather Services
SHE	Safety Health and Environment
SoC	State owned Company
TDS	Total Dissolved Solids
WMR	Water Management Report
WRC	Water Research Commission
WSP	Water Service Provider
WUL	Water Use License
WULAR	Water Use License Application Report



1 INTRODUCTION

1.1 Project Background

The Kangra Coal's Ballengeich Colliery has operated for more than 60 years under various owners and in this time the area has grown to include a number of surface features as a result of the mining including:

- Opencast and underground mining;
- Coal stockyard/screening operation;
- Duff reworking operation;
- Waste Dumps and Pollution Control Ponds;
- Road and railway lines

The contact details for the applicant of the Water Use License authorisation are contained in **Table 1-1** below:

Table 1-1: Contact Details of Kangra Coal Personnel

Holding Authority:	Menar Capital
Address:	Menar House, 68 Grayston Drive, Sandton, 2031
Mining Operation:	Ballengeich Colliery
Applicant:	Kangra Coal (Pty) Ltd
Contact Person:	Mr. Paul Redelinghuys
Designation:	General Manager
e-mail:	Paul.Redelinghuys@kangracoal.co.za
Telephone:	079 897 9464

Over the recent years, the operational area saw many initiatives and implementation strategies that relate to environmental management as depicted in **Table 1-2**.

Table 1-2: Overview of development – environmental and process milestones

Date	Activities
1997	Natal Cambrian Colliery applies for Mine Closure
1997	WMB conducted Groundwater Assessment and Monitoring
1980 -1990	Active mining ceases at Ballengeich, part of Kangra Group
1984	Horn River was diverted at western and eastern opencast areas
2000	GCS compiled WQMR on Ballengeich Siding
2003	GCS submits Ballengeich Water Quality Assessment and identification of decant positions
2004	Kangra submits closure plan for Kilbarchan Colliery: Discard Dump
2007	GCS submits Status for the determination of Closure Aspects



Date	Activities
2007	Submission of Ballengeich Dump and Mining Section EMP Performance Assessment and Compliance Report
2008	Ballengeich submits Annual Water Monitoring Report (Feb 2008)
2009	GCS submits Management Plan for Proposed Irrigation Trails
2009	Kangra registers for Waste Discharge Related Water Use in terms of section 21(e) of the NWA
2011	GCS prepares IWWMP in support of Rehabilitation of Waste Rock Dump at Ballengeich
2013	The Department of Water and Sanitation issued Directive
2014	Kangra commences with Rehabilitation Actions
2018	Kangra Coal acquisition by Canyon Coal
2019	WUL application was rejected
2020	DWS concerned about the lack of progress with Rehabilitation
2022	Kangra submits an amended Action Plan for approval and implementation
2023	DWS states that action plan has physical measures for implementation that are subject to WULA. Kangra to apply within 30 days for WULA
2024	Ongoing consultation between Kangra and DWS regarding the lack of compliance with 2013 Directive
	Include 2025 and 2026 update

1.2 Regional setting and location of activity

The Ballengeich Colliery is situated approximately 15 km south of Newcastle, KwaZulu-Natal, within the administrative jurisdiction of Amajuba District Municipality and Newcastle Local Municipality. The site is accessed via the N11 national road, which runs along the eastern boundary of the property. The central coordinates of the site are 27°53'23.97"S; 29°58'15.56"E.

The site falls within the Pongola-Mtamvuna Water Management Area (WMA 4). Water resources in close proximity to the site include the Horn River (Quaternary Catchment V31F) and the Ngagane River (Quaternary Catchment V31K), which converge at their confluence directly adjacent to the Ballengeich Colliery boundary. The Horn River drains into the Ngagane River, which in turn flows northward into the Thukela River system. The Newcastle Water Treatment Plant (WTP), which abstracts up to 220 Ml/day for potable supply to the greater Newcastle area, is located downstream of the Horn/Ngagane confluence on the Ngagane River, making the protection of these water resources of direct public interest.

The property on which the activities are proposed is surrounded primarily by agricultural land. The Kilbarchan Residential Area is located to the east of the site, on the opposite side of the N11. The Springlake Laboratory and Springlake Colliery are located to the north. The site itself comprises Portions 10, 11, 14, 19, and 25 of the Farm Ballengeich 3299 HS, held under Mining Right 10433MR.



Please refer to **Figure 1-1** for the regional setting of the Ballengeich Project.

1.3 Property Description

The property details are depicted in **Table 1-3** below. The study area is situated on portions 10, 11, 14, 19 and 25 of the farm Ballengeich 3299.

Table 1-3: Property Details of Project Area

Description of Sub Division	Surface Owner	Surface Area (ha)	Mining Right
Portions 10, 11, 14, 19 and 25 of the Farm Ballengeich 3299	Kangra Coal (Pty) Ltd)	1450	10433MR

The property boundaries are illustrated in **Figure 1-2**.

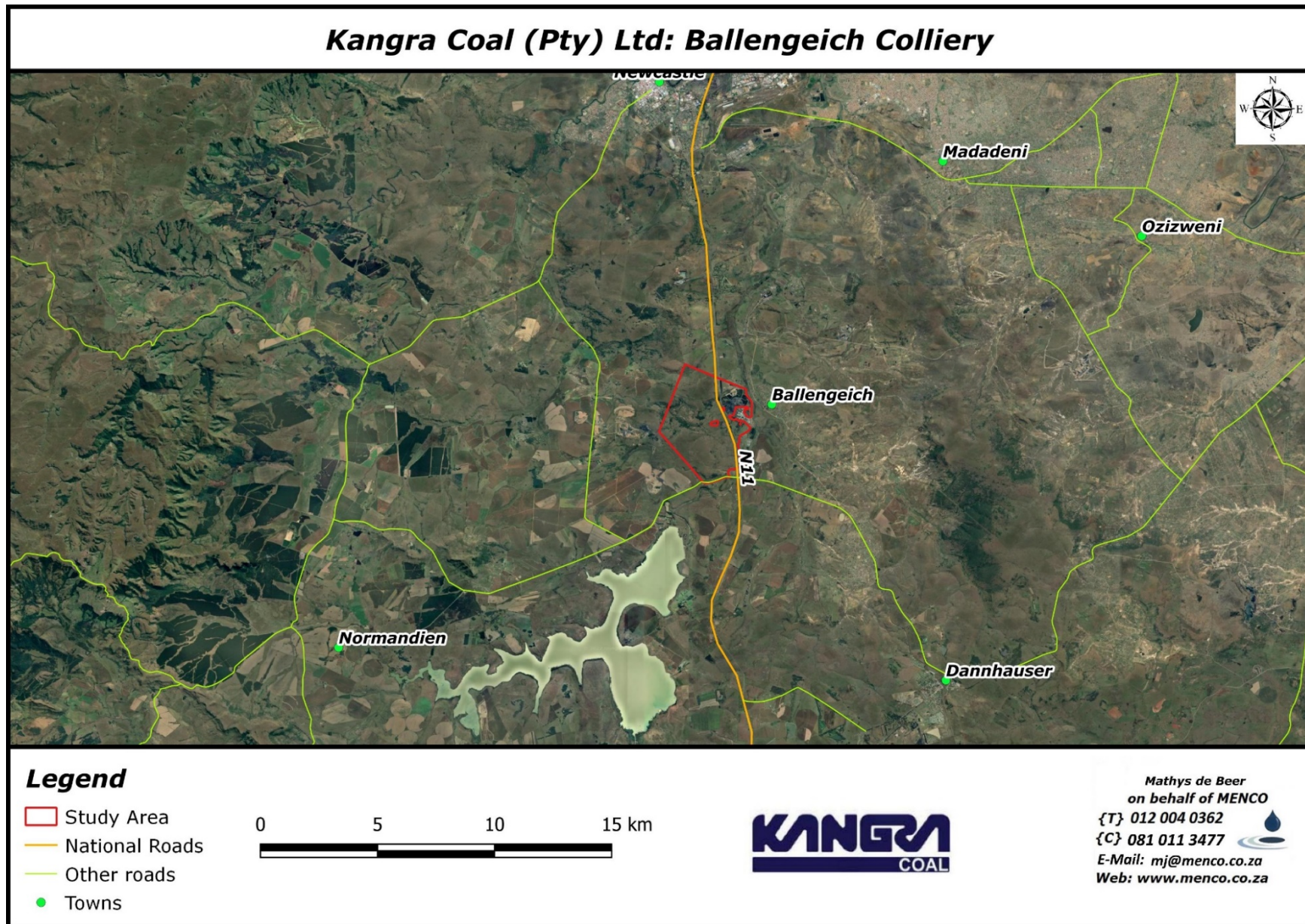


Figure 1-1: Regional Setting of Kangra Coal: Ballengeich Colliery



Kangra Coal (Pty) Ltd: Ballengeich Colliery



Legend

Ballengeich 3299

 Farm portions

0 1 2 3 km



KANGRA
COAL

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Figure 1-2: Farm Boundaries for Ballengeich Colliery



The Commission on Restitution of Land Rights administers land claims in terms of the Restitution of Land Rights Act, 1994 (Act 22 of 1994). In terms of this legislation, it is revealed that there is no land claims gazetted against the property as described in the Mining Right (refer **Table 1-4**).

Table 1-4: Title deed description

Farm Name	Portion	Components	Extent (ha)	Title Deed
Ballengeich	19	Sub 1 of Ballengeich 3299 Remainder of Ballengeich 3299	1406,173 ha	T19913/1994

1.4 Purpose of the IWWMP

This IWWMP has been compiled in terms of the DWS Operational Guidelines for the Compilation of an IWWMP (2010) and the Best Practice Guidelines Series (BPG; 2009), and is aligned with the requirements of GN 267 of 24 March 2017 (Regulations for Water Use Licence Applications in terms of the National Water Act, 1998). It serves as the primary supporting document for the WULA; DWS Ref: WU33839 submitted on behalf of Kangra Coal (Pty) Ltd for the rehabilitation and passive AMD treatment activities at the Ballengeich Colliery.

The purpose of this IWWMP is to assist Kangra Coal (Pty) Ltd, its appointed consultants, and the DWS in effectively managing all water resources associated with the Ballengeich Colliery, in a manner that mitigates potential impacts in accordance with the principles of the NWA and associated regulations. Specifically, this document is aimed at serving the following purposes:

- To integrate a comprehensive water management programme into a practically implementable management plan, aligned with the approved engineering designs and specialist studies prepared for the project;
- To present the following key water management components:
 - *Water and salt balances (GFK SWMP Pitman model, March 2026);*
 - *Stormwater management (GFK SWMP and Civil Infrastructure Report, March 2026);*
 - *Water reuse and reclamation (AMD-impacted PCD water for dust suppression);*
 - *Water conservation and demand management;*
 - *Integration of water and waste management in accordance with GNR 634, 635, and 636; and*
 - *Monitoring plans to assist in achieving and demonstrating compliance with the GN 1873 (March 2022) Resource Quality Objectives for the V31K catchment;*
- To give an overview of all activities taking place at the Ballengeich Colliery, including the passive AMD treatment system, discard dump rehabilitation, siding operations, and Quantum Crushing and Screening operations;
- To provide an overview of the surrounding receiving environment, including the Horn River, the Ngagane River, and the associated wetland systems;



- To identify and describe all water uses as defined in Section 21 of the NWA applicable to the applicant, as registered in the Water Uses Register (Rev 5, June 2026; 60 definitive entries across five S21 categories);
- To identify issues of concern raised by Interested and Affected Parties (IAPs) during the Public Participation Process (PPP), to be conducted in accordance with the NWA process independently of the Environmental Authorisation process;
- To determine the possible impacts that the activities of the applicant may have on other water users, including the Newcastle Water Treatment Plant downstream on the Ngagane River;
- To provide strategies and objectives for the proactive management of possible impacts, including contingency measures in terms of Sections 19 and 20 of the NWA; and
- To define management and technological commitments from the applicant to mitigate possible impacts, with reference to the applicable environmental management principles, implementation timelines, and budgets contained in this IWWMP and the associated Rehabilitation Plan (EMP/2024/086, November 2024).



2 CONCEPTUALISATION OF ACTIVITY

This section provides a description of the proposed activities at the Ballengeich Colliery, the background organisational context of Kangra Coal (Pty) Ltd, and the regulatory history that has led to the current WULA. It also provides an overview of the water uses and waste streams associated with the activities.

2.1 Description of the Activity

The Ballengeich Colliery is currently undergoing rehabilitation to address legacy surface water and groundwater pollution arising from more than 30 years of uncontrolled AMD generation following the cessation of mining operations in the early 1990s. Kangra Coal as the property owner and responsible party under the Section 19 Directive (Ref: 16/2/7/V301/A/1, August 2013), has the following objectives for the Ballengeich Colliery:

- Implement a passive AMD treatment system to intercept, treat, and manage AMD from all three identified source areas that include underground workings, opencast spoils, and the discard dump before any discharge to the Horn River;
- Rehabilitate the existing discard dump through in-situ reshaping, capping, and revegetation (Scenario 1), or reprocessing and removal (Scenario 2), to eliminate the primary surface AMD source and achieve long-term geotechnical stability;
- Upgrade and line the existing Pollution Control Dams (PCDs 3, 4, 7, and 8) with a Class C HDPE-Clay composite liner (GNR 636) and construct a new Quantum PCD (8,600 m³) to achieve GN 704 compliance;
- Implement a comprehensive stormwater management system achieving complete clean and dirty water separation across the full site footprint, in accordance with the GFK SWMP (Report G2025/06/338(1), March 2026);
- Refurbish and operate the Ballengeich Siding as a coal screening and storage facility for a period of 15 years at a capacity of 95,000 tonnes per month (~1,140,000 tonnes per annum); and
- Obtain a Water Use Licence in terms of Section 40 of the NWA for the full 20-year WUL period — comprising the 15-year operational and rehabilitation implementation period and a 5-year post-implementation monitoring and compliance verification period.

The proposed activities are described in detail in the following specialist and engineering reports, which form part of the WULA submission package:

- *GFK Water and Stormwater Management Report (Report G2025/06/338(1), 24 March 2026, signed B.D. Muhl Pr.Eng. Civil, ECSA 202604247);*
- *GFK Civil Infrastructure Report (Report G2025/06/338(2), 24 March 2026);*
- *GFK Master Layout Plan Rev 2 (Drawing G2025/06/338-100, 9 April 2026);*
- *Bhekani Passive Treatment Plant Civil Design Report (Report B120, February 2023);*
- *EWS Hydrogeology Assessment (Report EWS24-12_GW, April 2025);*
- *MENCO Wetland Delineation and Assessment (Report WET/KANGRA/03/25, March 2025); and*
- *MENCO Rehabilitation Plan (EMP/2024/086, November 2024).*



Regulatory History

An initial Water Use Licence Application was submitted by GCS Water and Environmental Consultants on 31 March 2015 on behalf of Kangra Coal (Pty) Ltd, based on a phytoremediation approach using Eucalyptus tree plantations to intercept and evaporate contaminated decant water. Following a site inspection and extensive correspondence with DWS, this application was formally declined on 29 April 2019. Key DWS objections included the inadequacy of the phytoremediation approach to address the volume and characteristics of AMD at the site and the failure to satisfy the requirements of the issued Directive.

Following the decline, Kangra Coal submitted an amended Action Plan in October 2022, which proposed a passive constructed wetland treatment system as the preferred approach. DWS conducted a formal site inspection on 3 July 2023 and issued a letter on 24 August 2023 (Ref: 16/2/7V301/C/4) confirming the acceptability of the passive wetland approach and directing Kangra Coal to submit a new WULA within three months. The current application (DWS Ref: WU33839) represents the culmination of that process and is the most technically comprehensive submission to date.

The DWS correspondence history and responses to previous departmental comments are summarised in **Table 2-1** below.

Table 2-1: Interventions from the DWS on the Ballengeich Colliery

DWS Intervention	Ballengeich Response and progress
During August 2013 the former DWAF issued a Directive to Ballengeich Mine to address the pollution affecting the water quality in the Horn River:	Kangra acknowledges the receipt and commence with the following activities:
• Manage the contaminated water seeping from the Ballengeich discard and slurry dumps that impact on the Horn River and hence pollute the Ngagane River. • Take every step in your ability to stop the effects of pollution occurring to the water resources from the activities listed above. • Stop the discharges occurring from the pollution control dams to the Horn River and any other water resource thereof. • Remedy the effects of pollution on the water resources. • Put measures in place to stop this kind of pollution from occurring or recurring	• Appoint GCS to conduct site assessment in order to delineate the areas earmarked for rehabilitation; • Compile action plan with detailed time schedules and budget; • Submit to the DWAF a proposal for identified water uses to be authorised
	During November 2013 until May 2014 the following tasks were completed:
	• Manage the contaminated water seeping from the Ballengeich discard and slurry dumps that impact on the Horn River and hence pollute the Ngagane River. • Take every step in your ability to stop the effects of pollution occurring to the water resources from the activities listed above. • Stop the discharges occurring from the pollution control dams to the Horn



DWS Intervention	Ballengeich Response and progress
	River and any other water resource thereof. • Remedy the effects of pollution on the water resources. • Put measures in place to stop this kind of pollution from occurring or recurring
The Department notified Kangra about several statutory non-compliances: 1. Kangra Coal is reminded that this Department rejected the Water Use License Application for Ballengeich on 24 April 2019. This implies that Kangra Coal is not complying with the provisions contained in Chapter 4 of the Act that requires all water uses to be lawful and authorized. 2. Details of the Ballengeich's water uses are not registered on our Water Use Authorisation Registration Management System (WARMS) database. 3. Performing a water use without an authorisation from this Department is a contravention of section 22(1) of the National Water Act (NWA). 4. Authorisation is therefore required in terms of Sections 21 and 40, Chapter 4 of the NWA for all of the water uses at Ballengeich. The range of water uses are listed in terms of Section 21 of the NWA.	Kangra acknowledges the statutory contravention pointed out by the Department. As correctly indicated by the Department Kangra did lodge a water use license application for the Ballengeich operations which was later rejected because of failure of Kangra to submit requested information to Department. Kangra will be resuming the water use license application upon deciding on the best technology to use to remediate the impacts on the Horn River.
In a letter dated 10 December 2020 the Department raised their concerns regarding water quality issues in the Horn River and non-compliances of Ballengeich Operations: 1. Kangra Coal has failed to completely address the issues that were identified in the Directive of August 2020. Kangra Coal is further advised that the directive is still in force until issues are completely addressed to the satisfaction of this Department. 2. Kangra Coal was directed to: a. Manage the contaminated water seeping from the Ballengeich discard and slurry dumps that impact on the Horn River and hence pollute the Ngagane River. b. Take every step in your ability to stop the effects of pollution occurring to the water resources from the activities listed above. c. Stop the discharges occurring from the pollution control dams to the Horn River and any other water resources thereof. d. Remedy effects of pollution on the water resources. e. Put measures in place to stop this kind of pollution from occurring and recurring. 3. Kangra Coal is advised that pollution of the water resources that persists due to the activities on site need to be stopped with immediate effect.	Following receipt of the Directive in 2013, Kangra submitted an action plan/ mine site rehabilitation plan to DWS in May 2014. Based on the action plan, rehabilitation was to take place over four phases. Ballengeich Rehabilitation Plan Phase 1 included the following: • Clean a portion of the slurry dam starting at the eastern side; • Expose the clay soil to spread and profile the open cast area; • Fill the underground sink holes and area adjacent to old Horn River bed; • Construct the polluted water cut off drains to report to the PCD • Fill up area for the proposed tree planting program between the old and new Horn River; and • Start Construction of final proposed covered dump. Trollope was appointed in May 2014 and they excavated the slurry from the pond. Clay material was spread over the open pit area to seal of the inflow of water into old workings and all underground sink holes were closed. Phase 2 of the plan was to complete cleaning of the slurry dams to ensure that slurry material was removed from the existing PCDs and that the balance of clay is removed from the PCD and spread on old opencast. This was completed as slurry ponds are free from slurry and opencast pits were capped. There was also a plan to redirect the Horn River back to the original bed so as to bypass the old opencast



DWS Intervention	Ballengeich Response and progress
4. Interventions proposed by Kangra Coal in the conceptual action plan in response to the directive were never executed into completion. Kangra Coal is required to comply with the directive.	area as to ensure the creation of a wetland. Kangra will have to liaise with the DWS to understand what the plan was concerning this action. Phase 3 was meant to be the removal of the discard dump by KC Energy, which unfortunately did not materialise because of discard qualities which were poor and KC Energy could not use. Phase 4 of the plan was going to be the capping of the discard material and continuation of water monitoring on a quarterly basis. Kangra intends to continue with the reshaping and capping of the discard dump as per the rehabilitation designs in the submitted documentation. Water monitoring continues to take place on a quarterly basis.
Departmental letter dated 24 August 2023 in which Kangra is instructed to: • Apply for the required water uses as the amended Action Plan dated 4 October 2022 have several physical activities that requires a WUL; • Expedite the submission of a WUL within a period of three months; • The WUL will unlock the remediation and rehabilitation process; • Continue with the monitoring network and submission of quarterly water quality reports; • Construction of the pilot scale passive wetland system will require a WUL; • The Directive will remain in force until all its instructions are successfully carried out.	

2.2 Extent of Activity

The Ballengeich Colliery is a defunct coal mining operation that will be subject to comprehensive rehabilitation to reduce and ultimately eliminate the risk of AMD leaching into the Horn and Ngagane River systems. The proposed water use activities will take place within the Ballengeich rehabilitation area, which covers less than 75 hectares — representing less than 7% of the total property extent of approximately 1,450 hectares across Portions 10, 11, 14, 19, and 25 of the Farm Ballengeich 3299 HS.

The rehabilitation and water management footprint is comprised of the following key components, all of which are depicted on the final Master Layout Plan Rev 2 (*GFK Drawing G2025/06/338-100, 9 April 2026*):

- **Discard Dump:** The existing unrehabilitated discard dump covers approximately 14 ha with a maximum height of approximately 55 m above natural ground level. The dump was constructed primarily by conveyor during active mining operations, with a compacted buttress of approximately 10 m height constructed on the northern face towards the end of mining. The dump is unshaped, with steep slopes, extensive surface erosion, and active spontaneous combustion confirmed on the northern face. The dump constitutes approximately 15% of the total AMD salt load at the site. Under Scenario 1 (preferred), the dump will be reshaped, capped with



a minimum of 600 mm overburden material and 150 mm topsoil, and revegetated to achieve a stable, free-draining profile. Under Scenario 2, the dump will be reprocessed and removed from site entirely. An infra-red thermal drone survey must be completed over the full dump surface before any earthworks commence.

- **Pollution Control Dams (PCDs):** Nine existing earth-lined PCDs are present on site (PCDs 1–8 and the West Containment Sump). PCDs 3, 4, 7, and 8 will be upgraded with a Class C HDPE-Clay composite liner (GNR 636) to achieve GN 704 compliance. A new Quantum PCD (8,600 m³; Class C lined) will be constructed to replace the existing undersized Quantum PCD. PCDs 1, 2, 5, 6, and the West Containment Sump (86,400 m³) will be retained as unlined facilities, licenced as regular dams, with pollution loads expected to decrease progressively as AMD sources are remediated.
- **Passive AMD Treatment System:** Two treatment areas across Portions 25 and 19 comprising ALD 1 (420 m, Portion 25), ALD 2 (230 m, Portion 19), SAPS (minimum 18,900 m²), Sedimentation/Oxidation Pond (670 m²), and two Aerobic Wetland units (1.3 ha and 4.4 ha, respectively). The system is designed for a treatment capacity of 1,000 m³/day.
- **Stormwater Management Infrastructure:** Concrete-lined dirty water channels, grass-lined clean water V-drains, concrete silt traps, culverts (D9, D3, D4 upgraded; V1 and C1 new), and flood protection berms along the Horn River and Ngagane River (crest 1,183.1 m amsl; ~20,400 m³ fill).
- **Ballengeich Siding:** The existing siding will be refurbished and operated for 15 years at a capacity of 95,000 tonnes per month. Infrastructure includes a screening and crushing plant, weighbridge, offices, wash bay, and chemical/portable toilets. All siding runoff is captured by concrete-lined dirty water channels and routed to the New Quantum PCD.
- **Old Underground Workings:** The flooded underground workings on Portions 19 and 25, to the west of the N11 road, are the primary source of artesian AMD decant (~1,000 m³/day; pH <4.5; SO₄ >4,000 mg/L; Fe 189 mg/L). Artesian AMD decant from the underground workings is directed to the West Containment Sump via existing surface drainage before entering the passive treatment system.
- **Old Opencast Area:** The old opencast area to the north of the Horn River contributes approximately 55% of the total AMD salt load through pyrite-bearing spoil leaching. This source is addressed by ALD 2 and Aerobic Wetland Unit 2 as an eastern cut-off system.
- **Quantum Crushing and Screening Operations:** The existing Quantum operation occupies approximately 2.93 ha on Portion 19 and operates calcining kilns for anthracite processing. All Quantum operational water is sourced externally from NCCA by pipe and water tanker — no on-site water abstraction takes place.

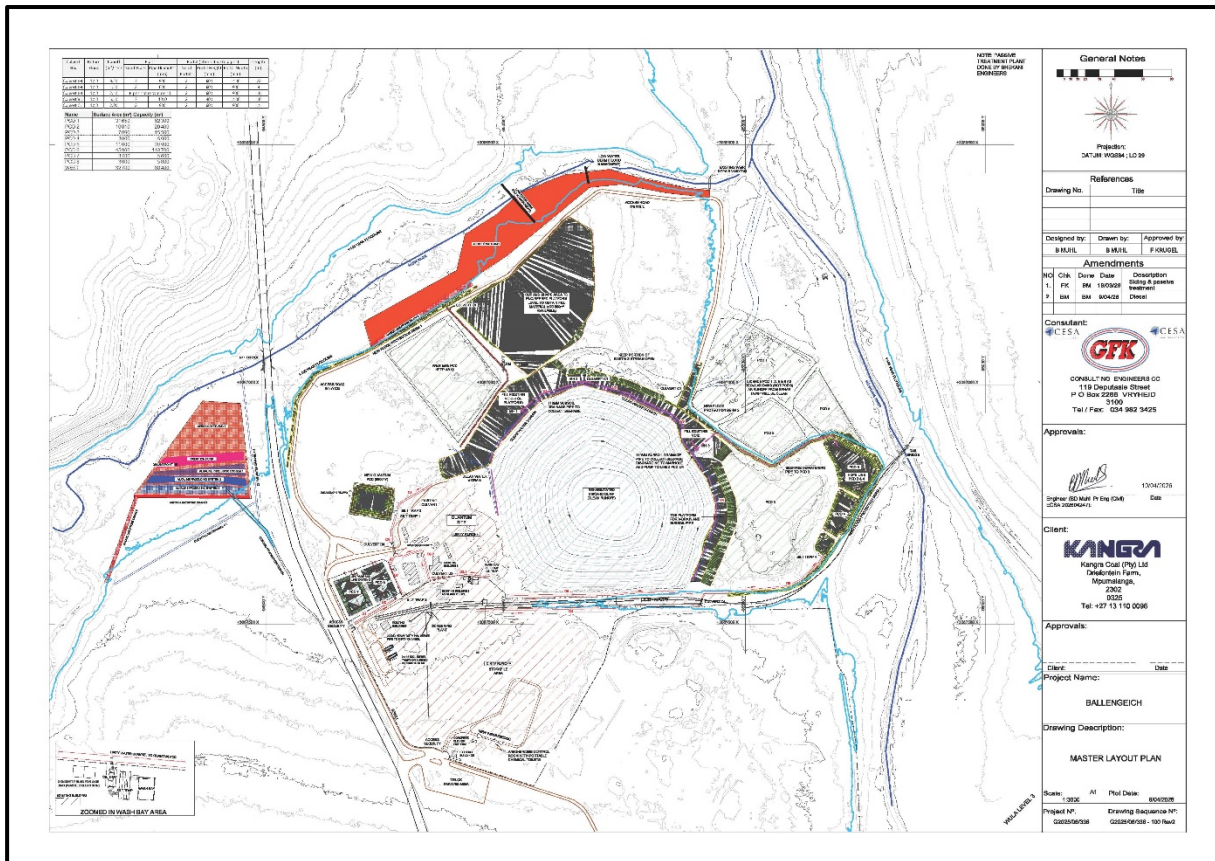


Figure 2-1: Site Infrastructure & Extent of Activity

2.2.1 Opencast Mining

Two distinct opencast mining areas are present at the Ballengeich Colliery, both in close proximity to the Horn River and contributing significantly to the AMD pollution load on the receiving water resource. Together, these two opencast spoil areas contribute approximately 55% of the total AMD salt load at the site — the dominant pollution source by volume.

The two areas are:

- **Spoils Block I** — located to the west of the N11 national road; and
- **Spoils Block II** — located to the east of the N11 national road, north of the discard dump.

Spoils Block I covers approximately 34 ha and encompasses the original course of the Horn River, which was rerouted during active mining operations to its present position where it crosses the opencast spoils over a distance of approximately 550 m. This diverted Horn River section constitutes a registered Existing Lawful Water Use (ELWU; Item 3, Water Uses) under the authority of the Minerals Act, 1991. The artesian AMD decant point from the flooded underground workings is situated on the western bank of the Horn River within Spoils Block I.

Spoils Block II covers approximately 45 ha, including a small isolated mined section to the north-east. The area straddles the Horn River and borders on the Ngagane River. The Horn River has been relocated from its original position in this area and currently flows across approximately 1,000 m of partially rehabilitated opencast spoils. Spoils Block II is the primary source of pyrite-bearing spoil leachate contributing to the eastern AMD



seepage pathway, which is intercepted by ALD 2 (230 m; Item 8.2) and Aerobic Wetland Unit 2 (4.4 ha; Item 9.2) as part of the proposed passive treatment system.

Both opencast areas were mined using the roll-over (toe) opencast method — a box cut was made in which coal overburden was blasted until the coal seam was exposed, coal extracted, and spoils progressively placed in the adjacent open void. At the Ballengeich Colliery, the final voids were not filled with the original box cut spoils as is standard practice, leaving unfilled excavations that continue to collect AMD-contaminated water and contribute to the groundwater pressure system feeding the artesian decant.

Both opencast areas have been partially rehabilitated with a fair vegetation cover established in places. However, significant areas of severe drainage problems, steep eroded slopes, and exposed pyrite-bearing spoil material remain, particularly in areas adjacent to the Horn River corridor. These areas continue to generate AMD seepage that flows toward the Horn River system and are specifically addressed by the eastern passive treatment cut-off system.

2.2.2 Underground Mining

In the past, mining operations at the Ballengeich site utilised the bord-and-pillar mining method. This technique involves the blasting and extraction of coal in a grid-like pattern, while strategically leaving behind pillars of coal to support the overlying rock (overburden). Extensive underground mining was undertaken across the Ballengeich Section, covering an area of approximately 405 hectares.

2.2.3 Ballengeich siding

The Ballengeich Siding, which Kangra Coal intends to operate for a period of 15 years at a capacity of 95,000 tonnes per month (~1,140,000 tonnes per annum), will be refurbished and re-established as a fully operational coal screening and storage facility. The siding infrastructure, as confirmed on the final Master Layout Plan Rev 2 (*GFK Drawing G2025/06/338-100, 9 April 2026*), comprises the following:

- Coal stockyard with a maximum storage capacity of approximately 95,000 tonnes;
- Screening and crushing plant to process raw coal prior to rail dispatch — a dry process requiring no wash water;
- Weighbridge for vehicle and load management;
- Existing office building to be renovated and reused;
- Chemical/portable mobile toilets for operational staff — no permanent sanitation infrastructure;
- New GFK-designed wash bay with concrete bunded slab, silt trap, and oil trap, discharging to the dirty water channel network and ultimately the New Quantum PCD (Item 37). Wash bay water (5,000 L/day) is supplied externally by NCCA via water cart to two 5,000 L JoJo tanks — no on-site water abstraction;
- Bunded concrete slab for temporary hydrocarbon waste skip bins, removed off site by a licensed contractor;
- Two existing Pollution Control Dams (PCD 7 and PCD 8) located on the western side of the siding property adjacent to the N11, both to be upgraded with a Class C HDPE-Clay composite liner (GNR 636); and
- Maintenance and upkeep of the existing railway line to ensure safe and efficient coal transport.



Rehabilitation of the passive AMD treatment system and monitoring obligations under the Water Use Licence will continue beyond the 15-year siding operational life as part of the 20-year WUL period.

2.2.4 Quantum

The area that Quantum occupies is comprised of the following:

- Two kilns for de-volatilising of anthracite coal.
- Storage of processed coal stockpiles.
- Mobile screening plants.
- Offices, workshop and ablution facilities.
- Chemical/portable mobile toilets only (no septic tanks or permanent sanitation on Quantum site — confirmed May 2026)

2.3 Key activity-related processes and products

At Ballengeich Colliery, the following key processes and products form part of the proposed rehabilitation activities:

- **Existing Residue stockpile:**

The primary rehabilitation alternative for the existing discard dump is the reworking and removal of the discard material. This approach is driven by the site-specific constraint of limited suitable topsoil, which significantly reduces the feasibility and long-term effectiveness of conventional capping and rehabilitation methods. As such, a rehabilitation strategy based primarily on reshaping and topsoil cover is not considered sustainable. In contrast, the reprocessing of the discard material reduces reliance on scarce topsoil resources while enabling the removal of potentially contaminated material, and is therefore regarded as the preferred alternative.

Under this preferred alternative, approximately 2 million cubic metres of discard material will be reworked. The recovered material will be processed on site and transported to an off-site facility with the required infrastructure. It is anticipated that approximately 60% ($\pm 1,200,000$ tonnes) of the recovered product will be transported by road to the end-user, Karbochem, near Newcastle. The remaining 40% ($\pm 800,000$ tonnes; $\pm 804,000$ m³), representing the waste fraction, will remain on site and be incorporated into a final residue stockpile. This stockpile will be reshaped and engineered in accordance with applicable standards and capped using the limited available topsoil, followed by vegetation establishment to meet rehabilitation objectives. In response to the existing pollution plume, an appropriate seepage management system, including subsoil drains, will be implemented across the rehabilitated footprint.

The reclamation operation is expected to process approximately 100,000 tonnes per month, resulting in an anticipated operational lifespan of about two years.

The secondary alternative entails the in-situ rehabilitation of the discard dump through reshaping, profiling, and capping. This would involve regarding the dump to achieve stable slopes and effective stormwater management, followed by the placement of a minimum of 600 mm of suitable soft overburden material to facilitate vegetation establishment. However, due to the limited availability of topsoil, this option is considered less favourable. Should it be pursued, additional infrastructure would be required, including the construction of a toe platform for access and maintenance, installation of V-drains for clean stormwater diversion, and subsoil drainage systems to intercept seepage and direct it to pollution control dams.



The northern and eastern extents of the discard dump are bounded by water features, namely the historic Hor River channel and Dam 6, with reshaping activities extending to the toe of these features. Given the increased dependence on imported cover material and the continued risk of seepage associated with retaining the discard in situ, this alternative is considered secondary to the preferred option of reworking and removing the discard material.

- **Cleaning of Slurry dam /Constructing new discard dump:**

In the past the slurry dam was cleaned, and the slurry was disposed of on the existing discard dump. Material underneath the slurry was used to fill in and profile the opencast areas north of the Horn River as well as the section adjacent to the N11.

The newly rehabilitated Discard Dump will be reshaped and lined with 600mm of soft material in preparation for hydroseeding.

- **Pollution Control Dams (PCDs)**

Numerous existing earth-lined dams are present on site. None of the PCDs are currently lined with a synthetic (commercial) liner; however, the underlying clayey soil provides a degree of natural lining. Monthly water quality monitoring is undertaken to assess and track groundwater conditions.

It is recommended that the majority of these dams be retained in their current configuration, with the primary objective being the removal of the pollution source associated with the discard dump. However, Pollution Control Dams (PCDs) 3, 4, 7, and 8 are classified as dirty water dams and will require upgrading through the installation of an appropriate Class C liner to improve containment and environmental protection. In addition, a new PCD will need to be constructed to accommodate dirty water runoff generated from the Quantum siding operations.

On the eastern side of the discard dump, a cluster of older PCDs is present, comprising PCD 1, PCD 2, PCD 5, and PCD 6. These structures are currently unlined and will require refurbishment, including the removal of contaminated sediments and the existing in-situ lining material. Thereafter, the dams will be relined with suitable liner systems to enable their use as clean water retention dams.

Once the discard dump has been fully rehabilitated, a revised stormwater management system will be implemented. Clean surface runoff from the rehabilitated area will be diverted to the primary stormwater retention facility, PCD 6. From there, water will cascade through PCD 5, PCD 2, and PCD 1, ultimately discharging in a controlled manner back into the Ngagane River.

- **West decant sump**

The Western decant sump has been constructed to collect decant from the open cast area north of the discard dump. The sump is clay lined as its main purpose is to collect water through seepage. The lowest level of this sump is at 1180mamsl elevation, which is the level where water decants from the mine works.

As part to the current application Kangra aims to install a anoxic limestone trench below the West Decant Sump to assist in the neutralisation of acidic seepage. Between the constructed trench and the riparian zone of the Horn River, an aerobic constructed wetland



system will be constructed to further ameliorate diffuse seepage water that could enter the Horn River.

- **Decant Horn River**

Two distinct Acid Mine Drainage (AMD) decant points have been identified within the project area. The first is located on the western side of the N11, where decant currently flows directly into the Horn River. The second decant point originates from the opencast area situated to the north of the existing residue stockpile and is currently diverted to the western decant sump.

Both pollution sources have been assessed and are incorporated into a pilot-scale passive wetland treatment system designed by Bhekani (Pty) Ltd.

At present, the western decant area, located west of the N11 bridge crossing the Horn River, has been partially contained through the construction of a concrete sump. Decant water is directed from this point to the West Decant Sump (PCD 5) as an interim management measure.

This temporary solution will be replaced by a permanent passive treatment system comprising a Successive Alkaline Producing System (SAPS), which will facilitate the neutralisation of acidic water. Treated effluent from the SAPS will overflow into a series of constructed anaerobic wetland cells, providing further polishing treatment prior to controlled discharge into the Horn River.

- **Upgrading and Recommissioning of the Existing Coal Siding**

Kangra intends to refurbish the existing, previously operational rail siding by upgrading and re-establishing associated infrastructure to support a coal screening and storage facility. The proposed development will include a coal stockyard with a maximum storage capacity of approximately 95,000 tons, equating to an annual throughput of up to 1,140,000 tons per annum, as well as the installation and operation of a coal sizing and quality screening plant to process raw coal prior to dispatch. The project further entails the upgrading of existing security infrastructure and the refurbishment, upgrading, and reimplementation of the stormwater management system, including infrastructure associated with both the western and eastern PCDs, with specific upgrades to PCDs 7 and 8 to improve containment efficiency and environmental compliance. In addition, portable ablution facilities, including toilets and change houses, will be provided to support operational staff. The scope also includes the general maintenance and upkeep of the existing railway line to ensure safe and efficient transport of coal, as well as the refurbishment and continued use of supporting infrastructure such as weighbridges and administrative office facilities. All activities will be undertaken in accordance with applicable environmental management requirements to ensure that potential impacts on water resources are effectively mitigated and managed.

2.4 Activity life description

The Ballengeich Water Use Licensing Project has an active expected life span of 15 years with a proposed monitoring period of 5 years. This is the effective project lifespan to 20 years. The anticipated commencement date of the project will be January 2027 for Rehabilitation subject to the finalisation of the associated licensing as well as relevant environmental authorisation and permitting. It should be noted that since the initial intervention with a Directive dated 2013, several actions had been completed by Kangra



following a phased approach. The estimated timeframe to complete the Rehabilitation Project is provided in **Table 2-2**.

Table 2-2: Project Timeframe

Phase	Activity Description	Completion Date
1	Slurry clean-up, opencast areas filled and profiled to reduce infiltration, Fill underground sinkholes, construction of berms to contain water in the Eastern PCD Complex, construct final discard pit	Completed
2	Investigate reworking of Old Discard Dump, completion of Western Sump, investigate treatment technology to deal with AMD	Jan 2017 – 2024 (Completed)
3	EA - WUL application and implementation of rehabilitation measures	June 2026 – December 2028

2.5 Activity infrastructure description

The mine has operated for more than 60 years under various owners and in this time the area has grown to include a number of surface features as a result of the mining, including:

- coal stockyard/screening operation
- duff reworking operation
- waste dumps and ponds
- road and railway lines

Kangra intends to refurbish the Siding and operate said siding for a period of 15 years.

2.5.1 Coal Stockyard and Screening

The coal siding will primarily function as a handling and logistics facility for coal product sourced from surrounding mining operations. Coal will be delivered to the site via trucks, offloaded, temporarily stockpiled, and screened to meet specified size and quality requirements prior to being transported via rail to various end-users and industrial clients.

Historically, coal has been stockpiled over extensive areas to the west of the main discard dump. Portions of this material have undergone beneficiation through screening and, where required, washing processes before being dispatched off-site by rail. The stockyard area is largely covered by a layer of fine coal material, which presents a potential source of dust generation, particularly due to vehicle movement across the site.

Dust emissions may be exacerbated by wind action, especially during dry and windy conditions, resulting in the mobilisation of fine coal particles. To mitigate these impacts, dust suppression measures are implemented, including the use of water tankers and fixed spray systems to maintain moisture on stockpiled material and operational surfaces.

Additional dust generation may occur during the screening process, particularly when handling dry coal. This is managed through the application of water sprays at screening points to minimise airborne particulate matter. The undersized fraction generated during screening is stockpiled separately and sold as a secondary product.

2.5.2 Historic Waste Dumps

Two distinctly separate waste dumps can be identified:

- large northern coal discard dump
- small southern coal discard dump



The large northern discard dump is essentially an end tip dump which is largely burnt-out. It is totally unshaped and has very steep sides. It appears as if the dump is still burning halfway up, on the northern slope.

The small coal discard dump to the south of the Siltech plant is also burnt out. Currently, it is covered by blue-gum trees. The exact content of this dump is unclear.

2.5.3 Roads and Railways

The state of the roads on the site varies from between fair to poor.

A rail siding is present on the site. The siding branches from the main railway line between Newcastle and Dannhauser. A portion of the siding up to the Siltech Plant is still active. The remaining portion of the siding which originally serviced the now defunct Natal Coal Exploration mine, is partially dismantled. Some of the sections of the remaining railway embankment are used as access roads to local farms.

Refer to **Figure 2-1** for the historic infrastructure layout of the mine.

2.6 Key water uses and waste streams

The key water uses that form part of this WULA are detailed in the Section 3.1. Several Section 21 water uses as defined in the NWA have been identified and registered across five categories. The identified water uses applicable to this application are:

- Section 21(c) & (i) — Impeding or diverting the flow in a watercourse; altering the bed, banks, course, or characteristics of a watercourse: 32 water use entries. This is the primary category covering all rehabilitation infrastructure, passive AMD treatment components, PCDs, stormwater management structures, flood protection berms, siding activities, and all new infrastructure confirmed from MLP Rev 2.
- Section 21(d) — Engaging in a Streamflow Reduction Activity (SFRA): 1 water use entry. A new 3.57 ha Eucalyptus plantation (Item 23) established adjacent to the West Decant Sump on Portion 19 as part of the rehabilitation and AMD mitigation programme.
- Section 21(f) — Discharging waste or water containing waste into a watercourse: 4 water use entries. Covers treated AMD discharge from the passive treatment system to the Horn River, subject to GN 1873 RQO compliance conditions.
- Section 21(g) — Disposing of waste in a manner which may detrimentally impact on a water resource: 19 water use entries. Covers all PCDs, discard dump, underground workings, opencast areas, siding operations, Quantum operations, dust suppression, wash bay, and diesel storage.
- Section 21(j) — Removing, discharging, or disposing of water found underground: 2 water use entries. Covers haul road dust suppression using AMD-impacted PCD water, and subsoil seepage dewatering at the discard dump toe.

The full Water Uses Register (Rev 5, June 2026; 60 definitive entries across five S21 categories) is provided as a supporting document to this IWWMP and must be read in conjunction with this section. The Water Use Table presented below provide more detail of each water use being registered.

Figure 2-2 presents all the water uses applicable to the site with three GIS Maps included.



Table 2-3: Ballengeich Colliery Water Uses

Water Use Number	Water use(s)	Purpose	Capacity / Volume (m ³ , tonnes and/or m ³ /annum)	Property Description	Co-ordinates
SECTION 21 (c) AND (i) – Impeding or Diverting the Flow of Water in a Watercourse					
1 – (c&i)	Impeding and diverting the natural flow	Discard Dump pit within 500m regulated wetland buffer area	12.2 ha	Portion 19	27°53'27.78"S 29°58'17.29"E
2 – (c&i)	Impeding and diverting the natural flow	Stormwater Management Complex — integrated dirty and clean water separation infrastructure associated with the discard dump rehabilitation and siding operations. Includes: discard dump toe platform, grass-lined V-drains on the rehabilitated dump surface, concrete-lined dirty water channels, and associated silt traps. All infrastructure is located within the 500 m regulated wetland buffer area and within the 1:100-year floodline.	367,500 m ³ (combined PCDs 1–8 and West Decant Sump). See Items 5.1–5.8 for individual PCD capacities.	Portion 19	Start: 27°53'25.39"S 29°58'6.49"E End: 27°53'25.19"S 29°58'40.44"E
3 – (c&i)	Impeding and diverting the natural flow	Old opencast area within 500m regulated wetland buffer area and within 100m of NFEPA River buffer.	43 200 m ³ /a	Portion 19	27°53'13.68"S 29°58'14.52"E
4 – (c&i)	Impeding and diverting the natural flow	The Oxidation Pond is part of passive wetland treatment process and situated within a current wetland and within 100m of NFEPA River buffer.	0.4 ha	Portion 25	27°53'25.08"S 29°57'48.32"E
5.1 – (c&i)	Impeding and diverting the natural flow	PCD 1 within 500m regulated wetland buffer area. Existing unlined earth dam. Retained as regular dam — GN 704 Reg. 4 exemption applied.	31,650 m ² ; 62,300 m ³	Portion 19	27°53'18.51"S 29°58'29.89"E
5.2 – (c&i)	Impeding and diverting the natural flow	PCD 2 within 500m regulated wetland buffer area. Existing unlined earth dam. Retained as regular dam — GN 704 Reg. 4 exemption applied.	10,010 m ² ; 20,400 m ³	Portion 19	27°53'21.55"S 29°58'35.71"E
5.3 – (c&i)	Impeding and diverting the natural flow	PCD 3 within 500m regulated wetland buffer area. To be upgraded with Class C HDPE-Clay composite liner	7,090 m ² ; 15,500 m ³	Portion 19	27°53'25.39"S 29°58'38.07"E
5.4 – (c&i)	Impeding and diverting the natural flow	PCD 4 within 500m regulated wetland buffer area. To be upgraded with Class C HDPE-Clay composite liner (GNR 636).	3,800 m ² ; 6,800 m ³	Portion 19	27°53'28.28"S 29°58'37.38"E
5.4.1 – (c&i)	Impeding and diverting the natural flow	PCD 4 Silt Trap — inlet silt trap associated with PCD 4, located within the 500 m regulated wetland buffer area. Designed to capture sediment-laden stormwater runoff from an 8.8 ha catchment before discharge into	109 m ³	Portion 19	27°53'28.28"S 29°58'37.38"E



Water Use Number	Water use(s)	Purpose	Capacity / Volume (m ³ , tonnes and/or m ³ /annum)	Property Description	Co-ordinates
		PCD 4. Calculated total length: 16.2 m; overflow width: 4.5 m; depth below FSL: 1.5 m; cleaning interval: 28 days.	14.9 m ³ per 28-day interval		
5.5 – (c&i)	Impeding and diverting the natural flow	PCD 5 within 500m regulated wetland buffer area. Existing unlined earth dam. Retained as regular dam — GN 704 Reg. 4 exemption applied.	11,600 m ² ; 20,900 m ³	Portion 19	27°53'22.59"S 29°58'31.31"E
5.6 – (c&i)	Impeding and diverting the natural flow	PCD 6 (Old Horn River Dam) within 500m regulated wetland buffer area. Largest on-site PCD. Existing unlined. Retained as regular dam — GN 704 Reg. 4 exemption applied.	45,900 m ² ; 143,700 m ³	Portion 19	27°53'28.54"S 29°58'31.90"E
5.7 – (c&i)	Impeding and diverting the natural flow	PCD 7 within 500m regulated wetland buffer area. To be upgraded with Class C HDPE-Clay composite liner (GNR 636).	3,700 m ² ; 5,600 m ³	Portion 19	27°53'34.07"S 29°57'59.87"E
5.8 – (c&i)	Impeding and diverting the natural flow	PCD 8 within 500m regulated wetland buffer area. To be upgraded with Class C HDPE-Clay composite liner (GNR 636).	3,000 m ² ; 5,600 m ³	Portion 19	27°53'33.35"S 29°58'1.97"E
6 – (c&i)	Impeding and diverting the natural flow	Successive Alkaline Producing System (SAPS) used during passive wetland treatment. Located within a wetland system and within a 100m NFEPA River buffer.	1.2 ha	Portion 25	27°53'26.39"S 29°57'47.61"E
7 – (c&i)	Impeding and diverting the natural flow	Anoxic Limestone Drain (ALD 1) used to treat net-acidic, anoxic mine drainage of low to moderate flow. Located within a wetland system and within a 100m NFEPA River buffer.	Length = 420 m	Portion 25	Start: 27°53'33.43"S 29°57'41.38"E End: 27°53'27.63"S 29°57'52.17"E
8 – (c&i)	Impeding and diverting the natural flow	Anoxic Limestone Drain (ALD 2) used to treat net-acidic, anoxic mine drainage of low to moderate flow. Located within a wetland system and within a 100m NFEPA River buffer.	Length = 230 m	Portion 19	Start: 27°53'17.33"S 29°58'1.35"E End: 27°53'12.99"S 29°58'8.95"E



Water Use Number	Water use(s)	Purpose	Capacity / Volume (m ³ , tonnes and/or m ³ /annum)	Property Description	Co-ordinates
9 – (c&i)	Impeding and diverting the natural flow	Aerobic Wetland 1 collects AMD water and provides time for metals and sediments to precipitate. Located within a wetland system and within a 100m NFEPA River buffer.	1.3 ha	Portion 25	27°53'23.00"S 29°57'49.07"E
10 – (c&i)	Impeding and diverting the natural flow	Aerobic Wetland 2 collects AMD water and provides time for metals and sediments to precipitate. Located within a wetland system and within a 100m NFEPA River buffer.	4.4 ha	Portion 19	Start: 27°53'16.64"S 29°58'1.01"E End: 27°53'6.79"S 29°58'27.02"E
11 – (c&i)	Impeding and diverting the natural flow	West Decant PCD ensures that groundwater rebound and decant from mine openings take place in the form of surface water discharge. Located within 500m regulated wetland buffer area.	32,700 m ² ; 86,400 m ³	Portion 19	27°53'19.06"S 29°58'6.84"E
12 – (c&i)	Impeding and diverting the natural flow	Screening and Crushing plant area associated with Quantum's operations. Located within 500m of regulated wetland area.	2.93 ha	Portion 19	27°53'29.72"S 29°58'7.89"E
13.1 – (c&i)	Impeding and diverting the natural flow	Septic Tank 1 — grey water (Kangra/siding operations only). Quantum uses mobile toilets. Located within 500m of regulated wetland area.	10 000 L	Portion 19	27°53'31.03"S 29°58'5.70"E
13.2 – (c&i)	Impeding and diverting the natural flow	Septic Tank 2 — toilet waste (Kangra/siding operations only). Quantum uses mobile toilets. Located within 500m of regulated wetland area.	5 000 L	Portion 19	27°53'31.40"S 29°58'7.59"E
14 – (c&i)	Impeding and diverting the natural flow	New Quantum PCD — newly constructed pollution control dam (Class C HDPE-Clay composite liner; GNR 636) for stormwater/dirty water management at the Quantum operations area. Located within 500m regulated wetland buffer area.	1.8 ha 8,600 m ³	Portion 19	27°53'27.65"S 29°58'0.59"E
15 – (c&i)	Impeding and diverting the natural flow	Sharp crested V-Drain weir located directly within the Horn River close to the Ngagane River confluence.	Flow: 8.3 Mm ³ /a	Portion 19	27°53'5.99"S 29°58'26.89"E 27°53'6.53"S 29°58'15.04"E)



Water Use Number	Water use(s)	Purpose	Capacity / Volume (m ³ , tonnes and/or m ³ /annum)	Property Description	Co-ordinates
16 – (c&i)	Impeding and diverting the natural flow; altering the bed, banks, course or characteristic of a watercourse	Riverbank and riparian rehabilitation along a significant portion of the Horn River on the northern and southern banks.	740 m	Portion 19	Start: 27°53'18.21"S 29°57'54.11"E End: 27°53'4.83"S 29°58'30.03"E
17 – (c&i)	Impeding and diverting the natural flow	Siding & Coal stockpile at Ballengeich Siding within 500m regulated area.	540 000 tonnes/a	Portion 19	27°53'39.19"S 29°58'11.20"E
18 – (c&i)	Impeding and diverting the natural flow	Flood Protection Berms — Berm 1 along Horn River;	Berm 1	Portion 19	Berm 1 Start: 27°53'24.01"S 29°58'8.13"E End: 27°53'14.57"S 29°58'6.95"E
19 – (c&i)	Impeding and diverting the natural flow	Berm 2 along Ngagane River (western side of rail line).	Berm 2	Portion 19	Berm 2 Start: 27°53'33.96"S 29°58'28.68"E End: 27°53'18.21"S 29°58'26.36"E
20 – (c&i)	Impeding and diverting the natural flow	Emergency Spillway — overflow structure associated with the western PCD/dam, designed to discharge excess water during storm events. Located within 500m wetland buffer.	—	Portion 19	27°53'27.26"S 29°58'0.06"E
21	Impeding and diverting the natural flow	New Instream Flow Gauging Weir 2 — located in the Horn River downstream of passive treatment system. Used for flow measurement and compliance monitoring	Flow gauging structure	Portion 19	Start: 27°53'4.65"S 29°58'17.44"E End: 27°53'6.07"S 29°58'17.78"E



Water Use Number	Water use(s)	Purpose	Capacity / Volume (m ³ , tonnes and/or m ³ /annum)	Property Description	Co-ordinates
22	Impeding and diverting the natural flow	New Instream Flow Gauging Weir 1 — located in the Horn River downstream of passive treatment system. Used for flow measurement and compliance monitoring	Flow gauging structure	Portion 19	Start: 27°53'6.29"S 29°58'11.18"E End: 27°53'8.74"S 29°58'13.67"E
SECTION 21 (d) – Engaging in Stream Flow Reduction Activities					
23 – (d)	Engaging in stream flow reduction activity	Eucalyptus Tree Plantation — Category 1b invasive alien (GN R598, August 2014). AMD Decant Stream Flow Reduction	3.57 ha	Portion 19	27°53'21.91"S 29°58'1.27"E
SECTION 21 (f) – Discharging Waste or Water Containing Waste into a Watercourse					
24 – (f)	Discharging of effluent from mine related infrastructure into a watercourse	Aerobic Wetland 1 — final passive treatment step receiving treated AMD from the Bhekhani Passive Treatment Plant. Treated effluent discharges to Horn River. GN 1873 RQOs required within 12 months of commissioning.	1.3 ha Design Flow: 1,000m ³ /d Annual: 365,000m ³	Portion 25	27°53'22.97"S 29°57'47.24"E
25 – (f)	Discharging of effluent from mine related infrastructure into a watercourse	Aerobic Wetland 2 collects AMD water and provides time for metals and sediments to precipitate. West decant sump and old opencast area contribute to these contaminated effluents.	4.4 ha Approximately 178–255 m ³ /day	Portion 19	Start: 27°53'16.77"S 29°58'1.12"E End: 27°53'6.78"S 29°58'27.02"E
26 – (f)	Discharging of effluent from mine related infrastructure into a watercourse	Overflow structures associated with lined PCDs and western dam — excess water discharges via overflow weirs during high rainfall events.	Overflow weirs <i>Intermittent storm event discharge only. Spill frequency <1 in 50 years (GN 704 compliant)</i>	Portion 19	27°53'15.27"S 29°58'30.30"E



Water Use Number	Water use(s)	Purpose	Capacity / Volume (m ³ , tonnes and/or m ³ /annum)	Property Description	Co-ordinates
SECTION 21 (g) – Disposing of Waste in a Manner Which May Detrimentally Impact on a Water Resource					
27 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	Discard Dump within 500m regulated wetland buffer area. Active spontaneous combustion confirmed on northern face.	12.2 ha	Portion 19	27°53'27.78"S 29°58'17.29"E
28 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	Old opencast area located close to the Horn River and within the regulated area. Mining material remnants continue to leach AMD into the system.	43 200 m ³ /a	Portion 19	27°53'13.68"S 29°58'14.52"E
29.1 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	PCD 1 within 500m regulated wetland buffer area. Existing unlined earth dam. Retained as regular dam — GN 704 Reg. 4 exemption applied.	31,650 m ² ; 62,300 m ³	Portion 19	27°53'18.51"S 29°58'29.89"E
29.2 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	PCD 2 within 500m regulated wetland buffer area. Existing unlined earth dam. Retained as regular dam — GN 704 Reg. 4 exemption applied.	10,010 m ² ; 20,400 m ³	Portion 19	27°53'21.55"S 29°58'35.71"E
29.3 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	PCD 3 within 500m regulated wetland buffer area. To be upgraded with Class C HDPE-Clay composite liner	7,090 m ² ; 15,500 m ³	Portion 19	27°53'25.39"S 29°58'38.07"E
29.4 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	PCD 4 within 500m regulated wetland buffer area. To be upgraded with Class C HDPE-Clay composite liner (GNR 636).	3,800 m ² ; 6,800 m ³	Portion 19	27°53'28.28"S 29°58'37.38"E
29.4.1 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	PCD 4 Silt Trap — inlet silt trap associated with PCD 4. Captures and retains sediment-laden stormwater from an 8.8 ha catchment. Accumulated sediment (14.9 m ³ per 28-day cleaning interval) to be characterised and managed per GNR 635. Located within 500 m regulated wetland buffer area.	109 m ³ silt volume 14.9 m ³ per cleaning cycle	Portion 19	27°53'28.28"S 29°58'37.38"E



Water Use Number	Water use(s)	Purpose	Capacity / Volume (m ³ , tonnes and/or m ³ /annum)	Property Description	Co-ordinates
29.5 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	PCD 5 within 500m regulated wetland buffer area. Existing unlined earth dam. Retained as regular dam — GN 704 Reg. 4 exemption applied.	11,600 m ² ; 20,900 m ³	Portion 19	27°53'22.59"S 29°58'31.31"E
29.6 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	PCD 6 (Old Horn River Dam) within 500m regulated wetland buffer area. Largest on-site PCD. Existing unlined. Retained as regular dam — GN 704 Reg. 4 exemption applied.	45,900 m ² ; 143,700 m ³	Portion 19	27°53'28.54"S 29°58'31.90"E
29.7 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	PCD 7 within 500m regulated wetland buffer area. To be upgraded with Class C HDPE-Clay composite liner (GNR 636).	3,700 m ² ; 5,600 m ³	Portion 19	27°53'34.07"S 29°57'59.87"E
29.8 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	PCD 8 within 500m regulated wetland buffer area. To be upgraded with Class C HDPE-Clay composite liner (GNR 636).	3,000 m ² ; 5,600 m ³	Portion 19	27°53'33.35"S 29°58'1.97"E
30 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	Aerobic Wetland 1 collects AMD water and provides time for metals and sediments to precipitate. Iron hydroxide sludge accumulates — characterised per GNR 635 annually.	1.3 ha Iron hydroxide sludge accumulation approximately 50–100 mm/yr. Desludging every 5–7 years via scour valve.	Portion 25	27°53'22.97"S 29°57'47.24"E
31 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	Aerobic Wetland 2 collects AMD water and provides time for metals and sediments to precipitate. Same sludge management obligations as Item 30.	4.4 ha Approximately 178–255 m ³ /day	Portion 19	27°53'9.66"S 29°58'11.51"E



Water Use Number	Water use(s)	Purpose	Capacity / Volume (m ³ , tonnes and/or m ³ /annum)	Property Description	Co-ordinates
32 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	West Decant PCD. — receives AMD decant from underground workings via existing surface drainage.	32,700 m ² ; 86,400 m ³	Portion 19Di	27°53'19.06"S 29°58'6.84"E
33 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	Quantum Operations Screening, Crushing and Stockpile area. Dirty footprint — full operational area inclusive of screening plant, crusher, coal stockpiles and associated hardstand	2.93 ha	Portion 19	27°53'29.72"S 29°58'7.89"E
34.1 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	Septic Tank 1 — Sewage storage (Kangra/siding operations only). Quantum uses mobile toilets.	10 000 L	Portion 19	27°53'31.03"S 29°58'5.70"E
34.2 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	Septic Tank 2 — Sewage storage (Kangra/siding operations only). Quantum uses mobile toilets.	5 000 L	Portion 19	27°53'31.40"S 29°58'7.59"E
35 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	Quantum PCD — disposal of dirty stormwater into a water containment facility. (New Quantum PCD).	1.8 ha 8,600 m ³	Portion 19	27°53'27.65"S 29°58'0.59"E
36 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	Kangra Siding & Coal stockpile at Ballengeich Siding. 15-year operational life at 95,000 t/month.	540 000 tonnes/a	Portion 19	27°53'39.19"S 29°58'11.20"E
37 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	Dirty water from PCDs used for dust suppression. (Haul Roads, Discard Dump, Siding)	38,400 m ³ /a	Portion 19	27°53'26.28"S 29°58'16.82"E



Water Use Number	Water use(s)	Purpose	Capacity / Volume (m ³ , tonnes and/or m ³ /annum)	Property Description	Co-ordinates
38 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	Passive Treatment Plant (Bhekhani) — treated/partially-treated AMD disposal from passive treatment infrastructure. Iron hydroxide sludge classified per GNR 635.	1,000 m ³ /day. Iron hydroxide sludge precipitate generated	Portion 25	27°53'24.16"S 29°57'48.81"E
39 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	Wash Bay — wash bay generates oily/contaminated wash water collected via silt and oil traps → dirty channel → New Quantum PCD.	5,000 L/day (150 m ³ /month)	Portion 19	27°53'33.19"S 29°58'9.53"E
40 – (g)	Disposing of waste in a manner which may detrimentally impact on a water resource.	Quantum Diesel Storage — 2,500 L fully bunded diesel tank on site.	2,500 L (fully bunded)	Portion 19	27°53'29.72"S 29°58'7.89"E
SECTION 21 (j) – Removing, Discharging or Disposing of Water Found Underground					
41 – (j)	Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of the people.	Seepage Dewatering Pipeline — 110mm subsoil drainage pipes collect seepage from discard dump toe, discharge to manholes and pump to lined PCDs 3 and 4. Scenario 1 (dump rehabilitated) only.	Subsoil pipe perimeter; pipeline ~200m to PCDs	Portion 19	27°53'24.10"S 29°58'26.19"E

Legend

Infrastructure

- Clean water channel
- Culvert
- Dirty water channel
- Old opencast
- Dump toe platform
- Existing rail
- Existing trenches
- PCDs (existing)
- PCD 7 & 8
- PCD (Quantum new)
- Emergency spillway
- Dewatering pipeline
- Access road
- Quantum Siding
- Screening plant
- Kangra Siding
- Silt trap
- Dump rehab
- Existing buildings
- Flood protection berm

Aerobic wetlands

- Seepage drain
- Seepage drain 2
- Oxidation pond
- Anoxic limestone drain
- Alkaline producing system
- Aerobic wetland 1
- Aerobic wetland 2

Aquatic features

- Horn river
- Ngagane river
- Rivers - 100m Buffer
- Wetlands - 500m Buffer

Water uses

- SEEP
- UVB

Map Labels:

- 16 - START
- 16 - END
- 21 - Start
- 21 - end
- 22 - Start
- 22 - End
- 10 - END
- 15
- 8 - End
- 3
- 18 - Berm 1 End
- 10 - START
- 8
- 11
- 19 - Berm 2 End
- 5.1
- 5.5
- 5.2
- 5.3 2 - END
- 5.4
- 5.6
- 33 - END
- 19 - Berm 2 Start
- 13.1
- 13.2
- 12
- 2 - START
- 33 - START
- 1
- 17
- 5.7
- 5.8
- 20
- 14
- 7 - END
- 7 - START
- 9
- 4
- 6

Scale: 0 250 500 m

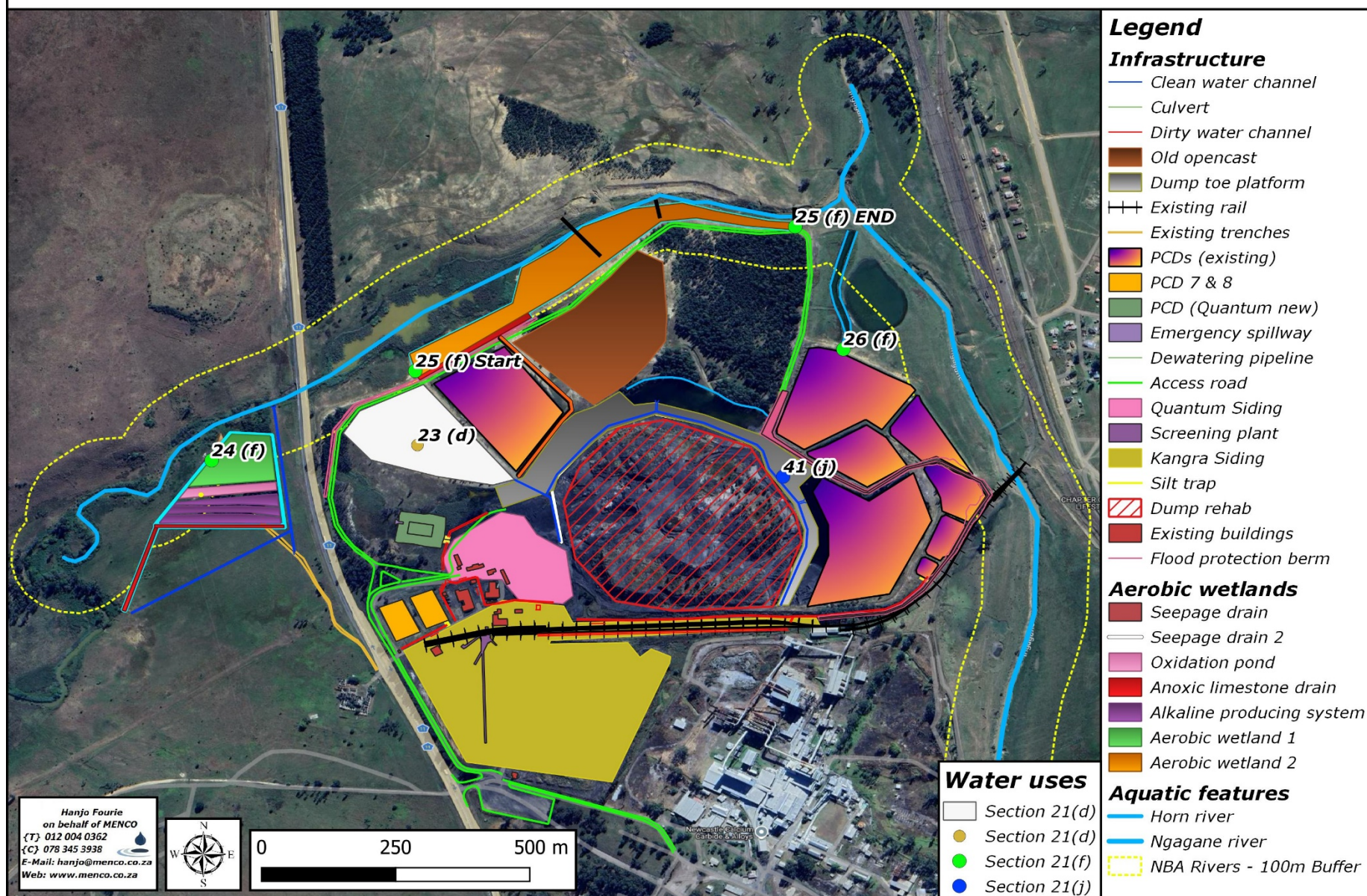
North Arrow: N, S, E, W

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Kangra Coal (Pty) Ltd: Ballengeich Colliery





Kangra Coal (Pty) Ltd: Ballengeich Colliery

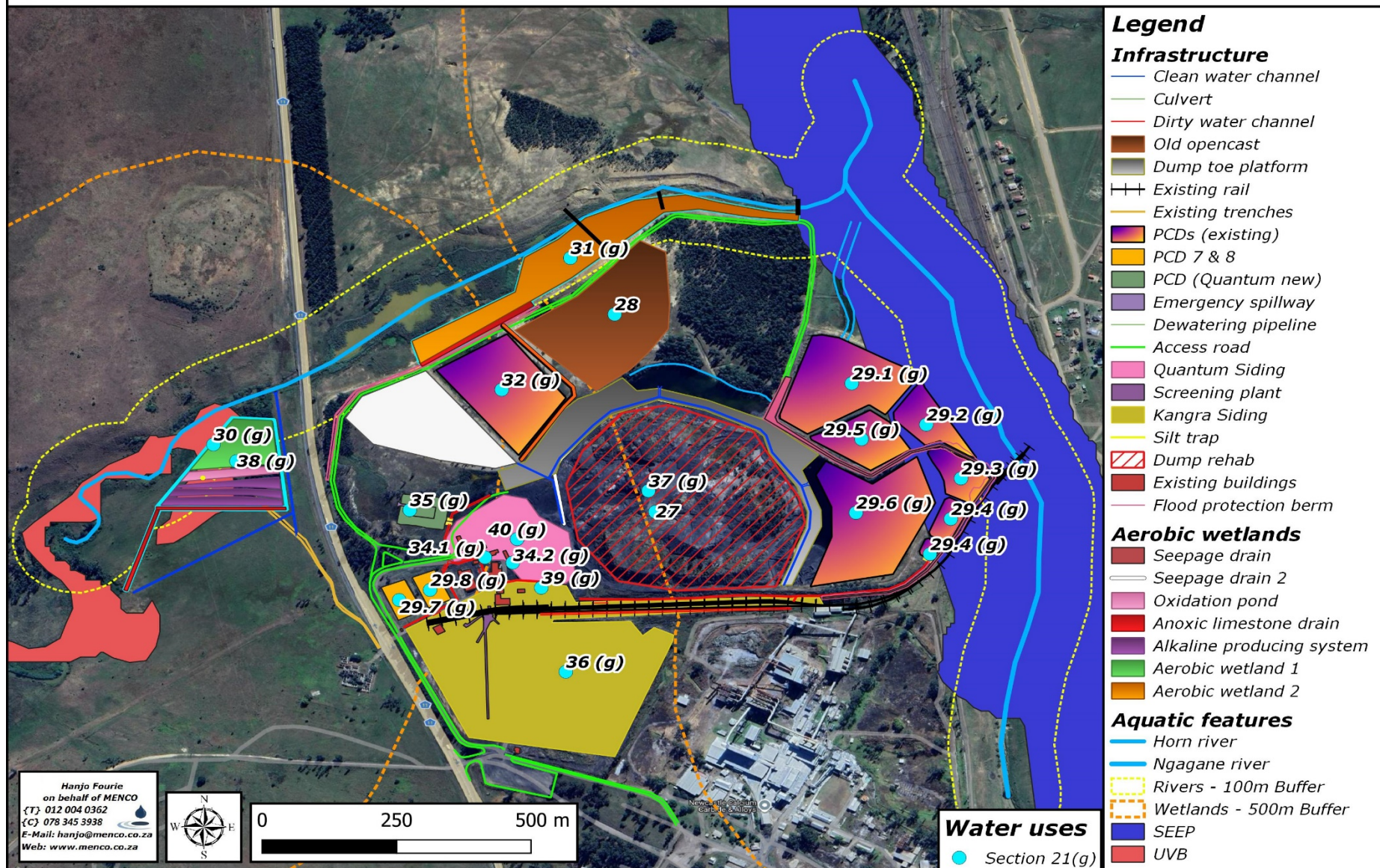


Figure 2-2: Overview of All Water Uses





2.7 Organisational structure of activity

Refer to **Figure 2-2** for the organigram of Kangra Coal. Kangra Coal is a subsidiary company of Menar Capital who operates various coal mining operations in South Africa.

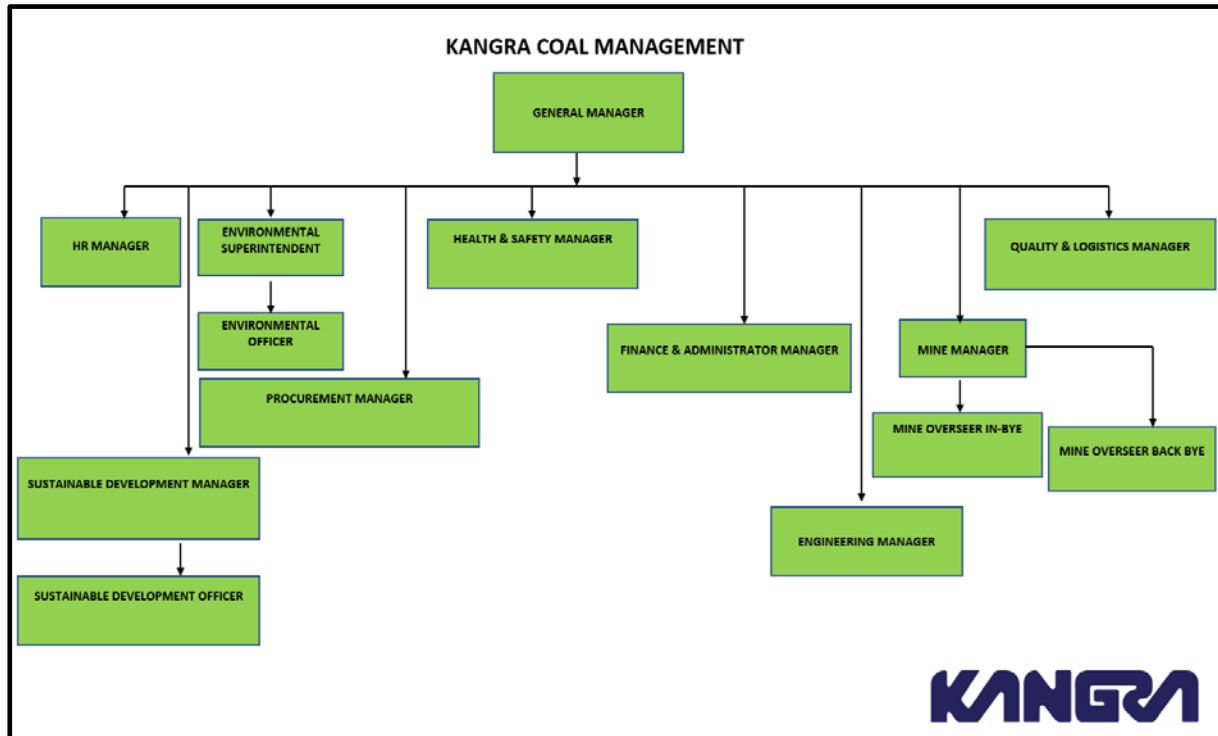


Figure 2-4: Organigram for Kangra Coal

The hierarchical management structure for Ballengeich is outlined in **Table 2-4**.

Table 2-4: Ballengeich Management Structure

Designation	Name	Contact
General Manager	Paul Redelinghuys	079 374 1926
Environmental Superintendent	Mahlatse Monareng	076 829 0719
Technical Services Manager	Ernest Mandere	083 417 0544

2.8 Business and Corporate Policies

Kangra, as a South African mining company, implements the principles and recommendations of good corporate governance contained in the King Code of Governance Principles for South Africa (the King III Report). The company complies with the following Standards and Principles:

- OHSAS 18001 Health and Safety Standards;
- ISO14000/14001: Environmental Management

2.8.1 Corporate Policy

Kangra aims to abide by all relevant provisions of the Mineral and Petroleum Resources Development Act, 28 of 2002 (MPRDA) which is the primary piece of legislation governing rights to conduct reconnaissance, prospecting and mining in South Africa. We also adhere to all other pieces of legislation that specifically governs mining such as the Mining Titles Registration Act 16 of 1967, Mineral and Petroleum Resources Royalty Act 28 of 2008, as well as the Mine Health and Safety Act 29 of 1996 which specifically focuses on the health and safety of the employees on mines.



We further conduct business with our employees on the basis of the Labour Relations Act 66 of 1995 as well as Employment Equity Act 55 of 1998, and also have a particular focus on the Broad-Based Black Economic Empowerment Act 53 of 2003 in terms of how we source our employees and contractor. We have also annually submitted our progress on compliance and alignment with the Mining Charter of South Africa.

We take our Corporate Social Responsibility serious and address it in terms of our Social and Labour Plans (SLP's), which is also regulated by the MPRDA, but we always try and adopt a compassionate practice while focusing on the promotion of sustainable development in the communities in which we operate.

Our environmental compliance is primarily regulated by our Environmental Impact Assessments and Environmental Management Programmes (EIA's and EMP's) and Water Use Licenses (WUL's), which is compiled and approved in terms of the National Environmental Management Act 107 of 1998 and the National Water Act 36 of 1998 respectively. We have a strong compliance focus and see it as part of our Corporate Responsibility to minimise our negative impact on the environment and promote sustainable development. During the licensing, operational and closure periods of our mines all other pieces of environmental and other legislation is considered and where required complied with, with specific reference to the National Environmental Management: Waste Act 59 of 2008, National Environmental Management: Air Quality Act 39 of 2004, National Environmental Management: Biodiversity Act 10 of 2004, National Environmental Management: Protected Areas Act 53 of 2003, National Heritage Resources Act 25 of 1999.

2.8.2 Core values of Kangra Coal (Pty) Ltd

- o **People:** They strive to conduct business dealings and communication with integrity and in a professional, courteous and honest manner.
- o **Planet:** They are responsible for the impact of their actions on the community and environment. They embrace our cultural heritage and have a responsible approach to all stakeholders. They use natural resources in a way that will sustain life for future generations.
- o **Performance:** They are uncompromising in their professionalism and strive to be the best in everything they do. Kangra will utilise their time, energy and resources to make a valuable contribution to other customers, colleagues and business partners.

2.8.3 Environmental Policy

Kangra advocates for Zero Harm to ensure that all workers return home to their loved ones unharmed and healthy. To demonstrate compliance with the Mine Health and Safety Act 29 of 1996, we have implemented a comprehensive safety policy to prevent injuries.

Kangra has actively encouraged employees, contractors, and community members to observe safety protocols on-site. We conduct daily toolbox talks, weekly Visible Felt Leadership (VFL) meetings, and monthly Safety Committee meetings. Inspections are an essential part of preventing work-related injuries. We conduct audits to ensure compliance with safety standards across Kangra operations.



2.8.4 Community Policy

Kangra is deeply committed to building meaningful partnerships with our host communities. We believe in creating value by implementing community development projects, supporting local businesses, promoting supplier enterprise development, and investing in Human Resource Development initiatives.

In accordance with the Mineral and Petroleum Resources Development Act (MPRDA), Kangra regularly submits Social and Labour Plans (SLPs). These plans are strategically aligned with the local municipality's Integrated Development Plan (IDP), ensuring that our community development efforts are well-coordinated and effective. Kangra is dedicated to making a life-changing impact on people's lives.



3 REGULATORY WATER AND WASTE MANAGEMENT FRAMEWORK

3.1 Summary of all water uses

A water use is defined in terms of Section 21 of the NWA to include the following:

- S21(a) Taking water from a water resource;
- S21(b) Storing water;
- S21(c) Impeding or diverting the flow of water in a watercourse;
- S21(d) Engaging in a stream flow reduction activity contemplated in Section 36;
- S21(e) Engaging in a controlled activity identified as such in section 37 (10) or declared under Section 38(1). Section 37 (1)(a) identifies the following controlled activity: "irrigation of any land with waste or water containing waste generated through any industrial activity or by a waterworks;
- S21(f) Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
- S21(g) Disposing of waste in a manner which may detrimentally impact on a water resource;
- S21(h) Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
- S21(i) Altering the bed, banks, course or characteristics of a watercourse; and
- S21(j) Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of any activity or for the safety of people.

If any of the abovementioned water uses are triggered a water use authorisation will be required. A water use authorisation can be any of the following:

- Existing lawful water use;
- General Authorisation; and
- Water Use License.

The type of water use authorisations is explained in the next section below.

3.2 Existing lawful water uses

An existing lawful water use is defined in terms of Section 32 of the NWA as a water use which has taken place lawfully two years prior to the promulgation of the NWA. This is a new application for a historic and defunct ("brownfield") mine and therefore no existing lawful water uses apply. As per issued Directive in terms of sections 19 and 154 of the NWA, Ballengeich was instructed to apply for a WUL as part of remediation measures to be implemented to deal with the control of AMD that leaches into the Horn River.

3.3 Relevant Exemptions

It is a requirement of the Department of Water and Sanitation that the backfilling with overburden of the open voids with spoils are subject to Departmental approval. In this instance an application in terms of Regulation 3 of GN 704 is requested for an exemption of Regulation 5: Restrictions on use of material. Exemption of Regulation 4: Restriction on Location is also required.

The motivation for these exemptions is that the sections (4 and 5) were not in the original licensing and the mining process has been conducted for many years (existing lawful use means any lawful use authorised at any time during the period from 1 October 1996-30th



September 1998) without the sections in use. The location of the mining area itself cannot be moved and the structure that is used was constructed before the sections were relevant and therefore the mine should be exempted from these regulations. Therefore, as the Mine cannot move, no alternatives are available to be considered.

This is a historic use of the Mine aggregate as a stabilising wall for the river diversion. For more information regarding the required exemptions, please refer to **Appendix 28** (GN704 Exemptions).

3.4 Generally authorized Water Uses

All relevant General Authorisation are handled as full licence applications as per departmental request.

3.5 New Water Uses to be Authorised

The issuance of a Directive under reference 16/2/7/V301/A/1 by the DWS during August 2013 triggered the need to apply for a WULA. An IWWMP was compiled by GCS Water and Environmental Consultants (2014) utilising phytoremediation as a Section 21(d) water use as the primary option to address AMD at the site. This application was updated during 2015 to include hydrological, geohydrological, geochemical, and wetland studies in support of the IWWMP. The submitted WULA (2015) made provision for Section 21(a), (c), (d), (f), (g), and (i) water uses to be authorised. That application was formally declined by DWS on 29 April 2019.

The current application (DWS Ref: WU33839) is considered an entirely new WULA. All applicable water uses identified are summarised in **Table 2-3**. The current application covers a materially revised and substantially expanded scope relative to the 2015 submission, comprising 60 definitive water use entries across five Section 21 categories. Section 21(a) does not apply to the current application — no groundwater abstraction takes place on the Ballengeich site, as confirmed in writing by the Quantum operator and Kangra Coal in May 2026.

3.6 Waste Management Activity (NEMWA)

The National Environmental Management Waste Act, 2008 (Act 58 of 2008) determine that wastes must be characterized and classified to determine requirements for safe disposal. In terms of waste classification, NEMWA refers to three regulations namely:

- GNR634: Waste classification and management regulations that provides generic regulations for the classification and management of waste
- GNR 635: National Norms and Standards of Waste for Landfill Disposal that provides regulations governing waste types assess methodology;
- GNR636: National Norms and Standards for Disposal of Waste to landfill that provides regulations for selecting the appropriate barrier system

In order to meet with the NEMWA requirements the mine has appointed Knight Piesold Consulting Engineers to characterize the waste samples taken at Ballengeich (Knight Piesold, 2016). Five samples were selected as indicated in **Table 3-1** below.

Table 3-1: Ballengeich Colliery waste samples

Sample ID	Sample Material
Discard Dump	Coal
Quantum Siding	Coal
Existing Ballengeich Siding	Coal



Old Clay Stockpile	Clay
--------------------	------

The waste material samples were analysed at a SANAS accredited laboratory for the following analytical suite on the dry samples:

- An aqua regia (total) digestion of the samples, followed by quantitative analysis by inductively coupled optical emission spectrometry (ICP-OES) for the following in accordance with GNR635:
 - o ICP analysis for 15 elements (As, B, Ba, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, V, Zn)
 - o Additional analysis for mercury (Hg), hexavalent Chrome (Cr_{VI}), total fluoride (F) and total Cyanide (CN)
- An aqueous extraction conducted in accordance with the prescribed leach testing procedures AS 4439.3 (1997) standard that is analysed as follows:
 - o ICP analysis for 16 elements (As, B, Ba, Cd, Co, Cr (total), Cu, Hg, Mn, Mo, Ni, Pb, Sb, Se, V, Zn);
 - o Total dissolved salt (TDS) concentration and specific anions and cations including Cr⁶⁺, Cl, SO₄, NO₃ as N, F and CN (total);
 - o pH of the leach solution

3.6.1 Waste Type Assessment

The analysis was conducted according to the methods as prescribed in GNR635. This Regulation requires that waste type be assessed as follows:

- ID chemical substances present in the waste;
- Analyse the waste to determine total concentrations (TCs) and leachable concentrations (LCs) of elements and chemical substances in the waste;
- Compare TCs and TCs to threshold limits as specified in GNR635 to determine the waste type

TC threshold limits (TCT) are sub-divided into the following categories:

- TCT0 limits based on screening values for the protection of water resources;
- TCT1 limits derived from land remediation values for commercial/industrial land;
- TCTs limits derived by multiplying the TCT1 values by factor 4

LC threshold limit (LCT) is sub-divided into the following categories:

- LCT0 limits derived for human health effects;
- LCT1 limits derived by multiplying LCT0 values by a Dilution Attenuation Factor (DAF) of 50;
- LCT2 limits derived by multiplying LCT1 values by factor 2;
- LCT3 limits derived by multiplying LCT2 values by factor 4

Please refer to **Table 3-2** for a summary of the waste type assessment criteria.

Table 3-2: Waste type assessment criteria

Waste Type	TC	LC	Disposal
0	> TCT2	> LCT3	Not allowed
1	Between TCT1 and TCT2	Between LCT2 and LCT3	Class A or Hh:HH landfill
2	< TCT1	Between LCT1 and LCT2	Class B or GLB+ landfill
3	< TCT1	Between LCT0 and LCT1	Class C or GLB- landfill
4	< TCT0	< LCT0	Class D or GLB- landfill



The results of the waste type assessment is illustrated in **Table 3-3**.

Table 3-3: Ballengeich waste type assessment

Sample ID	Sample Material	Waste Type	Parameters for TC	Parameters for LC
Discard Dump	Coal	Type 3	B, Ba, Cu, Hg, F	Cd, Mn, Ni, TDS SO ₄
Quantum Siding	Coal	Type 3	B, Ba, F	-
Existing Ballengeich Siding	Coal	Type 3	B, Ba, F	-
Old Clay stockpile	Coal	Type 3	Ba, Cu, F	-

According to GNR636, landfills for disposal of Type 3 waste must comply with Class C Landfill requirements.

3.7 Waste-related authorisations

The waste related activities that require authorization in terms of NEM:WA are listed in **Table 3-4**.

Table 3-4: Waste activities at Ballengeich

Description	Footprint	Listed Activity	Listing Notice
The decommissioning of a facility for a waste management activity listed in Category A or B of this Schedule.	14 ha	Category A12 (activity 14)	GN 921 R - NEMWA
The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a prospecting right or mining permit, in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	14 ha	Category A12 (activity 15)	GN 921 R - NEMWA

3.8 Other Authorisations

As part of the mitigation measures envisaged for Ballengeich Colliery, the construction of artificial induced wetlands as part of a passive treatment process triggers listed activities in terms of NEMA Regulations published in GN 327 (as amended).

Activities which require a Basic Assessment in order to be authorised are listed in Listing Notice 1 in Government Notice (GN) 327(as amended), and Listing Notice 3 GN 324 (as amended):

Indicate the Activity Number:	Provide the relevant Activity (ies) as set out in Listing Notice 1, 2 & 3 (GNR327, GNR325 & GNR324)	Describe each listed activity as per the project description (and not as per wording of the relevant Government Notice 1):
12	Listing notice 1 / GNR327	Installation of two (2) open limestone trenches. Construct two (2) Oxidation ponds of 670m ² each. A stormwater berm will be constructed along the Ngagane River to ensure that there is no spillage of the 1:100-year storm into the Ngagane River.



		The proposed works entail the construction of two (2) additional weirs upstream of the existing weir situated within the Horn River, as well as the upgrading of the existing weir that will increase the existing water surface area by more than 100 m ² .
19	Listing notice 1 / GNR327	Implementation of an aerobic constructed wetland and limestone trenches for the passive treatment of Acid Mine Drainage. Removing soil more than 10 m ² and in filling of trenches with limestone of more than 10 m ² and Construction of two (2) additional instream wires.
22(i)	Listing notice 1 / GNR327	Decommissioning of the existing residue stockpile.
25	Listing notice 1 / GNR327	The Anoxic Limestone drain is designed for a flow rate of 1000m ³ /day. The Successive Alkaline Producing System is designed for 1000m ³ /day. The combined through-punt capacity of both Anoxic Limestone drains for the two(2) passive wetland systems 2000m ³ /day or less.
27	Listing notice 1 / GNR327	Western - passive wetland treatment facility covers an area (3,45 ha) and falls within a CBA (clearance of indigenous vegetation)
34	Listing notice 1 / GNR327	Construction of a new PCD for Quantum Crushing and Screening (Pty)Ltd. Construction of two (2) passive wetland treatment facilities with Anoxic Limestone trenches to treat AMD from underground workings Upgrading of the existing infrastructure of the Coal Siding.



48(i)	Listing notice 1 / GNR327	The proposed works entail the construction of two (2) additional weirs upstream of the existing weir situated within the Horn River, as well as the upgrading of the existing weir, which will increase the existing infrastructure footprint by more than 100m ²
48(ii)	Listing notice 1 / GNR327	The proposed works entail the construction of two (2) additional weirs upstream of the existing weir situated within the Horn River, as well as the upgrading of the existing weir, which will expand the water surface area by more than 100m ²
67	Listing notice 1 / GNR327	The current passive wetland treatment facilities with Anoxic Limestone trenches are approved at a pilot scale level by DWS. Should this structure prove to be effective, it is possible that additional passive wetland treatment facilities could be constructed in the future.
12(d)(v)	Listing Notice 3 / GNR 324	KZN: Critical biodiversity areas as identified in systematic biodiversity plans. The Western Passive Wetland Treatment System will require the clearance of more than 300m ² of vegetation within a Critically Biodiverse Area (CBA)
14(d)(vii)	Listing Notice 3 / GNR 324	The activities related to the construction of the Western Passive Wetland Treatment System fall within a Critically Biodiverse Area 2 (CBA 2) as per KZN C plan information. The activities related to the construction of the Northern Passive Wetland Treatment System within 32m of a water course. The proposed works entail the construction of two (2) additional weirs upstream of the existing weir situated within the Horn River, as well as the upgrading of the existing weir, which will increase the existing infrastructure footprint by more than 100m²
23 (d)(viii)	Listing Notice 3 / GNR 324	The proposed works entail the construction of two (2) additional weirs upstream of the existing weir situated within the Horn River, as well as the upgrading of the existing weir, which will



		increase the existing infrastructure footprint by more than 100m² The activities related to the construction of the Western Passive Wetland Treatment System fall within a Critically Biodiverse Area 2 (CBA 2) as per KZN C plan information. The activities related to the construction of the Northern Passive Wetland Treatment System within 32m of a water course.
26	Listing Notice 3 / GNR 324	The current passive wetland treatment facilities with Anoxic Limestone trenches are approved at a pilot scale level by DWS. Should this structure prove to be effective, it is possible that additional passive wetland treatment facilities could be constructed in the future.



4 PRESENT ENVIRONMENTAL SITUATION

4.1 Climate

The nearest South African Weather Service (SAWS) monitoring station to the Mine is found in close proximity to the town of Newcastle. This is approximately 20 kilometres to the north of the mine and is therefore seen as being a reliable source of information. Therefore, the information reflected in this Section was obtained from WR2005, WR2012, WRC 2015 data.

The area has a very distinctive climate with seasonal variation in rainfall and temperatures. It rarely has extremes such as snow, hail, or temperatures lower than 0°C.

4.1.1 Rainfall data

Monthly and annual rainfall statistics for the project area are given in **Table 4-1**. Newcastle falls in rainfall zone V3B with a mean annual precipitation of 834 mm/year as per WRC 2015. From the rainfall data the average rainfall is in the order of 739 mm/year.

Table 4-1: Rainfall as per WR2012 (mean in mm)

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Year
79.7	120.1	124.8	147.6	124.1	103.4	48.0	19.5	10.9	14.5	17.0	34.9	809

The maximum rainfall intensities obtained from the Newcastle Weather Station were given as 165mm over 24 hours and this event took place on the 18th of October 1965.

4.1.2 Temperature data

The average yearly temperature for the project area ranges from 27 to 35°C (high) and 1 to 4°C (Low). As per the Köppen Climate Classification (Kottek, et al., 2006), the study area is situated in a humid subtropical climate (Köppen: Cfa). The maximum, minimum and mean expected temperatures as derived from the Newcastle Weather Station are provided in **Table 4-2** below:

Table 4-2: Maximum, Minimum and Mean Monthly Temperatures (Degrees Centigrade)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Max	25.8	25.8	40.1	41.6	36.8	31.9	27.1	29.9	36.1	37.2	38.1	33.3	33.6
Min	2.0	-0.6	9.5	11.2	9.9	6.6	3.1	-0.2	4.6	6.5	10.6	4.1	5.6

4.1.3 Wind data

Wind data was obtained from the Environmental Impact Report compiled by Science Associates for the proposed chrome chemicals plant expansion published in July 2009. The data for the reference document was obtained from the Newcastle SAWS station in 2005.

Generally calm and light wind speed conditions (0 – 3 m/s) are experienced in the lower lying valley regions and increases as height increases. The annual average wind speed recorded at the Newcastle SWAS station in 2005 is 2.69 m/s. Wind roses depicting the wind speed and wind direction for the Newcastle SAWS meteorological station is provided in **Figure 4-1** and **Figure 4-2**. From the wind rose, it can be seen that north-easterly winds dominate throughout the year, with the exception of winds which blow from the south in May and from October to December.

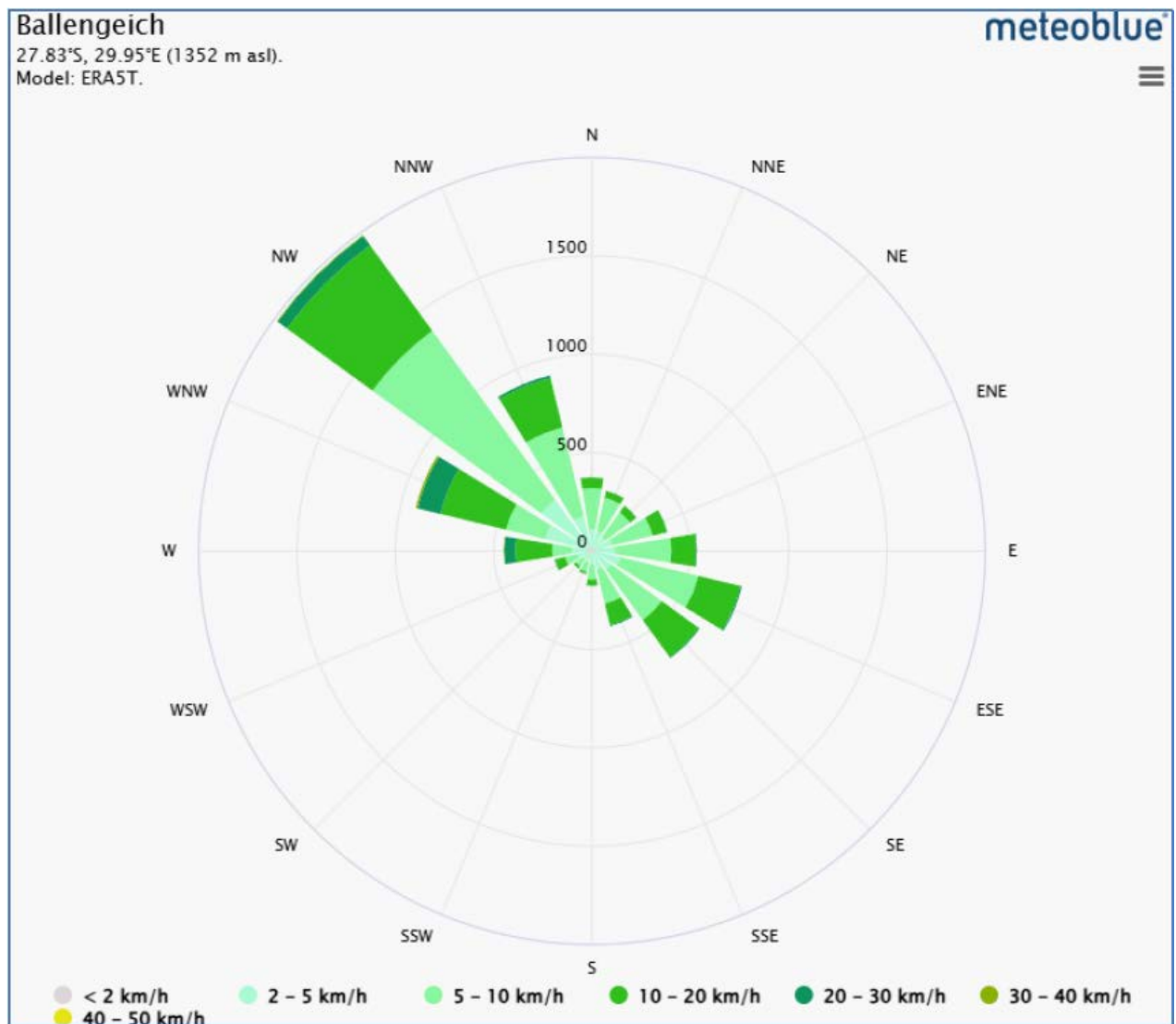


Figure 4-1: Annual wind rose plot for Newcastle (Meteoblue 2025)

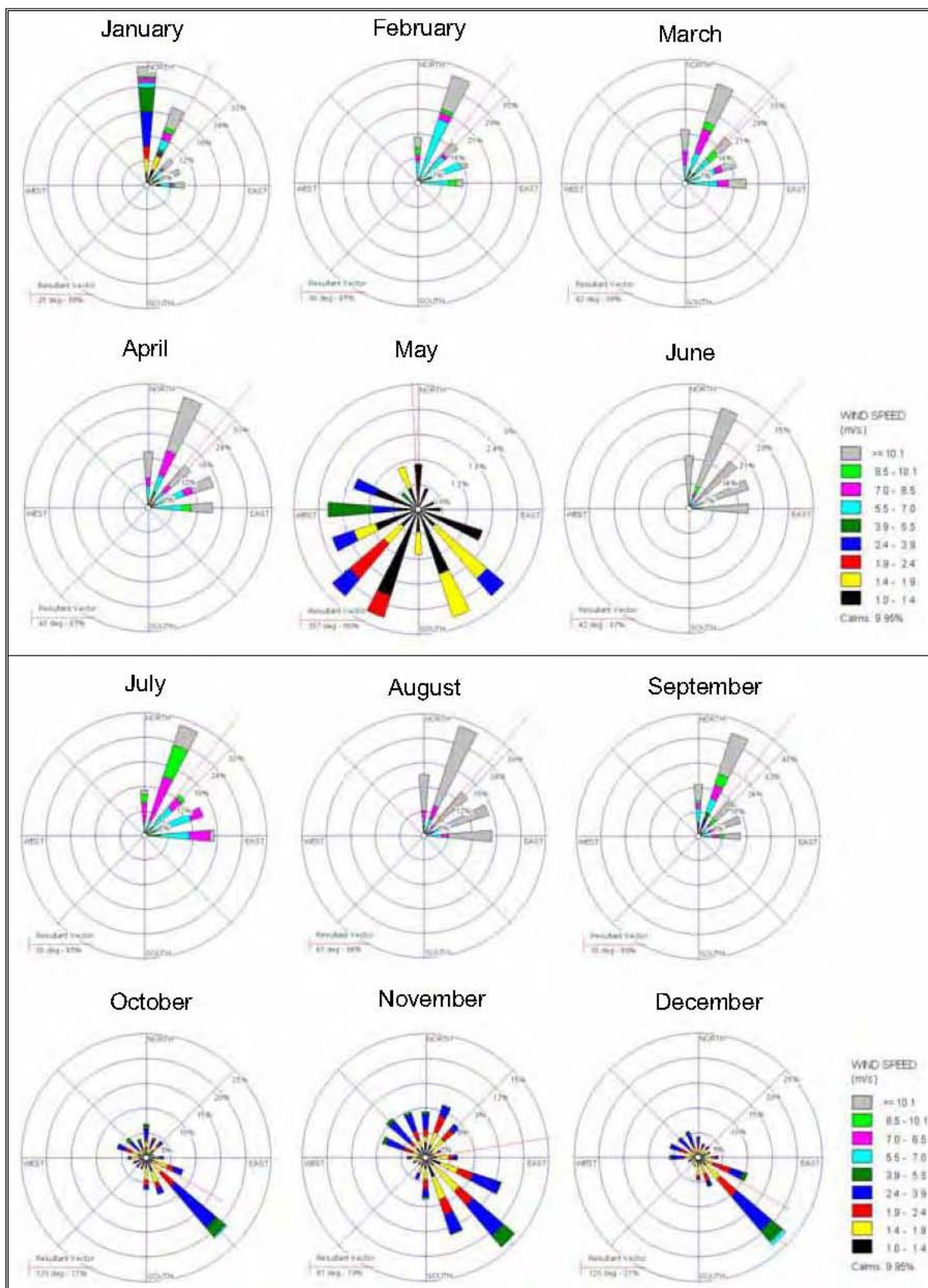


Figure 4-2: Monthly wind roses for the Newcastle SAWS meteorological station (2005)



4.2 Evaporation data

The mean evaporation figures are provided in **Table 4-3** and **Figure 4-3**. The figures are in millimeters (mm). The project area is located in Evaporation zone 21A with an annual A-pan evaporation of between 1800 and 2000 mm per year as per WR2005.

Table 4-3: Evaporation Characteristics (Department of Water Affairs: Site V3E002: Chelmsford Dam, December 1966 – July 2009 (A-pan), October 1964 – July 2009 (S-pan))

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
A-pan	189.3	[195.4]	[219.6]	[208.2]	[170.1]	[157.2]	125.0	107.7	89.9	103.9	144.7	177.6	[1804]
S-pan	149.0	161.0	180.7	[174.4]	[143.3]	134.9	102.5	[86.2]	69.3	77.6	106.2	[134.7]	[1475]
Estimated [] donates missing readings													

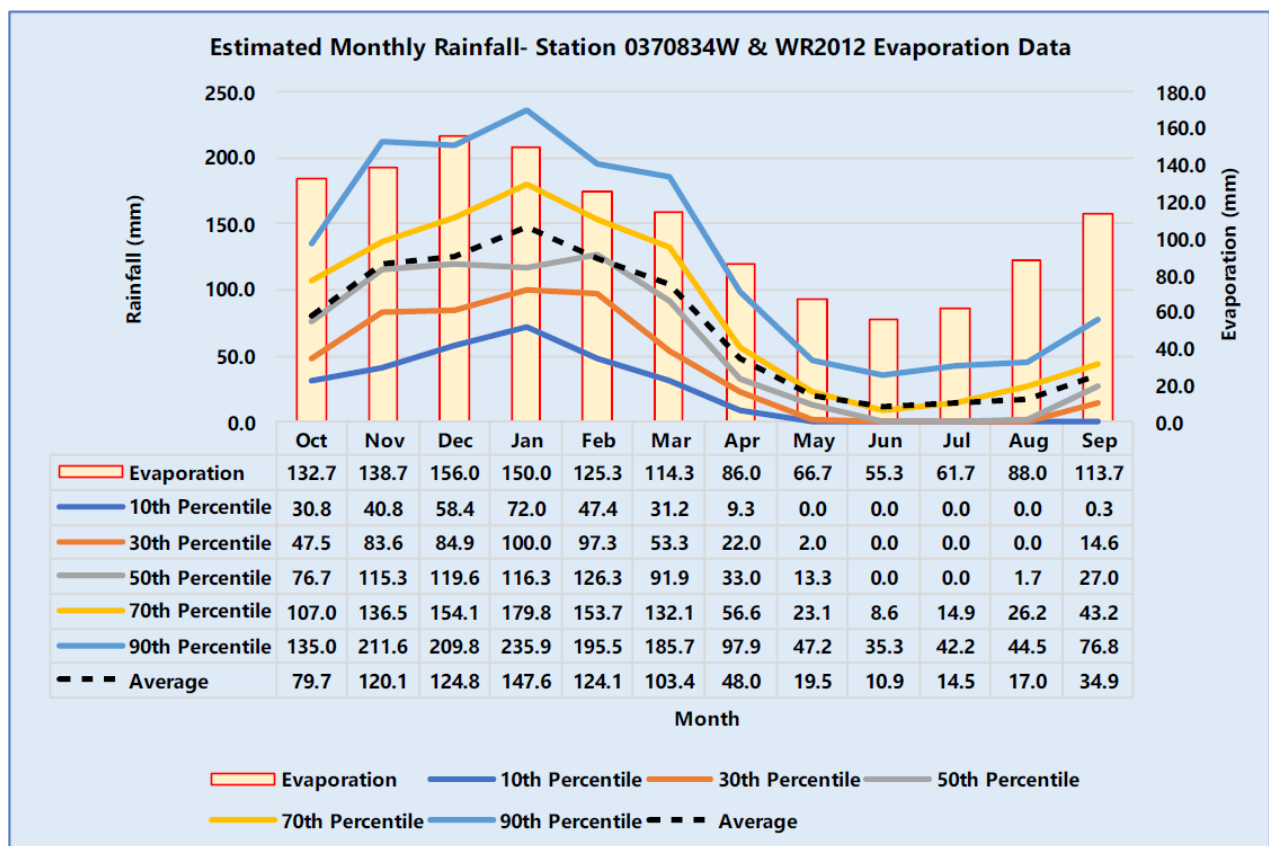


Figure 4-3: Average rainfall for Station 0370834W & WR2012 evaporation
Extreme weather condition prevalence

From the data received from the World Bank Climate Change Knowledge database the following extreme weather conditions occurred and the average number of days for the period 1990 – 2009 is provided in **Table 4-4** below.

Table 4-4: Average number of days from 1962 – 1990 with Thunder, Hail, Snow and Fog (World Bank, Portal 2.0)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Des	Year
Thunder	10	6.8	6.2	3.5	1.1	0.3	0.4	1.3	4.1	7.6	11	10	63
Hail	1.1	0.3	0.1	0.1	0.1	0.1	0.2	0.3	0.2	0.3	0.6	0.5	4
Snow	0.0	0.1	0.0	0.0	0.1	0.2	0.2	0.3	0.1	0.3	0.1	0.0	1
Fog	1.6	1.3	2.6	2.9	3.4	2.9	3.8	2.6	1.8	1.8	0.8	0.7	26



4.3 Surface Water

The site falls within the Pongola-Mtamvuna primary drainage region, lying in the lower reaches of the V31K quaternary catchment as depicted in **Figure 4-3**. The site falls approximately 3 km to the west of the Ngagane River and 300m north of an unnamed tributary feeding the iNgagane River. Other surface water in close proximity to the Study Area includes several other unnamed tributaries and the Ncadu River, which flows into the Ngagane River which eventually merges into the Buffels River which in turn flows into the Thukela River.

4.4 Water Management Area

Ballengeich Colliery is situated in the V31K Quaternary Catchment of the Pongola-Mtamvuna Water Management Area (refer to **Figure 4-4**).

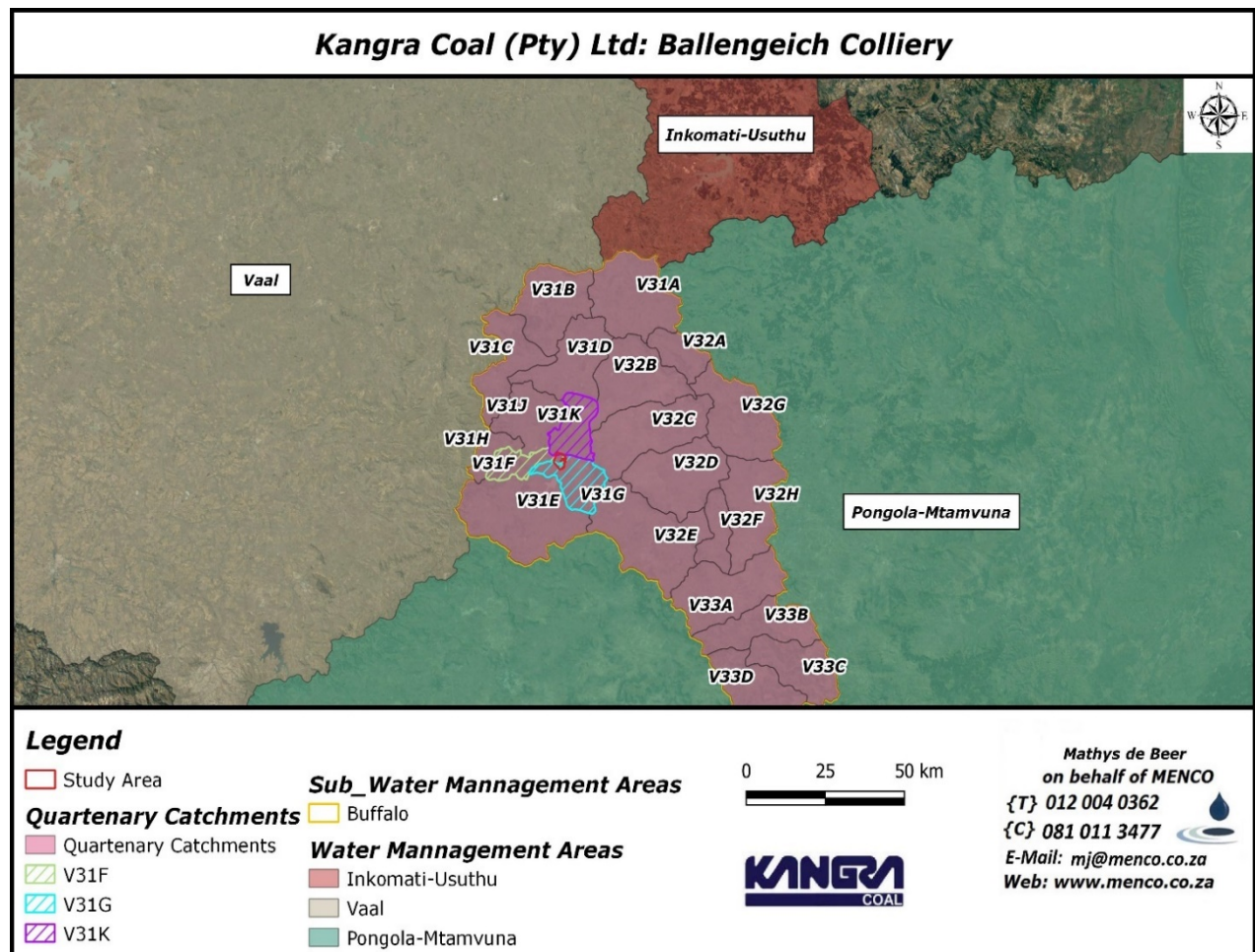


Figure 4-4: Quaternary Catchment Regions



4.5 Surface Water Hydrology

4.5.1 Naturalised Flow

The naturalized flow (as modelled by Gibb Africa, 1999) for the Ngagane River before the confluence with the Buffels River is presented in **Table 4-6**. With the total remaining catchment being less than 5%, **Table 4-7** could be accepted as the naturalized flow at the proposed discharge point.

Table 4-5: Naturalized flow in Ngagane River (m³/d)

Oct	Nov	Dec	Jan	Feb	Mar
7.45	17.324	23.033	32.978	32.248	23.578
Apr	May	Jun	Jul	Aug	Sep
10.409	4.054	2.076	1.770	2.278	4.451

Table 4-6: Naturalized low flow conditions in m³/s, sub-catchment V31K

Oct	Nov	Dec	Jan	Feb	Mar
0.78	1.264	1.664	2.332	1.126	1.209
Apr	May	Jun	Jul	Aug	Sep
1.779	1.069	0.687	0.546	0.514	0.595

4.5.2 Flood Lines

For the purpose of the conceptual closure plan the flood lines were determined for the Horn River downstream of the N11 and for the Ngagane River downstream of the river crossing up to the confluence. The area under investigation falls within Primary Catchment V, the Horn River falls within Quaternary Catchment V31F and the Ngagane River downstream of the Chelmsford Dam falls within Quaternary Catchment V31G.

The catchments were delineated from the 1:50 000 maps to determine the peak flows and flood volumes. The contour drawing was used to extract cross sections along the river centerlines. Flood lines for the 1:50 and 1:100 recurrence intervals were calculated using computer modelling software HEC-RAS.

The peak flows for the catchments were calculated according to the Rational Method. The Rational Method predicts peak runoff values from data on rainfall intensity and drainage basin characteristics. The method assumes that a rainstorm of uniform intensity covers the whole basin. Runoff will increase as water from more distant parts of the catchment area reaches the outlet. When the whole drainage area is contributing, a steady state is reached, and discharge becomes a constant maximum. The time required to reach this steady state is called the *time of concentration*, and after this time, storm flow discharge is a fixed proportion of the rainfall intensity. **Table 4-7** summarizes the peak flows and flood volumes for the sections under investigation of the Horn River and Ngagane River.

Table 4-7: Peak Flows and Flood Volumes

Drainage Area	Recurrence Interval	Catchment Area (km ²)	C - Runoff Factor	Intensity (mm/h)	Modification Factor	Peak Flow (m ³ /s)	Flood Volume (m ³)
Horn	1:50	155.57	0.35	23.2	0.95	350.52	7,759,000
Horn	1:100	155.57	0.35	27.0	1	408.94	9,529,000
Ngagane	1:50	254.67	0.35	31.5	0.95	779.65	12,278,000



Drainage Area	Recurrence Interval	Catchment Area (km ²)	C - Runoff Factor	Intensity (mm / h)	Modification Factor	Peak Flow (m ³ / s)	Flood Volume (m ³)
Ngagane	1:100	254.57	0.35	36.9	1	914.08	15,153,000

The 1:50 and 1:100 flood lines for the Horn River indicate that during flood events, clean water will mix with polluted water in the old Horn River, which is currently utilized to store polluted water. To prevent clean stormwater from entering the polluted areas, it is proposed that a flood control wall be constructed to an elevation of 1183.7 m (approximately 2 m high).

On the Ngagane River side, the walls of the various pollution control dams (evaporation ponds) are situated within the 1:50 and 1:100 flood lines. The top elevation of these walls will have to be checked to ensure the following:

- The pollution control dam to the east of the old coal slurry ponds, currently utilized by Quantum, has been upgraded recently. The minimum elevation of the wall should be 1185.0.
- The pollution control dam wall to the north of the abovementioned dam will have to be upgraded to a minimum elevation of 1184.5.

The walls should be constructed out of selected fill material and compacted as specified by a Geotechnical Engineer. It is proposed that the embankment slopes on the river side be protected against erosion with reno mattresses filled with selected rock.

The flood line elevations for the Horn River and Ngagane River are summarized in **Table 4-8** below.

Table 4-8: Flood Line Elevations

River	Section	1:50 Flood Line Elevation	1:100 Flood Line Elevation
Horn	H1	1182.70	1183.40
Horn	H2	1182.60	1183.30
Horn	H3	1182.30	1182.90
Horn	H4	1181.40	1181.60
Ngagane	N1	1183.30	1183.80
Ngagane	N2	1182.70	1183.0
Ngagane	N3	1181.60	1181.90
Ngagane	N4	1181.50	1181.80
Ngagane	N5	1181.40	1181.60

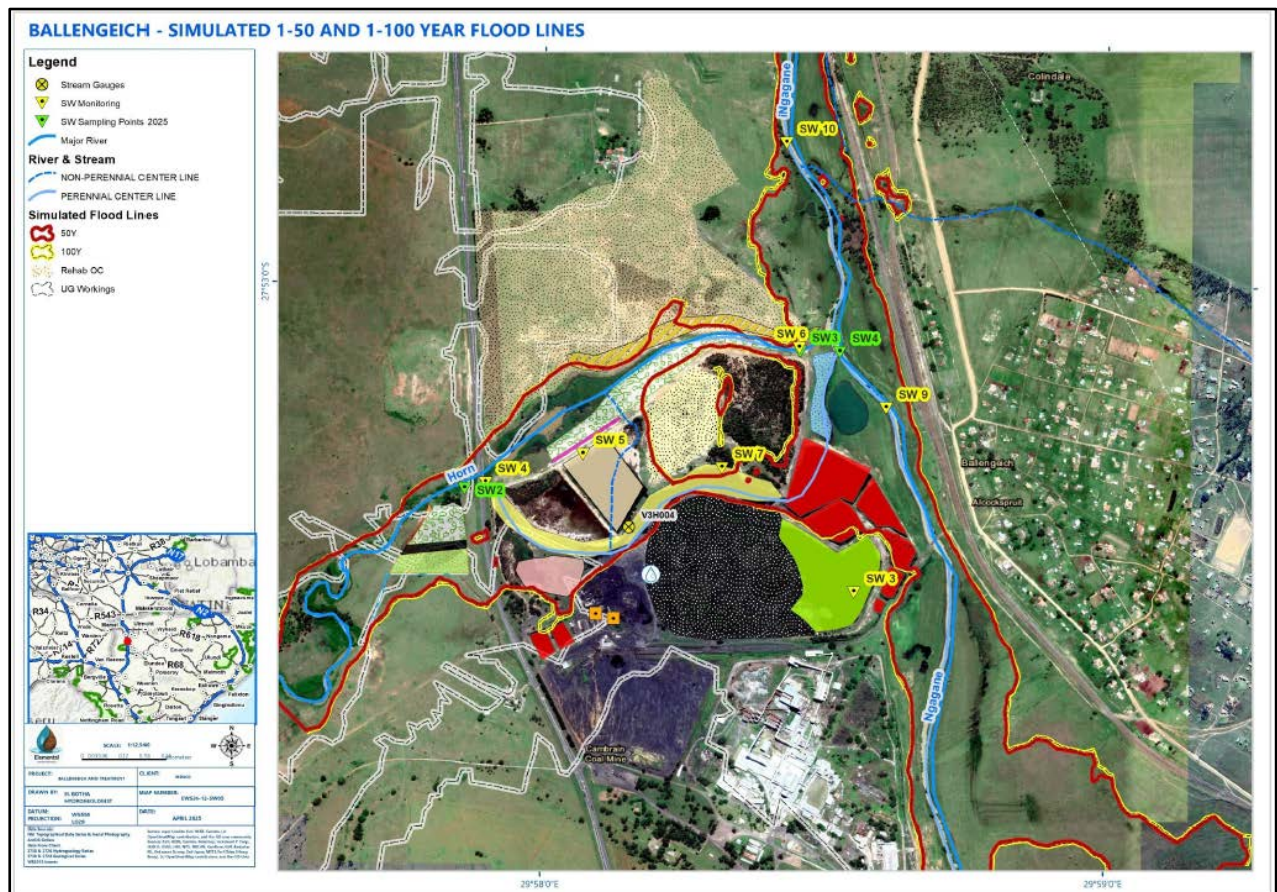


Figure 4-5: 1:50 and 1:100 Flood Lines

4.6 Surface Water Quality

The Directorate: Resource Quality Studies of the DWS operates several monitoring stations in the Ngagane River. Water quality data representative of the Ngagane River was taken from WMS Monitoring Station 188872 at the Ballengeich Weir at location 29°58'27.0"E and 27°53.06'2"S for the period 22 March 2006 to date. The historic water quality data is represented in **Table 4-9**. Site specific water quality for the Ballengeich Colliery is contained in **Table 4-10**.

Table 4-9: Water Quality in the Ngagane River

Variable	Unit	Mean	Maximum	Minimum
Total Dissolved Solids (TDS)	mg/l	481	4320	72.2
Electrical Conductivity (EC)	mS/m	82	130	6
pH	-	6.5	7.6	2.8
Sodium (Na)	mg/l	24	398	6.2
Potassium (K)	mg/l	2.4	9.3	0.4
Calcium (Ca)	mg/l	46.5	343	3
Magnesium	mg/l	46.0	960	2
Chloride (Cl)	mg/l	2.5	280	2.5
Sulphate (SO ₄)	mg/l	317	3180	23.6
Total alkalinity (TAL)	mg/l	24	48	5
Fluoride (F)	mg/l	0.54	1.82	0.025



Variable	Unit	Mean	Maximum	Minimum
Phosphate (PO ₄)	mg/l	0.05	0.19	0.05
Total Phosphorous (P)	mg/l	7.5	7.5	0.82
Nitrate/Nitrate (NO ₂ /NO ₃ as N)	mg/l	0.435	0.82	0.04
Ammonia (NH ₄)	mg/l	0.42	2.84	0.04
Silica (SiO ₂)	mg/l	7.59	68.6	0.5

Considering the water quality data in the Ngagane River it is evident that seasonal fluctuation occurs. Several coal mining related activities in the catchment of the Ngagane River has already caused water quality degradation during low flow conditions. In this instance it was already reported that the pH has decreased to low as 2.8, with increased TDS as high as 4320 mg/l as well as SO₄ concentrations in the excess of 3000 mg/l. Overall the mean water quality data of the Ngagane River shows a slightly impaired condition with the water quality range within acceptable limits. Variables such as EC at 82 mS/m and SO₄ at 317 mg/l exceed the TWQR for potable water.

The long-term surface water quality in the area of the Mine (including Mine water) is provided in **Table 4-9** and compared to the interim Water Quality Objectives as seen in **Table 4-17**. From this data it is clear that the decant water in general is of a poor quality. The impact of Mine activities on surface water quality is moderate, as for most variables almost no negative changes are registered between monitoring points Horn US (up-stream) and Horn DS (down-stream). However, the most notable change in water quality is sulphate (SO₄) which increases from a mean of 300 mg/l upstream to 509 mg/l downstream of the Mine. Electrical conductivity concentrations also seemed to increase from 80 mS/m upstream to 115 mS/m downstream, going above the Target Water Quality Range of 70 mS/m. Even though the mean Sulphate concentration in the PCD of >3000 mg/l as well as the decant (>4000 mg/l) are far above the Target Water Quality Range of 200 mg/l, the temporal scale of sulphate spikes associated with AMD discharges towards the Horn River, ultimately having a very low potential of causing any negative impacts downstream of the confluence with the Ngagane River as the SO₄ levels are well within the RQO of 200 mg/l.

While upstream has a lower concentration, Calcium (Ca), Magnesium (Mg), Aluminium (Al) and Iron (Fe) seems to have similar increasing trends downstream compared to the mine water quality in the PCD and AMD decant. However, it is suggested that this trend can be explained by the lower pH that contributes towards mobilisation of heavy metals that seeps with groundwater as diffuse source of pollution towards the Horn and Ngagane Rivers.

In comparison, water quality at Ballengeich Colliery is indicative of a deterioration condition within the sub-catchment, implying that the Mine operation has significant pollution potential.



Table 4-10: Water quality taken at Ballengeich Colliery (December 2023)

Variable	Unit	Decant	PCD	Horn US	Horn DS2	Horn DS1	Ngagane US	Ngagane DS
pH		3,3	2,6	7,6	6,3	7,1	7,1	7,3
Electrical conductivity as EC	mS/m	735	500	81	115	88	42	35
Total Dissolved Solids as TDS	mg/l	7111	4552	213	265	253	45	43
Total alkalinity (TAL) asCaCO ₃	mg/l	<5	<5	56	24	56	68	72
Chloride as Cl	mg/l	168	29	7	12	9	14	11
Sulphate as SO ₄	mg/l	4379	3036	300	509	334	67	88
Dissolved Oxygen as DO	mg/l	8,7	8,9	9,4	7,2	8,8	8,5	8,8
Sodium as Na	mg/l	1006	261	21	51	29	32	37
Potassium as K	mg/l	36	8,6	2,5	3,3	2,9	2,3	2,3
Calcium as Ca	mg/l	531	414	61	85	66	17	16
Magnesium as Mg	mg/l	511	281	51	75	57	13	10
Aluminium as Al	mg/l	0,568	151	<0,100	0,148	<0,100	0,443	0,582
Total Iron as Fe	mg/l	8,83	57	<0,025	0,042	<0,025	0,251	0,237
Ferrous Iron as Fe ²⁺	mg/l	0,146	0,462	<0,025	<0,025	<0,025	0,032	0,082
Ferric iron as Fe ³⁺	mg/l	8,68	56	<0,025	<0,025	<0,025	<0,025	0,155
Manganese as Mn	mg/l	4,22	16	0,735	1,84	0,882	0,145	0,136

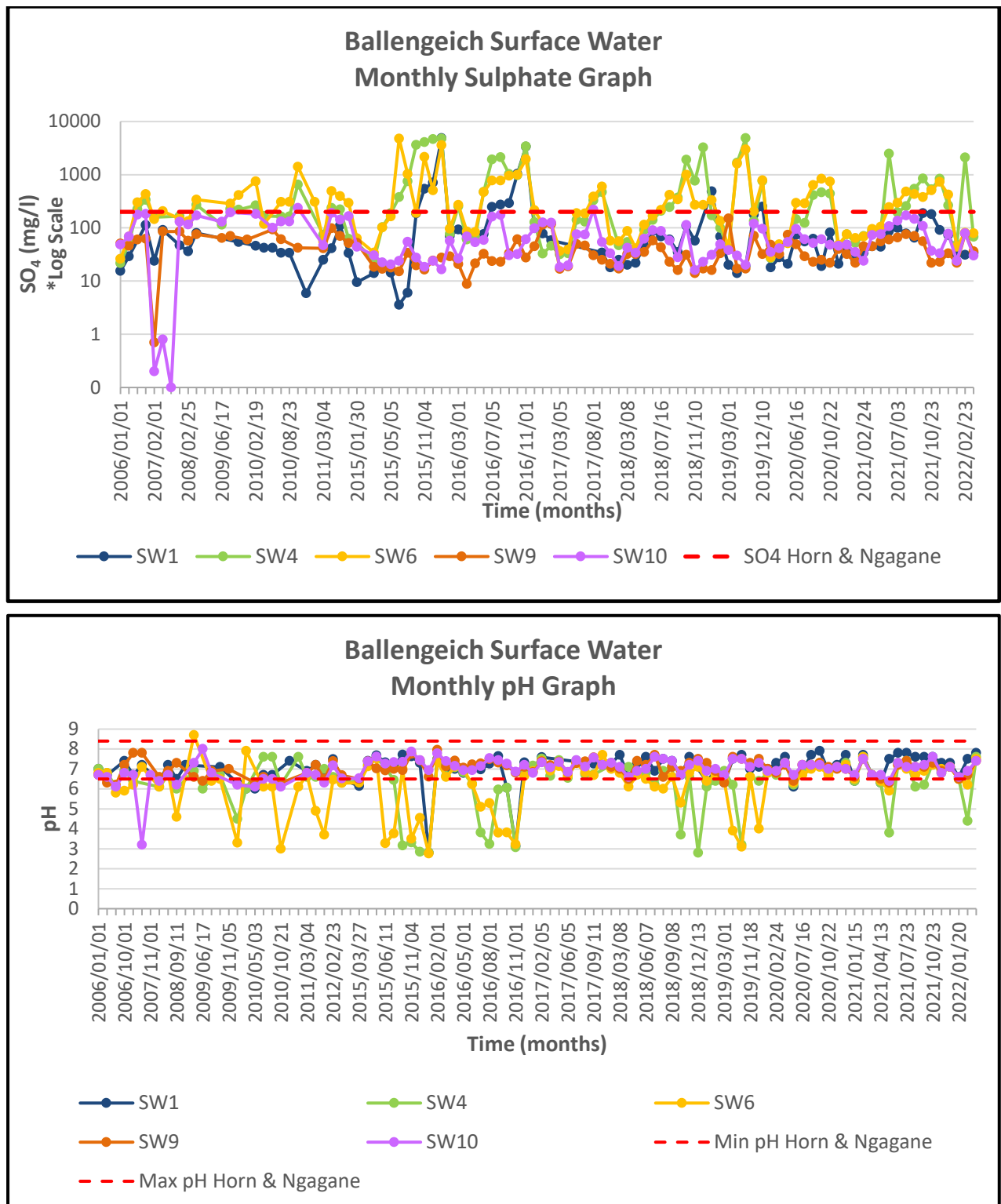


Figure 4-6: Water quality graphs for surface in Horn and Ngagane Rivers



Kangra Coal (Pty) Ltd: Ballengeich

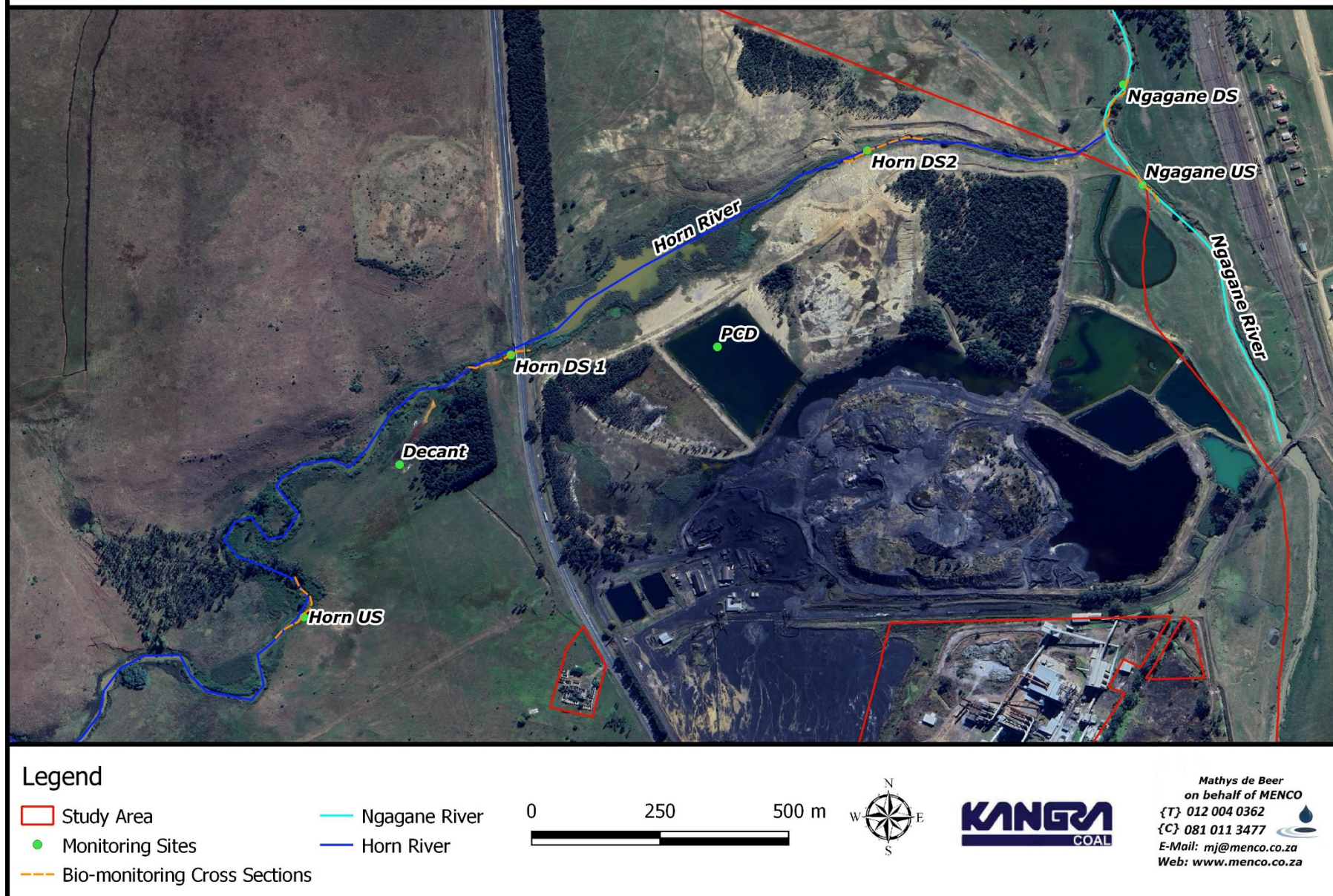


Figure 4-7: Map showing points of water quality sampling



4.7 Mean Annual Runoff

Due to the mountainous nature of the Thukela WMA and its proximity to the Indian Ocean, the rainfall is high by South African standards, ranging from over 1 500 mm per annum in the mountains to about 650 mm per annum in the central parts of the catchment. As a result of the high rainfall, there is substantial runoff from the Thukela catchment, with the Mean Annual Runoff (MAR), estimated at 3,799 million m³/a (DWAf, 2004). Rainfall is however erratic and years of prolonged drought in the central and lower catchment alternate with very wet periods.

If the rainfall data presented in the **Table 4-1** above is taken into consideration, it could be concluded that December, January and February combined, contributes to 50% of the project area's MAR. The MAR for the Horn River is summarised in **Table 4-11** below:

Table 4-11: Mean Annual Runoff (MAR)

Catchment	Area (km ²)	MAR
Horn River	155	3,7 Mm ³ /a
Ngagane River	3948	469,9 Mm ³ /a

The maintenance and drought flows required for the Ngagane River is indicated in **Table 4-12**.

Table 4-12: Maintenance and Drought flows required for Ngagane River

Month	Low Flows (m ³ /s)	
	Maintenance	Drought
October	0,366	0,091
November	0,560	0,068
December	0,762	0,051
January	1,138	0,527
February	1,541	0,711
March	1,269	0,587
April	0,928	0,433
May	0,539	0,202
June	0,326	0,112
July	0,243	0,123
August	0,234	0,119
September	0,273	0,111

4.8 Resource Class and River Health

The Ecological Status (EcoStatus) of a river refers to its overall condition or health, i.e. the totality of the features and characteristics of the river and its riparian areas, which manifests in its ability to support a natural array of species. This ability relates directly to the capacity of the system to provide a variety of goods and services.

The overall Eco Status for the part of the V31K in which Ballengeich Colliery falls is Moderately Impaired (Class C/D) (refer **Table 4-13**) and comprises the following indices:

- In-stream Habitat Integrity
- Riparian Zone Habitat Integrity
- Fish Assemblage Integrity
- Macro-invertebrate Integrity
- Water Quality



The Ecological Importance and Sensitivity is Moderate – monitoring data scores can be attributed to the diversity of species and habitat types within this reach of river, primarily the result of minor modifications of flows and of channel morphology.

Table 4-13: EISC and PES of the applicable water courses

Attribute	Project Details
Water Management Area	Pongola-Mtamvuna
Quaternary Drainage Region	V31K
Rivers	iNgagane River and its unnamed tributaries
DWA RQO PES	Class C
EISC	Class D
SANBI 1999 PES	Moderate

4.9 Surface Water User Survey

Due to the relatively poor state of the natural surface water resources within the V31K quaternary catchment and the WMA in general, it is advised to look at the existing infrastructure and waste water infrastructure that is already impacting onto the surrounding environment. Major water and wastewater infrastructure in the Pongola-Mtamvuna WMA is described below. This information is a combination of data retrieved from the then Thukela WMA¹, Mvoti-Mzimkulu WMA² and Usutu-Mhlathuze WMA³ that now form the Pongola-Mtamvuna WMA.

Surface water users in the within the Buffalo System is detailed in the Infrastructure Master Plan developed for the catchment (Umgeni Water, 2020). From this Master Plan it could be derived the water users in the vicinity of Ballengeich being the following:

- Horn River:
 - o Irrigation upstream of Ballengeich.
 - o Livestock watering along the entire river.
 - o Limited informal domestic use, only further upstream.
 - o Natural aquatic environment.
- Ngagane River:
 - o Newcastle Water Works – potable water treatment plant (the Ngagane River provides the conduit to transport water from Ntshingwayo (Chelmsford) Dam to the water treatment plant on the Ngagane River near Newcastle),
 - o Potable water to Madadeni, Osizweni, Emadlageni, Blaauwbosch, Waterval, Alcockspruit, Northdown, Signal Hill (all fed from the Ngagane WTP);
 - o ArcelorMittal Newcastle Works.
 - o Siltech Potable Water Treatment Plant.
 - o Informal domestic use.
 - o Irrigation for moderately sensitive crops.
- Livestock watering.
- Natural aquatic environment.

This is common amongst most of the South African watercourses as the management practices in the areas are inadequate and this leads to a system that is continually degrading. The main impacts in this area are seen as domestic and industrial, with agriculture and mining not seen as a major contributor towards the poor environmental status.

The waste water and sewage from the Newcastle Municipality is currently treated at three major plants:

¹ ISP: Thukela WMA V1 (2004)

² Eastern Region ISP: Mvoti-Mzimkulu WMA (2004)

³ISP: Usutu-Mhlathuze WMA (2004)



- Newcastle (KwaMathukuza) Waste Water Treatment Plant: The works currently serves the Newcastle Central Business District, the industrial and surrounding areas. The works has a design capacity of 25 MI/day and is currently running at 20 MI/day Average Dry Weather Flow. The Works have a spare capacity of 5 MI/day and will serve future housing developments at Viljoen Park and Tuam Farm.
- Osizweni Waste Water Treatment Plant: The Works' catchment is the greater Osizweni Township and the surroundings. The current capacity of the Works is 14 MI/day and the current hydraulic loading is 15 MI/day. The Works is currently running at capacity in terms of hydraulic loading, but the biological loading is below design capacity.
- Madadeni Waste Water Treatment Works: The catchment area for Madadeni WWTW is the Madadeni Township, Ithala Industrial area, and the surrounding areas. The design hydraulic loading is 12 MI/day. The Works are currently operating at 15MI/day. However, during the wet season, the flows peak at between 25MI/day to 30MI/day due to high infiltration. Plans have been made to increase the hydraulic capacity to 35MI/day. It is envisaged that future flows from Blaauwbosch, Johnstown and Cavan will be directed to Madadeni WWTW.

There are a number of large dams in the then Thukela WMA, some of which make up the Thukela Vaal Transfer Scheme. The largest of these is Woodstock Dam, from which water is released to the Driel Barrage near Bergville. Water is then pumped into a canal that conveys this water to the Kilburn Dam, from which it is pumped over the escarpment from the Kilburn Dam into the Driekloof Dam (at the upper end of the Sterkfontein Dam). Spioenkop Dam supplies the downstream requirements of Ladysmith and irrigated agriculture. In future the dam could be used to supplement flows in the lower Thukela to ensure that the water requirements of the Fairbreeze Mine, the Sappi mill at Mandini and the ecology are met. Other significant infrastructure is Zaaihoek Dam on the Slang River (a tributary of the Buffalo River) with its related pump station and pipeline. This scheme, situated in the northern part of the WMA, was constructed primarily to transfer water to the Eastern Vaal sub-system. Some water is also released to local users. Ntshingwayo Dam (formerly Chelmsford Dam) in the Buffalo River in the northern part of the WMA supplies water to Newcastle, while Wagendrift Dam in the Bushmans River near Escourt supplies water to irrigators and the town of Escourt.

Major water and wastewater infrastructure in the Pongola-Mtamvuna WMA can be seen in **Table 4-14** below.

Table 4-14: Brief overview of major potable and wastewater infrastructure within the Mvoti-Mzimkulu WMA

Raw water infrastructure (Constructed Dams within Major Rivers)	Major potable infrastructure (Waterworks; flow exceeding 10 MI per day)	Major wastewater infrastructure (Wastewater works; flow exceeding 10 MI per day)
• Midmar dam (Mgeni) • Albert Falls dam (Mgeni) • Inanda dam (Mgeni) • Nagle dam (Mgeni) • Hazelmere dam (Umdloti) • Shongweni dam (Umlaas) • EJ Smith dam (Umzamaai) • Mzinto dam (Mzinto)	• DV Harris waterworks (Pietermaritzburg) • The Midmar waterworks (Howick) • The Durban Heights waterworks (Pinetown) • Umlaas Road waterworks • Amanzimtoti waterworks • Mzinto waterworks • Bhobhoyi-Umzimkulu waterworks • Umtamvuna waterworks • Kokstad waterworks	• Darvill wastewater works (Pietermaritzburg) • The Northern wastewater works (Durban) • Southern wastewater works (Durban) • Sappi Saiccor wastewater works (Umkomaas) • Tongaat wastewater works • Stanger wastewater works • Sappi Fire Paper works (Stanger) • Mondi Southern sewerage works • KwaMashu wastewater works



	• Sappi Saiccor waterworks (Umkomaas) • Craigieburn waterworks • Mtwalume waterworks	• Phoenix sewerage works • Umbilo purification works • Central wastewater works (Durban) • Amanzimtoti sewerage works • Phoenix sewerage works • AECl works (Umbogontwini)
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Several major dams have been constructed in the Usutu-Mhlatuze WMA. A list of all registered dams can be seen in **Table 4-15**.

Table 4-15: Dams and natural lakes in the Usuthu-Mhlatuze WMA

Dam Name	Live Storage Capacity (million m ³)
Goedertrouw	304
Lake Cubu	6.5
Lake Nsezi	2.9
Lake Msingazi	38
Lake Nhlabane	39.7
Lake Sokhule	2.2
Bloemveld	2.3
Grootfontein	0.7
Grootgewaagd	1.1
Klipfontein	19.0
Sokhulu	4
Boulder	1.5
Kranskop	2.1
Mhlabinyati	2.6
River side	1.2
Silver Sands	3
Silver Sands No 2	2.5
Hluhluwe	25
Pongolapoort	2448
Heyshope	453
Morgenstond	101
Jericho	60
CJ van Rooyen	3.7
Westoe	6.1
Burgers	1.4

4.10 Sensitive Areas Survey

According to the Environmental Management Framework (EMF) for the Amajuba District Municipality (Institute of Natural Resources, 2019), the upper reaches of the Ngagane and Horn Rivers are densely populated with wetlands. These wetlands are areas of high biodiversity and provide many ecosystem services inclusive of water purification, flood control, groundwater replenishment and sediment control. These wetlands are also important from an eco-tourism perspective as it contributes economically towards the areas known birding region with more than 400 bird species identified. There is a high emphasis on avi-fauna tourism in promoting continued economic growth within the Amajuba District Municipality.

Please refer to **Figure 4-7** for the sensitive areas within the catchment.



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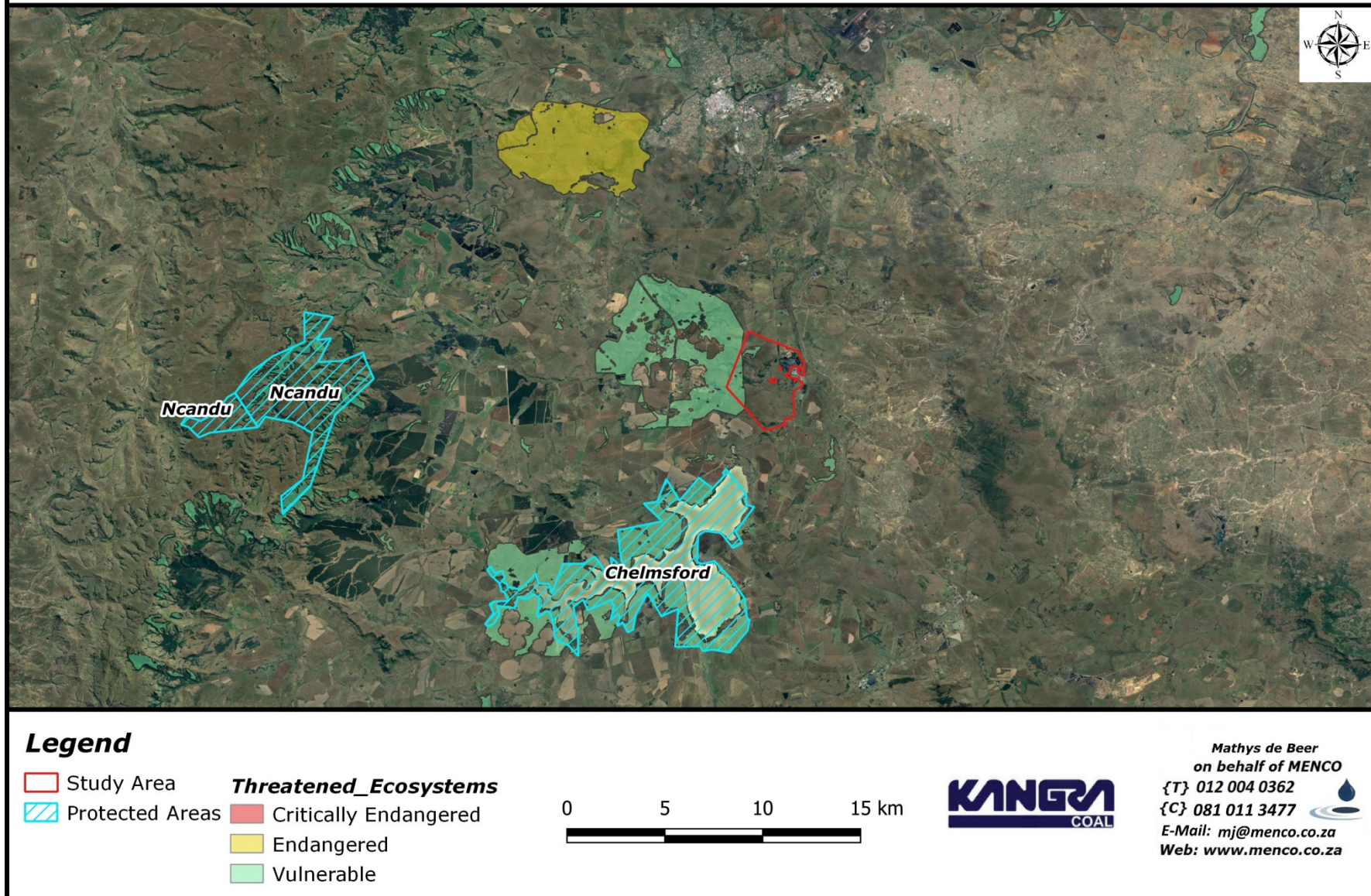


Figure 4-8: Threatened eco-systems within V31K catchment



4.11 Groundwater

4.11.1 General Geology

Ballengeich Colliery is situated almost in the center of the Klip River Coalfield of Northern Natal, within the Newcastle area. It comprises Carboniferous and Permian sediments of the Dwyka Formation and Ecca and Beaufort Groups of the Karoo Supergroup, which were deposited on an undulating glaciated surface.

The coal zone is found within the Vryheid Formation, the lower part of which comprises a delta dominated upward coarsening sediments of shale, siltstone and sandstone. The coal zone itself comprises upward fining fluviially dominated sediments with shale and coal seams separated by sandstone partings. The upper Vryheid and Volksrust Formations again comprise upward coarsening delta dominated deposits.

The coal seams in the coal zone are made up of three seams, a lower # 3 Seam (0.4m thick), a bottom seam (1.3 m thick) and an upper top seam (3.25 m thick). Of the three only the bottom and top seams have been commercially exploitable. As far as can be ascertained, only the top seam has been mined at Ballengeich Colliery. The site-specific geology is illustrated in **Figure 4-8**.

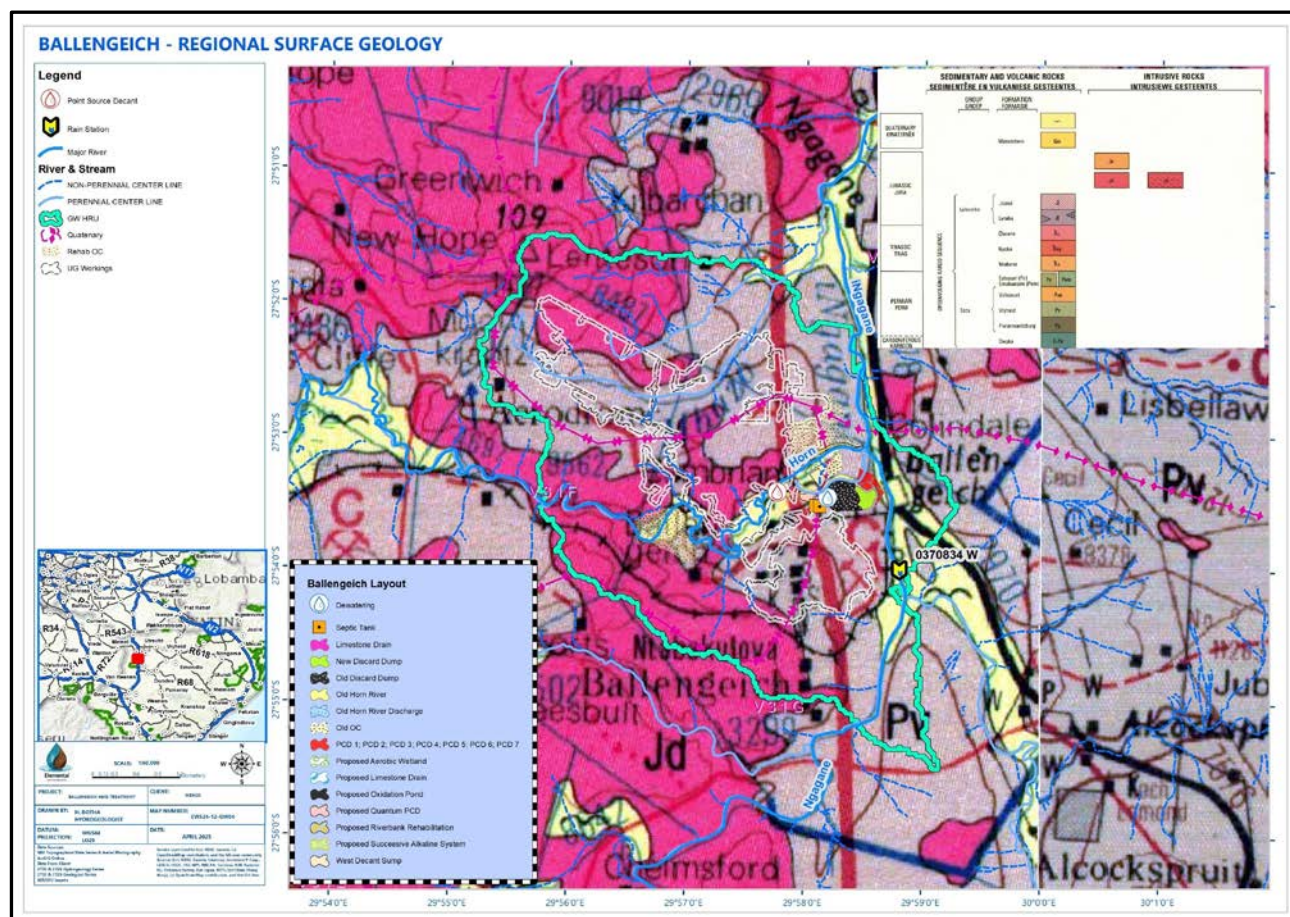


Figure 4-9: Geological profile

The Karoo sediments themselves are almost horizontal with a gentle dip to the south. Apart from minor faulting, all tectonic disturbances can be attributed to intrusive dolerite sills which vary from concordant to transgressive in nature. Associated with the sills are numerous dolerite dykes. The main dolerite sills associated with the area of the Ballengeich Section are the "A" and



Ingogo Dolerites. Between the eastern opencast and the underground sections, a displacement of some 40 m is evident as a result of a transgressive sill.

The erosion surface appears to be typical of the Post African Erosion Surface. The Post African Erosion I and II cycles having occurred during the Miocene (about 20 Ma) and Pliocene (about 5 Ma) respectively, resulting in undulating topography and wide valley floors such as that found at Ballengeich.

4.11.2 Regional Geohydrology

The geology of the project area is characterised by Karoo Supergroup. This indicates that the average regional piezometric surface is topographically controlled, with groundwater generally draining towards surface stream channels. Water strikes are typically encountered within twenty meters of the surface, and static water levels are usually recorded between 5 and 25 meters below ground level. The results of borehole drilling further support the concept of topographic control on the piezometric surface.

Regionally, the aquifer system within the Karoo Supergroup is considered to comprise a non-continuous, multi-layered system. Based on the geological characteristics of the area, the following aquifer types are inferred:

Shallow perched aquifer: This aquifer is largely independent of the underlying geology and is typically perched on a well-developed pedogenic horizon, or occurs at the shallow interface between soil and bedrock. This shallow (1.0–5.0 m) perched or temporary water table is commonly found at the base of permeable sandy hill-wash material, either resting above or within the ferruginous horizon, above the residual soil, or at the residual soil–bedrock interface. Groundwater flow generally follows the topography and may approach the surface in topographic lows.

Fractured Karoo rock aquifers: Extractable groundwater within sandstones and shales is generally associated with water-bearing fractures or fractured contacts adjacent to intrusive dykes or sills. Overall, the groundwater potential of these aquifers is considered moderate to low. However, higher yields have been reported where boreholes are located within low-lying floodplains or alluvial valleys. In such settings, abstraction from shallow (1–5 m deep) perched water or alluvial aquifers is often feasible. Enhanced recharge from the perched aquifer to the underlying fractured rock or contact aquifers may result in increased yields from deeper boreholes. Structural features such as dykes, geological contacts, and faults may act as impermeable barriers, along which storativity and transmissivity can be enhanced. The permanent water table is generally encountered at depths of approximately 5–15 metres below ground level.

Aquifers associated with dolerite intrusions: Permanent groundwater commonly occurs within the upper portions of weathered and jointed dolerite sills in the region. Recharge to these semi-confined fractured rock aquifers may occur via leakage through remnant joints within the residual soils, or in areas where residual soils are thin or absent. The depth to the permanent water table is typically in the order of 5–15 metres below ground level.

Aquifers associated with coal seams: Groundwater is often associated with the margins of coal seams or with clastic partings within the seams.

4.11.3 Coal Floor elevation

Coal floor elevation data was obtained from the old mine plans, data on the maps were digitized and contoured (Figure 3-1). The mine floor / coal floor elevation is between 1 144 and >1 180 mamsl. The mine floor forms a depression between the two opencast mine areas. The



depressed area was mined during the underground phase. Based on the available data the coal floor can be described as representing a syncline with an almost north-south striking axis. In the north of the Ballengeich area, the axis turns towards the northwest.

The floor elevations were compared to the topographical elevation. In opencast areas, the pit floor varied between 10 and 35 m below ground level (refer to **Figure 4-9** for the coal floor contours). It can be seen that the coal floor sub-outcrop is generally shallow along the Horn River and in general east of the N11 national road. Underground mine areas range between 25 and 150 meters below ground level (mbgl). The average depth below ground level, for the majority of the underground area, ranges between 65 and 95 m.

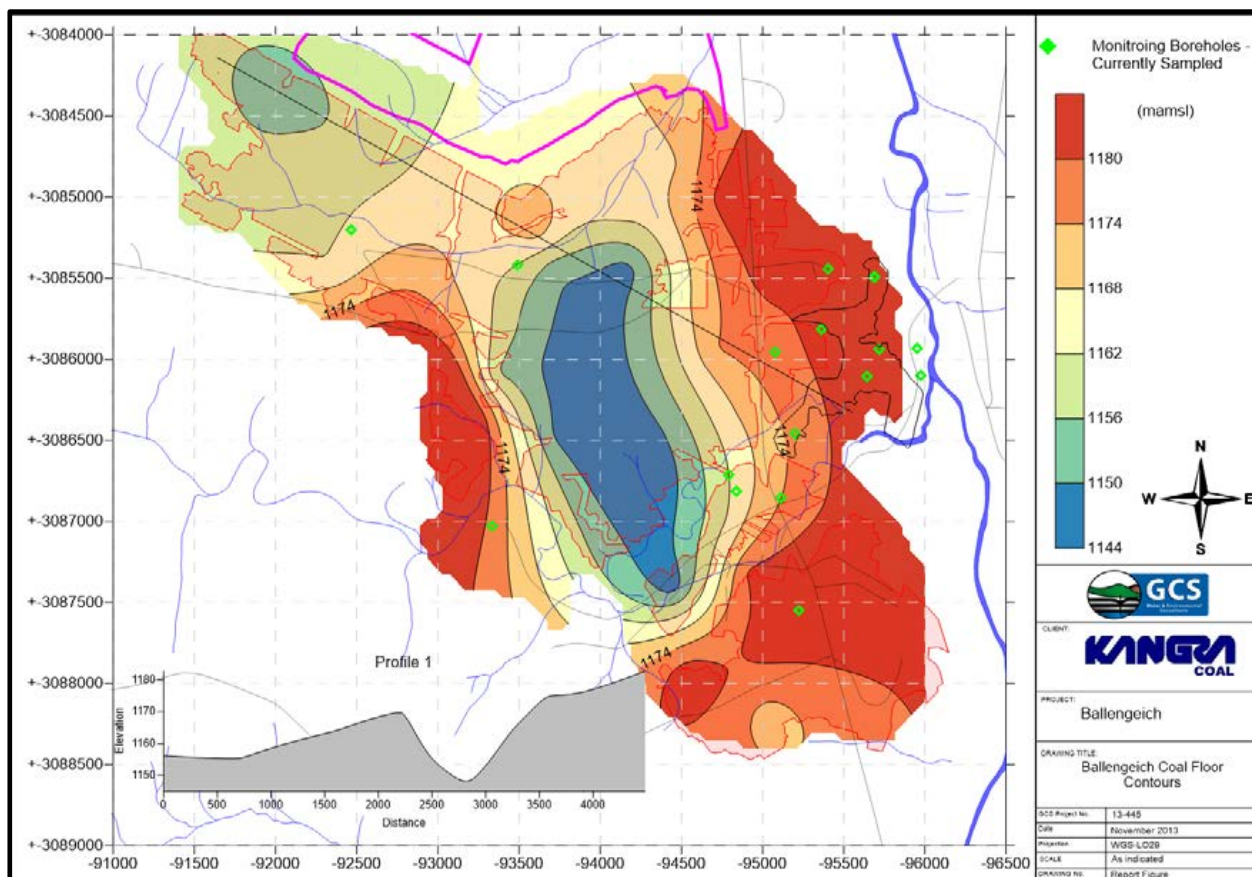


Figure 4-10: Coal floor contours

4.12 Aquifer Characterisation

The Ballengeich Colliery is underlain by sedimentary rocks of the Vryheid Formation (Ecca Group, Karoo Supergroup), comprising interbedded sandstones, shales, mudstones, carbonaceous shales, and coal seams. Dolerite intrusions are present throughout the sequence. Based on the EWS Hydrogeology Assessment (Report EWS24-12_GW, April 2025), three distinct aquifer systems have been identified at the site:

Shallow weathered aquifer: Developed in the weathered zone of the Vryheid Formation. Groundwater flow rates are slow — between 0.001 and 0.38 m/day — reflecting the low hydraulic conductivity of the weathered sediments. This aquifer is directly influenced by AMD contamination from the overlying mining infrastructure, PCDs, and discard dump. The aquifer stress index is 0.00, confirming the aquifer is effectively unstressed by abstraction.

Fractured rock aquifer (Ecca Group): Developed along joints, fractures, and contact zones between dolerite intrusives and the Ecca Group sediments. Hydraulic conductivities range from



0.4 to 7.7 m/day, with an estimated storativity of 0.001. Borehole yields in the Eccca Group fractured aquifers are generally moderate, ranging from approximately 0.2 to 1.4 l/s. Due to the brittle nature of the rocks, joints and fractures are well-developed, allowing significant groundwater transmission through these aquifers.

Secondary dolerite aquifer: Dolerite intrusions act as secondary aquifers where fractured. Hydraulic conductivities vary widely — from near zero in unweathered massive dolerite to up to 10^3 m/day in highly fractured zones. Fault zones are important high-yielding areas in these rocks. A median yield of approximately 0.4 l/s can be expected in the dolerite aquifer system.

The main source of recharge to the shallow aquifer is direct rainfall infiltration through the unsaturated (vadose) zone. Vertical movement of water is faster than lateral movement, as water moves predominantly under gravity. In its natural uncontaminated state, groundwater quality in the Eccca Group aquifers can be described as generally good, with elevated concentrations of calcium, magnesium, and chloride common in the deeper fractured zones.

However, due to decades of AMD generation at the Ballengeich Colliery, groundwater quality across all three aquifer systems has been significantly compromised. The EWS Hydrogeology Assessment (April 2025) confirmed a sulphate plume with concentrations of 4,000 mg/L at the AMD source (underground workings/decant point), decreasing to approximately 1,000 mg/L at the Horn River — indicating active AMD propagation through the shallow and fractured aquifer systems toward the receiving water resource. Both the Horn and Ngagane Rivers have been confirmed as losing rivers in this reach, meaning they lose water to the surrounding groundwater system, which further facilitates AMD transport. All rivers on site confirming losing river conditions means that AMD-contaminated groundwater continues to migrate toward and impact the river systems even during periods of low AMD surface discharge.

4.12.1 Typical Aquifer Properties

Unconfined Quaternary Alluvial Aquifer Zones: In areas associated with river systems such as the Ngagane River, Horn River, and the historical Horn River channel at Ballengeich, consolidated alluvial deposits form unconfined aquifer zones. These aquifers are characterised by relatively high porosity and permeability compared to surrounding formations. Recharge to these systems is typically high, estimated at approximately 10–20% of the Mean Annual Precipitation (MAP). Due to their intergranular nature, these aquifers exhibit high storativity, with permeability values generally exceeding those of the underlying weathered and fractured systems.

Shallow Weathered Aquifer Zone (Unconfined to Semi-Confined): The shallow weathered aquifer occurs within the weathered sandstones of the Eccca Group and is typically unconfined to semi-confined in nature. Although multi-layered in reality, the system is conceptualised as a single, interconnected unit. Recharge to this aquifer is derived from rainfall infiltration and is estimated to range between 4% and 6% of MAP. Porosity within this zone is moderate, reflecting its partially weathered and secondary aquifer characteristics, while permeability can vary depending on the degree of weathering and the nature of the overburden material. Typical permeability values are in the order of 10^{-4} to 10^{-8} m/s. The relatively high porosity and weathered nature of the material contribute to moderate storativity within this unit.

Intergranular and Fractured Karoo Rock Aquifer Zone (Semi-Confined to Confined): The deeper fractured aquifer system is associated with the older, less weathered rocks of the Karoo Supergroup (Eccca Group) and is typically semi-confined to confined. Groundwater occurrence is primarily controlled by fractures, joints, and bedding plane discontinuities, with limited primary porosity. Recharge to this unit occurs predominantly via percolation from the overlying



weathered aquifer and is estimated to be in the order of 1–3% of MAP. Effective porosity is generally low to moderate (approximately 5–15%), with high specific retention, resulting in relatively low groundwater yields, as only a small proportion of stored water is released. Permeability values typically range between 10^{-6} and 10^{-8} m/s.

Aquifers Associated with Coal Seams: Coal seams and associated clastic partings within the sedimentary sequence may locally enhance groundwater flow due to increased fracture development and microstructural permeability. These zones can exhibit moderately increased transmissivity and storativity relative to adjacent lithologies, with permeability values typically ranging from 10^{-5} to 10^{-7} m/s. However, the continuity of coal seam aquifers is often limited due to weathering along river valleys and compartmentalisation caused by dolerite intrusions. As a result, these aquifers are typically discontinuous, and their groundwater exploitation potential is considered moderate to low.

Aquifers Associated with Geological Features and Mine Workings: Geological structures such as dolerite dykes and sills may locally enhance aquifer properties by increasing fracture density, thereby improving transmissivity and storativity. The hydraulic properties of these zones are highly variable and dependent on the degree of weathering and alteration of both the intrusive material and surrounding host rock. Permeability in such zones can be significantly elevated, occasionally reaching values as high as 10^{-4} m/s.

In addition, historical underground mining activities have likely resulted in the development of secondary hydrogeological units associated with mine voids and backfilled areas. These zones typically exhibit significantly higher hydraulic conductivity and storage capacity compared to the surrounding rock mass, due to the presence of voids and disturbed material.

Hydrogeological Investigation: Limited borehole drilling was undertaken to confirm the regional hydrogeological conditions, including the average piezometric surface and groundwater levels within abandoned mine workings. This information was used to refine the understanding of regional groundwater flow patterns and to assess groundwater quality.

4.13 Hydro Census

A formal hydrocensus was conducted for the project area. Available data as per the latest groundwater and surface water monitoring were used in the groundwater setup. The boreholes as listed in **Table 7-10** were used in the hydrocensus. The main reason for the current opinion on hydrocensus is because of the location of the Ballengeich mine and its topographical elevation in respect to the rest of the sub-catchment. The site is located at the lowest elevation in the area and no upstream areas can be impacted on. No groundwater users exist in the direct vicinity of the mine area except for one monitoring borehole at the old eastern opencast mine, labelled as GWO. NOTE: Borehole GWO is a monitoring borehole only. No groundwater abstraction takes place from GWO or any other borehole on the Ballengeich site as confirmed by Quantum and Kangra Coal.

4.14 Potential Pollution Source Identification

Groundwater monitoring at Ballengeich started in 1995. The aim of the monitoring is to detect any contamination originating from the old mine workings. Eleven boreholes were installed initially (GW1 to GW11), but only five were used during the 2008 assessments (GW2, GW3, GW4, GW6 and GW8). These groundwater monitoring sites are situated to the north of the eastern opencast workings on the old rehabilitated opencast workings.

During the August 2009 site visit the geohydrologist conduct the siting and drilling of new additional groundwater monitoring boreholes. Six monitoring boreholes (GW12 to GW17) were



drilled, five boreholes were drilled on the old opencast sites and one borehole was drilled on the old underground mine site.

A third phase of monitoring borehole drilling was initiated in the 4th quarter of 2013 and four (4) boreholes were drilled into the underground workings. During the 4th drilling phase in March 2014 boreholes GW20a, GW20b, GW21, GW22 and GW23 were drilled (drilled in March 2014) to fill some identified information gaps. Boreholes GW20a, GW20b and GW21 were drilled hydraulically down gradient of the Siding Area that supplied some idea of groundwater flow and quality conditions emanating from the siding area.

The implementation of the groundwater monitoring programme based on the identified boreholes and the groundwater quality results that were obtained over a 30-year period (1995 -2025) are sufficient to determine the pollution sources at Ballengeich.

4.15 Groundwater Model

Sulphate (SO₄) is the most dominant pollutant at the Ballengeich Colliery and, due to the presence of AMD, iron (Fe), manganese (Mn), and magnesium (Mg) are readily dissolved into solution, elevating metal and non-metal concentrations across all water resources on site. The SO₄ contour map (Figure 4-11; GCS, November 2013) illustrates that the highest sulphate concentrations are associated with the shallow mining areas east of the N11, concentrated around the decant points, opencast workings, and the discard dump.

The estimated groundwater seepage rates from the three AMD source areas, based on historical rainfall data and typical recharge rates for a Karoo aquifer system, are summarised in Table 4-16 above. These figures indicate a total estimated decant of 1,184 m³/day in summer and 829 m³/day in winter, confirming the design flow of 1,000 m³/day used for the passive treatment system.

Table 4-16: Estimated seepage rates

Estimated Decant Volumes	Summer			Winter		
	L/s	m ³ /d	%	L/s	m ³ /d	%
UG Workings	9.7	838	71	6.8	586	71
OC Workings	2.9	255	22	2.1	178	22
Discard Area	1.1	92	8	0.7	64	8
TOTAL	13.7	1184		9.6	829	100

Note: Both Table 4-16 and Figure 4-11 represent historical baseline data from the GCS numerical groundwater model (2013/2014). These have since been updated and superseded by the EWS Hydrogeology Assessment (Report EWS24-12_GW, April 2025), which provides the current authoritative groundwater characterisation for WULA purposes. The EWS assessment confirmed a sulphate plume with concentrations of 4,000 mg/L at source decreasing to approximately 1,000 mg/L at the Horn River, three distinct aquifer systems, and losing river conditions along both the Horn and Ngagane Rivers.

The GCS conceptual model identified that the poor water quality in the Horn River is driven not only by direct seepage from the northern opencast workings, but also by groundwater interflow transmitted along dykes that cross through the area. These dykes act as preferential flow paths through which groundwater is transmitted at greater velocities than through the Karoo aquifer matrix. Seepage into the underground mining network in the north increases water volumes in the southern underground workings, raising the water table and enabling artesian decant where depressions expose the groundwater table.

The EWS Hydrogeology Assessment (April 2025) confirmed and refined this conceptual model, identifying that the artesian AMD decant from the old underground workings (~71% of total AMD load; 1,000 m³/day design flow) is the most chemically aggressive source (pH <4.5; Fe



189 mg/L; SO₄ >4,000 mg/L) and the primary driver of the passive treatment system design. The proposed rehabilitation addresses this conceptual model by targeting all three AMD source areas simultaneously through the two-area passive treatment approaches. The rehabilitation of the opencast areas and discard dump, combined with the passive treatment system, is expected to achieve the following groundwater benefits over the 20-year WUL period:

- Reduced recharge from rainfall through capping and revegetation of the dump and reshaped opencast spoils;
- Progressive stabilisation of groundwater levels and reduced seasonal fluctuations;
- Reduced hydraulic head driving the artesian decant;
- Limited oxygen ingress to pyrite-bearing spoil material, reducing ongoing acid generation; and
- Progressive improvement in the SO₄ plume extent as AMD sources are remediated.

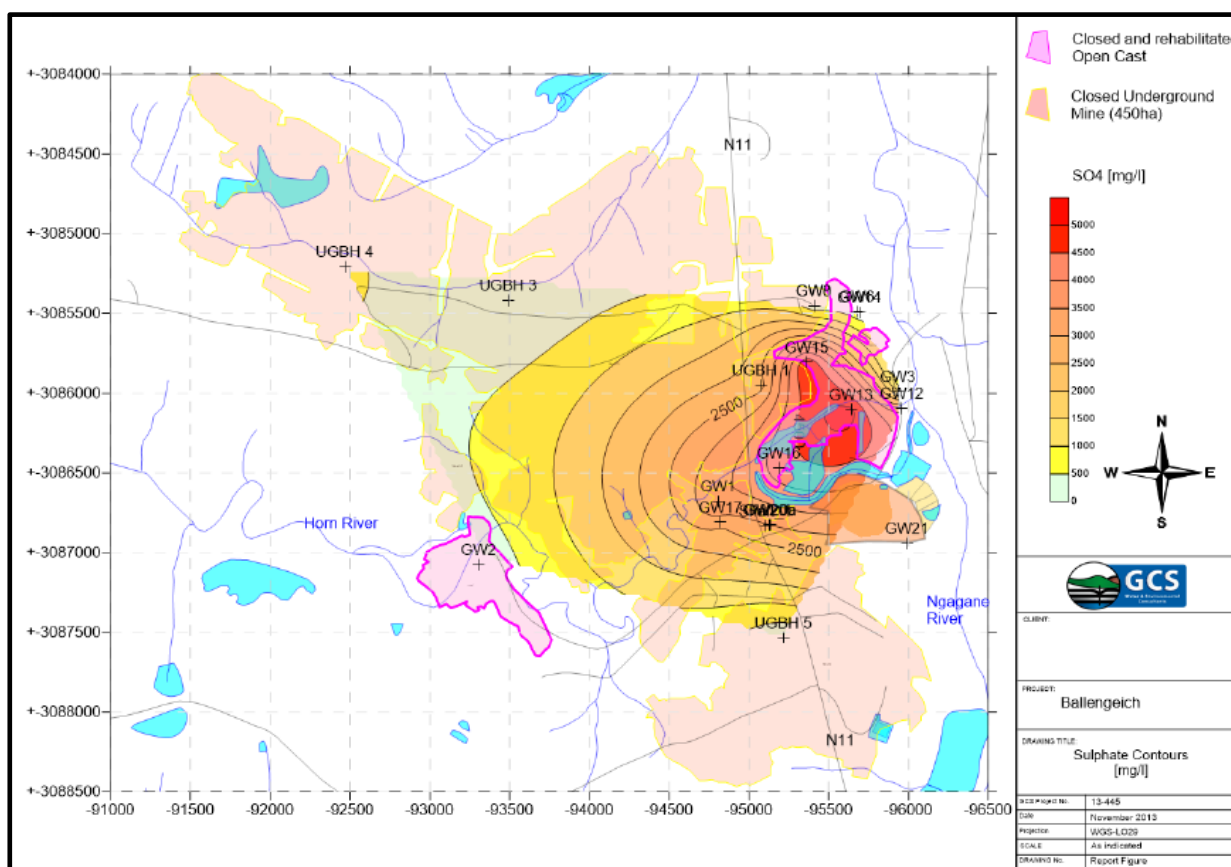


Figure 4-11: Sulphate contour map for the Ballengeich project site

This theory addresses the reason why the outflowing decant water has a low pH and high sulphate concentration, and that the data recorded for the underground workings show neutral pH and stable SO₄ concentrations. It is therefore expected that the poor water thus comes directly from the northern opencast area, and has been transmitted along the dykes towards the decant points. This is the main reason why the conceptual rehabilitation plan involves the re-rehabilitation of the northern opencast areas to achieve:

- Less recharge from rainfall,
- Stable groundwater levels and less seasonal fluctuations,
- Limited head,
- Less oxygen ingress.



4.15.1 Conceptual Geohydrological Model

To assist with the understanding of the groundwater system at the Ballengeich Colliery, a conceptual geohydrological model was developed by GCS based on available groundwater level and water quality data. This model has since been updated and superseded by the EWS Hydrogeology Assessment (Report EWS24-12_GW, April 2025), which provides the current authoritative conceptual and numerical groundwater model for WULA purposes. The historical GCS model is retained here for contextual reference.

- **Figure 4-11** supplies the anticipated groundwater flow directions from the area east of the N11 (i.e. from the old opencast mine area). Elevated groundwater elevation data east of the N11 suggests that a phreatic head developed in this area and groundwater flow appears to be both south towards the Horn and west towards the underground workings. It is further believed that the phreatic surface is a direct result of high recharge in these areas. The main focus of mine rehabilitation must therefore be to reduce recharge and to achieve a gentle flow gradient towards the east. Furthermore, it is also believed that the dolerite dykes, especially the north-south dyke west of the N11 may act as a buffer and split the area in an eastern and western compartment. These dykes are all mined through but may act as some localised flow boundaries.
- The geohydrological study (GCS, 2015) supplies a series of cross sections based on available groundwater level data to support the previous comment. It can be seen from groundwater data that a head of 1185 exists in borehole GW15 which is situated on the edge of the opencast workings, east of the N11.
- As a result of the observed groundwater flow and water quality data the majority of the observed deterioration of Horn River water quality starts more or less at the N11. This sample site is presented by SW4 and the site further east, just before the confluence with the Ngagane River is SW6. It is clear from water quality trend graphs (refer **Figure 4-5**) that the sulphate concentrations only exceed the identified water quality guidelines during the winter and low flow months.

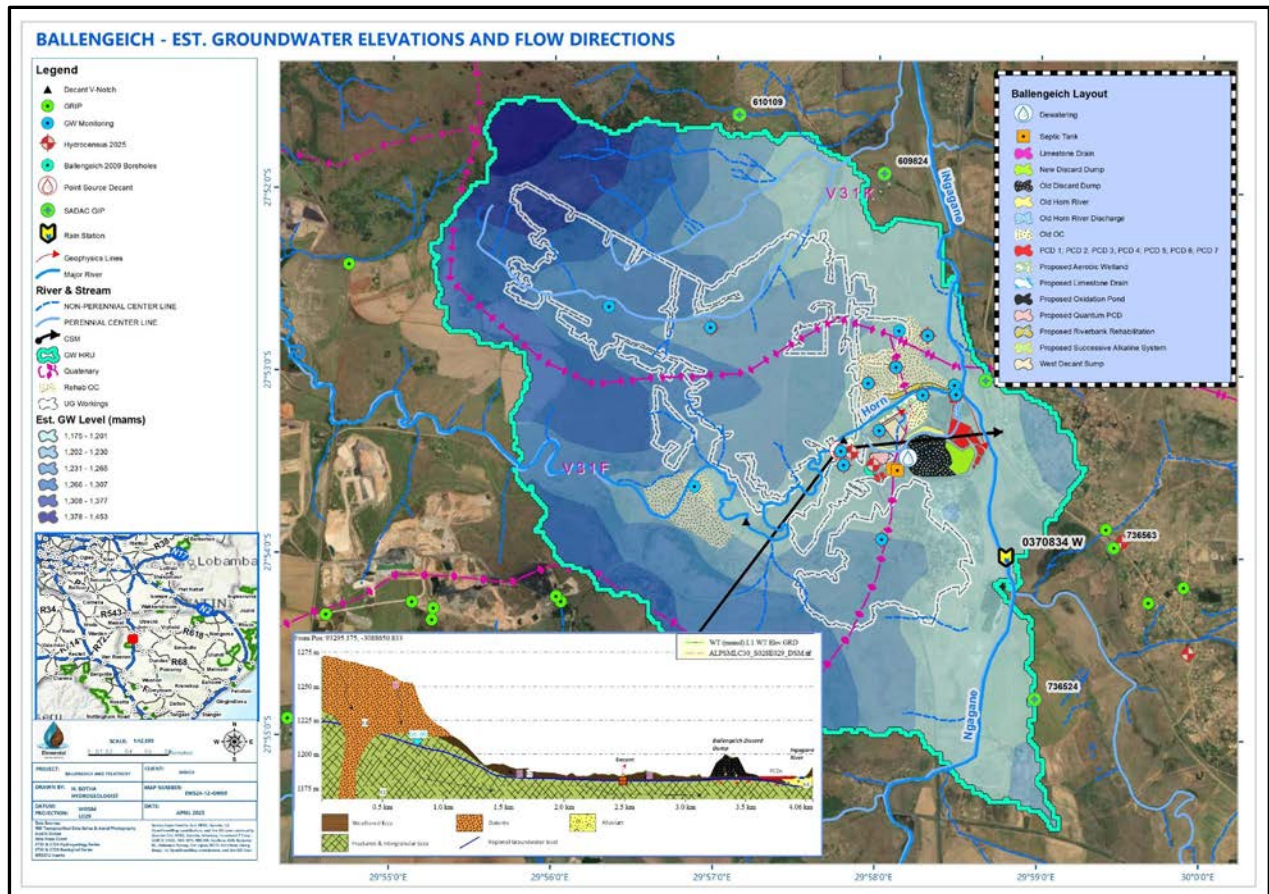


Figure 4-12: Simplified groundwater flow

A preliminary numerical groundwater model was constructed by GCS (2014) using the MODFLOW platform (Visual MODFLOW Version 2011.1 Pro). The model comprised four layers with a 50 m grid spacing, using the local Ngagane River sub-catchment as the model domain (**Figure 4-13**). River cells and drain cells were allocated to the main rivers and streams as the primary groundwater level control mechanism for the steady-state model. General head and constant head boundaries were applied to the western, northern, and southern extents. Hydraulic aquifer parameters were assigned based on available literature and field data, with recharge rates ranging from 3% to 12% (higher values applied to the old opencast workings). The flow model was calibrated to a Normalised RMS of 7%, which is considered adequate for a mine site with complex hydrogeological conditions.

The EWS Hydrogeology Assessment (April 2025) confirmed the key conclusions of the GCS conceptual model and provided updated aquifer parameter data from the UGBH monitoring borehole network installed specifically for this project. The EWS assessment confirmed: three distinct aquifer systems; groundwater flow rates of 0.001–0.38 m/day; an aquifer stress index of 0.00 confirming no abstraction-related stress; a sulphate plume of 4,000 mg/L at source decreasing to 1,000 mg/L at the Horn River; and losing river conditions along both the Horn and Ngagane Rivers in the vicinity of the site. These findings confirm the validity of the passive treatment approach as the appropriate intervention for the Ballengeich Colliery.

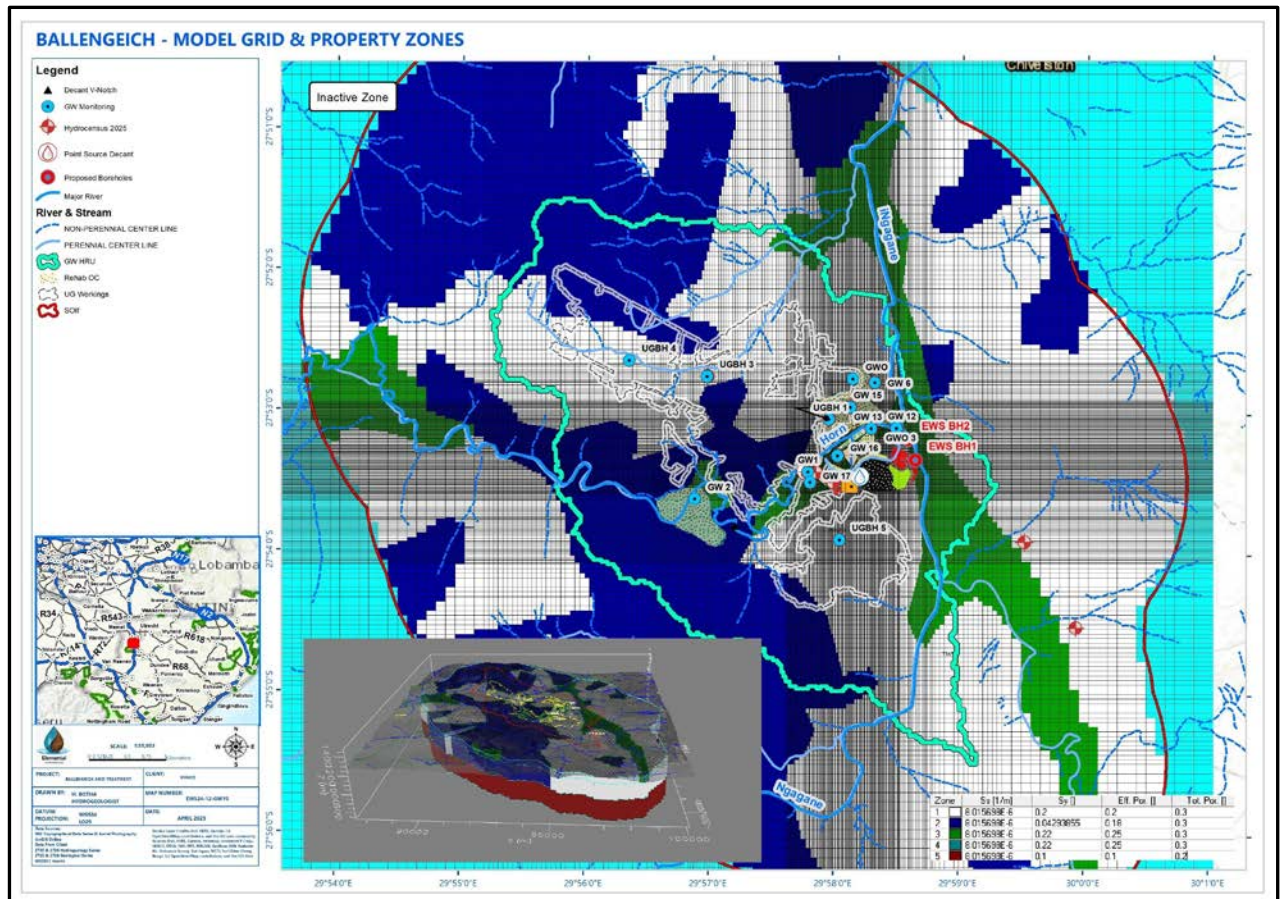


Figure 4-13: Numerical model grid for Ballengeich

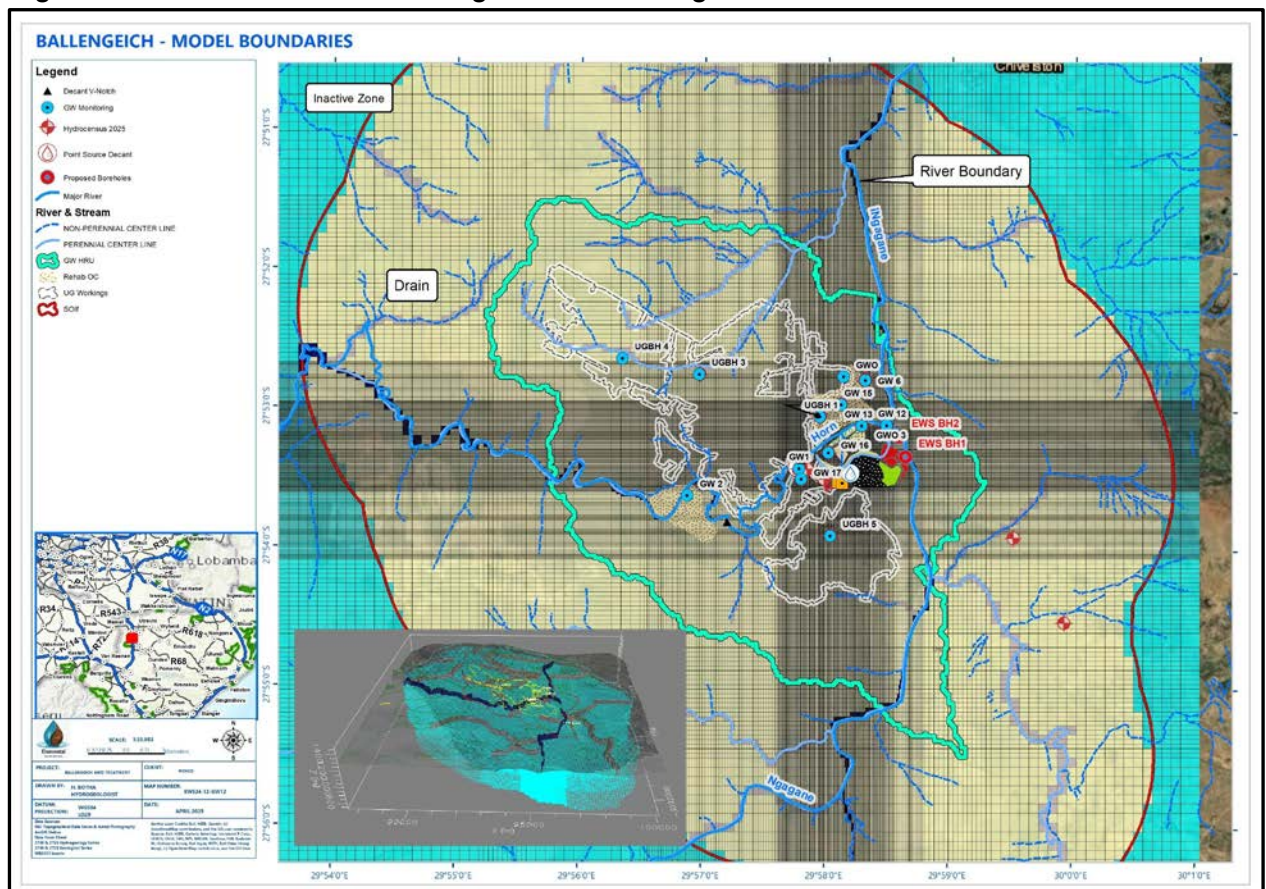


Figure 4-14: Boundary conditions for the numerical flow model



The flow model was calibrated and the Normalised RMS obtained was 7% (; the correlation between observed and calculated groundwater levels can be regarded as adequate.

Figure shows the calibrated flow directions and head elevations for the upper aquifer system.

After calibration of the flow model a transient state model with different recharge scenarios was constructed and simulated. **Figure 4-14** shows the calibration achieved and again the normalised RMS is 7%.

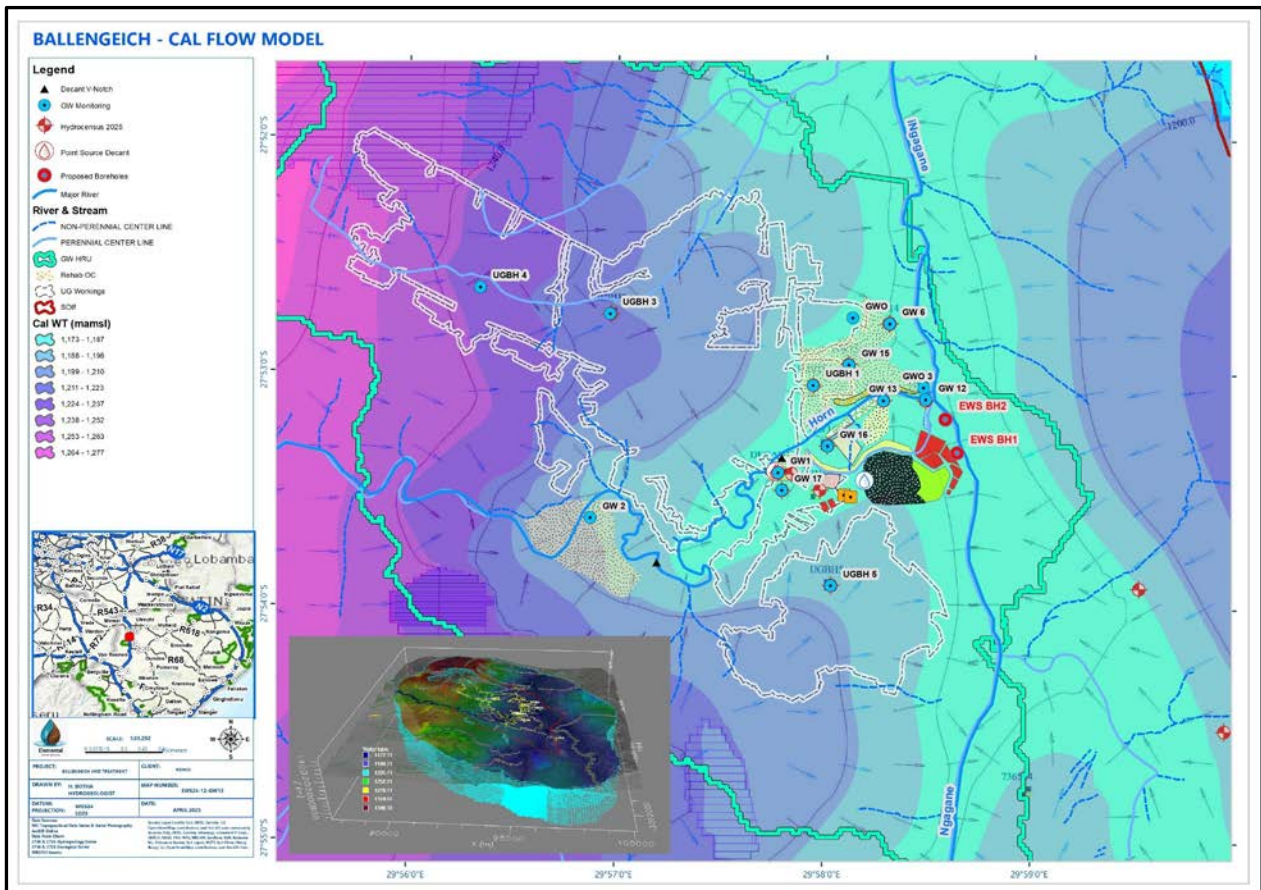


Figure 4-15: Calibrated flow and flow direction

Figure 4-15 and **Figure 4-16** show the calibrated sulphate plumes for the upper or shallow aquifer system and the deeper coal seam related system, respectively.

4.16 Groundwater Quality

Groundwater quality for the period April 2024 as monitored by GCS 2024) is contained in **Table 4-17**.

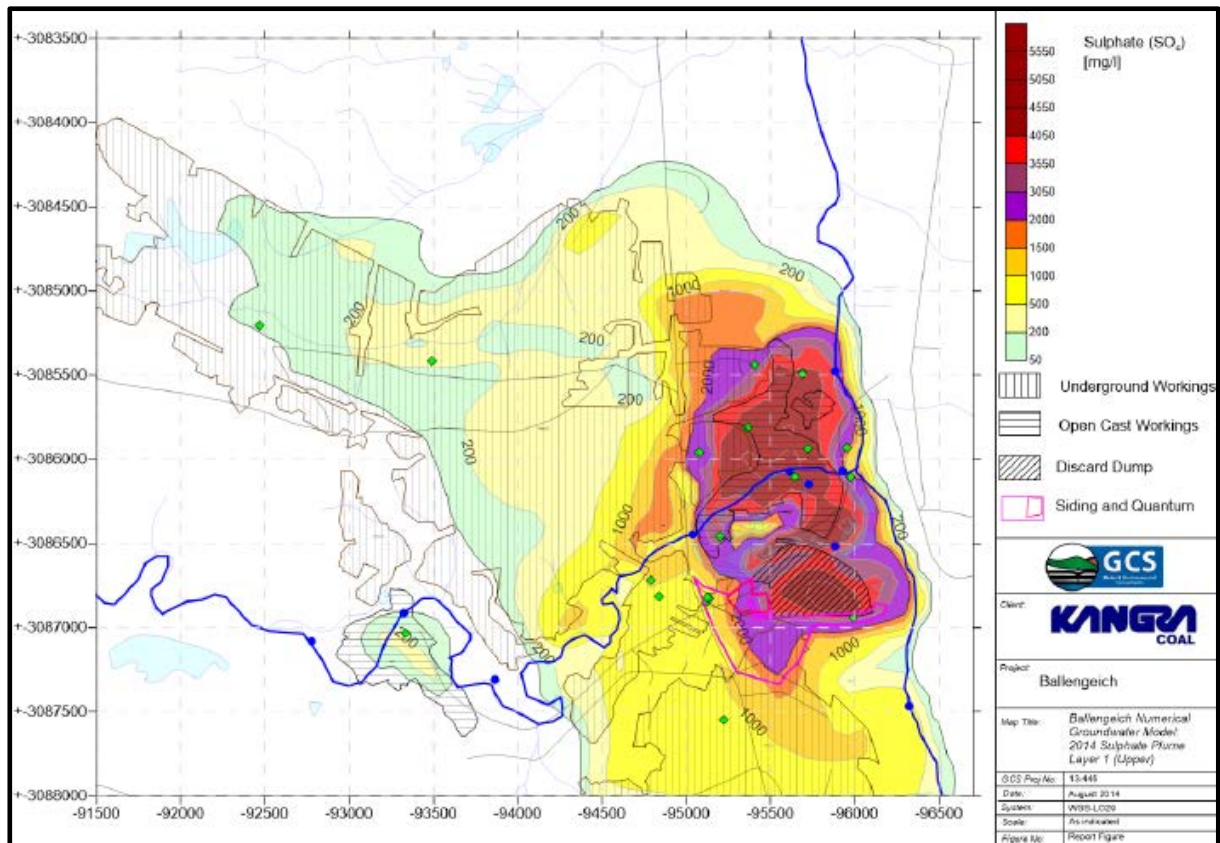


Figure 4-16: Calibrated sulphate plume for the upper aquifer system

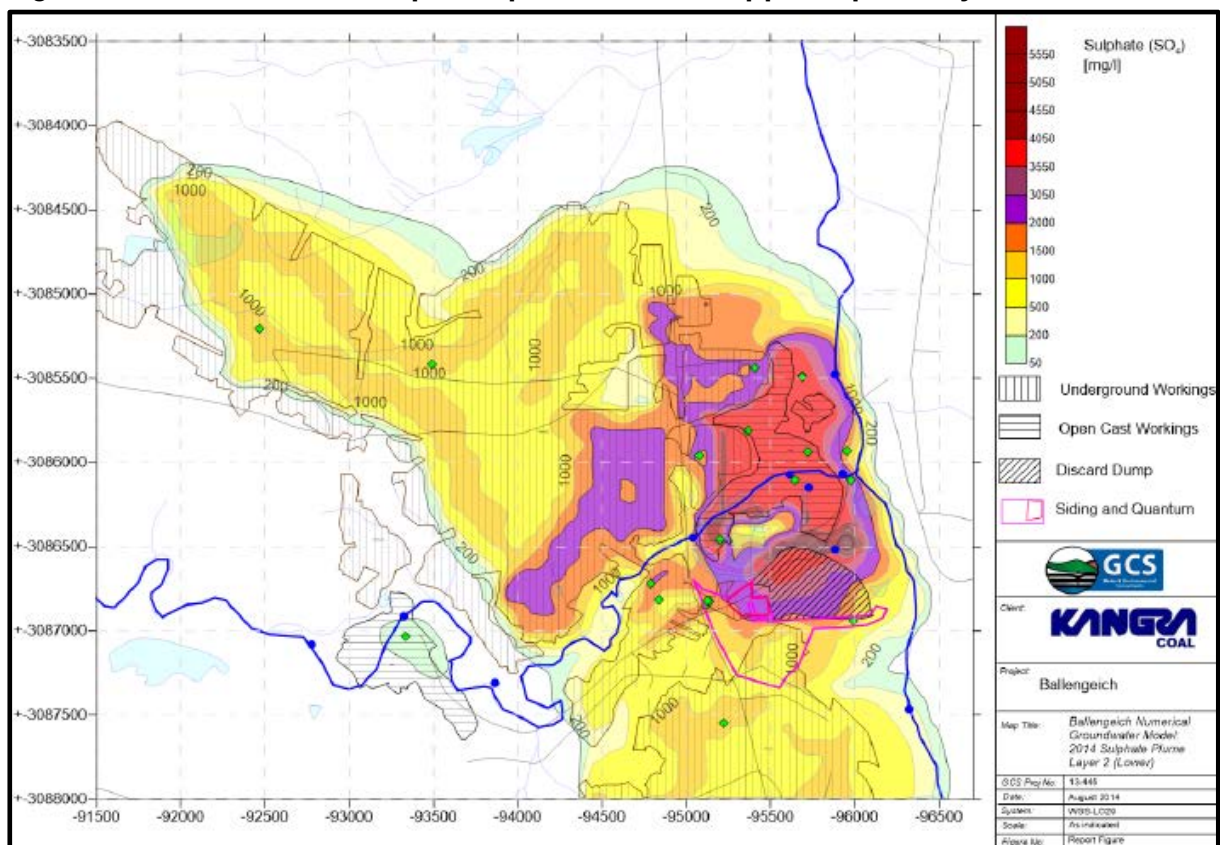


Figure 4-17: Calibrated sulphate plume for the lower aquifer system

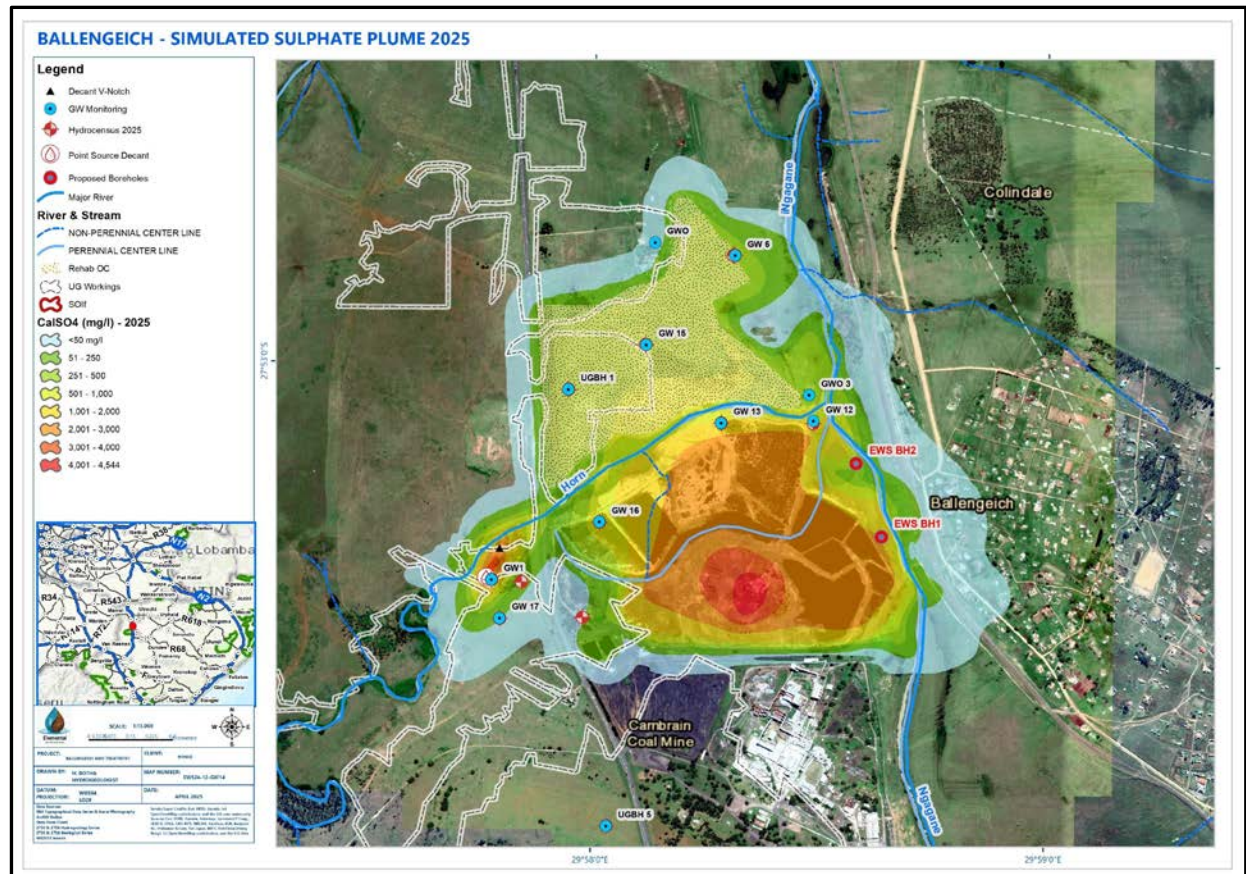


Figure 4-18: Simulated sulphate Plume EWS 2025



Table 4-17: Groundwater quality at Ballengeich Colliery – April 2024

Variable	RQO – Ngagane	GW03	GW1	GW2	GW6	GW12	GW13	GW15	GW16	GW17	DWAF SAWQTV	SANS 241-2015	GWO
pH	6.5 – 8.4	7.1	5.8	7.2	7.3	2.9	2.8	3.3	6.3	7.7	6.0-9.0	5.0-9.0	8.6
EC mS/m	<40	93	373	58	23	242	337	236	206	17	<70	<170	80
TDS in mg/l	<260	550	2300	380	170	1500	2000	1700	1300	120	<450	<1200	560
Calcium as Ca in mg/l	<32	43	453	82	17	187	530	209	155	9.5	<32	n/s	7
Magnesium as Mg in mg/l	<30	29	373	54	10	121	599	493	203	8	<30	n/s	3.2
Sodium as Na in mg/l	<70	142	507	6.6	14	122	120	30	427	16	<100	n/s	184
Potassium as K mg/l	<50	1.3	26	4.2	2.7	20	7.2	17	7.4	1.6	<50	n/s	1.7
T. Alkalinity	n/s	<12	40	90	20	<12	<12	<12	60	40	n/s	n/s	320
Chlorine as Cl in mg/l	<100	2.2	154	3.2	1.8	5.4	2.6	0.58	40	2.2	<100	<300	105
Sulphate as SO ₄ in mg/l	<200	542	4360	350	101	2160	4770	2970	2350	13	<200	<250	14
Nitrate as NO ₃ in mg/l	n/s	<0.0	<0.0	<0.0	<0.0	0.3	<0.0	<0.0	<0.0	<0.0	<3.28	<0.9	<0.0
Nitrite as NO ₂ in mg/l	n/s	1.9	<0.0	2.8	0.76	<0.0	<0.0	1.3	0.93	0.62	<26.5	<11	1.2
Fluoride as F in mg/l	<0.75	0.06	0.18	0.07	<0.05	0.35	1.9	0.44	0.1	0.06	<1	<1.5	0.93
Aluminium as Al in mg/l	n/s	<0.02	<0.02	<0.02	<0.02	5.2	18	5.9	<0.02	<0.02	<0.15	<0.3	<0.02
Iron as Fe in mg/l	n/s	<0.05	61	<0.05	<0.05	301	127	1.7	<0.05	<0.05	<0.1	<0.3	<0.05
Manganese as Mn in mg/l	n/s	0.7	3.5	0.54	0.02	18	52	127	4	0.25	<0.05	<0.1	0.02
Ammonia as N	<0.007	<0.01	0.36	<0.01	<0.01	0.53	0.31	0.55	0.80	0.13	<1.22	<1.5	0.2
T. Hardness	n/s	229	2670	425	85	968	3790	2550	1220	56	n/s	n/s	31
Ca Hardness	n/s	108	1130	204	44	468	1320	522	386	24	n/s	n/s	18
Mg Hardness	n/s	120	1540	221	41	500	2460	2030	834	33	n/s	n/s	13
Boron as B in mg/l	n/s	<0.005	0.2	0.014	0.01	0.31	0.13	0.011	0.034	0.006	n/s	<2.4	0.057
Silicon as Si in mg/l	n/s	13	12	5.3	12	26	31	19	5.3	14	n/s	n/s	11
Suspended Solids as SS	<50	<21	114	<21	<21	<21	56	124	144	28	n/s	n/s	<21
Bicarbonate	n/s	<12	40	90	20	<12	<12	<12	60	40	n/s	n/s	320



4.17 Socio-economic Environment

Ballengeich Colliery is situated in the Amajuba District Municipality (ADM), just west of the N11 in the neighbourhood of Kilbarchan. The surrounding area is characterised by residential settlements and some other Industrial and Agricultural Activities.

According to the Final Draft Integrated Development Plan for ADM for the period 2018-2019, the following information is relevant as depicted in **Table 4-18**. The ADM is located on a 6 910 km² area, includes Newcastle Municipality which covers 1 855 km², Emadlangeni Municipality which has a surface area of 3 539 km² and Dannhauser Municipality which covers 1 516 km² and is home to an estimated 531 327 people of whom:

- African Community 93%
- Asian Community 2.7%
- White Community 3.4%
- Coloured Community <1%

In terms of gender, the demography within the ADM area consists of female dominated demography (52.2%) with a sex ration of 91:100 (males vs females)

Major economic activities and sources of employment

The Amajuba District made a limited contribution to the economy of KwaZulu-Natal in 2016, contributing about 3.5% of the total provincial GVA, with the structure of the District Economy differing from the structure of the provincial economy.

Table 4-18: Table showing % contribution of each sector in relation to the GDP

Economic Activity	% of GDP
Agriculture	3.5
Mining	14.2
Manufacturing	16.2
Electricity	1.9
Construction	3.3
Trade	10.6
Transport	7.9
Finance	14.5
Community services	20.5

- 21% of the district's GVA stems from the manufacturing sector, while this figure is 16% for the Amajuba district. However, the Amajuba District experienced negative growth (-1.6%), compared to an average annual growth in the province of 0.4%.
- Mining is relatively small however it contributes substantially within the district contributing 14% to total GVA, but this is more than the province's contribution of 1.7%.
- The general government sector (Community service) contributes approximately 12.8% to the provincial GVA, while this figure is 20% for the district.

The business services sector (finance) accounts for 14% of total GVA in Amajuba, in comparison with 11% in the province. Average annual growth was about 6.6% for the district, compared to 2.7% for KZN.



4.18 Sensitive Receptors

4.18.1 Wetlands

The sensitive aquatic receptors at and in the vicinity of the Ballengeich Colliery have been comprehensively assessed through a series of specialist wetland delineation and ecological studies. The current authoritative wetland delineation for WULA purposes is the Menco Wetland Delineation and Assessment (Report WET/KANGRA/03/25, March 2025), which supersedes all previous delineation studies for this application. The key findings of that study are described below.

According to the SANBI NFEPA database, multiple wetlands occur in the broader Ballengeich area. Several NFEPA wetlands within 500 m of the project boundary are separated from the active mining footprint by a ridge line to the northwest and are not directly impacted by the proposed activities and are not discussed further in this section.

Two wetland units have been delineated within and immediately adjacent to the Ballengeich Colliery operational footprint. Both units have been confirmed as artificial in origin, created by historical mining-related activities and alterations to the natural drainage system. This confirmation is significant for the alternatives assessment, as it supports the conclusion that the treatment infrastructure footprint occurs within an already artificially disturbed landscape.

As indicated in Table 4-19 it was determined that the wetland obtained a Class C category in the PES assessment, which indicates that, the habitat is moderately modified due to loss of natural habitats. The Ecological Importance and Sensitivity of the wetland is considered to be Moderate; the wetland was considered ecologically important on a provincial or local scale. The biodiversity of this valley bottom is not usually sensitive to flow and habitat modifications. The Hydrological Functional and Importance of this wetland is considered to be moderate; the wetland plays a small role in moderating the quantity and quality of water in major rivers. Direct Human Benefits obtained from this wetland is considered to be a Class D and consisted of uses such as grazing and livestock watering. This wetland contributes little towards the larger community.

Table 4-19: Summarised results for the wetland at Ballengeich Colliery

Quaternary	Coordinates	Wetland	PES	EIS	Confidence	REC
V31K	27°50'22.56"S 29°56'29.22"E	Channelled Valley Bottom	C	Moderate	High	C
V31F	27°53'27.00"S 29°57'43.64"E	Floodplain	C	High	High	C

The Horn River PES at the AMD impact zone is Class D/E per the Menco Aquatic Ecological Assessment, reflecting severe AMD impacts. The Class C PES in **Table 4-19** above refers to the broader wetland unit assessment conducted upstream of the direct AMD influence zone. Class C may apply to portions of the wetland system upstream of the decant point.

Channelled Valley Bottom Wetland

The Channelled Valley Bottom Wetland (CVB-01) is located on the old Horn River terrace on the eastern boundary of the site. It was created by the historical impoundment of the old Horn River channel, resulting in back-flooding and permanently saturated soil conditions over many years. The wetland is severely degraded with limited wetland vegetation cover — primarily sparse,



secondary pioneer wetland vegetation — due to a combination of AMD contamination, overgrazing, and historical mine-related disturbance. A 100 m strict no-go buffer around CVB-01 is maintained under the proposed rehabilitation programme. No construction activity is permitted within this buffer. The wetland is used as a compliance monitoring reference feature.

Floodplain Wetland

The Floodplain Wetland (4.5 ha) is located along the western bank of the Horn River, within the area earmarked for the passive AMD treatment infrastructure. It was created by the Horn River diversion during active mining operations in the late 1980s and is confirmed as artificial in origin. The wetland currently receives direct AMD contamination from the artesian decant point, which has resulted in a severely degraded ecological state (PES Class D/E at AMD impact zone; Toxicity Class IV; 100% ostracod mortality confirmed at Horn DS1; MENCO November 2023). The proposed passive treatment system is specifically designed to improve water quality within and downstream of this floodplain wetland over the 20-year WUL period, with a predicted improvement toward the Recommended Ecological Category (REC) of Class C within 5 years of commissioning.

Both wetland units are regulated watercourses in terms of the NWA, triggering the 500 m wetland buffer and 100 m NFEPA river buffer requirements. GN 704 Regulation 4 exemptions have been applied for (MENCO, December 2024) for all infrastructure located within these buffer zones. The full wetland delineation methodology, HGM classification, PES assessment, and supporting data are contained in MENCO Report WET/KANGRA/03/25 (March 2025), attached as Appendix 14.

With reference to **Table 4-20**, the historic wetland study by Eco-Pulse (2016) has documented the following findings related to the Ballengeich Operations:

- Soil and vegetation sampling within and in the vicinity of the pan-like feature enabled the delineation of two wetland units, namely a depression wetland (Unit DP-01) within the pan feature and a channelled valley bottom wetland (Unit CVB-01) on the old Horn River terrace.
- Wetland soils and vegetation were present within Unit DP-01 and wetland soils (not wetland vegetation) were present within Unit CVB-01.
- The habitat associated with both wetland units is severely degraded with limited wetland vegetation cover. The limited vegetation cover present comprises secondary, sparsely vegetated pioneer wetland vegetation. The reasons for the severe degeneration appear to be intense overgrazing and possibly high levels of soil contamination, exacerbated by recent drought conditions.
- A review of historical imagery indicates that both of the delineated wetland units are artificial in origin.
- The pan feature (Unit DP-01) was artificially excavated in the past as part of the establishment and operation of the mine and as such is a relict pollution control dam feature.
- Unit CVB-01 was created by the impoundment of the old Horn River channel that resulted in back flooding and the occurrence of permanently saturated soil conditions over a number of years.
- Based on onsite observations as discussed, it is clear that the ecological importance and biodiversity maintenance value of the delineated wetland areas is low.
- In terms of regulating and supporting ecosystem services it is speculated, based on the hydro- geomorphic setting, that the depression could provide some flood attenuation services as it is a depression located on a terrace that could provide flood storage, as well

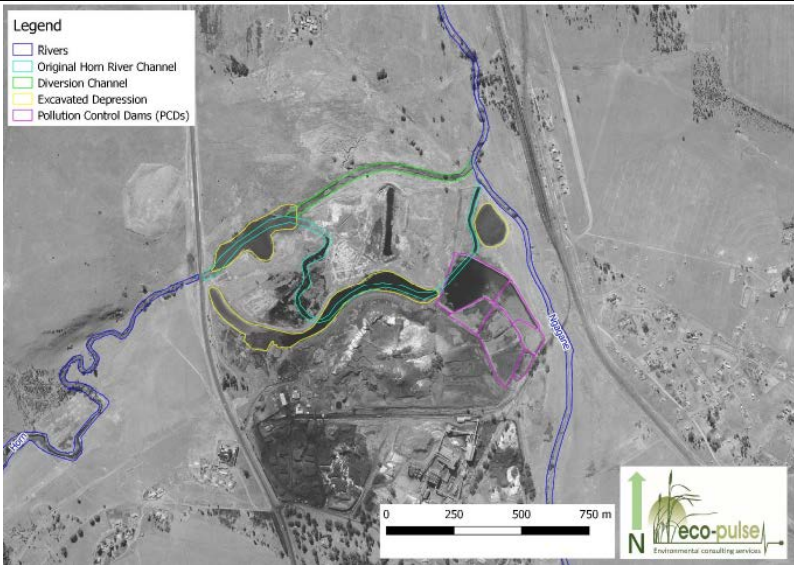
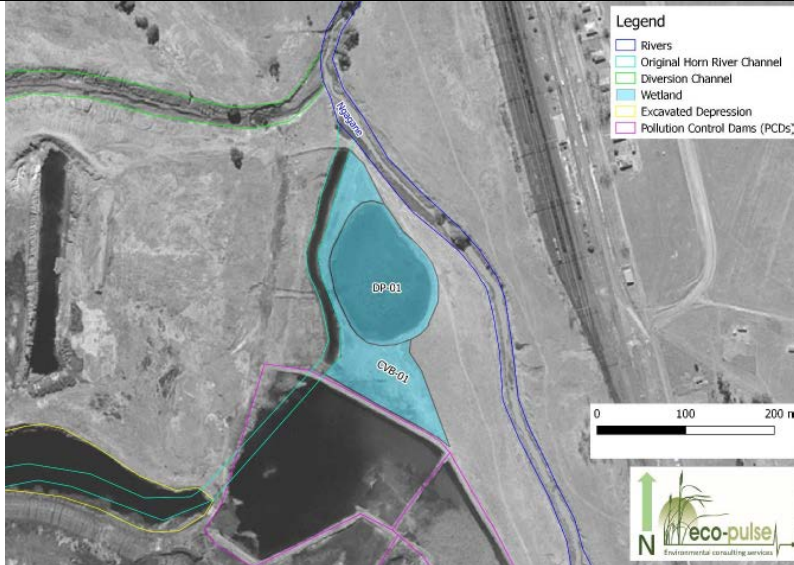


as some water quality enhancement services associated with the capturing of floods and/or seepage from the upstream PCDs.

- In terms of direct services, the depression appears to be providing moderately important winter (drought) grazing for local livestock.
- In light of this, reinstating the depression wetland as a PCD would likely not cause significant impacts to the ecological value and regulating and supporting services supplied by the depression. However, such a reinstatement would result in the loss of grazing area / food for livestock.



Table 4-20: Results of Wetland Study (Eco-Pulse, 2016)

Drainage Setting		
		
	Located ±70 m upstream of confluence of Horn River with Ngagane River Based on HGM features two wetland units identified:	
Delineation and Classification	Depression wetland labelled Unit DP-01;	Channelled valley bottom Unit CVB-01
Terrain	Depression on Ngagane River terrace	Ngagane River Terrace
Wetland Size	1,44 hectares	1,17 hectares
Soil Description	Most of the soils sampled comprise medium to dark grey silty clay characterised by low matrix chromas and moderate to abundant amounts of distinct orange mottles, with few black mottles. These redoximorphic features are indicative of seasonally saturated soils.	The soils sampled within the terrace to the west of the depression comprise medium to dark grey silty clay characterised by low matrix chromas and moderate to abundant amounts of distinct orange mottles.



The hydrological benefits from the wetlands are indicated in **Table 4-21**. The channelled valley bottom system is surrounded by grazing land and is maintained by rain water precipitation draining the catchment that feeds into the wetland system. Flow within this wetland is therefore predominantly surface flow, generated as a result of rainfall events. The wetland has several functions still intact of which nutrient removal, flow regulation and sediment trapping appear to be most important.

Table 4-21: Hydrological benefits provided by identified wetland units

Wetland	Generic Hydrological benefits provided by the wetlands							
Hydro-Geomorphic Type	Flood attenuation		Stream flow regulation	Erosion control	Sediment trapping	PO ₄	NO ₃	Toxicants
	Early wet season	Late wet season						
Floodplain	++	+	0	0	++	++	+	+
VBC	+	0	0	0	++	+	+	+
Depression	+	+	0	0	0	0	+	+
Rating	0 + ++	Benefit unlikely to be provided to any significant extent Benefit likely to be present at least to some degree Benefit very likely to be present (and often supplied to a high level)						

Of importance to the study is the floodplain wetland that run along the Horn River just upstream and adjacent to the area where the AMD decant and ultimately discharges to the Horn River. The size of the wetland is 4,5 hectares and is earmarked to be altered to include the area for the artificial induced wetland system consisting of a Successive Alkaline Producing System (SAPS) and an anaerobic wetland system that discharges to an aerobic wetland system prior to flow into the Horn River. The floodplain wetland was classified as Class B (Largely Natural) with an EIS of High. For reason that the wetlands are situated within a mining fenced area, there is controlled but limited access to the area. The floodplain has therefore no direct human benefits but have several ecoservices contributing towards a higher biodiversity.

The summarised results are contained in **Table 4-22** below.

Table 4-22: PES, EIS, Hydro-functional Importance and Direct Human Benefits

Wetland	PES	EIS			Eco services	
		Ecological Importance & Sensitivity	Hydro-Functional Importance	Direct Human Benefits	Natural	Human
CVB	2.45 Class C	2.11	2.1	1.0	2.3	0.4
F	3,82 Class B	2,44	3,33	1,0	3,1	3,8

The wetland delineation manual of South Africa (DWAF, 2005) considers four wetland indicators in the delineation process namely:

- 1) terrain unit;
- 2) soil form;
- 3) soil wetness; and
- 4) vegetation indicators.



While a combination of the four indicators may be used in delineation, the soil wetness indicator is primary and vegetation indicator is confirmatory (DWAF, 2005). This criterion uses the soil forms in the Soil Classification of South Africa to delineate wetlands. The soil forms indicators in the permanent wet zone include the Champagne, Katspruit, Willowbrook and Rensburg forms. The existence of any of the four soil forms represents a wetland (DWAF, 2005).

Please refer to **Figure 4-17** for a description of the wetland soils augured at the site.

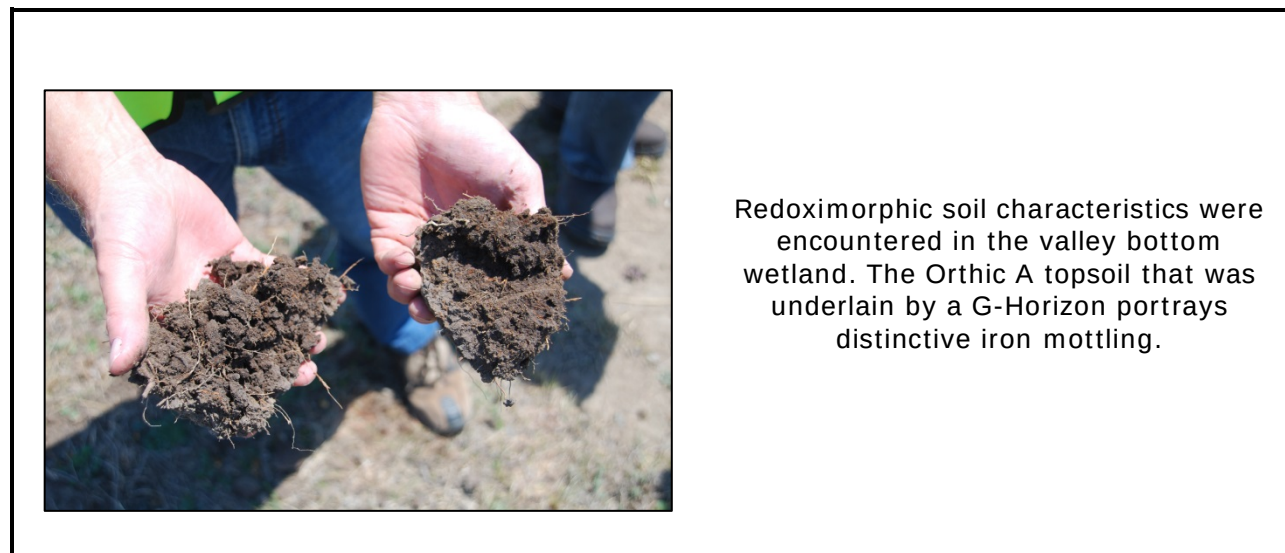


Figure 4-19: Description of the wetland soil

The terraces of the tributary of the Ngagane River are covered by deep, poorly drained, vertic clay with black topsoil overlying dark greyish, gleyed, calcareous subsoil of the **Rensburg form** (soil code Rg). Although the local soil water table has been lowered due to the incision of the river channel (therefore assuming the subsoil is presently displaying relic gleyed properties), the rusty streaking of the upper topsoil is proof of waterlogged conditions prevailing for long periods during the rainy season. The soils encountered within the project area have a low arable land use.

There were a low abundance and frequency of hydrophyllic plants in all temporary wetland zones. The delineated wetland is of moderate importance to the ecosystem functioning of the Ngagane River, which supplies water to downstream users (agriculture, mining, urban areas and conservation) and therefore must be managed with long term sustainability of these enterprises. It is thus important that the receiving water resource be protected to prevent any further degradation or at least, attempt to manage the resource to maintain the PES at Class C. Therefore, it is recommended that the following considerations be taken into account and applied accordingly to ensure protection of the natural resource and to prevent any further degradation of wetlands within the region:

- A minimum of 100 m buffer zone be maintained around the wetland areas wherein no mining activities are allowed to take place in order to protect the integrity of the wetland. This buffer zone should be clearly demarcated as a “NO GO” area to prevent any accidental entrance into the area (refer **Figure 4-18**).
- To this end, in terms of section 39 or 40 of the National Water Act, 1998 (Act No. 36 of 1998), Section 21(c) and (i) uses are applied for in this application.
- Any activities that may potentially result in significant adverse effect on the in wetland should be avoided.

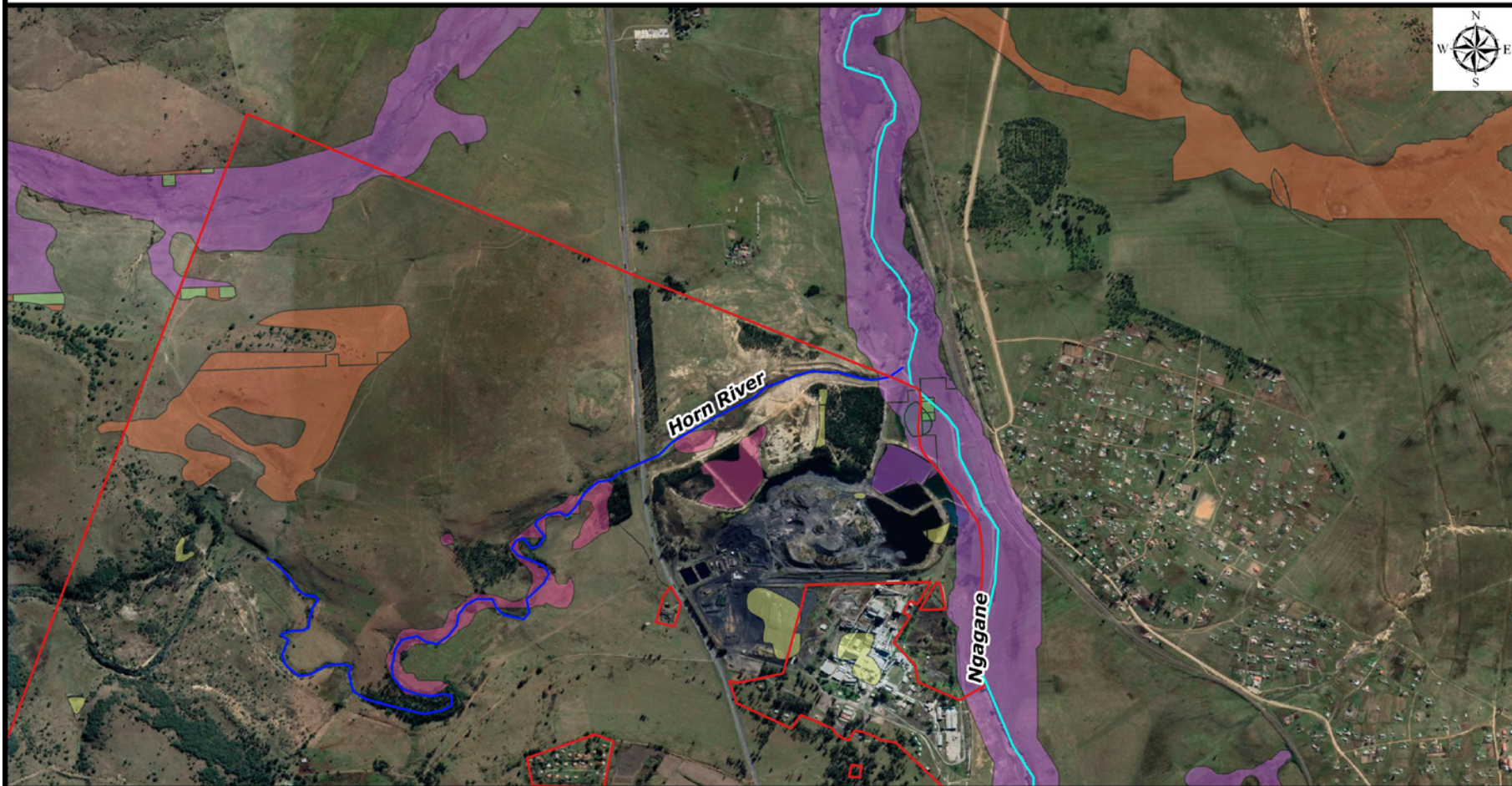


- Stormwater management practices must be applied and incorporated into management with the aid of a suitably qualified engineer to avoid disposal or spillage of any environmentally harmful materials or waste into the wetland.
- Should the mitigation measures fail to adequately protect the integrity of the wetland habitat, compensatory measures in terms of a wetland offset strategy needs to be negotiated with the Regulatory Authority.

The results of the soil analyses conducted by Eco-Pulse (2016) is included in **Table 4-23**.



Kangra Coal (Pty) Ltd: Ballengeich Colliery



Legend

 Study Area	NFEPA_Wetlands	 Floodplain wetland
 Ngagane River	 Channelled valley-bottom	 Seep
 Horn River	 Depression	 Unchannelled valley-bottom
	 Flat	 Valleyhead seep

0 500 1 000 m



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Figure 4-20: NFEPA and Delineated Wetlands in relation to the Ballengeich Colliery



Table 4-23: Results of Soil Analyses (Eco-Pulse, 2016)

IP No	Depth (m)	Description	Particle Size %				Atterberg Limits			MC	GM	Modified AASHTO		Classification and Activity
			Clay	Silt	Sand	Gravel	LL	PI	LS %			MDD (kg / m ³)	OMC %	
1	0.00 – 1.00	Dark grey to olive brown sl. gravelly sl. sandy CLAY. Res Sandstone	32.4	39.0	26.1	2.5	33	10	5.0	27.7	0.22	-	-	A-4(8), CL, Low
1	3.00 – 4.00	Olive brown, clayey SAND, Res. Sandstone	12.2	14.2	73.2	0.4	18	SP	1.0	21.0	0.63	-	-	A-4(2), SC, Low
2	2.00 – 3.00	Olive brown speckled orange, clayey SAND, Res Sandstone	10.3	14.2	74.6	0.8	20	SP	1.0	19.4	0.63	-	-	A-4(1), SC, Low
2	4.00 – 5.00	Orange light grey, clayey SAND, Res Sandstone	25.4	30.2	43.2	1.2	25	9	4.5	20.9	0.42	-	-	A-4(7), CL, Low
3	1.00 – 2.00	Olive brown, sandy SILT, Res Sandstone	25.7	41.1	31.3	1.8	29	6	3.0	-	0.34	-	-	A-4(8), OL, Low
4	2.00 – 2.60	Olive brown speckled orange, clayey silty SAND, Res Sandstone	12.2	17.5	65.7	4.6	21	4	2.0	17.9	0.80	-	-	A-4(2), SM-SC, Low
5	1.00 – 2.00	Olive brown, clayey SAND, Res Sandstone	24.4	25.6	47.3	2.7	28	9	4.5	23.4	0.42	1700	17.2	A-4(7), CL, Low
6	0.00 – 1.00	Olive brown, clayey SAND, Res Sandstone	26.7	9.2	61.9	2.1	27	9	4.5	19.4	0.75	-	-	A-4(2), SC, Low

Legend

LL – Liquid Limit; PI – Plasticity Index; LS – Linear Shrinkage; MC – Moisture Content; GM – Grading Modulus; MDD Maximum Dry Density; OMC – Optimum Moisture



5 ANALYSIS AND CHARACTERISATION OF WATER USE ACTIVITY

5.1 Site Delineation for Characterisation

The Ballengeich Section is divided into four groundwater units. Two are underground and two are in the opencast section of the mine.

The main section of the underground workings extends from Kilbarchan Colliery in the north to the Horn River in the south, and from just east of the R23 road to about 3 km west of the road. Little data is available on water levels and water quality in the underground section. The floor of the workings appears to have large scale rolls with an amplitude of approximately 10 metres, but dipping generally towards the south and south-east. Hence, water is expected to accumulate in depressions caused by the rolls in the floor and flow southwards as these local depressions fill. The south-western extent of the reserve appears to be limited by a dolerite intrusive which result in a displacement of the coal in the order of 40 m. Investigation which will include drilling to determine water levels or extent of flooding will be required to make meaningful predictions of long term flooding and impacts.

The floor of the western opencast and the western underground block are effectively 40 m higher than the main underground section as a result of the sill mentioned above.

The roof of the small triangular shaped western underground section is known to be unstable, and collapse has been recorded in 1986 at the southern end, near the adit. This is expected to enhance recharge to the workings. Again, no detail of water levels in the workings is available. However, the area of the ramp to the adit has been observed to be flooded. The dip of the coal seam also appears to be in a southerly direction.

The western opencast section has mined through the original course of the Horn River and the river now crosses the opencast spoils in an unlined channel. Therefore, a direct connection between the water in the spoils body and the river is expected. There is evidence that the spoils body is flooded to its decant level and seeps directly into the Horn River at and downstream of the diversion canal. Analysis of the water quality in the spoils to date indicates that the water is marginally alkaline with quality deteriorating from north-west to south-east, where the rapid recharge effect of the river - diversion is not as pronounced. The water levels indicate a hydraulic head in the same direction, supporting the assumption of a high recharge from the river diversion channel to the spoils.

The eastern opencast section is also in the Horn River flood plain near the confluence of the Ngagane River. The Horn River has been apparently subject to numerous phases of diversion, such that there is a large wetland area in the central and southern area. The invert level of the diversion canal is cut deeply into the spoils, and at the eastern end it is almost at the level of the coal floor. Hence, one may conclude the spoils are essentially free draining into the central area and the Horn River diversion. Water level information in the spoils supports this statement.

The main underground section was holed by the opencast some time in the past (approximately 1981). At the time a large influx of water was reported. This area of the workings is also characterised by a number of well-developed crown holes. A borehole drilled into the workings shows them to be dry in this area. Expecting high recharge to the underground section, but finding them dry, leads to the conclusion that the workings are still free draining into the opencast spoils.



The extent of the underground workings drained by the breaking through of the opencast is not certain, however. There is a substantial barrier pillar with limited access between the west and east of the R23 road. Assuming that the roof elsewhere on the underground section is intact and there are no major aquifers intersecting the workings, they will probably take decades to flood and impact significantly on the opencast recharge and consequent seepage into the Hom River. Again, it should be stated that investigations to determine water levels in the workings are required.

There are two dolerite dykes connecting the underground and opencast areas. It is assumed that these are able to act as preferential flow paths or conduits between the two mining areas also. The dolerite dykes are believed to be water bearing. A local farmer has a borehole which is believed to be drilled into the margins of one of the dykes.

Included in the eastern opencast area is a block in the north-east which appears to be isolated from the main spoils area. It is not certain if it is really isolated, or if it was part of the main spoils body. However, it is believed that the two spoils bodies are hydraulically connected along the coal seam, even if they are separate.

5.2 Water and Waste Management

5.2.1 Water use and Supply

The detail on water uses and supply is shown in the water balance as contained in **Figure 5-1**. Projected water demand for Ballengeich Colliery is based on an Integrated Water Resource Management approach with emphasis on re-use, recycling and minimisation. These projections are part of the mine's water demand projections to be provided to DWS on a biannual basis.

As the bulk of the water at the mine entails water containing waste, the principles of sustainable waste management will be implemented and applied on a day-to-day basis as waste management measures for the Ballengeich Colliery. These include the following:

- *Waste prevention*: the prevention and avoidance of the production of waste;
- *Recovery*: the recycling or re-use of waste;
- *Waste reduction*: the reduction of the volume/quantity of waste during mine operation and production; and
- *Waste treatment*: the treatment of waste to reduce the volume of waste, risk to human and the environmental, and the degree of hazard.

Waste disposal/discharge/emission: the environmentally acceptable and safe disposal or discharge of waste, where applicable, to be done in line with the National Environmental Management Waste Act, 2008 (Act No. 59 of 2008).

5.2.2 Sewage Management Facilities

As this is a defunct mine with no operational activities, Ballengeich Colliery operates a conservancy tank system linked to a French drain. The Quantum Crushing and Screening operations are served by mobile/chemical portable toilets only — no septic tanks or permanent sanitation facilities are located on the Quantum site (confirmed at Menco/Kangra project meeting, May 2026). Septic tanks on site (Items 12.1 and 12.2) serve Kangra siding operations only. It is envisaged that Ballengeich Colliery will comply with the GN665 effluent standards (refer GN 665 of 6 September 2013).



5.3 Process Water

The development of the process water flow diagram is outlined in **Figure 5-1** and further based on the identified water use facilities with their associated inflows and outflows as illustrated in **Table 5-1**.

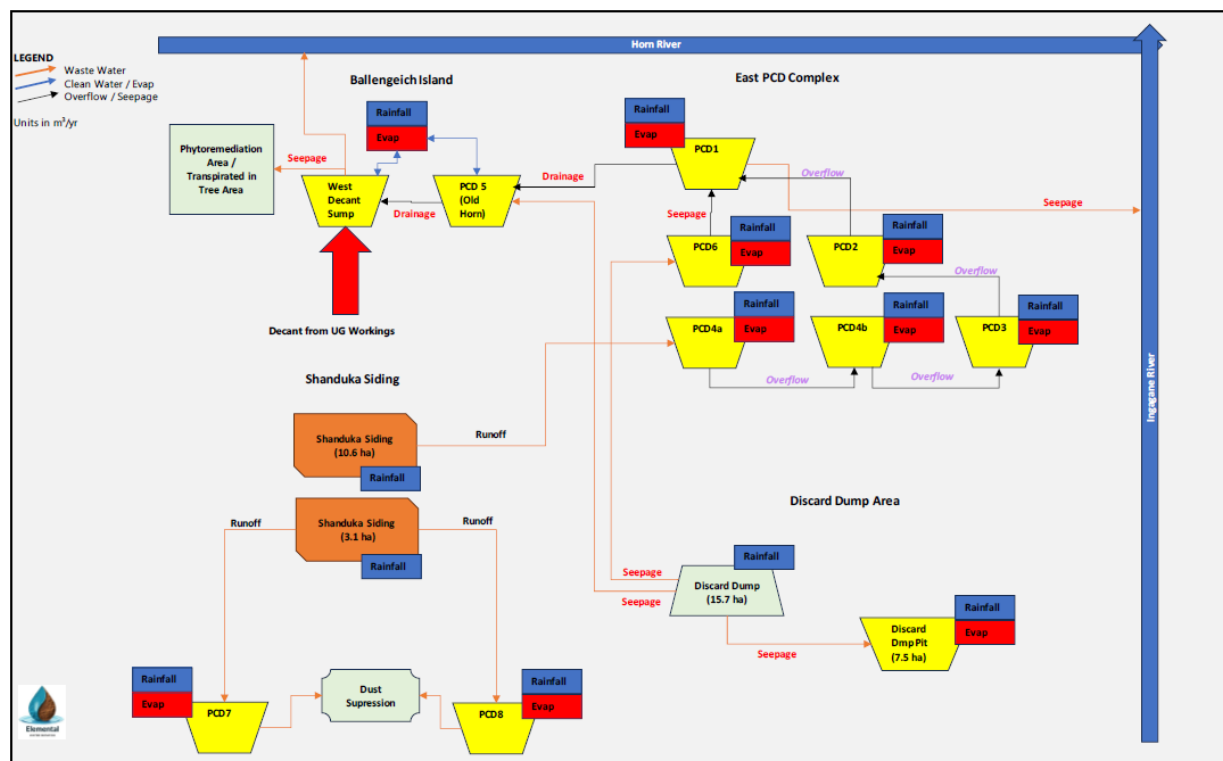


Figure 5-1: Water Process Flow Diagram

Table 5-1: Water and Salt outflows to Process Water Units at the mine

Process Units	Outflows
Discard Dump Area	To: Discard Dump Pit
	To: PCD 4a
	To: PCD 5
	To: PCD 6
Discard Dump Pit	To: Evaporation/Storage
	To: Dust Suppression
PCD 7	To: Evaporation/Storage
	To: Dust Suppression
PCD 8	To: Evaporation/Storage
	To: Dust Suppression
PCD 4a	To: Evaporation/Storage
	To: PCD 4b
PCD 4b	To: Evaporation/Storage
	To: PCD 3
PCD 3	To: Evaporation/Storage
	To: PCD 2
PCD 2	To: Evaporation/Storage
	To: PCD 1
PCD 1	To: Evaporation/Storage
	To: PCD 5
	To: Ngagane River
PCD 5	To: Evaporation
	To: West Decant Sump
PCD 6	To: PCD 1



Process Units	Outflows
	To: Evaporation
West Decant Sump	To: Constructed wetlands/Transpiration
	To: Horn River
Passive Wetland Treatment System	To: Horn
	-

5.4 Stormwater

The Ballengeich Colliery has been issued with a Notice of Intent to Issue a Directive in terms of Section 19(3) of the National Water Act, 1998 (Act 36 of 1998) for failing to take reasonable measures to prevent pollution from occurring, continuing or recurring at the site. The notice (dated 21 April 2014) was formally served on Ballengeich Colliery during September 2023. One of the key findings contained in the notice relates to the on-site stormwater management measures not conforming to the stipulations of GN 704 Regulations (Government Gazette 20118, June 1999). A stormwater management plan was originally drafted in February 1998 by Wates Meiring and Barnard (Pty) Ltd and submitted to the DMR in support of a Mining Right; however, this plan became obsolete following the cessation of mining operations in late 1998.

GFK Consulting Engineers CC was subsequently appointed by M2 Environmental Connections (Pty) Ltd on behalf of Kangra Coal (Pty) Ltd to redesign the Stormwater and Water Management Plan (SWMP) for the Ballengeich Colliery in full compliance with GN 704 Regulations. The redesigned SWMP is documented in the GFK Water and Stormwater Management Report (Report No. G2025/06/338(1), which forms part of the WULA submission package as Appendix 22.

The SWMP is underpinned by the principle of strict separation of clean and dirty water across the entire site. Clean stormwater arising from rehabilitated and uncontaminated catchment areas is diverted away from the contaminated operational footprint via grass-lined V-drains and clean water channels, while dirty stormwater from the Quantum Screening and Crushing Plant, the Ballengeich Siding stockpile area, and all contaminated surfaces is captured by concrete-lined dirty water channels and routed via concrete silt traps to the lined Pollution Control Dams. The following key design parameters apply:

- All dirty water channels are concrete-lined trapezoidal channels (Manning's $n = 0.017$) designed for the 1:50-year SCS return flow. Critical flow conditions apply at most channels, with flow control structures at 90° bends.
- Clean water V-drains (V1–V4) and channels (C1–C3) are grass-lined (Manning's $n = 0.035$) and designed for the 1:50-year return flow, with velocities maintained between 1.0 and 1.5 m/s to prevent deposition and erosion. Channel C3, running parallel to the Bhekhani passive treatment plant, is recommended as concrete-lined due to the calculated velocity of 2.5 m/s.
- Three new clean water culverts (V1 × 2 and C1) and three existing dirty water culverts (D9, D3, D4) requiring upgrading are identified. Culvert D4 passes under the existing railway line and must be replaced with SATS SAR-type portal culverts. All culverts are sized to convey the 1:50-year return flows.
- Concrete silt traps are provided at all PCD inlets with a recommended cleaning interval of 28 days during high storm flow periods. Two silt traps per PCD are provided where space allows to permit maintenance without interrupting operations.
- The flood protection berm, comprising TWO separate engineered earth berms (Berm 1 along the Horn River; Berm 2 along the Ngagane River on the western side of the railway line), has been designed to contain the 1:100-year flood event at a crest level of 1,183.1 m amsl with a minimum freeboard of 0.8 m throughout. This was



confirmed through a HEC-RAS 2D unsteady flow model (GFK, February 2026) using a 1:100-year Ngagane River peak flow of 1,660 m³/s and a Horn River peak flow of 418 m³/s (SDF method).

- The lined PCDs (PCDs 3, 4, 7, 8, and the New Quantum PCD of 8,600 m³) have been sized and confirmed through an 89-year WRSM2000 (Pitman) model simulation to spill less than once in 50 years, in compliance with GN 704 Regulation 7. Surplus water during the wet season (December to March) under Scenario 1 (dump rehabilitated) is managed by a 22 kW mechanical evaporator positioned over the lined PCD, with a design flow of 45 m³/hr at 60% evaporation efficiency.

The total dust suppression water demand for the site is 38,400 m³/annum (500 m³/month for the Quantum operational area and 2,700 m³/month for the Ballengeich Siding stockpile area), as confirmed by the GFK SWMP Pitman water balance. This demand cannot be fully met from the lined PCDs alone — a deficit of 13,600 m³/annum (Scenario 1) to 16,310 m³/annum (Scenario 2) must be supplemented from the unlined dams on site (PCDs 1, 2, 5, 6, and the West Decant Sump). All dust suppression water is AMD-impacted water applied only to the dirty operational areas contained by the concrete-lined dirty water channel network.

5.5 Groundwater

In terms of the NWA no person in control of a mine or activity may locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year flood-line or within a horizontal distance of 100 m from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on water-logged ground, or on ground likely to become water-logged, undermined, unstable or cracked without the necessary water authorisation in place or exemption from GN 704.

The relevant exemptions are covered in section 3.2 of the IWWMP and a standalone motivation is included as **Appendix 28**.

5.6 Waste

Mining at Ballengeich is classified as a DWS Category A mining activity implying mining with high environmental impact. Coal mines in general produce harmful mine residues such as AMD. The mine polluted water is contained in pollution control dams (PCD's) that constitute a section 21(g) water use.

In addition, there are waste disposal sites on the project site. All waste material or substances; Hazardous or Non-Hazardous shall be removed by authorised and permitted waste disposal contractors to authorised disposal sites.

5.6.1 Domestic and Industrial Waste

The types of domestic and industrial waste generated by the Mine and associated disposal procedures/facilities are summarised in **Table 5-2**.



Table 5-2: Disposal of Domestic and Industrial Waste

<i>Items to be considered</i>		<i>Actions and Intentions</i>
<i>General</i>	<i>Specific</i>	
Procedures	General	A waste management procedure will be developed. This will cover the storage, handling and transportation of waste.
	Classification	In accordance with GNR 634 (Waste Classification and Management Regulations) of the National Environmental Management: Waste Act (59 of 2008), all waste should be classified within 180 days using SANS 10234. Condition 4 (1) of GNR 634 states the following: Wastes listed in Annexure 1 of these Regulations do not require classification in terms of SANS 10234. Waste included in Annexure 1 are General waste (Domestic waste, Building and demolition waste, business waste and inert waste). Furthermore, "Hazardous waste "means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment. This can be classified as a Type 0 and 1 waste and needs to be labelled and a safety data sheet for hazardous waste needs to be completed (GNR 634 and 636). Waste generated by Ballengeich Colliery only require a Class B, C and D landfill site due to the waste being Type 3 and 4 waste (See GNR 634 and 636 for description of waste Class and Types).
	Waste minimization and recycling	Opportunities to minimise waste production will be identified and taken where possible. Where possible, waste will be recycled.
Waste disposal facilities	Collection points	Waste collection points will be established on site. Care will be taken to ensure that there will be sufficient collection points for each designated type of waste with adequate capacity and that these are serviced frequently.
	On site waste disposal facilities	At present there is no intention to develop waste disposal facilities on site. No waste disposal facility will be developed by the Mine without the relevant permissions. These permissions include an environmental authorisation and a waste license in terms of section 20 of the NEM: WA
	Off-site waste disposal facilities	Waste will be disposed of in accordance with National Norms and Standards. These will vary depending on the waste.
Waste transport	Contractor	An approved subcontractor, working to local authority standards, will undertake the waste transport to remove domestic waste, sewage sludge and the brine generated at water treatment facility (if necessary).
Disposal of different types of waste	Hazardous wastes	In accordance with GNR 634 (Waste Classification and Management Regulations) of the National Environmental Management: Waste Act (59 of 2008), disposal of hazardous waste will be controlled by a contractor (Class A or Class B landfill site).
	Non-hazardous waste	Disposal at a permitted non-hazardous waste disposal facility. An estimated 8 tons per annum is anticipated. (timber, cardboard, plastic, domestic waste)



<i>Items to be considered</i>		<i>Actions and Intentions</i>
<i>General</i>	<i>Specific</i>	
	Any soil polluted by a spill of chemicals	If remediation of the soil <i>in situ</i> is not possible, the soils will be classified as a waste in terms of the Minimum Requirements and will be disposed of at an appropriate permitted waste facility.
	Building rubble	Care will be taken to ensure that building rubble does not become polluted or mixed with any other waste.
	Scrap metal	Care will be taken to ensure that scrap metal does not become polluted or mixed with any other waste. (picks, bits, roof bolts, wire and cabling) The scrap metal will be collected in a designated area for scrap metal (scrap yard). It will be sold to scrap dealers.
	Oil	Oil will be collected in suitable containers at designated collection points. The collection points will be bunded and underlain by impervious materials to ensure that any spills are contained. Notices will be erected at each waste oil point giving instructions on the procedure for waste oil discharge and collection. An approved subcontractor will remove oil from site.
	Chemical Toilet Sludge	Will be removed off-site by an approved contractor.

5.6.2 Waste Water Treatment

Ballengeich Colliery does not operate any sewage treatment plant, but instead make use of two onsite conservancy tanks. The conservancy tanks are serviced by an independent contractor on an as and when needed basis.

5.6.3 Hazardous Waste

Hazardous waste recycling, in this case the recycling of old lubrication oils requires handling facilities that is of suitable design to prevent the spillage of oil on soil while stormwater ingress is limited to prevent wash off. This activity was conducted as part of the workshop layout with the construction of an oil trap. Waste oil is recycled through a reputable contractor. The existing plant is of suitable (concrete lined) construction to prevent contamination of soil while stormwater drainage from the facility is directly towards the existing oil and water separation facility. All hazardous waste material is handled in accordance with Environmental DGEW015 Protocol – Work Instruction for Oil Pollution Control. All SOPs will be made available from the applicant.

Audit and inspection reports will provide evidence to the effectiveness of the measures in place to prevent pollution in this area of the plant. Refer to **Table 5-2** above for further detail.

5.6.4 Other wastes

Note that topsoil will be removed from all stockpiling areas prior to formation of soft and hard overburden stockpiles. All topsoil, subsoil material will be removed during the closure phase and reused where possible. These stockpiles are considered low hazardous depositions with low impacts on the environment. The requirements for a low hazard residue deposit are as per **Table 5-3**. It should be noted that all waste material stockpiles will be left behind and that limited rehabilitation will take place at offices and roads depending on forecasted end use.



Table 5-3: Requirements for a Low Hazard Facility

Planning stage	Design stage	Commissioning and operational stages	Decommissioning stage
Conceptualisation by owner. Preliminary site selection by owner. Geotechnical investigation by owner (assisted by specialist if necessary).	Geotechnical report not mandatory. Residue characterisation on basis of past experience. Design by a suitably qualified person Risk analysis optional. Construction by a suitably qualified person.	Risk analysis optional. Suitably qualified person responsible for operation. Suitably qualified person to monitor. Suitably qualified person to audit every three years.	None

5.7 Operational Management

The Operational Management of Kangra is illustrated in **Figure 2-1**. There is no active mining taking place at Ballengeich. The General Manager has the overall responsibility to ensure compliance with the various environmental authorisations issued to the company. Environmental Management has the delegated responsibility to implement the required measures to meet with the requirements as specified in the issued EA's. The Environmental Manager reports to the General Manager on a regular (weekly) basis on environmental management performance measures.

5.8 Organisational Structure

The organisational structure for Kangra Coal (Pty) Ltd: Ballengeich Colliery is illustrated in **Figure 5-3**. Ballengeich is not operational and therefore there are no active mining activities to oversee. A contractor will be appointed to implement the required rehabilitation measures to be overseen by Kangra's engineering and environmental departments.

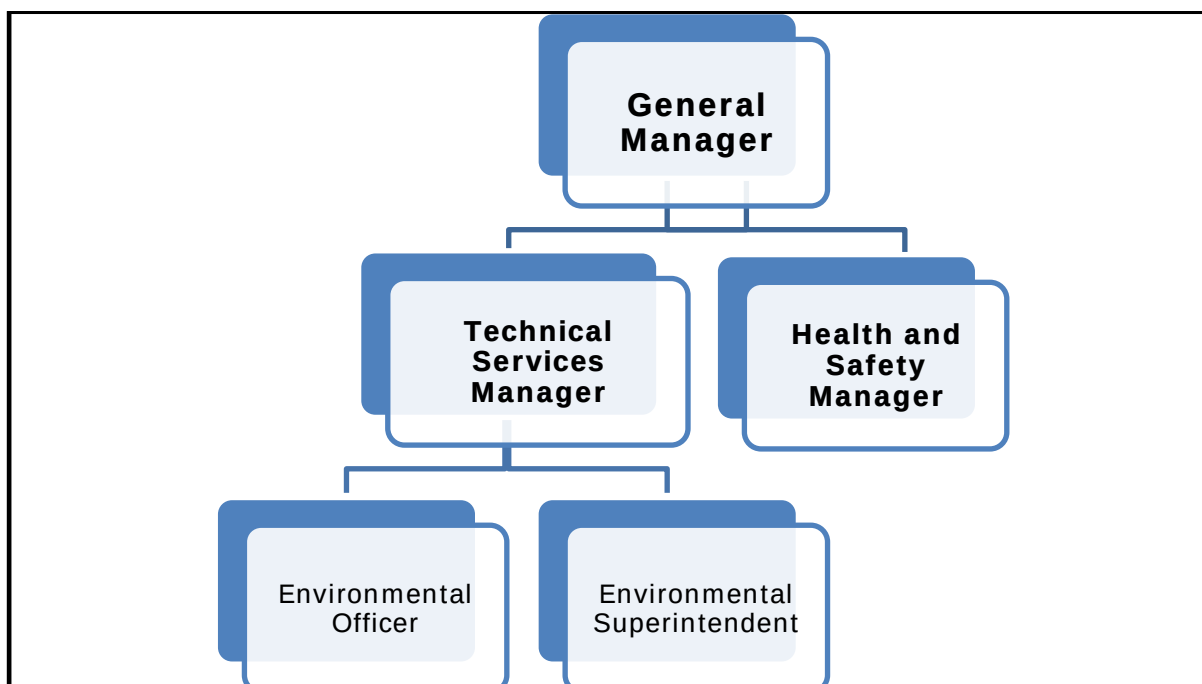


Figure 5-2: Kangra Coal Organisational Structure for environmental responsibilities



5.9 Resources and Competence

Kangra Coal as part of the Menar Group of companies have adequate and sufficient employee resources that meet the competency requirements as outlined in **Table 5-4**.

Table 5-4: Summary of employee resources and competencies

Employee	Job Grade	Job Band	Number of People
Senior management	E1 – E3	Band 5/13 – 4/16	22
Middle management	D2 – D4	Band 6/10 – 6/12	20
Superintendents/ Foremen	C4 – D1	C4, C4SS, D1	10
Technicians, senior clerks, tradesmen, miners, technical assistants	G6 – C1	G6 – C1	104
Skilled, general assistants, clerks, cleaners	G4	G4	164
TOTAL			320

5.10 Education and Training

Kangra provides the needed education and training for workers visiting Ballengeich. All contractors undergo induction training before commencing their work. Contractors are also issued with a contractor's pack containing detailed information regarding the Company profile, policies, code of practice, SOPs, work instructions and contact details. The contractors' pack is reviewed on a regular basis by the Safety Officials visiting the site.

5.10.1 Environmental Awareness Training

General environmental awareness training forms part of the induction. An employee will attend induction training and all contractor employees are required to undergo the general induction training should their work exceed a period of one (1) week on site.

The training material encompasses information regarding the SHE Policies, charter and visions, the description of environmental impacts, namely air pollution, waste management, water management, land management and energy conservation, the importance of environmental legislation, key roles and responsibilities in terms of environmental management and the reporting of non-conformances.

5.11 Internal and External Communication

Internal and external communication regarding Ballengeich is conducted by the Stakeholder and Human Relations department. Regular meetings are held with the ward councillors and communities adjacent to Ballengeich. Appointed contractors such as GCS and MENCO have undertaken extensive consultations on behalf of Kangra Coal with the Department of Water and Sanitation (DWS); The Department of Environmental Affairs; the Department of Mineral Resources; the Department of Land Affairs and all the other government departments who participate in the Ngagane Catchment Forum.

5.12 Awareness Raising

The objectives of the environmental awareness will be to ensure that:

- Training needs are identified and all personnel whose work may create a significant impact upon the environment have received appropriate training;



- Procedures are established and maintained to make appropriate employees aware of: The importance of conformance with SHE policies and procedures and the requirements of the Environmental Management System (EMS);
- The significance of environmental impacts, actual or potential, of their work activities and environmental benefits of improved personal performance;
- Their roles and responsibilities in achieving conformance with environmental policies, procedures and EMS;
- The potential consequences of departure from specified operating procedures; and
- Personnel performing specific tasks, which can cause significant environmental impacts, are competent in terms of appropriate education, training and/ or experience.

The identification of environmental training and development needs are derived from the analysis of role descriptions. The following general and specific training needs will be identified:

- General Training
 - o Environmental awareness training;
 - o Waste management;
 - o Awareness of the SHE policy; and
 - o Awareness of environmental legislation or any other requirements Canyon subscribes to.
- Specific Training
 - o Awareness of significant environmental aspects associated with work activities;
 - o Awareness of environmentally related operational procedures that need to be followed when conducting work activities;
 - o Awareness of the potential consequences of not following environmentally related operational procedures; and
 - o Environmental legislative requirements of work activities.

5.13 Monitoring and Control

As this is a historic and defunct mining activity, long-term monitoring has been implemented. The specialist investigations underwent monitoring/sampling to establish the environmental baseline characteristics of the site. These baseline characterisations are described in **Section 4** above.

The potential exists for the mining development to adversely affect water resources in close proximity to the study area. The proposed passive waste water treatment development could also substantially alter the hydrological and topographical characteristics of the footprint area, which would in turn affect the mean surface runoff, soil moisture, evapo-transpiration, and groundwater behavior. Consequently, sound management practices to prevent and minimise water pollution are fundamental for the implementation of the rehabilitation measures to be sustainable. Therefore, in order to manage the construction of the passive treatment with constructed wetlands properly, monitoring is critical to ensure that correct management decisions are taken. The monitoring systems described below are proposed to provide sound information on the effectiveness of protection measures to be implemented.

5.14 Surface Water Monitoring

Surface water monitoring is undertaken at various points at Ballengeich Colliery as indicated in **Table 5-5**. Surface water monitoring is done on a monthly basis.



Table 5-5: Ballengeich Colliery monitoring points for surface water

Sampling Point	Description	Coordinate
SW01	Horn River, upstream of the western opencast	27°53'35.84"S 29°56'21.09"E
SW02	Horn – DWAf gauging station (V3H009) downstream of the western opencast area	27°53'34.71"S 29°56'52.23"E
SW03	Horn – Final void of the western opencast.	
SW04	Horn – Beneath the bridge at the N11, west of the eastern opencast	27°53'18.28"S 29°57'52.63"E
SW05	Horn – Approximately 400m from N11, downstream of SW04 at the old east opencast	27°53'5.70"S 29°58'14.54"E
SW06	Horn – Downstream of the eastern opencast area, at the weir, before the confluence with the Ngagane River	27°53'6.05"S 29°58'27.05"E
SW07	Final void of the eastern opencast	
SW08	Old river channel below the discard dump	27°53'20.41"S 29°58'23.65"E
SW09	In the Ngagane River, at the SAR bridge	27°53'23.87"S 29°58'41.43"E
SW10	In the Ngagane River, downstream of the rehabilitated opencast workings, and approximately 500 m downstream of the confluence with the Horn River	27°52'46.32"S 29°58'25.71"E

5.15 Groundwater Monitoring

Groundwater monitoring is undertaken at various points at Ballengeich Colliery as indicated in **Table 5-6**. Groundwater monitoring is done on a quarterly basis.

Table 5-6: Groundwater monitoring points

Sampling Point	Description	Latitude	Longitude
UGBH1	Borehole drilled to the east of the N11	-27.883874°	29.965454°
UGBH01	East Underground workings, east of N11	-27.883870°	29.965530°
UGBH 3	West UG Workings approximately 1.45km west of N11	-27.879194°	29.949417°
UGBH 4	West UG Workings approximately 2.4km west of N11	-27.877361°	29.939000°
UGBH 5	South UG workings, 50m west of N11	-27.898290°	29.967150°
UGBH5	Borehole drilled into underground workings. West of the N11	-27.898206°	29.967064°
GW0	Borehole drilled upslope from GW08.	-27.87937°	29.96886°
GW01	Borehole drilled upslope from the Horn River, to the south, near the first decant point.	-27.890477°	29.962874°
GW02	Borehole, by Upper Bridge.	-27.894162°	29.947665°
GW03	Borehole by VN2.	-27.884192°	29.974252°
GW06	Borehole in old lands.	-27.879674°	29.971604°
GW08	Borehole drilled close to GW0. Replaced by GW0	-27.879370°	29.968860°
GW12	Borehole by VN2.	-27.885126°	29.974512°
GW13	Borehole on ridge.	-27.885230°	29.971292°
GW14	Old Borehole in old lands, replaced by GW06.	-27.879726°	29.971759°
GW15	Borehole between office and N11 road.	-27.882582°	29.968436°
GW16	Borehole by bridge.	-27.888554°	29.966723°
GW17	Borehole by discharge borehole.	-27.891669°	29.963036°
GW20a	Newly drilled borehole, drilled into underground workings. 40m.	-27.891784°	29.966222°



GW20b	Newly drilled borehole, drilled ±8m from GW20a. Drilled to first water strike at 12m. 13m deep	-27.891778°	29.966128°
GW21	Newly drilled borehole drilled south from the discard dump. Drilled to 30m.	-27.892780°	29.974920°
GW22	Experimental Borehole. 10m deep. Fitted with tubing to determine oxygen within the soil.	-27.882910°	29.974920°
GW23	Experimental Borehole. 10m deep. Fitted with tubing to determine oxygen within the soil.	-27.883350°	29.970230°

5.16 Bio-monitoring

An aquatic bio-monitoring program was initiated for Ballengeich during 2022. The aquatic ecological assessment is done twice a year, once during the wet season and once during the dry season. The aquatic biomonitoring points are described in **Table 5-7**.

Table 5-7: Selected bio-monitoring sites

Sampling Point	Description	Coordinate
Decant	The acidic decant along the Horn River, just upstream of the bridge on the N11 crossing the Horn River	27°53'20.87"S 29°57'47.37"E
PCD	The Pollution Control Dam is situated on site to treat mine waste water before it is discharged into the Horn River. The PCD is situated approximately 50 m upstream of the Horn River.	
Ngagane US	The site is located within the Ngagane River approximately 100m upstream of the confluence with the Horn River. This site is considered as an important reference site.	27°53'9.70"S 29°58'35.04"E
Ngagane DS	The site is located within the Ngagane River approximately 140m downstream of the confluence with the Horn River and represents an important comparative site when taking the impact of the Horn River into account.	27°52'56.98"S 29°58'30.90"E
Horn River US	This site is situated within the Horn River approximately 1.4 km upstream of the decant point. This site is considered as an important upstream reference site.	27°53'33.12"S 29°56'4.59"E
Horn River DS1	This site is situated approximately 200m downstream of the decant point also situated within the Horn River. This site is situated next to a bridge at the N11 road.	27°53'16.92"S 29°57'55.46"E
Horn River DS2	This site is located approximately 680 m downstream of the Horn DS 1 site also located within the Horn River. This site is clearly impaired by several erosion channels.	27°53'5.50"S 29°58'15.14"E

5.17 Waste Monitoring

The Ballengeich site is currently not operational, therefore there is no large-scale waste production currently taking place. The operations at Quantum do not generate large volumes of waste.

Once the site is recommissioned waste monitoring will be done on a regular basis (weekly) to ensure that the small amounts of domestic and hazardous waste listed under section 5.6.2 of this document are stored correctly and are removed off-site on a regular basis.



5.18 Risk Assessment

This section of the report describes and evaluates the potential impacts on the receiving water environment.

5.18.1 Impact Assessment Criteria

The criteria for the description and assessment of environmental impacts on the environment were provided by the DWS during the recent consultation process followed for proposed amendments to the regulations. This risk assessment key was referenced from the DWS risk-based water use authorisation approach and delegated guidelines. The criteria were drawn from the EIA Regulations, published by the Department of Environmental Affairs and Tourism (DEAT, 1998) in terms of the NEMA.

The level of detail as depicted in the DWS Risk-Based Water Use Authorisation Approach and Delegation Guidelines was fine-tuned by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes each aspect was assigned a value, ranging from one (1) to five (5), depending on its definition. This assessment is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. An explanation of the impact assessment criteria is defined below in **Table 5-8**.

Table 5-8: Explanation of the EIA Criteria

Spatial Scale / Extent			
Classification of the physical and spatial scale of the impact How big is the area that the aspect is impacting on?			
DWS	NEMA	Description	Class
Area specific	Footprint (F)	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.	1
Whole site	Site (S)	The impact could affect the whole, or a significant portion of the site.	2
Regional / neighbourhood areas	Regional (R)	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns.	3
National	National (N)	The impact could have an effect that expands throughout the country (South Africa).	4
Global	International (I)	Where the impact has international ramifications that extend beyond the boundaries of South Africa.	5
Duration			
The lifetime of the impact that is measured in relation to the lifetime of the proposed development. How long does the aspect impact on the environment and resource quality?			
DWS	NEMA	Description	Class
1 day – 1 month, PES, EIS and/REC not impacted	Short (ST)	The impact will either disappear with mitigation or will be mitigated through a natural process in a period shorter than that of the construction phase.	1
1 month – 1 year, PES, EIS and/REC impacted but no change in status	Short to Medium (S-M)	The impact will be relevant through to the end of a construction phase (1.5 years)	2
1 year – 10 years, PES, EIS and/REC impacted to a lower status but it	Medium (M)	The impact will last up to the end of the development phases, where after it will be entirely negated.	3



can be improved over this period through mitigation				
Life of the activity, PES, EIS and/REC permanently lowered		Long (LT)	The impact will continue or last for the entire operational lifetime i.e. exceed 30 years of the development, but will be mitigated by direct human action or by natural processes thereafter.	4
More than the life of the organisation/facility, PES and EIS scores a E or F		Permanent (P)	This is the only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.	5
Probability / Frequency				
This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. Activity frequency: How often do you do the specific activity? Frequency of impact: How often does the activity impact on the environment?				
DWS		NEMA		Class
Activity frequency	Impact frequency			
Annually or less	Almost never / almost impossible / >20%	Probable (Pr)	The possibility of the impact occurring is none, due either to the circumstances, design or experience. The chance of this impact occurring is zero (0 %).	1
6 monthly	Very seldom / highly unlikely / >40%	Possible (Po)	The possibility of the impact occurring is very low, due either to the circumstances, design or experience. The chances of this impact occurring is defined as 25 %.	2
Monthly	Infrequent / unlikely / seldom / >60%	Likely (L)	There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of this impact occurring is defined as 50 %.	3
Weekly	Often / regularly / likely / possible / >80%	Highly Likely (HL)	It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring is defined as 75 %.	4
Daily	Daily / highly likely / definitely / >100%	Definite (D)	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined as 100 %.	5
Magnitude / Intensity / Severity				
The intensity of the impact is considered by examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself. How severe does the aspect impact on the environment and resource quality characteristics (flow regime, Water quality, biota, habitat)?				
DWS		NEMA		Class
Insignificant / non-harmful	1	Insignificant (I)		2



Small / potentially harmful	2	Low (L)	The impact alters the affected environment in such a way that the natural processes or functions are not affected.	4
Significant / slightly harmful	3	Moderate (M)	The affected environment is altered, but functions and processes continue, albeit in a modified way.	6
Great / harmful	4	High (H)	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.	8
Disastrous / extremely harmful and/or wetland(s) involved ⁴	5	Very high / Don't know		10
Legal Issues				
How is the activity governed by legislation?				
DWS				
No Legislation				1
Fully covered by legislation (wetlands are legally covered) ⁵				5
Detection				
How quickly can the impacts/risks of the activity be observed on the environment (water resource quality, characteristics) people and property?				
Immediately				1
Without much effort				2
Need some effort				3
Remote and difficult to observe				4
Covered				5

⁴ Where "or wetland(s) are involved" it means the activity is located within the boundary (the temporary, seasonal / permanent zone of the wetland)

⁵ Within the outer edge of the 1 in 100-year flood line or delineated riparian area as measured from the middle of the watercourse measured on both banks, or within a 500 m radius from the boundary of any wetland (The boundary of a wetland is the outer edge of the seasonal or temporary zone as delineated for the wetland)



5.18.2 Determination of Significance

Determination of significance refers to the foreseeable significance of the impact after the successful implementation of the necessary mitigation measures. The Significance Rating (SR) is determined as follows:

Consequence = Severity + Spatial Scale + Duration

Likelihood = Frequency of activity + Frequency of Incident + Legal Issues + Detection

Significance / Risk Rating (SRR) = Consequence x Likelihood

Other aspects to take into consideration are:

- Impacts should be described both before and after the proposed mitigation and management measures have been implemented.
- All impacts should be evaluated for the full-lifecycle of the development.
- The impact evaluation should take into consideration the cumulative effects associated with this and other facilities which are either developed or in the process of being developed in the region.
- The specialist studies must attempt to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. Where appropriate, national standards are to be used as a measure of the level of impact.

5.18.3 Identifying the Potential Impacts

It is a general consensus that mining poses significant threats to the environment due to their destructive activities.

Generic key issues stemming from mining/sidings that are associated with aquatic ecology, wetlands and rivers are anticipated to include:

- Destruction of or alteration to NFEPA wetlands and rivers;
- Modification of Ecological Support Areas;
- Movement of sediments into the river or wetland;
- Loss of soil and riparian vegetation due to mining infrastructure and mining front development;
- Disruption of stream flow in rivers; and
- Contamination of the wetland or river through the release of stormwater or other pollutants (AMD) associated with former operational activities.

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned probabilities, resulting in a value for each impact (prior to the implementation of mitigation measures). Significance without mitigation is rated on the following scale as contemplated in **Table 5-9**.

In order to gain a comprehensive understanding of the overall significance of the impact, after implementation of the mitigation measures, it will be necessary to re-evaluate the impact.

Table 5-9: Significance Rating Scales without and with mitigation



Rating	Class	Management Description
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	(M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input.
170 – 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.

Table 5-10 below reflects all the potential impacts and their respective mitigation measures as proposed by the specialist studies. However, it should be noted that each specialist makes use of their own risk assessment matrix and thus the scores given in the table below might differ to the specialist report however the risk rating remains the same.



Table 5-10: Calculation of the severity rating based on the identified impacts of Ballengeich Colliery

No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
1	C	Site Clearance & Construction of infrastructure	Fauna/Flora; Aquatic ecology; Surface Water; Hydropedological	Loss of Riparian areas, wetlands; Loss of biodiversity and ecological function; and Loss of hydrological connectivity due to infrastructure impeding drainage lines and/or the flow of water (construction of weirs and artificial wetlands +- 8ha)	The footprint area should be limited as far as possible. Avoidance of unnecessary disturbance or destruction of natural habitat is an important mitigation tool for flora and thereby associated fauna. Avoid encroaching on natural areas directly adjacent to proposed activities in close proximity or within buffer areas; Rehabilitation must include planting of indigenous local species, preferably suitable riparian species if banks and beds are affected, and as per the approved rehabilitation plan for Section 21 (c) & (i) activities - focusing on species native to the river; To prevent the erosion of soil, management measures may include structures to protect areas and soil from areas susceptible to erosion. Water control structures should be constructed and well maintained to minimize erosion and to create a favorable habitat for the establishment of vegetation. Rehabilitation of the disturbed area should take place after construction, whereby a mixture of native grass species harvested from wetland areas is planted immediately to prevent erosion. Soils compacted by heavy machinery in areas that are not utilised post-construction should be ripped to allow infiltration. Roads should be maintained regularly to ensure that surface water drains freely off the road, preventing erosion, and Ensure that stormwater management structures are in good working condition	Severity:	Flow regime	
							3	2
							Water quality	
							4	3
							Habitat	
							3	3
							Biota	
							4	3
						Consequence:	Severity	
							3.5	2.5
							Spatial scale	
							2	1
							Duration	
							4	4
						Likelihood:	Freq. of activity	
							5	5
							Freq. of incident	
							4	2
							Legal issue	
							5	5
							Detection	
							3	3
						Significance	161.5	112.5
						Risk Rating	MODERATE (-)	MODERATE (-)



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
					through regular inspection, especially after large storm events.			
2	C	Site Clearance & Construction of Infrastructure	Fauna/Flora; Surface Water; Hydropedological	Habitat fragmentation and edge effects resulting in alien plant invasion	An alien plant species management plan should be compiled and implemented. Alien and Invasive Plants should be eradicated and controlled to prevent spread within and beyond the footprint, especially in disturbed areas. Where feasible, rehabilitate disturbed areas as soon as possible after construction and include the areas in and around wetland features. Erosion and incision within riparian and wetland areas are to be prevented during the construction phase of the proposed development. Where areas within the riparian and wetland habitat are at risk, immediate measures have to be taken in order to prevent erosion from occurring. If excessive erosion is observed, soil management and, such as erosion protected structures and measures should be implemented. No stockpiles and storage of construction material may be located within the riparian and wetland areas or buffer zones without the required permits. Any litter or waste material potentially generated on site as part of the construction process and excavation activities must be removed from the riparian and wetland areas and disposed of at a suitable landfill site. If possible, implementation/construction activities should be scheduled for the drier months / low flow season to decrease the risk of erosion during heavy thunderstorms; and	Severity:	Flow regime	
							2	1
							Water quality	
							2	1
							Habitat	
							5	3
							Biota	
							5	3
						Consequence:	Severity	
							3.5	2
							Spatial scale	
							2	1
							Duration	
							3	2
						Likelihood:	Freq. of activity	
							4	3
							Freq. of incident	
							4	3
							Legal issue	
							5	5
							Detection	
							2	1
						Significance	127.5	60
						Risk Rating	MODERATE (-)	MODERATE (-)



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
					The footprint area should be limited as far as possible.			
3	O	Increased vehicular movement on site	Fauna/Flora	Disturbance to fauna on site (road kills, noise)	Erect signage on site; Adhere to speed limits; Make use of internal fencing; and Avoid vehicular movement at night.	Severity:	Flow regime	
							1	1
							Water quality	
							1	1
							Habitat	
							4	2
							Biota	
							3	2
						Consequence:	Severity	
							2.25	1.5
							Spatial scale	
							2	1
							Duration	
							4	3
						Likelihood:	Freq. of activity	
							3	2
							Freq. of incident	
							3	2
							Legal issue	
							1	1
							Detection	
							4	4
						Significance	90.75	49.5
						Risk Rating	MODERATE (-)	LOW (-)
4	D	Dismantling and removal of infrastructure	Fauna/Flora	Alien plant invasion	An alien plant species management plan should be implemented for two years following closure.	Severity:	Flow regime	
							1	1
							Water quality	



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
							1	1
							Habitat	
							5	2
							Biota	
							5	2
						Consequence:	Severity	
							3	1.5
							Spatial scale	
							2	1
							Duration	
							3	3
						Likelihood:	Freq. of activity	
							5	5
							Freq. of incident	
							4	2
							Legal issue	
							1	1
							Detection	
							3	2
						Significance	104	55
						Risk Rating	MODERATE (-)	LOW (-)
5	D	Rehabilitation of infrastructure footprint areas	Fauna/Flora	Restoration of vegetation and habitat types	Reseed with naturally occurring grasses typical of the area and habitat.	Severity:	Flow regime	
							1	1
							Water quality	
							1	1
							Habitat	
							3	5
							Biota	



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
							3	4
						Consequence:	Severity	
							2	2.75
							Spatial scale	
							1	1
							Duration	
							3	5
						Likelihood:	Freq. of activity	
							3	5
							Freq. of incident	
							4	5
							Legal issue	
							1	1
							Detection	
							3	3
						Significance	66	122.5
						Risk Rating	MODERATE (+)	MODERATE (+)
6	O	Construction of stockpiles and artificial wetlands	Soil, Land Use and Land Capability; Aquatic Ecology	Soil compaction and erosion;	Follow adequate stripping guidelines. Topsoil should be stripped by means of an excavator bucket and loaded onto dump trucks. If possible, topsoil should be stripped when the soil is dry, as to reduce compaction. Ensure topsoil is stored in one dedicated stockpile, 10 m high and away from drainage lines and surface water; Only the designated access routes are to be used. If erosion occurs, corrective actions must be	Severity:	Flow regime	
							1	1
							Water quality	
							2	1
							Habitat	
							3	3
							Biota	
							3	2
						Consequence:	Severity	
							2.25	1.75
							Spatial scale	



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
					taken to minimise any further erosion from taking place; Stockpiles are to be maintained in a fertile and erosion free state by sampling and analysing annually for macro nutrients and soil pH, and vegetating the stockpiles to reduce erosion; Compaction of the removed topsoil should be avoided by prohibiting traffic on stockpiles; Prevent unauthorised borrowing of stockpiled soil; and Ensure proper storm water management designs are in place.		2	2
							Duration	
							4	4
						Likelihood:	Freq. of activity	
							5	5
							Freq. of incident	
							4	2
							Legal issue	
							1	1
							Detection	
							4	3
						Significance	115.5	85.25
						Risk Rating	MODERATE (-)	MODERATE (-)
7	O	Construction of stockpiles	Soil, Land Use and Land Capability; Aquatic Ecosystem Delineation (Wetlands)	Soil Contamination	Ensure that coal stockpile area is banded/ compacted prior to activities starting;	Severity:	Flow regime	
							3	2
							Water quality	
							3	2
							Habitat	
							5	4
							Biota	
							5	4
						Consequence:	Severity	
							4	3
							Spatial scale	
							2	2
							Duration	
							5	4
						Likelihood:	Freq. of activity	



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
							5	5
							Freq. of incident	
							5	4
							Legal issue	
							5	5
							Detection	
							4	4
						Significance	209	162
						Risk Rating	HIGH (-)	MODERATE (-)
8	D	Demolition of infrastructure	Soil, Land Use and Land Capability	Increased soil erosion and compaction	Deep rip compacted areas to allow for natural vegetation regrowth; Ensure proper storm water management designs are in place; Replaced soils to be re-vegetated and designed according to Chamber of Mines Rehabilitation Guidelines; Soils must be replaced according to the soil types; Compaction of the topsoil should be avoided	Severity:	Flow regime	
							1	1
							Water quality	
							3	1
							Habitat	
							5	3
							Biota	
							4	3
						Consequence:	Severity	
							3.25	2
							Spatial scale	
							2	1
							Duration	
							5	3
						Likelihood:	Freq. of activity	
							5	5
							Freq. of incident	
							5	3
							Legal issue	



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
							1	1
							Detection	
							4	3
						Significance	153.75	72
						Risk Rating	MODERATE (-)	MODERATE (-)
9	D	Demolition of infrastructure	Soil, Land Use and Land Capability	Loss of land capability	Mitigation is not possible on the pit areas due to size of the void that will be left after mining. Reshaping of the area must be done as far as possible to mimic the surrounding land scape.	Severity:	Flow regime	
							2	2
							Water quality	
							2	2
							Habitat	
							4	2
							Biota	
							3	2
						Consequence:	Severity	
							2.75	2
							Spatial scale	
							2	2
							Duration	
							5	4
						Likelihood:	Freq. of activity	
							5	5
							Freq. of incident	
							4	3
							Legal issue	
							5	5
							Detection	
							3	3
						Significance	165.75	128



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
						Risk Rating	MODERATE (-)	MODERATE (-)
10	D	Rehabilitation of old open pit and infrastructure areas	Soil, Land Use and Land Capability; Surface Water	Restoration of land capability to its pre-mining state or agreed upon alternative	Rehabilitate according to the rehabilitation plan; Return the land conditions capable of supporting prior land use or uses equal or better than prior land use to the extent feasible or practical; Contour slopes to minimise erosion and run-off; Return of natural drainage patterns as a result of freely draining topography; Soils compacted by heavy machinery can be ripped to allow infiltration. Rehabilitation processes such as restoring the topography to a pre-activity state, and re-vegetation of disturbed areas will assist in returning natural surface water drainage patterns, and Establish a free-draining final landform.	Severity:	Flow regime	
							3	2
							Water quality	
							3	1
							Habitat	
							3	4
							Biota	
							3	4
						Consequence:	Severity	
							3	2.75
							Spatial scale	
							2	2
							Duration	
							5	5
						Likelihood:	Freq. of activity	
							5	5
							Freq. of incident	
							3	4
							Legal issue	
							5	5
							Detection	
							3	3
						Significance	160	165.75
						Risk Rating	MODERATE (+)	MODERATE (+)
11	C, O, D	Removal of vegetation and exposure of soils for site	Surface Water; Aquatic Ecology;	Sedimentation of surface water resources leading to water siltation and	Implementation of SWMP and maintenance plan to allow for efficient functioning of infrastructure and sediment trapping;	Severity:	Flow regime	
							3	1
							Water quality	



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
		clearance; Erosion and runoff; and Loosening of soil during demolition	Hydropedological; Aquatic Ecosystem Delineation (Wetlands)	deteriorating water quality.	Monitor points of release; Installation of windrows to ensure water movement does not concentrate and lead to erosion; Pooling of water on site must be avoided and managed at all times Soils compacted by heavy machinery in areas that are not utilised post-construction should be ripped to allow infiltration. Implement erosion prevention measures and structures; Avoid contamination of soils and implement appropriate remedial measures if incidents of spillage occur; and Monitor Water Quality and Aquatic Health (Biomonitoring) regularly - every month and Aquatic Health bi-annually (wet and dry season).		3	1
							Habitat	
							3	2
							Biota	
							3	2
						Consequence:	Severity	
							3	1.5
							Spatial scale	
							3	2
							Duration	
							3	3
						Likelihood:	Freq. of activity	
							5	5
							Freq. of incident	
							4	3
							Legal issue	
							5	5
							Detection	
							4	4
						Significance	162	110.5
						Risk Rating	MODERATE (-)	MODERATE (-)
12	C	Movement of heavy machinery and vehicles; Construction of infrastructure	Surface Water; Aquatic Ecology; Hydropedological	Reduced surface water infiltration and baseflow as a result of soil compaction; Alteration in surface water drainage patterns; Diversion of clean water areas, altering the	Adherence to the engineered Storm Water Management Plan as compiled by an accredited engineer (Struxit) is crucial; Development and implementation of the storm water management structures to ensure that sediment generated during the construction phase is conveyed to the silt trap/PCD, and clean water is diverted away from dirty water areas;	Severity:	Flow regime	
							4	2
							Water quality	
							4	2
							Habitat	
							3	2
							Biota	



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
				drainage patterns; and Hydrocarbon contamination from heavy machinery and vehicles.	Soils compacted by heavy machinery in areas that are not utilised post-construction should be ripped to allow infiltration. Roads should be maintained regularly to ensure that surface water drains freely off the road, preventing erosion. Ensure that stormwater management structures are in good working condition through regular inspection, especially after large storm events. River crossings/wetland (if necessary) should be designed by an engineer to prevent impacts and failing structures; During the river / wetland crossing construction period, all care should be taken to prevent further impacts on the watercourse and riparian areas and the surrounding natural environment by keeping the construction footprint as small as possible; Flow must be maintained throughout the construction phase of the development and all contractors must be made aware of the high importance of instream flow maintenance; A clean and dirty water separation system shall be implemented and maintained throughout the operational life of the coal stockyard. Limit refueling and maintenance of machinery and vehicles to specified locations and ensure the appropriate spill prevention and incident management measures are in place.			
							3	2
						Consequence:	Severity	
							3.5	2
							Spatial scale	
							3	3
							Duration	
							4	4
						Likelihood:	Freq. of activity	
							5	5
							Freq. of incident	
							3	3
							Legal issue	
							5	5
							Detection	
							5	5
						Significance	189	162
						Risk Rating	HIGH (-)	MODERATE (-)
13	C, O, D	Dirty water runoff	Surface Water; Aquatic Ecology;	Potentially contaminated runoff and seepage into downstream surface water resources resulting	Adherence to the engineered Storm Water Management Plan as compiled by an accredited engineer is crucial;	Severity:	Flow regime	
							3	3
							Water quality	



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
			Hydropedological	in water contamination, Acid Mine Drainage (AMD) and the deterioration of the water quality; Reduction of Catchment Yield as dirty water runoff within the project area will be contained in the PCD; Deterioration of water quality in the downstream surface water resources due to contaminated stormwater runoff and potential AMD; Nutrient increase in Horn and Ngagane River and surrounding aquatic communities.	Ensure that effective separation of clean and dirty water systems is implemented, as designed by an engineer. No contaminated ("dirty") water should be allowed to enter the natural environment, clean water systems or water resources; Ensure that all the dirty water emanating from the dirty water areas is collected via silt traps before entering the PCD for re-use within the operation, to prevent unnecessary discharge into the environment. The dirty water collection trenches should be cleaned regularly to reduce the build-up of coal material, material will be deposited on the coal stockpiles and to ensure they are able to accommodate and convey the 1:50 year peak flows. This material should be disposed to an appropriately licensed facility; Stockpiling areas need to be licensed and constructed as per the requirements of the Competent Authority; Water quality in the PCDs should be monitored. This ensures that pollution sources are monitored during the operational phase and in the unlikely event of any spillages the downstream impacts can be estimated. The main constituents to check would be the TDS, EC, salts and some chemical parameters such as (pH, SO₄ and other metals); Seepage or discharge of waste water from the waste water containment facilities should be prevented to reduce pollution of surface water resources as well as to improve water conservation. Dirty water containment facilities and residue stockpiles should be appropriately lined as per the recommendations of a Geohydrological and/or Waste Classification Study; and Implementation of the recommended		5	2
							Habitat	
							4	3
							Biota	
							4	3
						Consequence:	Severity	
							4	2.75
							Spatial scale	
							3	2
						Likelihood:	Duration	
							5	4
							Freq. of activity	
							3	3
						Significance	Freq. of incident	
							2	2
							Legal issue	
							5	5
						Risk Rating	Detection	
							4	4
							168	122.5
							MODERATE (-)	MODERATE (-)



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
					monitoring plan to ensure that impacts to the surface water environment are detected timeously.			
14	C, O	Prolonged activities within and in proximity to watercourses and sensitive zones	Surface Water; Aquatic Ecology	Loss of biodiversity and ecological function of surface water features; Interference with ecological corridor functioning; Potential proliferation of Alien Invasive Plant species	Corridor movement and hydrological connectivity associated with water resources should not be hampered by the development. No sections of the streams/rivers should be cordoned off; Implementation of the recommended monitoring plan to ensure that impacts to the surface water environment are detected timeously; Avoid contamination of soils and implement appropriate remedial measures if incidents of spillage occur; Alien invasive control should be implemented, specifically for disturbed areas; To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees; No fishing, hunting or trapping should be allowed by the employees or other parties on the footprint and the land should be closely monitored regularly; and No waste will be disposed of in or around the project area, which can attract rodents or other types of fauna; waste will be managed correctly.	Severity:	Flow regime	
							1	1
							Water quality	
							2	1
							Habitat	
							5	2
							Biota	
							5	2
						Consequence:	Severity	
							3.25	1.5
							Spatial scale	
							2	1
							Duration	
							4	2
						Likelihood:	Freq. of activity	
							4	4
							Freq. of incident	
							4	2
							Legal issue	
							5	5
							Detection	
							4	4
						Significance	157.25	67.5
						Risk Rating	MODERATE (-)	MODERATE (-)
15	D	Demolition of infrastructure	Surface Water	Movement of heavy vehicles compacting soils leading to alteration of the natural surface water	Leaving the storm water management structures in place during the decommissioning and post closure phase until the rehabilitation process is completed	Severity:	Flow regime	
							4	2
							Water quality	



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
				drainage patterns and reduced infiltration; Sedimentation due to loosening of soil	(i.e., no more dirty water generated). This will ensure that sediment generated during this phase is captured; Keeping the storm water management systems in place will reduce potential impacts of pollutants due to the prolonged storage and transportation of coal; and Storm water management structures should be inspected after large storm events to ensure that there are no blockages or damage. Should blockages or damage occur, immediate action should be undertaken to remove debris or to repair damaged areas.		2	1
							Habitat	
							1	1
							Biota	
							1	1
						Consequence:	Severity	
							2	1.25
							Spatial scale	
							2	3
							Duration	
							4	2
						Likelihood:	Freq. of activity	
							5	5
							Freq. of incident	
							5	5
							Legal issue	
							5	5
							Detection	
							4	4
						Significance	152	118.75
						Risk Rating	MODERATE (-)	MODERATE (-)
16	C, O	Waste entering the water environment	Aquatic Ecology	Possible deterioration in the Present Ecological Status (PES)	Protect soil resource, beds and banks therefore preventing erosion and increased sedimentation in the resource. This will prevent increased sedimentation and smothering of aquatic ecosystems; Implement appropriate Stormwater Management Plan, which will include erosion prevention measures and sediment trapping	Severity:	Flow regime	
							1	1
							Water quality	
							3	1
							Habitat	
							5	2
							Biota	



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
					systems or measures; and Adequate monitoring to detect changed in the surface and groundwater environment must be initiated by the applicant, with special focus on contaminants associated with coal and the possibility of formation of Acid Mine Drainage in the area.		5	2
						Consequence:	Severity	
							3.5	1.5
							Spatial scale	
							3	2
							Duration	
							4	3
						Likelihood:	Freq. of activity	
							3	3
							Freq. of incident	
							3	3
							Legal issue	
							5	5
							Detection	
							3	3
						Significance	147	91
						Risk Rating	MODERATE (-)	MODERATE (-)
17	C, O, D	Stormwater Management Features	Aquatic Ecology; Hydropedological	Water Quantity impacts (possibly diverting or impeding water flow) reducing water available to sustain Aquatic diversity.	There will be no discharges of dirty water from the construction site and mobile chemical toilets to be provided for workers during construction; Avoid contamination of soils and implement appropriate remedial measures if incidents of spillage occur; Protect and prevent unnecessary impacts within the riparian and 32m zone (or otherwise delineated buffer as per surface water assessment) of the watercourse; Rehabilitate affected areas immediately to prevent sedimentation and protect against erosion;	Severity:	Flow regime	
							4	2
							Water quality	
							2	1
							Habitat	
							1	1
							Biota	
							1	1
						Consequence:	Severity	
							2	1.25
							Spatial scale	



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
					Protect or license impacts to wetlands, to ensure proper management and prevention of unnecessary impacts; Divert clean water around the site – implement formal SWMP; Optimise water use by means of reuse and recycling; and Implement divergences or impedances (crossings specifically) as per designs and formal management plans.		3	2
							Duration	
							4	3
						Likelihood:	Freq. of activity	
							5	5
							Freq. of incident	
							3	2
							Legal issue	
							5	5
							Detection	
							3	3
						Significance	144	93.75
						Risk Rating	MODERATE (-)	MODERATE (-)
18	D	Demolition of infrastructure	Aquatic Ecology	Decommissioning and material movement in close proximity to water resources impact on biodiversity and ecological functioning; Alteration of drainage patterns; Decrease in water quality due to insufficient waste management practices.	Adherence to the engineered Storm Water Management Plan as compiled by an accredited engineer is crucial; Corridor movement associated with water resources should not be hampered by the development. No sections of the river should be cordoned off; Continuous monitoring is important to ensure the baseline environmental condition is not impacted; To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees; No fishing, hunting or trapping should be allowed by the employees or other parties on	Severity:	Flow regime	
							2	1
							Water quality	
							2	1
							Habitat	
							2	1
							Biota	
							2	1
						Consequence:	Severity	
							2	1
							Spatial scale	
							2	1
							Duration	
							5	3
						Likelihood:	Freq. of activity	



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
					the footprint and the land should be closely monitored regularly; and No waste will be disposed of in or around the project area, which can attract rodents or other types of fauna; waste will be managed correctly.		5	5
							Freq. of incident	
							2	1
							Legal issue	
							5	5
							Detection	
							Significance	108
Risk Rating	MODERATE (-)	LOW (-)						
19	O	Excavation for Artificial wetland construction	Aquatic Ecosystem Delineation (Wetlands)	Increased flow volumes; Ecotone Removal	Monitor points of release; Ensure bunding of stockpiles; Installation of windrows to ensure water movement does not concentrate and lead to erosion; and Ensure activities adjacent to the aquatic eco-systems are managed/ limited to ensure impact is mitigated	Severity:	Flow regime	
							3	1
							Water quality	
							2	1
							Habitat	
							2	1
							Biota	
							1	1
						Consequence:	Severity	
							2	1
							Spatial scale	
							2	1
							Duration	
						Likelihood:	2	1
							Freq. of activity	
							2	2
							Freq. of incident	
2	2							
Legal issue								



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
							5	5
							Detection	
							1	1
						Significance	60	30
						Risk Rating	MODERATE (-)	LOW (-)
20	O	Excavations: rewording of the existing residue stockpile/Dump	Aquatic Ecosystem Delineation (Wetlands)	Sediment Ingress; Impact on long term ecosystem health; Reduced functionality of buffer; Possible spillage into natural areas; Physical excavation in soil and product	Monitor points of release; Ensure bunding of stockpiles; Monitor the systems with emphasis on water quality and preventative measures to ensure degradation is observed and mitigated; Ensure setback of buffer is maintained; Bunding of stockpiles; Placement of berms along natural areas to prevent ingress; The sequential nature of soils must be kept; and Stockpiling done outside setback areas.	Severity:	Flow regime	
							3	2
							Water quality	
							2	1
							Habitat	
							2	1
						Consequence:	Biota	
							2	1
							Severity	
							2.25	1.25
							Spatial scale	
							2	1
						Likelihood:	Duration	
							2	2
							Freq. of activity	
							3	3
							Freq. of incident	
							2	1
						Significance	Legal issue	
							5	5
							Detection	
							1	1
							68.75	42.5



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
						Risk Rating	MODERATE (-)	LOW (-)
21	O	Hydrocarbon spills	Aquatic Ecosystem Delineation (Wetlands)	Possible spillage into natural areas; Refilling of machinery.	Make use of drip trays and spill kits; and Refill outside the wetlands and buffers.	Severity:	Flow regime	
							1	1
							Water quality	
							5	3
							Habitat	
							3	2
							Biota	
							2	1
						Consequence:	Severity	
							2.75	1.75
							Spatial scale	
							1	1
							Duration	
							2	2
						Likelihood:	Freq. of activity	
							2	2
							Freq. of incident	
							2	1
							Legal issue	
							5	5
							Detection	
							1	1
						Significance	57.5	42.75
						Risk Rating	MODERATE (-)	LOW (-)
22	C, O	Access Road	Aquatic Ecosystem Delineation (Wetlands)	Crossing of aquatic ecosystems with machinery;	Ensure hydrological connections remain. Reduce sediment ingress into the aquatic ecosystems using sediment barriers; and	Severity:	Flow regime	
							4	2
							Water quality	



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
				Construction of access road including culverts and infilling around crossing points	Placement of sediment barrier during construction. Water must flow into downstream water at water level - i.e. no step in water allowed.		4	2
							Habitat	
							3	2
							Biota	
							3	2
						Consequence:	Severity	
							3.5	2
							Spatial scale	
							3	1
							Duration	
							4	3
						Likelihood:	Freq. of activity	
							4	4
							Freq. of incident	
							4	3
							Legal issue	
							5	5
							Detection	
							5	5
						Significance	189	102
						Risk Rating	HIGH (-)	MODERATE (-)
23	C	Leakages and spillages from machinery	Hydrogeological	Deterioration in groundwater quality	Monitoring of groundwater and surface water quality; and Dirty surface run-off should be pumped or transferred passively to dirty water dams. These dams should be lined to ensure no future pollution of groundwater resources.	Severity:	Flow regime	
							1	1
							Water quality	
							2	1
							Habitat	
							1	1
							Biota	



No	Phase	Activity	Specialist assessment	Impact	Mitigation	Criteria	Risk rating without mitigation	Risk rating with mitigation
							Specific factors	
							1	1
						Consequence:	Severity	
							1.25	1
							Spatial scale	
							2	2
							Duration	
							3	2
						Likelihood:	Freq. of activity	
							3	3
							Freq. of incident	
							3	1
							Legal issue	
							5	5
							Detection	
							2	2
						Significance	81.25	55



5.19 Public Consultation Process

The Public Participation Process (PPP) for this WULA has not yet commenced and will be conducted independently from the EA process in terms of the NWA and the DWS Public Participation Guidelines for Water Use Licence Applications. The NWA PPP process will include, as a minimum: advertisement of the application in a local newspaper circulating in the area of the project; erection of site notices at strategic points in and around the project site; notification of all registered Interested and Affected Parties (IAPs) by written correspondence; distribution of a Background Information Document (BID) and comment sheet; and maintenance of an IAP register throughout the process. The PPP is anticipated to commence in mid-June 2026. It must be noted that the Environmental Authorisation process under NEMA is being managed separately and will follow its own independent public participation and comment period requirements.

5.20 Issues and Responses

The PPP has not yet commenced. All issues raised by IAPs during the PPP will be captured with a written response and consolidated into a Comments and Response Report (CRR), which will be submitted to DWS as part of the WULA. The CRR will be made available to all registered IAPs upon request.

5.21 Matters requiring attention

The following technical and regulatory matters require attention in the context of the ongoing environmental authorisation and water use licensing processes:

- The passive AMD treatment infrastructure will interact with approximately 6 ha of floodplain wetland along the Horn River. Both delineated wetland units are confirmed artificial in origin. The Wetland Delineation and Rehabilitation Strategy must be implemented as part of the construction and operational phases — refer to Section 4.18.
- The Channelled Valley Bottom Wetland requires riparian stabilisation using gabion structures and indigenous revegetation. A 100 m strict no-go buffer applies — refer to Section 4.18 and the Method Statement.
- Discharge from the passive treatment system to the Horn River is subject to strict water quality conditions. Discharge may only commence once pH ≥ 5.5 and Fe ≤ 10 mg/L are confirmed on three consecutive weekly samples. Full GN 1873 RQO compliance is required within 12 months of commissioning — refer to Section 7.4.
- Community concerns will be addressed through the NWA Public Participation Process and documented in the Comments and Response Report (CRR) — refer to Section 5.19.

5.22 Assessment of level of confidence of information

Extensive specialist information was generated since 2014 to date in order to establish the baseline environmental conditions of the project areas. These assessments also considered historical studies conducted on the project area. The specialist assessments undertaken during the EIA and WULA process were used to compile the IWWMP. Specialist specific limitations and assumptions are covered and are included in the related Specialist Reports.



6 WATER AND WASTE MANAGEMENT

6.1 Water and Waste Management Philosophy

Kangra's respect for the environment shapes their commitment to minimising impact. The company is deeply devoted to conserving natural resources within and around their operations. Kangra's environmental policies and programs are guided by applicable legislation.

Aligned with the National Environmental Management Act, the Mineral and Petroleum Resources Development Act, and other relevant environmental regulations, Kangra has crafted a comprehensive Environmental Management Programme. Their dedicated team, comprising environmental scientists and compliance officers, diligently ensures ongoing compliance through regular monitoring.

Kangra also engage independent consultants to provide expert guidance on environmental protection measures. These include waste management, air quality control, pollution control, conservation of natural resources, and land rehabilitation.

6.2 Strategies

The rehabilitation activities at Ballengeich form a large part of the strategies presented in this section. It is further aligned with the Mine Water Management Policy of the DWS (May, 2022) insofar it relates to Integrated approaches to mine closure whereby the NWA will be used to address mine water directly.

6.3 Performance Objectives

Specific performance objectives for each of the management categories are summarised in **Table 6-1**.

Table 6-1: Performance Objectives for Ballengeich

Key Performance Indicator (KPI)	Objective
Surface Water	Compliance with relevant RQO's as stipulated in Table 6-2 for Horn and Ngagane Rivers
Process Water	- Reduction in process water based on WCDM principles - Containment of process and discharge in accordance with WUL conditions - Implementation of most appropriate Waste Water Treatment Technology
Stormwater	- Clean and dirty water operated as separated systems - Dirty runoff areas to be minimised, clean runoff to be maximised - Compliance with GN704 Regulations
Ground Water	- Reduction of rainwater infiltration to reduce AMD leachate - Reduce impact of AMD on water resources - Reduce pollution plume migration emanating from contaminated areas
Waste	- Minimisation of waste production - Implement waste reduction, re-use and recycle hierarchy - Correct storage of waste - Waste disposal is undertaken regularly and relevant waste disposal certificates kept

Table 6-2: Site Specific Water Quality Objectives



Chemical Parameter	Target Water Quality Range		
	Class 0	Class 1	Class 2
pH	5-9.5	4.5-10	4-10.5
Electrical Conductivity	< 70	70-150	150-370
Calcium as Ca	< 80	80-150	150-300
Magnesium as Mg	< 70	70-100	100-200
Sodium as Na	< 100	100-200	200-400
Chloride as Cl	< 100	100-200	200-600
Sulphate as SO ₄	< 200	200-400	400-600
Nitrate as NO _x -N	< 6	6-10	10-20
Fluoride as F	< 0.7	0.7-1.0	1.0-1.5

6.4 Measures to achieve and sustain performance objectives

Specific measures to achieve and sustain performance objectives for process water, storm water, groundwater and waste are detailed in the IWWMP action plan in **Table 6-3**.

The table indicates the responsible party and timeframes for implementation. This action plan is linked closely with management measures proposed in the Impact Significance Assessment tables in Section **5.18.3**. The performance objectives will be audited and reviewed on a regular basis to measure and determine if the performance objectives have been met.

6.5 Option Analysis and motivation for preferred option implementation

In May 2021 Renvelo Engineering was appointed by Kangra to implement a multi-phase approach to addressing the seepage in the area. After multiple meetings with the specialist, it was revealed that there are various gaps in the approach proposed which the specialist could not answer adequately which has delayed Kangra in moving forward with the project. During this period several alternative options were considered for implementation. The following options were investigated:

6.5.1 Treatment Option 1: Active treatment

The proposed system is a 600 m³/ day containerised biological and optional reverse osmosis system completely contained in multiple 40-foot intermodal shipping containers. This reduces delivery time, reduces civil cost for installation, and minimizes time for commissioning. The containerized system is designed so minimum piping is necessary between the containers once positioned on site.

The proposed treatment process includes the following steps:

- **Inlet Screening and Clarification** - A non-metallic, self-cleaning screen filters the raw feed water down to 300 microns to remove suspended materials that might otherwise plug the Filtration modules. Microfiltration - effluent from the primary inlet screens and clarifiers are filtered further down to 100 microns with basket filters, this is the overflow water from the clarifiers. The microfiltration membrane elements are arranged in multiple blocks to allow for efficient cleaning of a smaller number of elements while the balance of the membrane elements stay in service.
- **Scale Inhibitor Injection** - Use of a high-performance organic scale inhibitor can reduce the scaling and fouling potential from sparingly soluble salts, metal oxides, and naturally occurring organic materials in the feed water.
- **pH Control and Storage Dosing Tanks** - Sodium metabisulfite is dosed into the pre-treated feed water to remove any pre- contaminants before the Reverse Osmosis (RO) unit.



- **Reverse Osmosis** - The RO removes the majority of the dissolved solids in the feed water. The RO is arranged into a double stage unit 10m³/hr qmd 15m³/hr totaling 25m³/hr.
- **Post Treatment of RO Permeate** - Post treatment steps include pH adjustment, stabilization, and chemical disinfection. Permeate from the RO can be very low in alkalinity. Chemical feed systems for pH adjustment and injection are included to ensure maximum product quality and retention time in the dosing and agitation tanks via air agitation.

6.5.2 Treatment Option 2: Histosol Product

The Histosol OP-9840 product is used in effluent rich in sulphates. One fourth of this material is composed of reactive lignin. The reactive lignin's in Histosol OP-9840 have an average of 7 to 9 carbon oxygen hydrogen open bonding sites per molecule. This quality enables these lignin's to serve as macromolecular sponges adsorbing Sulphur compounds, forming covalent chemically bonding cross-linked polymers. The microorganism in the bio-series products consume nutrients from the effluent, enzymatically hydrolysing them into carbon dioxide, oxygen and water.

Kangra then took the decision to seek assistance from different specialists to address the seepage. Kangra consulted several experts in the field of water management. Site visits were conducted with the specialists. In doing so, Kangra was able to put together an Implementation Plan to address the seepage from Ballengeich.

This Plan outlines the company's proposed short, medium and long-term management strategies. This plan should be considered as a live document with proposed solutions that could be combined or applied separately, depending on the efficiency of that solution following monitoring results.

6.5.3 Treatment Option 3: Passive Treatment

In terms of flow, passive treatment may work, but a system will need to be constructed in the floodplain upstream and pumps must be installed to pump decant to the treatment wetland. Flood lines of the Horn River and the Ngagane River will need to be determined.

Option 3 is the preferred option tabled with the DWS to be considered for implementation. This option is to be initiated as part of the WUL process on a pilot scale. The proposed locations for the passive treatment system are depicted in **Figure 6-1**.

6.5.4 Treatment Option 4: Remining and Capping of Discard Dump

Investigations into the reworking of the dump is underway. Following the reworking of the dump, it will be reshaped to the design as indicated in **Figure 6-2** below. This will allow it to free drain and water from the dump will be diverted to the lined PCD, for treatment.

6.6 Rehabilitation and Closure

The Ballengeich Mine was operational from the early 1960's and ceased its operations in the early 1990's. As the mine is no longer operational Kangra Coal (Pty) Ltd intends to rehabilitate the effects of pollution on the site and officially apply for closure of the mine once all closure activities have been conducted.

The Rehabilitation and Closure implementation plan will address the concerns raised by the Department of Water and Sanitation on Ballengeich and the management of seepage. In 2021, Kangra consulted with several specialists in the field of engineering and environmental management to investigate measures that can be implemented to address seepage from Ballengeich.

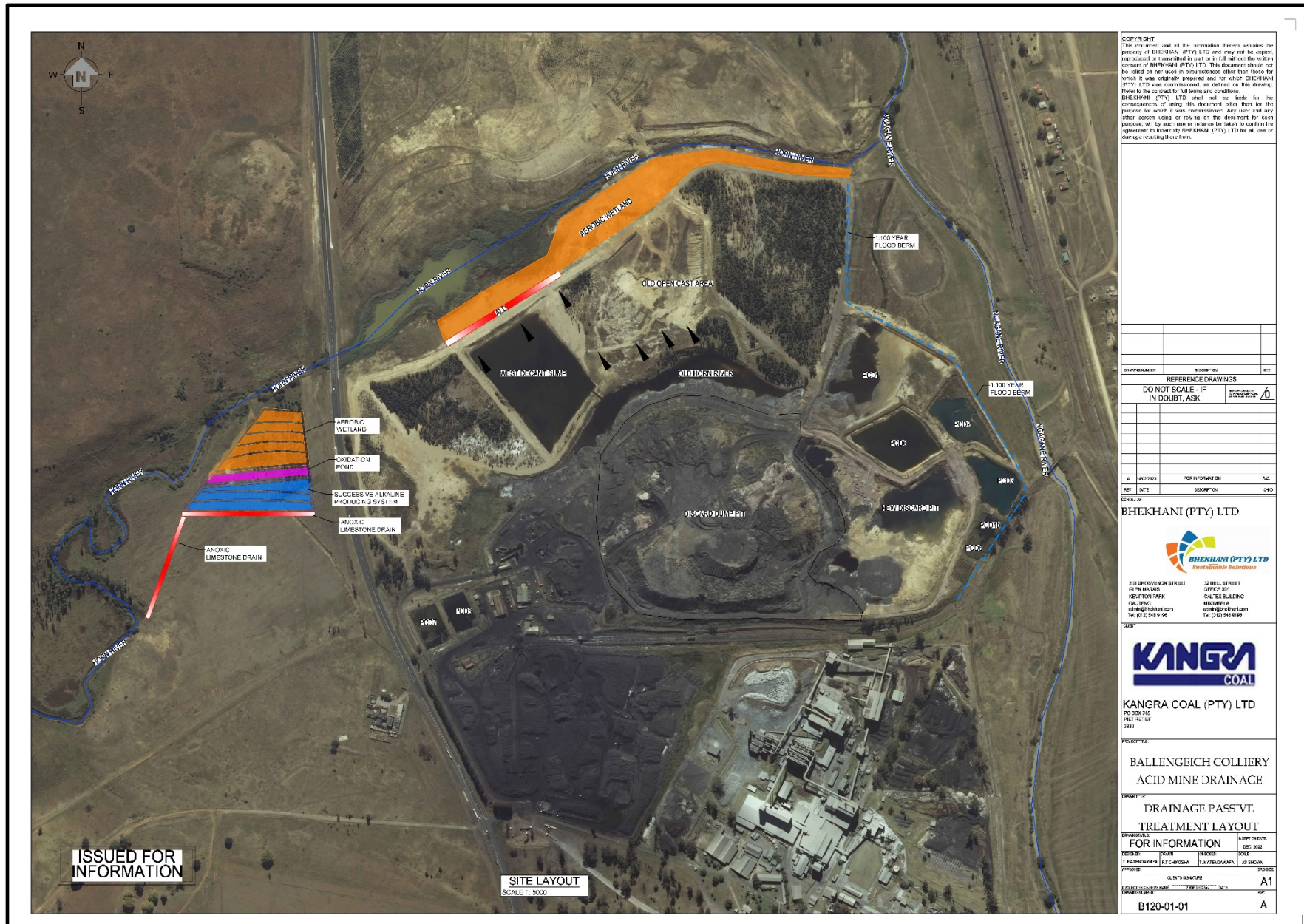


Figure 6-1: Layout of passive treatment system

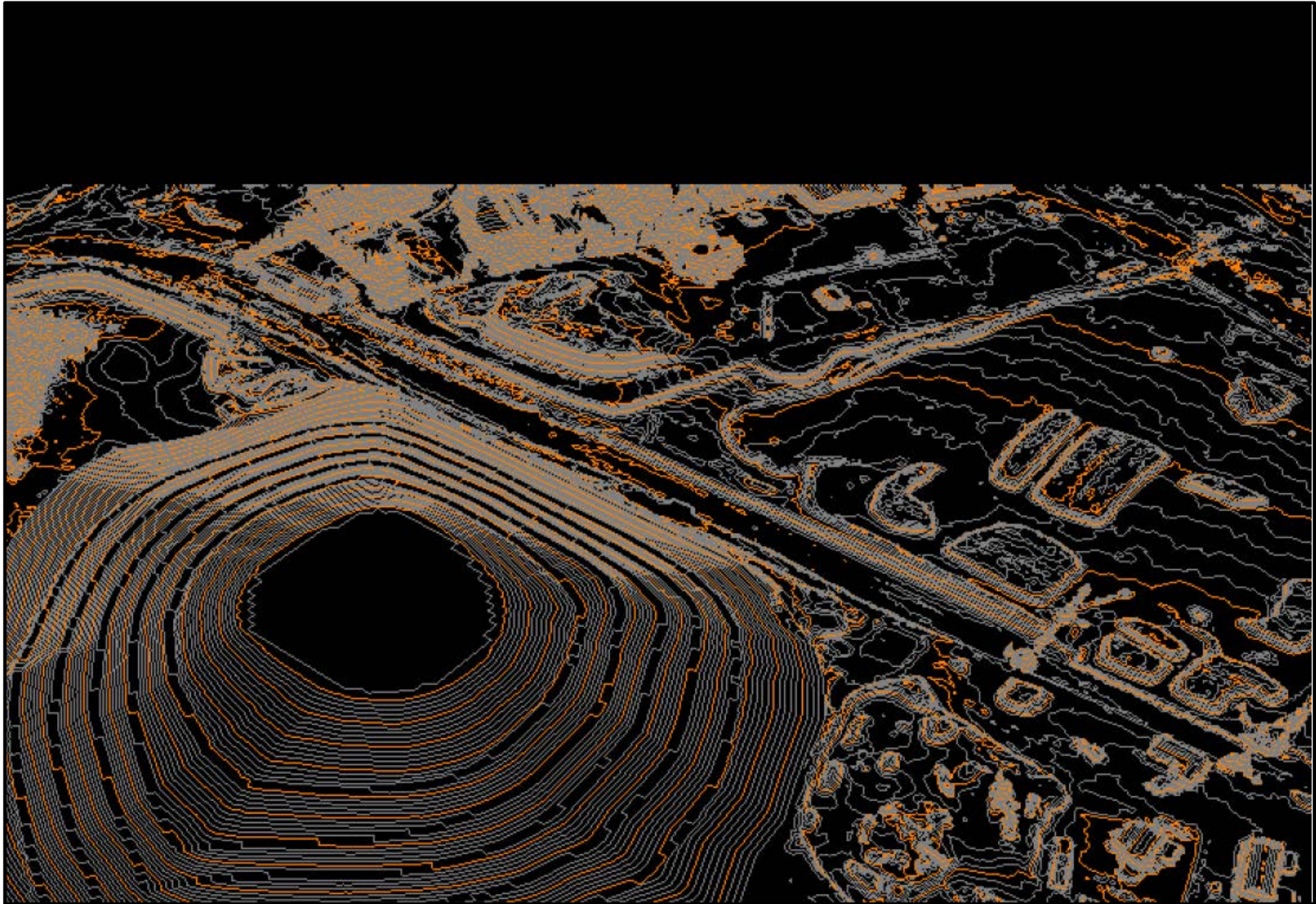


Figure 6-2: Proposed reshaping and capping design for the Discard Dump



6.7 IWWMP Action Plan

The IWWMP Action Plan for Kangra Coal was based on several interventions from the DWS. The following interventions have contributed towards the development and regular update of the Action Plan:

- Issued Directive in terms of section 19(3) of the NWA dated August 2013:
 - o Completion of the conceptual Ballengeich Water Management Plan submitted for approval;
 - o Completion of hydrological, geohydrological and civil engineering studies.
- DWS communication dated 14 November 2013 regarding the high conductivity in the Ngagane River in which the following actions were reported:
 - o Diversion of the concentrated water from the Discard Toe Pond into the old and existing PCD;
 - o Ongoing engineering assessments to obtain final designs of the PCD's and SWMP;
 - o Ongoing water quality monitoring
- Following the Directive Kangra submitted during May 2014 the following Action Plan:
 - o Clean a portion of the slurry dam starting at the eastern side;
 - o Expose the clay soil to spread and profile the open cast area;
 - o Fill the underground sink holes and area adjacent to the old Horn River bed;
 - o Construct the polluted water cut off drains to report to the PCD;
 - o Fill up area for the proposed tree planting program;
 - o Start construction of the final proposed covered dump.
- Kangra Coal response dated 11 January 2021 regarding non-compliances at Ballengeich Operations:
 - o Failure to manage the contaminated water;
 - o Steps taken to stop the effects of pollution occurring to the water resources;
 - o Stop the discharges occurring from the PCD to the Horn River;
 - o Remedy the effects of pollution on the water resources
- Kangra Coal letter dated 2 June 2021 on non-compliances at Ballengeich:
 - o Investigations of engineering solutions as part of phase 1;
 - o Appointment of consultants;
 - o Ecological remediation as part of phase 2;
 - o Establishment of wetlands;
 - o Shaping and rehabilitation of Discard Dump
 - o Lodging of WUL

The ongoing interaction between the DWS and Kangra Coal has eventually led to the implementation of the Action Plan as contemplated in **Table 6-3**. As per DWS communication dated August 2023, Kangra Coal is instructed to apply for the triggered water uses at the mine to ensure that the implementation of the mitigatory measures is conducted in a controlled and regulated manner.

In addition, Kangra has submitted a Rehabilitation Plan in support of the WUL (MENCO, 2024).



Table 6-3: IWWMP Action Plan

Management Approach	Management Action	Function	Responsibility	Time schedule
<u>POLLUTION CONTROL AT SOURCE</u> Assessment of pollution sources	Identify and quantify possible sources of pollution in the Horn and Ngagane Rivers sub-catchments	Expand monitoring programme in Ballengeich area Identify new sources and report to DWS representative Routine inspections to identify and investigate new sources	Kangra Coal Community DWS representative	On-going
	Identify and quantify (as far as possible) diffuse sources of pollution associated with the salinity-problems experienced in the catchment directly associated with Ballengeich Colliery	Initiate water quality profile along Horn River Identify all unknown impacts/sources Conduct specialist studies in the field of assimilative capacity and available waste load	Kangra Coal Glencore Appointed Service providers	July 2022 – August 2023
	Installation of flow-measuring weirs at strategic points in the catchment to quantify the impact from various identified sources	<u>Horn River catchment</u> Install flow-measuring devices at Ballengeich Colliery – decant Calibrate flow-measuring device Continue monitoring on a monthly basis <u>Ngagane River catchment</u> Investigate suitable site for a flow-measuring weir u/s and d/s of confluence of Horn River with Ngagane River	Kangra Coal	Completed installation Calibration as soon as possible June 2025
	Verify the background TDS-values for the lower Ngagane River catchment	Expand monitoring programme in unpolluted sub-catchments on a monthly basis for one hydrological year	Kangra Coal Appointed service provider	January 2023 – December 2024



Management Approach	Management Action	Function	Responsibility	Time schedule
<u>POLLUTION CONTROL AT SOURCE</u> Development of land use and operational strategies	Implement land use strategies for afforestation and erosion control to minimise impact from these land use activities	Collect all available strategies/ guidelines and develop a simplified summary thereof Key documents to be considered; KZN C-Plans, Amajuba District Municipality EMF and Umgeni Water Master Plan 2020/2021 – 2050/2051 for Buffalo System Distribute strategies/guidelines Audit implementation	Kangra Relevant landowners	October 2024 November 2024 On-going
	Develop and implement a strategy to conserve and rehabilitate the decant area in the upper reaches of the Horn River within the Ngagane River catchment	Develop strategy Audit implementation	Kangra Coal	March 2022 On-going
<u>RESIDUAL IMPACT CONTROL</u> Refinement of objectives	Determine the actual potential (commercial and economical) for the rework of the Coal discard dump	Complete survey report. Submit action plan to DWS. No response received from DWS and all activities have ceased	Kangra coal	September 2024
	Determine the current and future class of the Ngagane River	Refer to Government Notice 1873 dated 11 March 2022 – Proposed Water Resource Quality Objectives for Thukela Catchment in the Pongola-Mtamvuna Water Management Area	DWS	Dependent on national priority
	Determine the resource quality objectives for the Ngagane River	Refer GN 1873 dated March 2022, Table 1 – Ngagane River: Recommended Water Resource Class III	DWS	Dependent on national priority



Management Approach	Management Action	Function	Responsibility	Time schedule
<u>RESIDUAL IMPACT REGULATORY CONTROL</u> Setting of compliance requirements	Set compliance requirements for sewage works, waste disposal sites, mining operations (both abandoned and operational)	Stipulate compliance requirements Revise water use licences Enforce requirements	DWS	Commence April 2013 and ongoing
<u>RESIDUAL IMPACT CONTROL</u> Treating of residual impact: Investigate available treatment options, selection of most feasible option and present as part of Project Feasibility	Development of a Master Rehabilitation Plan	To coordinate and align all regulatory requirements To ensure compliance with environmental legislation Obtain approval for envisaged Rehabilitation proposal	Kangra Coal DWS	Commence July 2023 End May 2024
	Develop and implement backup systems for AMD in the case of failure or emergency spills	Develop contingency plans to be integrated into IWWMP Pipeline to be installed to pump surplus water to PCD's Audit implementation	Kangra Coal DWS	July 2022 On-going
	Flood-releases during high-flow periods	Initiate investigation to evaluate the option of flood-releases from the Ntshingwayo Dam upstream of Ballengeich Colliery during high-flow periods in the Ngagane River	DWS (as part of WULA)	Commence April 2023
	Treatment options to reduce the residual impact from the coal mines situated in the upper reaches of the catchment	Initiate investigation to evaluate different treatment options to reduce the residual impact from the coal mines in order to obtain departmental consent	DWS Kangra Coal Appointed Service Provider	Commence April 2024



Management Approach	Management Action	Function	Responsibility	Time schedule
	Testing of proposed passive scheme on pilot scale entailing a comparative assessment between aerobic and anaerobic constructed wetlands	Passive treatment of AMD from decant in an anaerobic wetland linked to a SAPS and anoxic limestone drain Terrain preparation to ensure clearance of 3 hectares to treat 1Ml of AMD Existing Eucalyptus plantation to be felled to make space for passive wetland construction; felled material harvested for organic material for SAPS Engineering design report to be compiled for detail on locality, capacity, neutralisation dosage requirements and retention time	Kangra Coal Appointed Service Provider	Sep 2022 – Dec 2025
<u>COMPLIANCE WITH NWA</u> Obtain the required authorisations for identified water uses	Appoint suitable qualified professional service provider to conduct the required specialist studies and facilitate the application process	Collate all available information with regards to rehabilitation and mitigatory measures already implemented in order to delineate the scope of work for consideration of suitable AMD treatment technology	Kangra Coal Appointed Service Provider	Apr 2022 – Aug 2023
	Based on regulatory authority site inspection and outcome of pre-feasibility study commence with the stipulated actions to comply with environmental legislation	Compliance with GN 267 Regulations Specialist studies in the field of geohydrology, wetland delineation, civil engineering and public participation Additional studies required to conduct the IWWMP and RSIP reports inclusive of aquatic ecology, hydrology, waste load allocation, catchment assessment, alien invasive control, storm water control -GN704 requirements	Kangra Coal Appointed Service Provider	Aug 2022 – Apr 2023



Management Approach	Management Action	Function	Responsibility	Time schedule
<u>REMEDIATION</u> Remediation of historical mining operations	Implementation and upgrading of pollution control structures in accordance with Kangra's Master Rehabilitation Plan	Implementation of pollution control structures if in absence Upgrading of existing pollution control structures Implementation of additional pollution prevention structures if inadequate On-going maintenance programme to ensure the functionality of the pollution control structures	Kangra Coal	On-going
	Develop and implement management plans to address impacts	Develop EMP's and closure plans to manage impacts (if not State responsibility) Audit implementation		June 2022 On-going
<u>ENSURE ADEQUATE SURFACE WATER FLOW</u> Ensure adequate surface water flow, to increase base-flow conditions	Re-evaluate the hydrology pattern of the Ngagane River catchment	Update flow records based on additional flow measurements obtained through the installation of flow-measuring weirs Minimum data required: one hydrological year	Kangra/DWS	Commence April 2023 and ongoing
	Determine the basic human needs Reserve and ecological Reserve for the Ngagane River catchment	Determine intermediate and/or full Reserve Determine desk top estimate in the interim	DWS	Dependent on national priority December 2022
	Quantify and assess water use and land use	Evaluate water use in the catchment in accordance to the Reserve determination and based on the refined hydrology pattern of the catchment Revise water use licences	DWS	Commence March 2022



Management Approach	Management Action	Function	Responsibility	Time schedule
	Implement land use strategies for afforestation, agricultural and impoundments to encourage unpolluted runoff	Collect all available strategies/ guidelines to encourage runoff and develop a simplified summary thereof Distribute strategies/guidelines Audit implementation	Agriculture DWS	October 2022 November 2022 On-going
	Identify and remove alien vegetation in the catchment to increase the base-flow	Initiate survey in catchment to determine problem Initiate <i>Working for Water</i> programme if necessary	DWS SANRAL Kangra Coal	October 2022 and ongoing
<u>CREATE AN ENABLING ENVIRONMENT</u> Creation of an enabling environment to ensure successful implementation of the management strategy	Ensure suitable level of knowledge	Need to establish a Catchment Forum Develop and publish a simplified version of the WQMS Develop simplified summaries of all land use strategies and guidelines Initiate regular information sessions during the Forum meetings	DWS Kangra Coal Forum	September 2023 November 2024 On-going
	Ensure suitable level of skill	Involve the community during routine inspections in the catchment, thereby capacitating them to actively participate Identify and develop necessary management instruments and tools to assist stakeholders in implementing the WQMS Identify other stakeholders as the need arise, and empower them to participate in the implementation of the WQMS	DWS DMR Forum	On-going



Management Approach	Management Action	Function	Responsibility	Time schedule
	Ensure suitable level of cooperation	Continue with the capacity building program in the Ballengeich area initiated by stakeholders Maintain commitment to the WQMS	Forum	On-going
<u>IMPLEMENTATION ACTIONS</u> Strategic actions	Integrate future development in the Ngagane River catchment with the WQMS	Participate in future land use development projects as part of the EIA process or any other related process Provide input to ensure integration with the WQMS and management objective	Forum	On-going
	Cost-benefit analysis to determine the actual socio-economic impacts associated with each of the management actions	<i>[Dependent on finalisation of water quality simulation model – refer to page viii: Implementation actions]</i> <i>[Dependent on investigations with regard to treatment options – refer to page iii: Residual impact control]</i>	Kangra Coal	Commence April 2023 <i>On-going where major impacts already identified</i>
	Evaluation of the management actions by means of an appropriate water quality simulation model before implementation	<i>[Dependent on finalisation of water quality simulation model – refer to page viii: Implementation actions]</i> <i>[Dependent on investigations with regard to treatment options – refer to page iii: Residual impact control]</i>	Kangra Coal DWS	Commence April 2023 <i>On-going where major impacts already identified</i>
	On-going maintenance and revision of the WQMS	Update WQMS and action plan on an annual basis	Forum	On-going
	<u>IMPLEMENTATION ACTIONS</u> Operational actions	Update Horn River water quality model for the Ngagane catchment Calibrate the model using the updated hydrological information	Kangra Coal DWS	Commence April 2023



Management Approach	Management Action	Function	Responsibility	Time schedule
	Management and dissemination of information	Registration of monitoring points on RQS database. Spatial orientation of data using GIS (Such as Planet GIS)	Kangra Coal	On-going
	Continued chemical, bacteriological and biological monitoring	Implement WQMP for the sub-catchment based on KPI for pollutants stemming from mining related activities	Kangra Coal	On-going
	Maintenance of awareness and communication	Maintain awareness with respect to progress on the implementation of the WQMS Develop a Communication Strategy to maintain communication of the above to all stakeholders	Kangra/Forum	On-going
<u>IMPLEMENTATION ACTIONS</u>	Evaluation and monitoring of implementation of the WQMS as applicable to Ballengeich Colliery	Bi-annual review at Forum meeting	Forum	On-going
Control actions	Audit achievement of in-stream water quality objectives	Bi-annual review at Forum meeting	Forum	On-going
	Audit achievement of compliance requirements and licence conditions	Bi-annual review at Forum meeting	DWS	On-going



6.8 Monitoring of change in Baseline

The surface and ground water monitoring programme which is currently being undertaken, will continue and will provide baseline or pre-rehabilitation information which will allow for comparison to determine if the rehabilitation activities have been successful. It will also quantify how much Quantum Screening operation is contributing to the pollution load on the Ballengeich site.

Biomonitoring data of the impact of Quantum Siding operations on the Ngagane River and Horn River is available. The biomonitoring data for the Horn River is also important and will lead to a better understanding of the current impacts on the surface water resource and determine if rehabilitation has been successful.

6.9 Audit and Report on Performance Measures

In order to ensure compliance with the conditions of an IWUL issued with respect to the water uses at Ballengeich Colliery, annual IWUL audits must be undertaken by an external, independent and suitably qualified EAP. These audits should include visiting the site to inspect management facilities, as well as review of monitoring reports for the year. The results of this audit must be made available to the Regional Head, KZN Regional Office within a month of the audit taking place.

It is assumed that an external audit will be required within one (1) year of the issuance of an IWUL.

Environmental officers from both Kangra and Quantum should also be tasked with the responsibility of undertaking internal audits of the IWUL on an annual basis. Record of these audits should be made in the form of an audit report.

In addition to the annual audits, quarterly monitoring reports must be submitted to the DWS regional office for review to determine if the Ballengeich rehabilitation has been successful, that responsible management of water uses are taking place and if all activities have been undertaken in compliance with the IWUL conditions.

6.10 Audit and report on relevance of IWWMP Action Plan

In order to ensure that IWWMP remains relevant, it is recommended that the IWWMP is annually updated. The annual update of the IWWMP will allow for continuous improvement of water resource management at the mine. The IWWMP update will also allow for the update of the action plans in line with any changes proposed in respect of the rehabilitation and water uses at Ballengeich Colliery.



Table 6-4: Monitoring Programme

ASPECT	FREQUENCY	METHOD	CRITERIA	CONTINGENCY PLAN	RESPONSIBLE PERSON
Wetland & Surface Water					
Water Quality	Monthly as per WUL	Grab Samples	ISO 5667	Implement Monitoring Programme	General Manager
Water Quantity	Daily	Flow Meter Reading and Update of Datasheet	Water Balance to be Updated Annually	Implement a Water Conservation and Demand Management Plan as per WUL	General Manager
Bio-Monitoring	Bi-Annually	SASS 5 and IHAS	Sampling sites are to be established upstream and downstream of all Potential Impact	Implement an Aquatic Ecology Monitoring Programme	Independent Aquatic Ecologist
Wetland	Annually	WET-Tool; WET-Rehab Evaluation; WET-Health	A qualified and approved Wetland Specialist are to be contracted to conduct the Wetland Impact Monitoring	Implement Wetland Monitoring Programme	Aquatic Ecologist/ Wetland Specialist
Storm Water Management	After heavy rainfall	Visual Inspection	Check the system for blockages and possible spillage areas	Implement a Storm Water management Plan in accordance with GN 704 (BPG G2)	General Manager
Fauna & Flora					
Biodiversity Assessment	Annually	Visual Surveys	Compare the annual findings with those of the Baseline Studies	Align the Fauna & Flora	General Manager



ASPECT	FREQUENCY	METHOD	CRITERIA	CONTINGENCY PLAN	RESPONSIBLE PERSON
Alien Invasive Control Program (AICP)	Annual	Physical Inspection	During the Biodiversity Assessment a qualified ecologist must be contracted to ensure that the implementation of the AICP is adequately addressed.	Implement an Alien Invasive Control Programme	General Manager
Vegetation and Rehabilitation	Annually	Visual inspection	As specified in EMP	RSIP to be adhered to	General Manager
Groundwater					
Groundwater Quality	Quarterly	SANAS Standards	As specified in Geo-Hydro Report	Implement a Monitoring Programme	General Manager
Groundwater Levels	Quarterly	Depth meters	Determine the groundwater fluctuation over a LoM	Implement a Monitoring Programme	General Manager
Air Quality					
Dust Fallout	Monthly	Gravimetric Dust Fallout	To be analysed by an Accredited Laboratory	Implement a Monitoring Programme	General Manager
Noise Monitoring					
Environmental Noise	Annually	SANAS Standards	Noise monitoring is to be done to determine the effect of mining, and associated activities, on the receptors	Implement a Monitoring Programme	General Manager



BALLENGEICH: SAMPLING POINTS

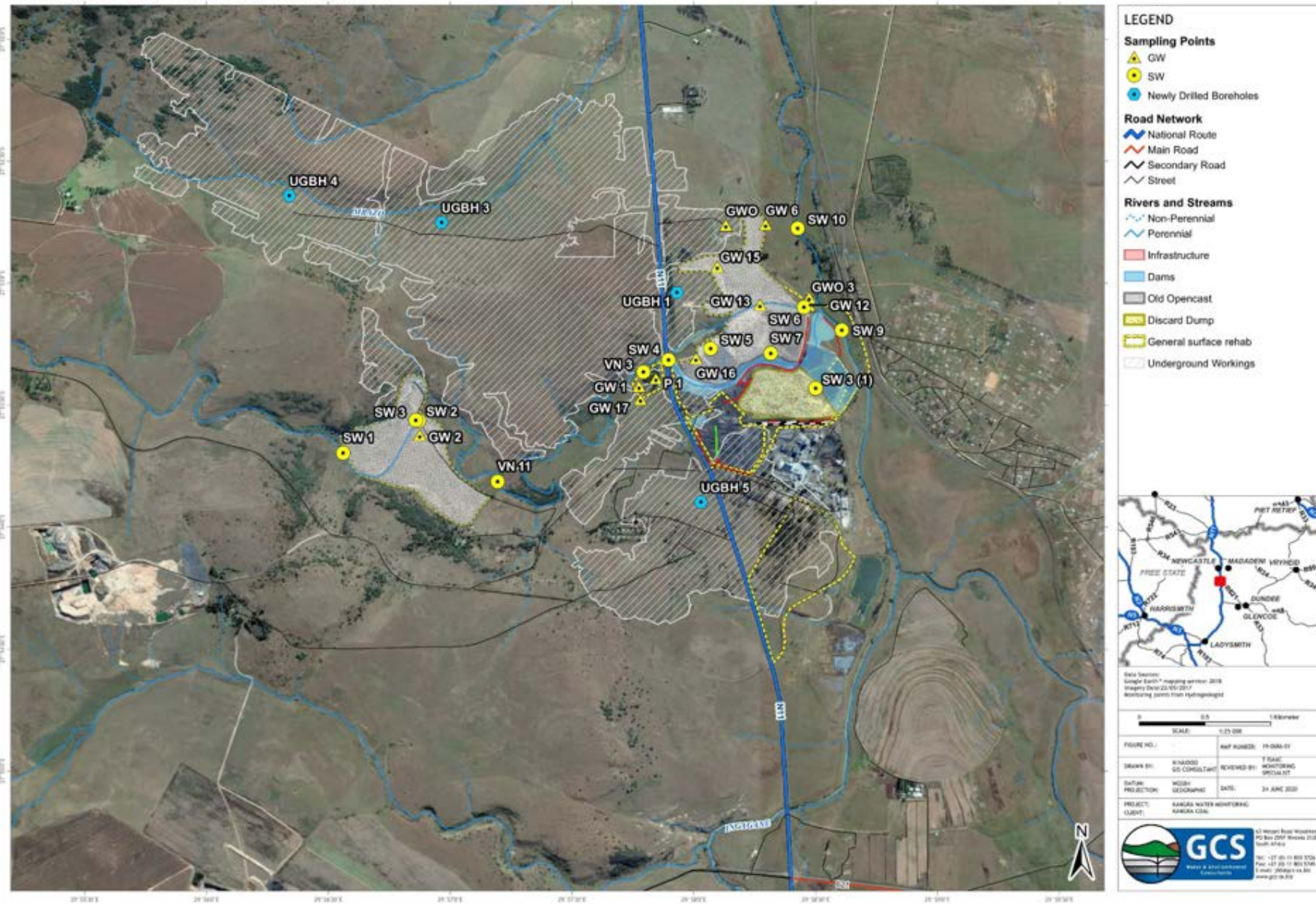


Figure 6-3: Monitoring points associated with Ballengeich Colliery



6.10.1 Water Demand Management

Water demand at the Ballengeich Colliery is limited to dust suppression on the operational haul road network and at the Quantum Screening and Crushing Plant and Ballengeich Siding stockpile area. No process water, potable water abstraction, or groundwater extraction takes place on site. All water used for dust suppression is AMD-impacted water sourced from the on-site lined Pollution Control Dams and, where the lined PCDs cannot meet the full demand, supplemented from the unlined dams on site (PCDs 1, 2, 5, 6, and the West Decant Sump). This approach maximises the beneficial reuse of contaminated on-site water while reducing the risk of PCD overflow.

The total dust suppression demand is 38,400 m³/annum, comprising 500 m³/month for the Quantum operational area (1.6 ha) and 2,700 m³/month for the Ballengeich Siding stockpile area (9.1 ha), as confirmed by the GFK SWMP Pitman water balance model (March 2026). The lined PCDs (PCDs 3, 4, 7, 8, and the New Quantum PCD) cannot fully supply this demand alone — a deficit of 13,600 m³/annum under Scenario 1 (dump rehabilitated) and 16,310 m³/annum under Scenario 2 (dump removed) is supplemented from the remaining unlined dams on site.

Potable water and wash bay water for the Ballengeich Siding operations are sourced entirely from an external supply provided by NCCA (Northern Coal Alliance) via pipe and water tanker to two 5,000 L JoJo tanks installed at the wash bay. No borehole abstraction takes place on site a. Refer to Section 7.4 for the detailed water balance.

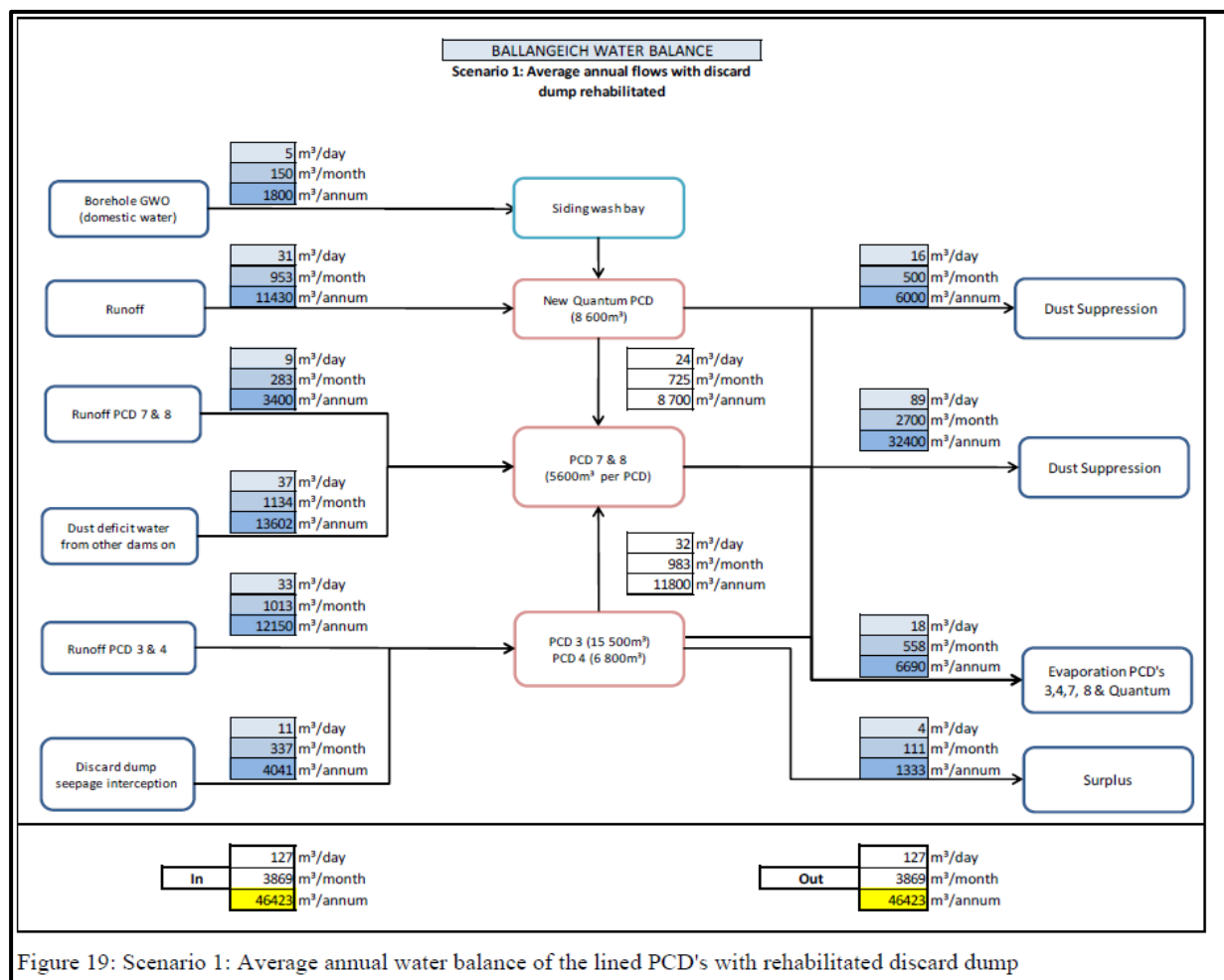


Figure 19: Scenario 1: Average annual water balance of the lined PCD's with rehabilitated discard dump

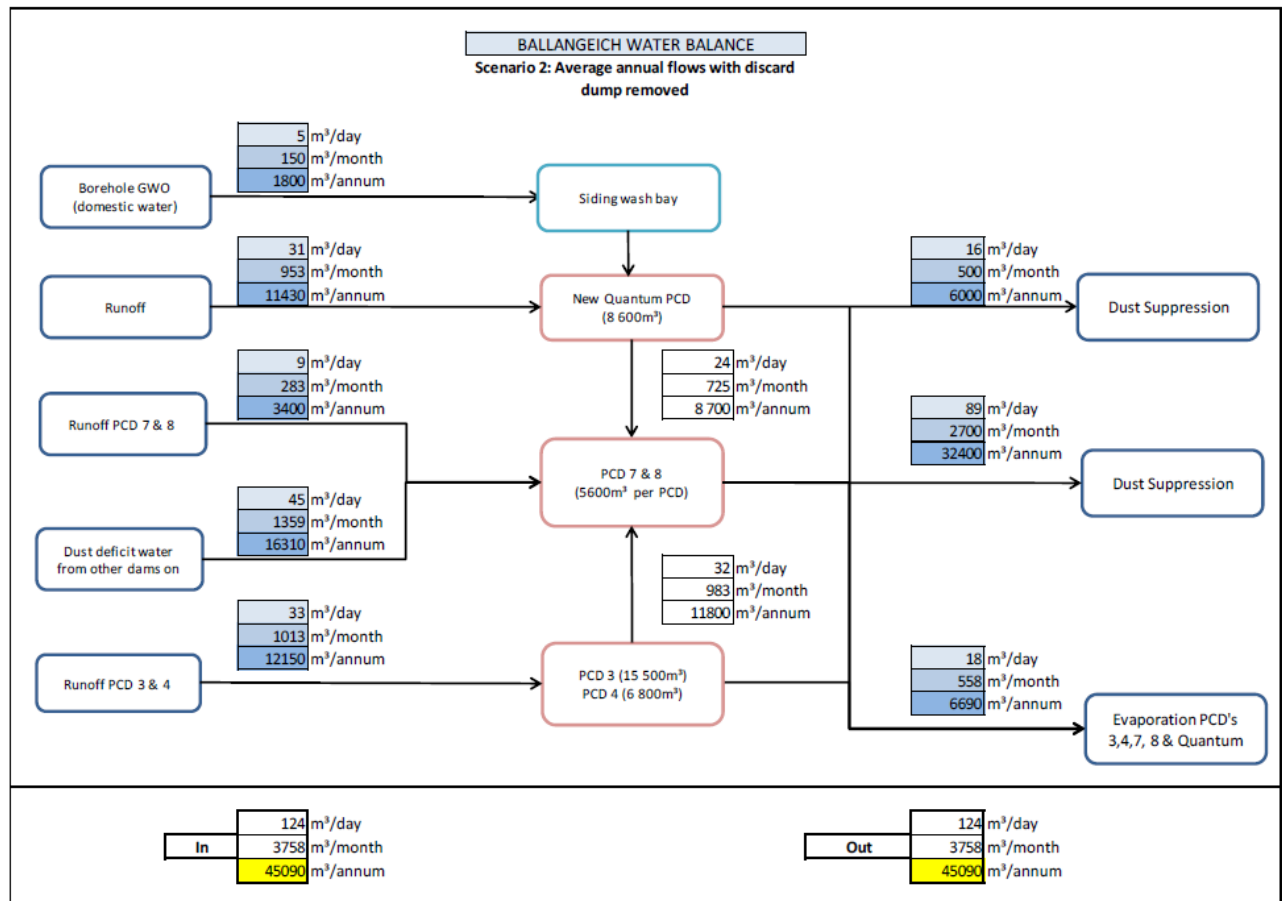


Figure 20: Scenario 2: Average annual water balance of the lined PCD's with removed discard dump

Figure 6-4: Ballengeich Colliery schematic water balance (Both Scenario's)



Table 6-5: Ballengeich Colliery Annual Water and Salt Balance

Facility	Circuit / Stream	Quantity (m ³ / a)	Quantity (kg / a)	Circuit / Stream	Quantity (m ³ / a)	Quantity (kg / a)
		Water In	Salt In		Water Out	Salt Out
Discard Dump Pit	Discard Dump Area	6547	22915	Evaporation/Storage: Discard Dump	23813	-
	Rainfall	52705	264	Seepage to PCD6	35440	23178
	Total	59252	23178		59252	23178
PCD7	Runoff: Ballengeich Siding (3.1ha)	2714	4071	Evaporation	3545	-
	Rainfall	3569	214	Dust suppression (Ballengeich Siding)	2738	4285
	Total	6283	4285		6283	4285
PCD8	Runoff: Ballengeich Siding (3.1ha)	2714	4071	Evaporation/Storage PCD8	2383	-
	Rainfall	2407	12	Dust suppression (Ballengeich Siding)	2738	4083
	Total	5121	4083		5121	4083
PCD4a	Runoff: Ballengeich Siding (10.6ha)	18559	27838	Overflow – PCD4b	22204	43181
	Discard Dump Area	4382	15338	Evaporation/Storage in PCD4a	1650	-
	Rainfall	913	5			
	Total	23854	43181		23854	43181
PCD4b	Rainfall	3154	16	Evaporation/Storage in PCD4b	5700	-
	PCD4a	22204	43181	Overflow to PCD3	16308	43197
	Total	25358	43197		23808	43197
PCD3	Rainfall	4150	21	Evaporation/Storage in PCD3	7500	-
	PCD4b	19658	43197	Overflow to PCD2	16308	43218
	Total	23808	43218		23808	43218
PCD2	PCD3	16308	43218	Evaporation/Storage PCD2	14700	-
	Rainfall	8134	41	PCD1	9742	43258
	Total	24442	43258		24442	43258
PCD1	PCD2	9742	43258	Seepage to Ngagane River	-	-
	Seepage from PCD6	39627	23230	Evaporation/Storage PCD1	14355	-
	Rainfall	8134	488	PCD5	43148	66976
	Total	57503	66976		57503	66976
PCD5	PCD1	43148	66967	Evaporation/Storage PCD5	21000	-
	Discard Dump Area	9854	34488	West Decant Sump	43622	102162
	Rainfall	11620	697			
	Total	64622	102162		64622	102162
PCD6	Rainfall	10375	52	Seepage to PCD1	39627	23230
	Discard Dump Pit	35440	23178	Evaporation/Storage PCD6	6188	-
	Total	45815	23230		45815	23230
West Decant Sump	PCD5	21000	102162	Evaporation/Storage	45450	-
	Rainfall	52705	264		367158	1198155



	Decant: Old OC and UG workings	338903	1095730	Transpiration /Seepage / Storage Seepage: West Decant Sump		
	<i>Total</i>	<i>338903</i>	<i>1095730</i>		<i>412608</i>	<i>1198155</i>
Grand TOTAL		748665	1594923		748665	1594923

Table 6-6: Ballengeich Colliery Monthly Water and Salt Balance

Facility	Circuit / Stream	Quantity (m ³ / mth)	Quantity (kg / mth)	Circuit / Stream	Quantity (m ³ / mth)	Quantity (kg / mth)
		Water In	Salt In		Water Out	Salt Out
Discard Dump Pit	Discard Dump Area	546	1910	Evaporation/Storage: Discard Dump	1984	-
	Rainfall	4392	22	Seepage to PCD6	2953	1932
	<i>Total</i>	<i>4938</i>	<i>1932</i>		<i>4938</i>	<i>1932</i>
PCD7	Runoff: Ballengeich Siding (3.1ha)	226	339	Evaporation	295	-
	Rainfall	297	18	Dust suppression (Ballengeich Siding)	228	357
	<i>Total</i>	<i>524</i>	<i>357</i>		<i>524</i>	<i>357</i>
PCD8	Runoff: Ballengeich Siding (3.1ha)	226	339	Evaporation/Storage PCD8	199	-
	Rainfall	201	1	Dust suppression (Ballengeich Siding)	228	340
	<i>Total</i>	<i>427</i>	<i>340</i>		<i>427</i>	<i>340</i>
PCD4a	Runoff: Ballengeich Siding (10.6ha)	1547	2320	Overflow – PCD4b	1850	3598
	Discard Dump Area	365	1278	Evaporation/Storage in PCD4a	138	-
	Rainfall	76	0			
	<i>Total</i>	<i>1988</i>	<i>3598</i>		<i>1988</i>	<i>3598</i>
PCD4b	Rainfall	263	1	Evaporation/Storage in PCD4b	475	-
	PCD4a	1850	3598	Overflow to PCD3	1638	3600
	<i>Total</i>	<i>2113</i>	<i>3600</i>		<i>2113</i>	<i>3600</i>
PCD3	Rainfall	346	2	Evaporation/Storage in PCD3	625	-
	PCD4b	1638	3600	Overflow to PCD2	1359	3601
	<i>Total</i>	<i>1984</i>	<i>3601</i>		<i>1984</i>	<i>3601</i>
PCD2	PCD3	1359	3601	Evaporation/Storage PCD2	1225	-
	Rainfall	678	4	PCD1	812	3605
	<i>Total</i>	<i>2037</i>	<i>3605</i>		<i>2037</i>	<i>3605</i>
PCD1	PCD2	812	3605	Seepage to Ngagane River	-	-
	Seepage from PCD6	3302	1936	Evaporation/Storage PCD1	1196	-
	Rainfall	678	41	PCD5	3596	5581
	<i>Total</i>	<i>4792</i>	<i>5581</i>		<i>4792</i>	<i>5581</i>
PCD5	PCD1	3596	5581	Evaporation/Storage PCD5	1750	-
	Discard Dump Area	821	2874	West Decant Sump	3635	8513
	Rainfall	968	58			
	<i>Total</i>	<i>5385</i>	<i>8513</i>		<i>5385</i>	<i>8513</i>

M² ENVIRONMENTAL CONNECTIONS (PTY) LTD
IWWMP: KANGRA COAL (PTY) LTD: BALLENGEICH



PCD6	Rainfall	865	4	Seepage to PCD1	3302	1936
	Discard Dump Pit	2953	1932	Evaporation/Storage PCD6	516	-
	Total	3818	1936		3818	1936
West Decant Sump	PCD5	1750	8513	Evaporation/Storage	3788	-
	Rainfall	4392	22	Transpiration /Seepage / Storage	30596	99846
	Decant: Old OC and UG workings	28242	91311	Seepage: West Decant Sump		
	Total	34384	99846		34384	99846
Grand TOTAL		62389	132910		62389	132910



6.11 Wetland and Riparian Management Plan

6.11.1 Construction Phase

Impacts to the marginal vegetation will be greatest, with further impacts on the water quality and other aquatic biota within the wetland ecosystem. The following measures to minimize, rectify and reduce the impacts are proposed:

- Obtain the required authorisation to operate within 500 m of wetland areas (Section 21(c) and (i) water use license;
- Adhere to all Work Method Statements (WMS) regarding activities within a delineated wetland system;
- Seepage wetlands that are artificially induced will suffer destructive impacts due to the construction of the open pits and it will be the Department of Water and Sanitation (DWS) discretion to allow this or not (as per pre-feasibility meeting). It must be kept in mind that these wetlands are severely degraded currently and although impacts are expected to be high, potential for repair and rehabilitation is greater if replaced with a dedicated on-site wetland rehabilitation area.

As per 2014 GDARD specifications⁶:

- The edge of the watercourse must be clearly demarcated in the field with pegs or poles that will last for the duration of the construction phase, colour-coded as follows:
 - o RED – Indicating the edge of the riparian zone [These should be placed along the entire length of the property/site.]
 - o ORANGE – Indicating the edge of the buffer zone (keep to the 41 m as delineated⁷).
- Implement an approved wetland rehabilitation and management plan with appropriate monitoring;
- Identify a suitable location to implement a wetland offset strategy to compensate for any degradation; the Horn River Channelled Valley Bottom wetland downstream will be ideal for this purpose;
- Implement good construction practices:
 - o Clear only areas necessary for immediate construction;
 - o Store excavated soils (or those brought to site) in a way to prevent erosion, runoff and seepage into the wetland.
- Construction of silt traps to decrease excess sedimentation entering the system;
- Large-scale impacts to specific habitats must be rectified by rehabilitation of the altered or lost habitat in critical areas of the aquatic and wetland ecosystems and the buffer zones on a continual basis during the operation phase of the project and during the closure;
- Monitor the habitat availability and species composition of identified species within the project area on a bi-annual basis and mitigate any further impacts immediately. This should be done during the construction, operation and closure phases;
- Long-term bio-monitoring of the project is required; and
- Rehabilitate wetland just downstream of the development to improve ecological services of area and contain negative impacts in a smaller area (footprint).

⁶ Department of Agriculture and Rural Development, Biodiversity Management Directorate (2014) "GDARD requirements for biodiversity assessments, Version 3, March 2014" Scientific Services.

⁷ Buffer zone determined for the severely impaired wetlands as per CSIR Buffer Tool



Soil preservation

- Wetland soils are easily impacted due to the degree of moisture within the matrix; Compaction will result from vehicle or other movement through these sensitive areas. It should be avoided at all costs;
- Geotextile and wooden planks may be used to distribute weight and lessen the degree of compaction to the underlying soils. This should be implemented only as a contingency measurement, as movement otherwise should be restricted from the delineated wetland areas;
- Vehicular movement should be restricted during all phases of the proposed development;
- Adequate buffer zones should be designated around all wetland areas on the property;
- If soil was disturbed and needed to be removed, the soil should be kept within the layers in which they were removed and then replaced and rehabilitated afterwards;
- Channel formation should be avoided through re-vegetation of visible bare soils or previously disturbed soil areas;
- Ensure trucks and vehicles remain on roads and areas designated as construction sites to limit disturbance to areas unaffected by construction;
- Prohibit off-road driving and include penalty clauses in contractor agreements that result in fines or expulsion from site should there be a contravention of the agreement. Off-road driving by employees should result in disciplinary action; and
- Ensure speed limits are set on all roads and enforce speed limits. Ensure all drivers at the site are informed about speed limits.

Aquatic biodiversity

- Alien vegetation should be cleared or felled during construction phase to remove the numbers of these invasive species; and
- Regularly maintain equipment to reduce unnecessary emissions. These emissions tend to accumulate within moist areas and therefore will accumulate within the wetland zones, vegetation and soils.

Storm water management

The principles in GN 704 Regulations (July 1999) of the National Water Act (Act 36 of 1998) would be applied in the management of storm water on the Ballengeich Colliery area. The essence of this approach is based on DWS: Best Practice Guidelines:

- Clean runoff should be kept separate from the dirty runoff water, specifically if coal is stored on-site for periods of time;
- The 'dirty' water would be used for dust suppression and could also be used to contribute to the water requirements of the crushing and screening plant, if appropriate. This is considered to represent a negative impact of minor magnitude;
- Both the 50-year and the 100-year flood lines should be determined to indicate the risk of flooding to the surface infrastructure that is situated next to the Horn River. Adequate planning and contingency measures should be incorporating this risk or possibility thereof; and
- Storm water (especially contaminated with coal residue or products) should not be allowed to enter the Horn River and the associated un-channelled valley bottom wetland as well as riparian zone (41 m protective buffer zone) to ensure prescribed water quality adherence.

Monitoring

- Monthly visual assessment of areas to determine if vegetation in undisturbed areas is being impacted;



- A biodiversity baseline assessment should be conducted and include photographs of the riparian edges and shoreline. Once this data is available, annual biodiversity monitoring of areas both affected and unaffected by activities should be initiated to determine annual fluctuation in species numbers and if necessary, relate this to activities on site; and
- Establish a monitoring programme for early detection of alien invasive species and establish an alien invasive eradication and control programme.

6.11.2 Operational Phase

Long-term Wetland Management

Impacts to the marginal vegetation will be greatest as impacts accumulate over time, with further impacts on the water quality and other aquatic biota within the wetland ecosystem. The following measures to minimize, rectify and reduce the impacts are proposed:

- Implement a permanent fence around the wetland buffer zone or the mining footprint at this stage;
- Coal waste materials to be stored at the mine should not be near the wetland area or within the recommended buffer zone area;
- Obtain the required authorisation to operate within 500 m of wetland areas (Section 21(c) and (i) water use license);
- Implement an approved wetland rehabilitation and management plan with appropriate monitoring;
- Rehabilitate Channelled Valley Bottom wetland downstream (if impacts on the Horn River un-channelled valley bottom wetland system are apparent at this stage);
- Large-scale impacts to specific habitats must be rectified by rehabilitation of the altered or lost habitat in critical areas of the aquatic and wetland ecosystems and the buffer zones on a continual basis during the operation phase of the project and during the closure;
- Regularly monitor and maintain the buffer zone fenced areas;
- Monitor the habitat availability and species composition of identified species within the project area on a bi-annual basis and mitigate any further impacts immediately. This should be done during the construction, operation and closure phases; and
- Long-term bio-monitoring of the project is required at specified points.

Soil preservation

- Wetland soils are easily impacted due to the degree of moisture within the matrix;
- Compaction will result from vehicle or other movement through these sensitive areas. It should be avoided at all costs;
- Have communication channels set up to report hydrocarbon spills and leaks. Ensure such leaks are remediated in a reputable manner.
- Have dust suppression mechanisms in place to avoid dust smothering of vegetation and wetland zones;
- Ensure trucks and vehicles remain on roads and areas designated as construction sites to limit disturbance to areas unaffected by mining; and
- Prohibit off-road driving and include penalty clauses in contractor agreements that result in fines or expulsion from site should there be a contravention of the agreement.

Aquatic biodiversity

- Alien vegetation should be cleared or felled on a regular basis to remove and control the numbers of these invasive species and their seed dispersal within the area;



- Regularly maintain equipment to reduce unnecessary emissions. These emissions tend to accumulate within moist areas and therefore will accumulate within the wetland zones, vegetation and soils; and
- Activities on site must comply with the regulations of the Animal Protection Act 1962 (Act No. 71 of 1962). Workers should also be advised on the penalties associated with the needless destruction of wildlife, as set out in this act.

Storm water management

The principles in GN 704 Regulation (July 1999) of the National Water Act (Act 36 of 1998) would be applied in the management of storm water at Ballengeich Colliery. A storm water management berm must be constructed along the buffer zone to protect the tributary from any further degradation. The essence of this approach is based on DWS: Best Practice Guidelines:

- Clean runoff should be kept separate from the dirty runoff water;
- The only area on the proposed coal mine is the area used for storage of coal before usage, which can be considered to be “dirty” is the area containing the crushing and screening plant, coal stockpiles, processed stockpiles, fuel bays, workshops and other ancillary facilities;
- A pollution control dam and berm system sized to meet the requirements of Regulation 704 would be used to catch ‘dirty’ runoff from this area;
- “Polluted” water should be treated and re-used where possible; and
- The ‘dirty’ water could be used for dust suppression and could also be used to contribute to the water requirements of the crushing and screening plant, if appropriate. This is considered to represent a negative impact of minor magnitude.

Monitoring

- Monthly visual assessments of areas to determine if vegetation in undisturbed areas is being impacted;
- Continue with annual monitoring of areas both affected and unaffected by activities to determine annual fluctuation and if necessary, relate this to activities on site;
- Compare shoreline baseline status on a seasonal basis and restore any degradation noticed; and
- Establish a monitoring programme for early detection of alien invasive species and establish an alien invasive awareness, eradication and control programme.

6.11.3 Decommissioning and Closure Phase

Wetland management

Impacts will be similar to a short construction phase at the stage of decommissioning. The following measures to minimize, rectify and reduce the impacts are proposed:

- Implement an approved wetland rehabilitation and management plan with appropriate monitoring;
- Implement good construction practices;
- Focus activities only on areas to be immediately decommissioned and material to be disposed of correctly;
- Store coal wastes responsibly if not able to dispose immediately into pit prevent runoff and possible contaminated seepage into the wetland;
- Implement rehabilitation plans for the Ballengeich Colliery Project; and
- Long-term bio-monitoring of the project is required.



Monitoring

- Continue with annual biodiversity monitoring after closure phase. Include biodiversity monitoring sites in rehabilitated areas to determine if these are improving with regard to habitat; and
- Continue with alien invasive monitoring, eradication and control programme.

6.11.4 General Mitigation and Management Measures

Golden rules to follow are to comply and integrate good housekeeping practices within a good management system. The following is recommended with regards to wetlands:

- No dumping of any materials or storage should be allowed within wetland zones;
- Policy and awareness in place to prevent littering should be strictly adhered to;
- Ensure adequate domestic waste bins are supplied and that domestic waste is removed by a reputable contractor;
- Adhere to the waste management plan developed to efficiently handle the proposed development's waste products; and
- Erect posters to educate staff about the dangers of littering and dangers of damaging sensitive and endemic plant species they may encounter.

Generally, wetland restoration and creation first involve establishment or re-establishment of appropriate natural hydrologic conditions, followed by establishment of appropriate vegetation communities. Although many of these created and restored wet-lands have become functional, there have been some cases of “failure” of created or restored wetlands generally caused by a lack of proper hydrology.

Wetland rehabilitation needs to be based on the concept of self-design whereby any number of native aquatic vegetation can be introduced, but the eco-system adapts and changes itself according to its physical constraints, and success should not solely be determined by specific plant presence.



7 REHABILITATION

7.1 Background

It is reported that mining started in the 1950's at the Ballengeich Colliery but active mining ceased during the early 1990's. Underground and opencast mining methods were used to exploit the coal reserves. The opencast pits were operated in two separate areas, approximately 2km west of the N11, and directly adjacent to the N11 east of the site. The total area used for open cast mining was 36ha. The underground workings connected the two open cast areas and also extended northwards in the direction of the now defunct Kilbarchan Colliery. The underground operations extended over 405ha.

7.2 Mine Plan and Infrastructure

7.3 Closure Planning

Closure planning for the Ballengeich Colliery has been developed progressively over several decades, from the initial conceptual rehabilitation design commissioned from GCS (Pty) Ltd following the cessation of active mining in the early 1990s, through to the current comprehensive Rehabilitation Plan (EMP/2024/086, November 2024) and the GFK Civil Infrastructure Report (Report G2025/06/338(2), 24 March 2026), which together constitute the authoritative closure design basis for this application.

The primary objective of the closure plan is to achieve a stable, self-sustaining, free-draining site with no ongoing AMD generation or discharge to the Horn and Ngagane Rivers, requiring minimal long-term maintenance. The following components form the core of the current closure planning framework:

Discard Dump Rehabilitation

The existing unrehabilitated discard dump (approximately 14 ha; maximum height 50 m) will be rehabilitated under one of two confirmed scenarios, as described in the GFK SWMP (March 2026) and Rehabilitation Plan (EMP/2024/086):

- Scenario 1 — In-situ Reshaping (Preferred): The discard dump will be reshaped to suitable profiles and slopes for stormwater management, with unstable and steep faces regraded. The reshaped dump will be capped with a minimum of 600 mm compacted overburden material and 150 mm topsoil to allow grass establishment and prevent spontaneous combustion. The reshaped dump surface area is 164,120 m², requiring a minimum of 98,500 m³ compacted cover material. Grass-lined V-drains (Items 41) and a subsoil seepage collection drain (Item 42) at the dump toe will manage residual seepage and clean stormwater runoff respectively. A mandatory infra-red thermal drone survey must be completed over the full dump surface before any earthworks commence.
- Scenario 2 — Reprocessing and Removal: Should the opportunity arise, the discard dump will be reprocessed and removed from site entirely. The final footprint will be shaped to be free-draining and covered with a minimum of 600 mm Type 4 softs material, seeded and grassed. This scenario eliminates the need for the subsoil seepage drain and manholes.

Under both scenarios, the rehabilitated dump surface is classified as clean after establishment of the vegetative cover, and runoff will be managed as clean stormwater.



➤ **PCD Closure and Decommissioning**

PCDs 3, 4, 7, and 8 will be upgraded to Class C lined facilities (GNR 636) during the operational phase and will remain as functional stormwater management infrastructure throughout the 20-year WUL period. At closure, the lined PCDs will be decommissioned in accordance with GN 704 requirements and the WUL conditions. The West Containment Sump (86,400 m³) and unlined PCDs (1, 2, 5, 6) will be progressively cleaned out as AMD loads decrease following source remediation, with water quality monitored until RQO compliance is demonstrated.

➤ **Passive Treatment System — Post-Closure Monitoring**

The passive AMD treatment system is designed for a service life exceeding 30 years for the aerobic wetland components, 20–30 years for the SAPS, and more than 25 years for the ALD pipe components — all well beyond the 15-year Ballengeich Siding operational life. The treatment system will continue operating and be maintained during the 5-year post-implementation monitoring period (years 16–20 of the WUL period) to confirm sustained achievement of GN 1873 RQOs before formal closure of WUL conditions. Sludge from the aerobic wetlands and oxidation pond will be characterised per GNR 635 and disposed of at an approved facility as part of the closure process.

➤ **Eucalyptus Plantation Decommissioning**

The existing Eucalyptus plantation on Portion 19 will be decommissioned to make space for the construction of the passive wetland treatment infrastructure. Felled material will be composted on site for a minimum of 90 days before use as the organic carbon layer in the SAPS. As part of the rehabilitation programme, a new 3.57 ha Eucalyptus plantation (Item 23; S21(d) SFRA) will be established adjacent to the West Decant Sump on Portion 19. This plantation serves as an AMD impact mitigation measure, reducing streamflow contributions from the western decant area to the Horn River during the passive treatment system implementation phase.

➤ **Safety Classification**

The discard dump at closure conditions is classified as a low-hazard facility. Slope stability analyses confirm that the stability at closure is acceptable under both rehabilitation scenarios. No PCD on site is classified as a dam safety risk — all PCDs have wall heights of less than 5 m and capacities below 50,000 m³ (GFK Civil Infrastructure Report, March 2026).

➤ **Rehabilitation Costs**

Updated rehabilitation cost estimates are provided in the Rehabilitation Plan (EMP/2024/086, November 2024) and the GFK Civil Infrastructure Report (March 2026). The indicative capital cost for the passive treatment system civil works is approximately R4,079,750 (excl. VAT). Full rehabilitation cost estimates including PCD lining, dump rehabilitation, stormwater infrastructure, and flood berms are detailed in the Rehabilitation Plan. The previously estimated range of R14–R19.5 million (GCS, 1990s) is no longer applicable given the substantially expanded scope of the current rehabilitation programme.

7.4 Site Specific Closure Activity

The following key processes and products form part of the proposed rehabilitation activities:

7.4.1 Ballengeich Siding

The Ballengeich Siding has historically been used for the screening, sorting, stockpiling, and rail loading of coal sourced from Springlake Colliery, with deliveries made daily by truck haulage. Historical throughput was approximately 50,000 tonnes per month (600,000 tonnes per annum),



screened and sorted using mobile crushing and screening plants before being stockpiled for rail dispatch. The siding aimed to load rail wagons twice per week, with stockpile capacity at the time limited to less than 90,000 tonnes.

The siding has two Pollution Control Dams (PCD 7 and PCD 8) located adjacent to the N11, which collect approximately 35% of the stormwater runoff from the siding and coal storage areas. The remaining 65% of stormwater flows toward the eastern PCD complex and is collected by PCDs 3 and 4. Water from these PCDs is used for dust suppression on the operational areas. All dust suppression water is AMD-impacted water sourced from the on-site lined PCDs — no groundwater abstraction takes place on site.

Kangra Coal intends to refurbish and re-establish the Ballengeich Siding as an operational coal screening and storage facility for a period of 15 years at a designed capacity of 95,000 tonnes per month (~1,140,000 tonnes per annum). The proposed siding infrastructure, as confirmed on the final Master Layout Plan Rev 2 (GFK Drawing G2025/06/338-100, 9 April 2026), comprises the following:

- A coal stockyard with a maximum storage capacity of approximately 95,000 tonnes and an annual throughput of up to 1,140,000 tonnes per annum;
- A coal sizing and quality screening plant to process raw coal prior to rail dispatch — the screening process is a dry operation and requires no wash water;
- A new GFK-designed wash bay with concrete bunded slab, silt trap, and oil trap discharging to the dirty water channel network and ultimately the New Quantum PCD (Item 37). Wash bay water (5,000 L/day) is supplied externally by NCCA (Northern Coal Alliance) via water cart to two 5,000 L JoJo tanks — no on-site water abstraction;
- Chemical/portable mobile toilets for operational staff — no permanent septic tanks or conservancy tanks on the Quantum site;
- A general waste disposal area with a concrete bunded slab onto which skip bins can be placed for temporary hydrocarbon waste storage prior to removal off site by a licensed contractor;
- Upgrading of existing security infrastructure, weighbridge, and administrative office facilities (existing building to be renovated);
- Maintenance and upkeep of the existing railway line to ensure safe and efficient coal transport; and
- Full refurbishment and upgrade of the stormwater management system in accordance with the GFK SWMP (Report G2025/06/338(1), March 2026), including lining of PCDs 3, 4, 7, and 8 with a Class C HDPE-Clay composite liner (GNR 636), construction of the New Quantum PCD (8,600 m³; Item 37), concrete-lined dirty water channels, concrete silt traps at all PCD inlets, and the flood protection berms along the Horn and Ngagane Rivers.

All siding activities will be undertaken in accordance with the applicable environmental management requirements, the conditions of the Water Use Licence, and the IWWMP, to ensure that potential impacts on water resources are effectively mitigated and managed throughout the 15-year operational life of the facility.

7.4.2 Quantum

The Quantum Crushing and Screening operation occupies a portion of the Ballengeich Colliery property on Portion 19 of the farm Ballengeich 3299 and is operated by Southern Coal (Pty) Ltd / Canaf Investments. The operation comprises an existing screening and crushing plant that processes raw coal product prior to stockpiling and road transportation. Kangra Coal intends to construct its own new screening plant on the adjacent to the Ballengeich Siding. The existing Quantum EA and associated AEL do not form part of this WULA application.



The Quantum operations are a relatively small-scale, coal gasification process. Dust is generated through the stockpiling and haulage of coal products on the operational footprint. Dust suppression water is sourced from PCDs 7 and 8 on the Ballengeich Siding operational area, supplemented where necessary from the other on-site PCDs. No groundwater abstraction takes place on the Quantum site — all operational water, including potable water, is sourced entirely from an external supply provided by NCCA (Northern Coal Alliance) by pipe and water tanker.

Sanitation for Quantum operational staff is provided by mobile/chemical portable toilets only. No septic tanks, conservancy tanks, or permanent sanitation infrastructure are located on the Quantum site. A 2,500 L fully bunded diesel tank is present on site for operational fuel storage. This constitutes a registered S21(g) water use (Item 43.3) due to the hydrocarbon storage risk to the adjacent water resources.

In future, dirty stormwater runoff from the Quantum operational footprint (2.93 ha) will be captured by the concrete-lined dirty water channel network and routed via concrete silt traps to the New Quantum PCD (Item 37; 8,600 m³; Class C HDPE-Clay composite liner), which replaces the existing undersized Quantum PCD (Item 14; 1.8 ha).

7.4.3 Ballengeich Decant

Treatment of mine waters has often been carried out through the use of chemicals; however, over the last two decades passive treatment systems in the form of engineered wetlands have been developed as a more sustainable option. The systems are engineered to maximise removal of metals and suspended solids, and neutralisation of acidity. Theoretically, constructed wetlands could emulate natural wetlands by providing habitats for fauna but to date there have been very few studies investigating the potential for constructed wet-lands to provide this ancillary benefit (Batty et al, 2005).

Some general principles of ecological engineering that apply to the mitigation and rehabilitation of wetlands is outlined below (Mitsch and Jørgensen, 2004):

- Design the system for minimum maintenance and a general reliance on self-design;
- Design a system that utilizes natural energies, such as the potential energy of streams as natural subsidies to the system;
- Design the system with the hydrologic and ecological landscape and climate;
- Design the system to fulfil multiple goals but identify at least one major objective and several secondary objectives;
- Give the system time to stabilise;
- Design the system for function, not form;
- Do not over-engineer wetland design with rectangular basins, rigid structures and channels, and regular morphology

Mining activities tend to pollute water resources and increase the sediment load if the processes are not controlled. Runoff from mines in areas where the geology is high in sulphide tends to be acidic (Mitchell, 2013), causing environmental damage when it enters a water resource. While wetlands can treat a certain amount of acid mine drainage, exceeding their capacity negatively impacts the eco-system services on which the population relies.

7.5 Pilot Scale Study

Using the information available at the time of writing this report, the passive treatment plant (on a pilot scale) has been preliminary designed to achieve the desired release qualities of various water quality standards from the predicted decant influent as indicated in **Table 7-1** below.



Table 7-1: Determinate concentrations

Constituent	Predicted Influent	Predicted Treated Release	Water Quality Standard
pH	4 – 6	6-8	SANS 241, RQO
Sulphate SO ₄ mg/l	2500	500	SANS 241
Fe (mg/l)	1	0.01	SAWQG Aquaculture, DWAF 1996 TWQR
Al (mg/l)	1	0.3	SAWQG Aquaculture, DWAF 1996 TWQR
Mn (mg/l)	1	0.1	SAWQG Aquaculture, DWAF 1996 TWQR
TDS (mg/l)	2800	1500	SAWQG Aquaculture, DWAF 1996 TWQR

It is important to note that these are only estimated values obtained interpreting the geochemical report. In this case only the primary metals were analysed. Strict water quality monitoring is necessary during the rehabilitation operation phase and post closure. The geochemical assessment will also require continuous updating in order to determine the actual concentrations for final design and implementation purposes. If more stringent release qualities are required by DWS, consideration of an active treatment plant should be made.

A system based on the Successive Alkalinity Producing System (SAPS) Wetland together with an aerated settling pond is best suited. This system allows for inclusion of limestone in the treatment plant. Although not specifically required in this instance to neutralise the mine water (as it will already have a pH between 6-8), the limestone will be beneficial for reduction of the sulphates. Enough space is available at the predicted decant point to construct such wetlands. The natural topography is also adequate to allow this system.

The 8 l/s decant water will be split via four pipes to allow a design flow of 2 l/s water to flow into each wetland. Each pipe will have an isolation valve which can be closed to prevent water inflow in the event of sludge removal and maintenance of the wetlands. Four treatment ponds (also further referred to as sulphate reducing ponds) will be required.

The schematic designs for the passive treatment system are illustrated in **Figure 7-1** 1 to **Figure 7-3**.

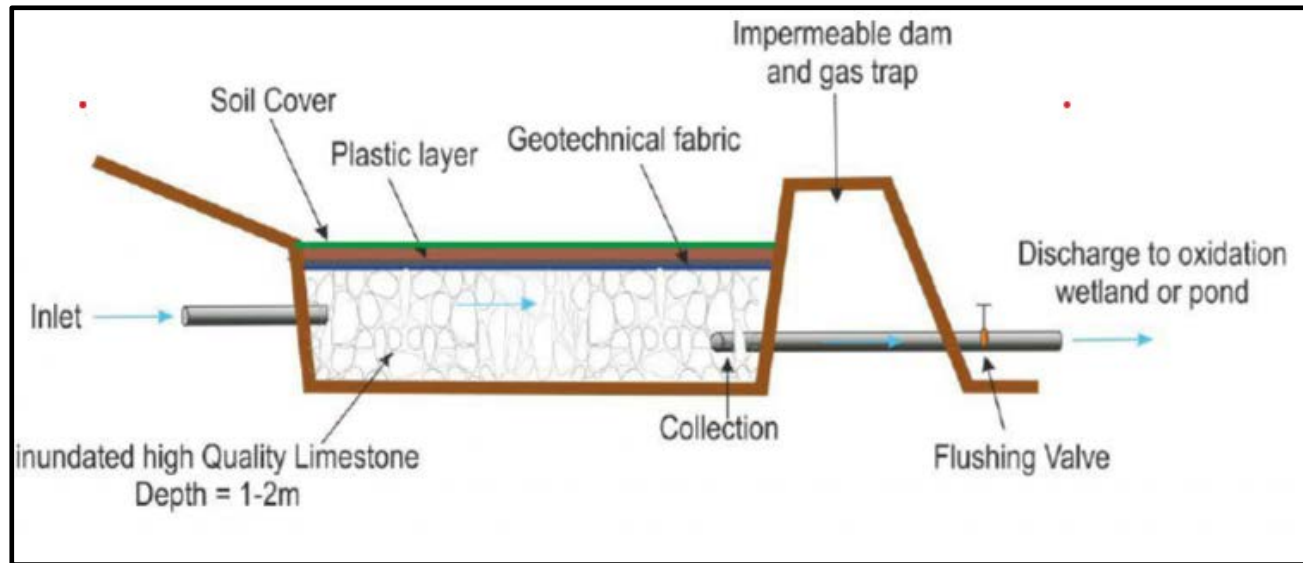


Figure 7-1: Typical section of Anoxic Limestone Drainage (ALD) system

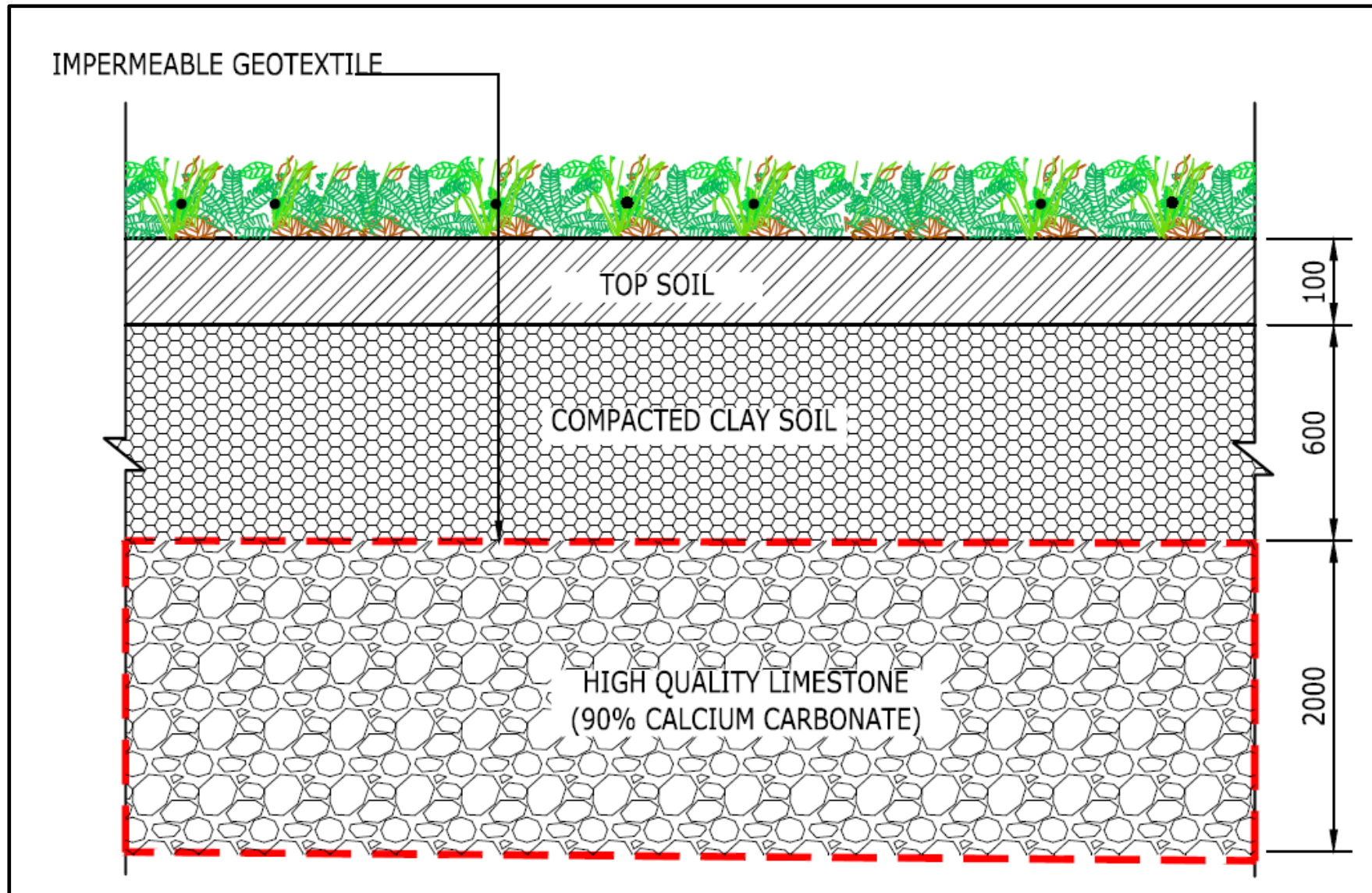


Figure 7-2: Section through ALD

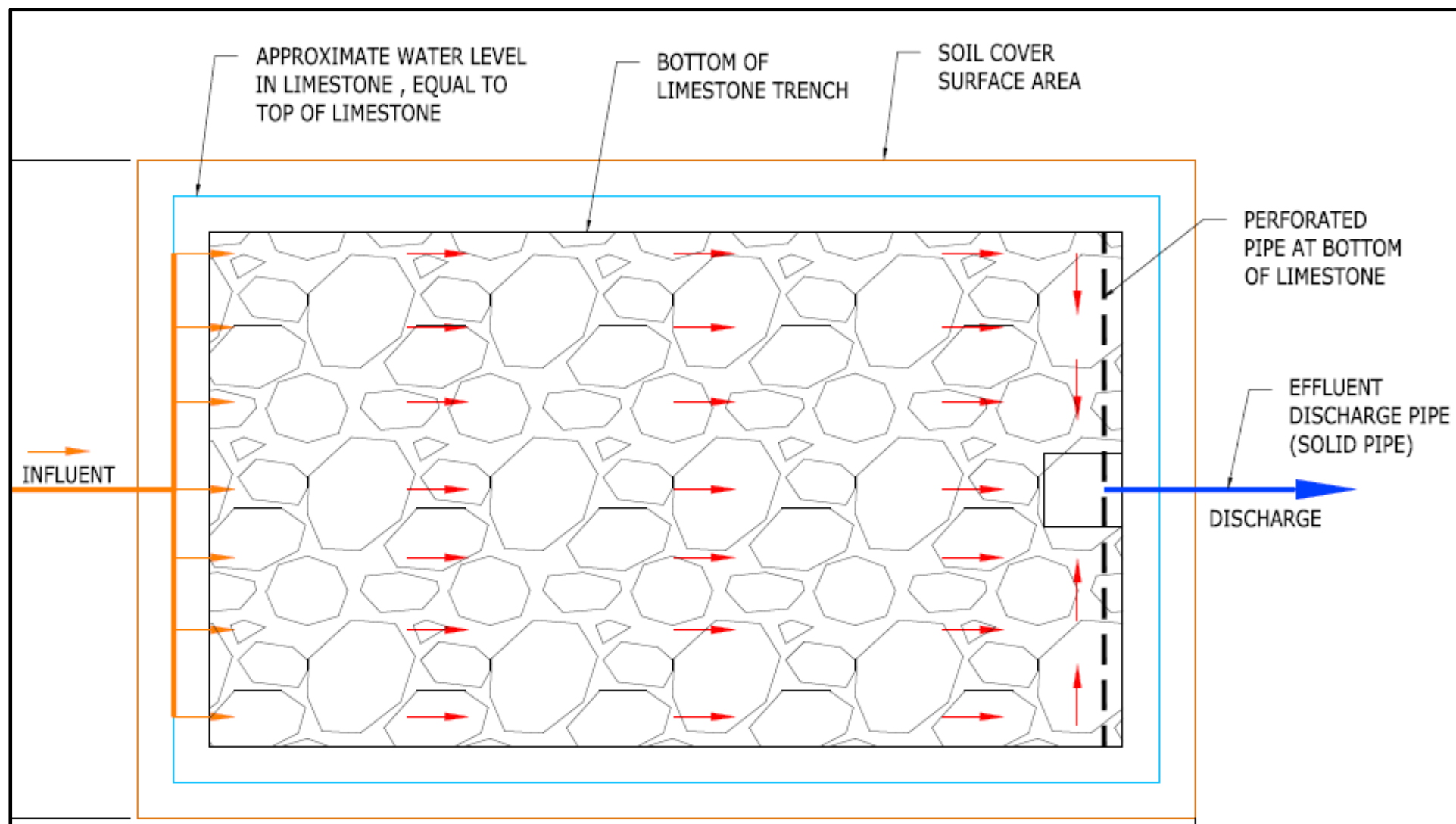


Figure 7-3: ALD layout plan



Table 7-2: Dimensions and capacities per pond

Wetland Pond	Dry Freeboard	Free water	Compost	Limestone	Total
Embankment side slope (S) S:1	3	3	3	3	3
Width (m)	45	40.2	36.6	28.2	45
Length (m)	90	85.2	81.6	73.2	90
Depth of each component (m)	0.8	0.6	1.4	0.5	3.3
Volume (m ³)	3240	2055	4181	1032	13365
Surface area (m ²)	4050	3425	2987	2064	4050

It can be noticed that even though the inflow is relatively low, a relatively large sulphate-reducing pond is still required. This is due to the following:

- Enough water head must be available to allow the system to flow and flush. Typically, the head loss in such a system can be up to 1.5m, meaning enough depth must be available to allow for some free water to provide this head.
- A minimum length-to-width ratio of 2:1 up to 5:1 is required to ensure the effective retention and contact time of the effluent to the compost and limestone.
- A minimum compost layer of 150 mm to 600 mm is required, but is increased as required.
- A typical limestone layer of 500 mm to 1000 mm is required.
- The inside slopes must be flat enough to allow small frogs, insects etc. to be able to climb out of the lagoons. A study by Adarlène M. Silva and Versiane A. Leão (2012) focused on treating mine water by reducing sulphates with limestone, which indicated. This can be possible with mine water that has a pH of 6.5, which was used in the study.

The limestone requirement is indicated in **Table 7-3** below:

Table 7-3: Summary of parameters for limestone requirement

Parameters	Value
Area	600 m ²
Depth	2,7 m
Clay layer	600 mm
Geotextile lining	22 mm thick smooth HDPE lining, complying SANS 10409 and A4 geotextile
Limestone depth	2000 mm
Incoming flow rate	1000 m ³ /day
Outgoing flow rate	1000 m ³ /day

To reduce the sulphate further, a carbon source is required. In this instance 1400mm thick layer of hay (or bark/woodchips), will be used as the sulphate reducing carbon source. Provision is made to allow for replacement of at least 200mm layer of hay during operation when the carbon gets depleted before having to remove and replace the hay. Alternative carbon sources such as kikuyu, chicken manure, wood chips, and mushroom compost can also be considered (Dill, Cloete, Coetser, & ZDYB, July 2001). Hay is however abundantly available in close proximity and can be bought from neighboring farmers. The carbon source and reducing ability should actively be evaluated and monitored during operation. It is also



recommended that if other carbon sources are abundantly available these could be placed in one of the cells for evaluation, as it will always be better to improve the system.

These sulphate reducing cells must be saturated with water at all times to ensure anaerobic conditions where oxygen is removed from the system. It is expected that the TDS will precipitate in the reducing ponds while the sulphate is reduced. The reduction of TDS will mostly likely only meet the meet the SANS 241:250 quality standards and the Agricultural Livestock watering Target Water Quality Requirement (TWQR) of the DWAF 1996 Guidelines.

The SAPS systems combine ALD and compost wetland systems with vertical flow of water. First the acidic water flows through the low hydraulic conductivity compost part of the SAPS, where dissolved oxygen is consumed, and ferric iron (Fe^{3+}) reduced to ferrous iron (Fe^{2+}). As a result, the water becomes anoxic and will flow through the anoxic layer of limestone resulting in alkaline water without any iron precipitating on the limestone. The removal capacity of SAPS system is approximately 10 g acidity /m²/d and estimated lifetime 20-30 years. The area-adjusted contaminant removal rate was derived by Hedin et al. (1994a) for systems that must meet regulatory standards a value of 10 g/m²/d for iron, and 0.5 g/m²/d for manganese is recommended. The effluent discharged from Ballengeich has a design loading of 1000 m³/d and 189 mg/L iron and 4.0 mg/L manganese. The minimum required area is 18 900 m². Schematic of the system is presented in **Figure 7-3**. The proposed SAPS systems will be as follows:

Table 7-4: Successive alkaline producing system design

Parameters	Value
Retention time	15 hours
Standing water height	1,0 meter
Compost layer thickness	0,6 meter
Limestone depth	2000 mm
Incoming flow rate	1000 m ³ /day
Outgoing flow rate	1000 m ³ /day

7.5.1 Implementation

The decant flow will be channeled to a collection point (sump) from where a pipe will direct it for the interim to an existing PCD. Once the monitoring and flow measurement data is validated for the pilot scale study, effluent will be redirected to the newly constructed sulphate reducing treatment facility.

The pipe inlet will discharge into a concrete channel constructed along the full length of the sump wall, which will have baffles, in order to distribute water evenly. This will minimise localised flow only at the pipe inlet.

Each Pond will be 3.3m deep, having a freeboard of 800mm. Each pond liner will consist of 2 x 150mm clay layers, with a 1.5mm HDPE liner.

The HDPE liner is to meet the SANS 1526:2015 and SANS 10409:2020 specifications. A non-woven geotextile (Bidim A7, or similar approved) will be placed above the HDPE to prevent puncture by the limestone.



The Construction Quaintly Assurance document and procedure as per ANNEXURE A of the Ballengeich Rehabilitation Plan (MENCO, 2024) shall apply. The pond walls will be constructed using an inside slope of 1:3 and outside slopes of 1:2. The natural topography allows for a well-balanced cut and fill construction method, which will be used. At the bottom of the pond, on top of the HDPE liner a, 500mm layer of high calcium limestone (50- 100 mm sizes) will be placed. The total volume of limestone required is based on a total retention time of 24 hours. The 1.4m thick layer of organic matter (carbon source) is then placed on top of the limestone. This compost will be sulphate reducing, hence substantially reducing the sulphate concentrations in the water.

The rest of the pond will be filled with water. A siphon system overflow, consisting of 160mm diameter solid PVC pipes is incorporated to assure the compost and limestone always remains saturated. The pipes will also be accessible from the pond crest for maintenance purposes. At least one 110mm perforated drainage pipe will be placed at the bottom of each pond in the limestone. This will force the water to vertically flow through the compost and limestone to the pipes.

Allowance will be made to flush out the water from the pond and clean the limestone and pipe due to possible clogging (armouring) of the Aluminum and other metals. As indicated in the attached drawings, the perforated drainpipe will be connected to a solid 160 PVC pipe. This pipe can be accessed via a manhole to open the valve. Due to the natural terrain slopes, 'flushed out' water will need to be pumped out from these manholes. A portable diesel self-priming pump will be required. This will be done during schedule maintenance periods as deemed necessary when clogging is observed.

7.5.2 Passive Settling: Fe, Al and Mn removal

Low concentrations of Manganese, Iron and Aluminum are expected. Provision in the form of a settling pond is however made to treat these concentrations to the Aquatic and Aquaculture criteria as set out in the South African Water Quality Guidelines by Department of Water and Sanitation, 1996. In order to treat the iron and manganese, water flowing over from the wetland ponds will discharge into aerobic settling ponds.

As the initial part of the passive system will function under anaerobic conditions, oxygen reintroduction into the water is required before the water enters the aerobic polishing wetlands. This is done by letting the water flow over aeration cascades in the form of steps in the overflow channel from the sulphate reducing channels to the settling ponds/wetlands. Aeration cascades/steps, each being 300mm wide and 250mm high, will be constructed at each inlet.

The settling ponds (or sometimes referred to as polishing wetlands) are shallow structures (800mm deep) to enable *Thypha* growth and to operate under aerobic conditions. At a reduction rate of 20mg/l for the iron and 1mg/l for the manganese (GDARD, 2014), a water surface area of 155m² will be required for each settling pond.

Table 7-5: Summary of settling pond design

Design inflow (l/s)	2.00
Design water flow rate per pond (m ³ /d) Q	200



Fe inflow concentration (mg/l)	1.5
Mn inflow concentration (mg/l)	1.00
Fe outflow concentration required (mg/l)	0.05
Mn outflow concentration (mg/l)	0.01
Fe required wetland area (m ²)	10
Mn required wetland area (m ²)	200

As with the sulphate reducing ponds, these settling ponds will be lined with 300mm clay layer and 1.5mm HDPE liner. Inside slopes will also be 1:3 and a freeboard of 800mm will be applied. The total water depth in this case will be 0.8m, with the total dam depth from crest level being 1.6m. Sludge removal will be required every 5 years. The removed sludge will be discarded at an approved municipal waste facility.

A final overflow at the last settling pond will discharge treated clean water into a v-drain. These v-drains will direct the overflow water the earth channel which eventually discharges into the wetland towards the Horn River. Water is to be tested immediately after this last overflow. The geochemical report by GCS indicates that low metal concentrations such as iron and manganese are expected. For preliminary design purposes it is therefore expected that the target water quality standards will be met with the current proposed system. Provision is however made and space is available, should the desired concentration not be met, to construct an aerobic polishing wetland downstream of the settling ponds (it is envisaged that the anaerobic wetlands are integral to the pilot scale study).

7.5.3 Passive Treatment Costs

The passive treatment costs are indicated in the schedule of quantities, in below. It should be noted; a large portion of the costs is attributed to the HDPE liner. No specific waste classification was done on decant water, but it is assumed a Class C liner applies. Should the water quality test results in the future however prove to be such that a Class D liner is permitted, the HDPE will be removed and only a 300mm clay liner will be in place. This will result in a cost saving of R 922 000 excl. VAT. A total capital costs of R 4.07 million is expected, with maintenance costs at approximately R 40 000 per annum.

Please refer to **Table 7-6** for a breakdown of the costs for the implementation of the passive treatment system on a pilot scale.

Table 7-6: Passive treatment costs Schedule of Quantities

No	Ref	Description	Unit	Qty	Rate	Amount
	SABS	SMALL WORKS				
	SANS					
1	1200AA	PRELIMINARY AND GENERAL				
1.1	8.3.1	CONTRACTUAL REQUIREMENT				
		Sum shall cover Contractors initial costs of providing sureties	Sum	1	R150 000,00	R150 000,00
1.2	8.3.2	PROVISION OF FACILITIES ON SITE				



No	Ref	Description	Unit	Qty	Rate	Amount
		The sum shall cover the costs of providing, establishing and commissioning facilities required by the Contractor	Sum	1	R100 000,00	R100 000,00
1.3	8.3.3	GENERAL RESPONSIBILITIES				
		The sum shall cover overhead fixed costs and other obligations	Sum	1	R100 000,00	R100 000,00
1.4	8.3.4	REMOVAL OF SITE ESTABLISHMENT				
		Demolition and removal of all items	Sum	1	R80 000,00	R80 000,00
1.5		NAMEBOARD				
		Chromadeck board 2.4 x 2.4 complete with poles	No	1	R6 000,00	R6 000,00
1.6		SPECIAL REQUIREMENTS				
		Occupational Health and Safety Plan	Sum	1	R25 000,00	R25 000,00
SUB-TOTAL						R461 000,00
	SANS	EARTH WORKS				
	1200DE					
2.1	8.3.5	SITE CLEARANCE				
	8.3.5.1	Clear and strip site	ha	250	R500,00	R125 000,00
	8.3.5.2	Boulder removal (extra)	m ³	300	R50,00	R15 000,00
	8.3.5.3	Topsoil removal, 150 mm depth	m ³	3500	R35,00	R122 500,00
2.2	8.3.6	EXCAVATION				
	8.3.6.1	Material unsuitable for embankment	m ³	500	R50,00	R25 000,00
	8.3.6.2	Material suitable for embankment	m ³	18000	R50,00	R900 000,00
	8.3.6.3	Excavation in hard rock	m ³	220	R400,00	R88 000,00
2.3	8.3.7	PREPARATION OF EXPOSED SURFACES				
	8.3.7.1	Core trench	m ²	1950	R25,00	R48 750,00
	8.3.7.2	Area to be covered by Dam	m ²	25000	R10,00	R250 000,00
2.4	8.3.8	FORMING EMBANKMENT				
	8.3.8.1	Selected impervious material	m ³	18000	R35,00	R630 000,00
	8.3.8.2	2x150 mm layers of clay	m ³	6000	R35,00	R210 000,00



No	Ref	Description	Unit	Qty	Rate	Amount
	8.3.8.3	Prepare basin and slopes for HDPE	m ²	18000	R15,00	R270 000,00
	8.3.8.4	Import high calcium limestone	m ³	500	R1 500,00	R750 000,00
	8.3.8.5	Import organic material	m ³	150	R250,00	R37 500,00
	8.3.8.6	Topsoil from mine property	m ³	1000	R35,00	R35 000,00
2.5	8.3.9	GRASSING				
	8.3.9.1	Seeding of suitable grass	m ²	7000	R5,00	R35 000,00
	8.3.9.2	Fertilizer as recommended	m ²	7000	R8,00	R56 000,00
	8.3.9.3	Watering for 3 weeks	m ²	7000	R3,00	R21 000,00
SUB-TOTAL						R3 618 750,00
TOTAL (EXCLUDING 15 % VAT)						R4 079 750,00

7.6 Maintenance and Monitoring

With the issuance of a WUL, condition-based monitoring and maintenance will be conducted at site. This is seen as crucial for the pilot scale study where the long-term objective is to protect the environment. The maintenance and monitoring programme entails studying the performance of the passive treatment system by observing and collecting data in order to assess impacts and make informed decisions for resource management of the Horn and Ngagane Rivers.

Therefore, the monitoring of surface water and groundwater must be conducted in accordance with the implemented monitoring network and the protocol must be continued throughout the post-operational phase. The monitoring results must be evaluated and reviewed annually by a relevant qualified scientist for interpretation and trend analysis for submission to the DWS for final decision on the efficiency of the passive treatment system.

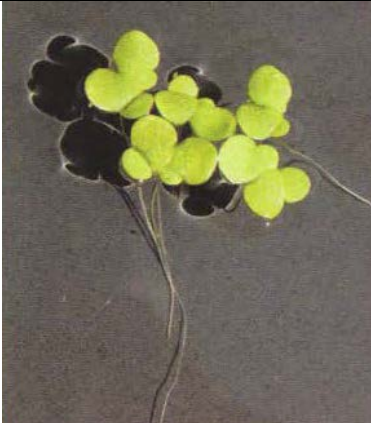
7.6.1 Wetland Vegetation

Typical aquatic vegetation to be used in the construction of the aerobic and anaerobic wetlands are illustrated in **Table 7-7** below.

The table provides for an image of the aquatic plant, the scientific name as well as common name. Many of the aquatic species are commonly found in the area that could be harvested to be used in the vegetation of the constructed wetlands.



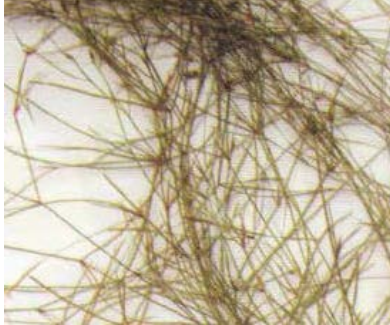
Table 7-7: Typical aquatic plants to be used in wetland vegetation

 <i>Azolla ficuloides</i> Red water fern	 <i>Azolla pinnata</i> Red water fern	 <i>Schoenoplectus paludicola</i> Sedge
 <i>Lemna gibba</i> Duckweed	 <i>Pistia stratiotes</i> Water lettuce	 <i>Salvinia molesta</i> "watervaring"
 <i>Alternanthera philoxeroides</i> Alligator weed	 <i>Hydrocleys nymphoides</i> Water poppy	 <i>Nymphaea Mexicana</i> Yellow water lily



 <i>Nymphaea nouchalia</i> Blue water lily	 <i>Nymphoides thunbergiana</i> Floating heart	 <i>Trapa natans</i> Water chestnut
 <i>Ceratophyllum demersum</i> Water hornwort	 <i>Isolepis fluitans</i> Water weed	 <i>Lagarasiphon major</i> Coarse oxygen weed (babergas)
 <i>Lagarasiphon muscoides</i> Fine oxygen weed	 <i>Myriophyllum aquaticum</i> Parrot's feather	 <i>Potamogeton crispus</i> Curled pondweed



 <i>Potamogeton pectinatus</i> Fennel leaved pondweed	 <i>Potamogeton thunbergii</i> Floating pondweed	 <i>Typha capensis</i> Bullrush
 <i>Utricularia stellaris</i> Star bladderwort	 <i>Cyclosorus interruptus</i> Fern	 <i>Pericaria decipiens</i> Slender knotweed
 <i>Persicaria lapathifolia</i> Spotted knotweed	 <i>Plantago longissimi</i> Broadleaved plantago	 <i>Veronica anagallis-aquatica</i> Water speedwell



Persicaria senegalensis
Snakeroot



Arundo donax
Giant reed



Cyperus marginatus
Water reed



Carex austro-africana
Rushes



Cyperus dives
Giant sedge



Cyperus eragrostis
Rushes



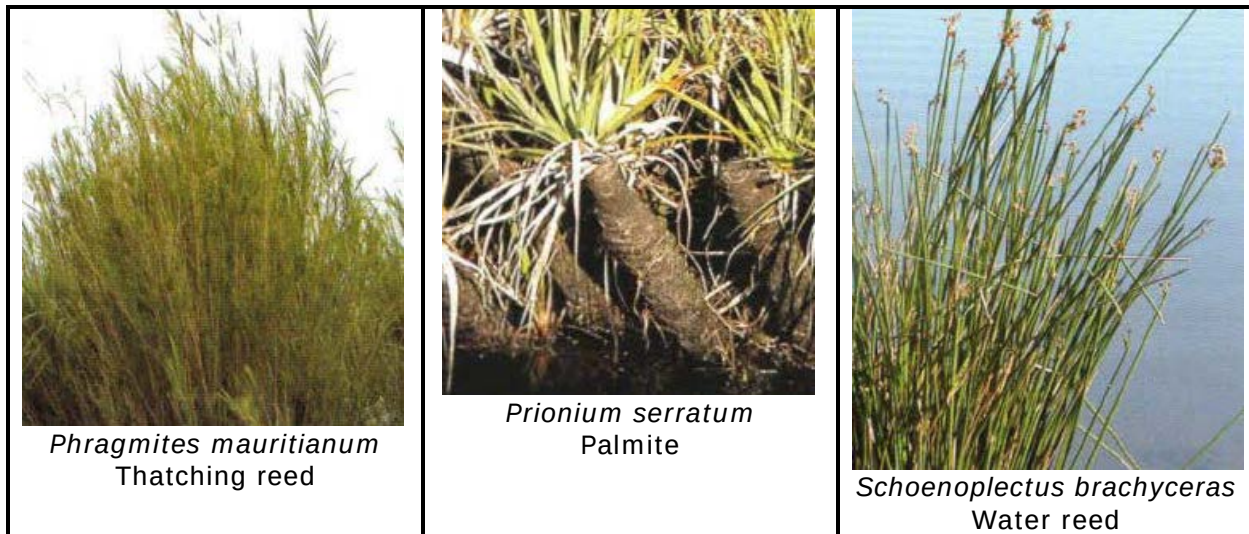
Cyperus sexangularis
Matjiesgoed



Juncus effuses
Rushes



Phragmites australis
Common reed



7.6.2 Groundwater Monitoring

Groundwater monitoring is required to be conducted on a quarterly basis to determine the impact of the plume migration on the receiving water resources. Specifications as per the proposed Reserve Determination (DWS 2022) were used to indicate RWQO in this report. Specific Resource Quality Objectives as per GN 1873 dated 11 March 2022 for the V31K Quaternary Catchment area listed in **Table 7-8** below. The variables to be analysed is listed in **Table 7-9** with the TWQR-Class II to be comply with.

Table 7-8: Groundwater Resource Directed Measures for V31K

Area	Recharge	GW component baseflow	Baseflow	BHN Reserve	Total reserve	Total GW use
km ²	Mm ³ /a	Mm ³ /a	Mm ³ /a	Mm ³ /a	Mm ³ /a	Mm ³ /a
227	14,8	3,2	2	1,09	1,9	0.20

Table 7-9: RWQO Specifications for groundwater (DWS, 2022)

Parameter in mg / l (Unless specified otherwise)	Target Water Quality Ranges		
	Class 0	Class I	Class II
pH (value at 25°C)	6 – 9	4.5 – 10	4 – 10.5
Electrical Conductivity (mS/m)	<70	70 – 150	150 – 370
Calcium as Ca	<80	80 – 150	150 -300
Magnesium as Mg	<70	70 – 100	100 – 200
Sodium as Na	<100	100 – 200	200 – 400
Fluoride as F	<0.7	0.7 – 1.0	1.0- 1.5
Chloride as Cl	<100	100 – 200	200 – 600
Nitrite as N	<6	6 – 10	10 – 20
Sulphate as SO ₄	<200	200 – 400	400 - 600

The groundwater monitoring points are described in **Table 7-10**.



Table 7-10: Groundwater Monitoring Programme

Sampling Point	Description	Latitude	Longitude
UGBH1	Borehole drilled to the east of the N11	-27.883874°	29.965454°
UGBH01	East Underground workings, east of N11	-27.883870°	29.965530°
UGBH 3	West UG Workings approximately 1.45km west of N11	-27.879194°	29.949417°
UGBH 4	West UG Workings approximately 2.4km west of N11	-27.877361°	29.939000°
UGBH 5	South UG workings, 50m west of N11	-27.898290°	29.967150°
UGBH5	Borehole drilled into underground workings. West of the N11	-27.898206°	29.967064°
GW0	Borehole drilled upslope from GW08.	-27.87937°	29.96886°
GW01	Borehole drilled upslope from the Horn River, to the south, near the first decant point	-27.890477°	29.962874°
GW02	Borehole, by Upper Bridge	-27.894162°	29.947665°
GW03	Borehole by VN2	-27.884192°	29.974252°
GW06	Borehole in old lands	-27.879674°	29.971604°
GW08	Borehole drilled close to GW0. Replaced by GW0	-27.879370°	29.968860°
GW12	Borehole by VN2	-27.885126°	29.974512°
GW13	Borehole on ridge	-27.885230°	29.971292°
GW14	Old Borehole in old lands, replaced by GW06	-27.879726°	29.971759°
GW15	Borehole between office and N11 road.	-27.882582°	29.968436°
GW16	Borehole by bridge	-27.888554°	29.966723°
GW17	Borehole by discharge borehole	-27.891669°	29.963036°
GW20a	Newly drilled borehole, drilled into underground workings - 40m	-27.891784°	29.966222°
GW20b	Newly drilled borehole, drilled ±8m from GW20a. Drilled to first water strike at 12m. 13m deep	-27.891778°	29.966128°
GW21	Newly drilled borehole drilled south from the discard dump. Drilled to 30m	-27.892780°	29.974920°
GW22	Experimental Borehole. 10m deep. Fitted with tubing to determine oxygen within the soil	-27.882910°	29.974920°
GW23	Experimental Borehole. 10m deep. Fitted with tubing to determine oxygen within the soil	-27.883350°	29.970230°

7.6.3 Surface water monitoring

The surface water monitoring plan as contained in section **5.14** of the IWWMP must be followed. Sampling point SW10 acts as the compliance point for Ballengeich Colliery. The surface water variables to be monitored is listed in **Table 7-11**.

Table 7-11: Surface water quality variables and frequency

Parameter / Substance	Unit	Frequency
pH		Monthly
Total Dissolved Solids as TDS	mg/l	Monthly
Electrical Conductivity as EC	mS/m	Monthly
Nitrate as NO ₂	mg/l	Monthly
Chloride as Cl	mg/l	Monthly
Fluoride as F	mg/l	Monthly



Parameter / Substance	Unit	Frequency
Sulphate as SO ₄	mg/l	Monthly
Calcium as Ca	mg/l	Monthly
Magnesium as Mg	mg/l	Monthly
Sodium as Na	mg/l	Monthly
Iron as Fe	mg/l	Monthly
Manganese as Mn	mg/l	Monthly

The surface water monitoring points are described in **Table 7-12** and indicated on **Figure 7-4**.

Table 7-12: Surface water monitoring points

Sampling Point	Description	Latitude	Longitude
SW01	Horn River, upstream of the western opencast.	-27.894065°	29.941769°
SW02	Horn – DWAF gauging station (V3H009) downstream of the western opencast area.	-27.893050°	29.947676°
SW03	Horn – Final void of the western opencast.	-27.896465°	29.952660°
SW04	Horn – Beneath the bridge at the N11, west of the eastern opencast.	-27.888620°	29.964843°
SW05	Horn – Approximately 400m from N11, downstream of SW04 at the old east opencast.	-27.884836°	29.970750°
SW06	Horn – Downstream of the eastern opencast area, at the weir, before the confluence with the Ngagane River.	-27.885113°	29.974442°
SW07	Final void of the eastern opencast.	-27.886036°	29.972135°
SW08	Old river channel below the discard dump.	-27.888897°	29.973335°
SW09	In the Ngagane River, at the SAR bridge.	-27.897850°	29.978596°
SW10	In the Ngagane River, downstream of the rehabilitated opencast workings, and approximately 700 m downstream of the confluence with the Horn River	-27.879667°	29.973981°

7.6.4 Record Keeping and Monitoring

As the envisaged remediation program is based on a river and wetland rehabilitation plan with objective to enhance the Horn River ecological functioning that is detrimentally impacted by AMD decant the following record keeping will be required:

- A photographic record must be kept as follows and submitted with reports:
 - o Dated photographs of all the sites to be impacted before construction commences;
 - o Dated photographs of all the sites during construction on a monthly basis; and
 - o Dated photographs of all the sites after completion of construction, seasonally.
- During the construction of the passive treatment system the site must be visited by a wetland, aquatic and/or ecological specialist prior to construction to determine baseline conditions. This should be repeated during and after rehabilitation measures have been implemented to assess the success of rehabilitation and erosion control measure. Areas in and around the watercourses must not be cleared, graded and ditched/trenched more than a week before construction. The aim is to prevent erosion



and sedimentation and the collection of run-off trench water that has high sediment content.

- All disturbed areas must be re-vegetated with an indigenous seed mix in consultation with an indigenous plant expert, ensuring that during rehabilitation only indigenous shrubs, trees and grasses are used in restoring the biodiversity.
- An active campaign for controlling invasive species must be implemented within disturbed zones to ensure that it does not become a conduit for the propagation and spread of invasive exotic plants.
- Rehabilitation must be concurrent with construction.

In terms of monitoring requirements, the Provincial Head must be notified in writing prior to commencement of the proposed activities and again after completion of the activities. The DWS must also be submitted with the following reports:

- Six (6) monthly monitoring reports must be submitted to the Provincial Head until otherwise agreed in writing with the Provincial Head;
- Submit a long-term wetland and river monitoring and audit plan for approval. This monitoring and auditing must be ongoing until the pilot scale study shows self-sustainability;
- Install flow meters on the Horn River weir which will need to be maintained and calibrated accordingly;
- The audit reports must include but are not limited to:
- Reporting in respect of the monitoring program referred to in **Table 6-4** and all other reporting and compliance conditions outlined in an issued WUL;
- A record of implementation of all mitigation measures including a record of corrective actions;
- If required, compensation measures for damage where mitigation measures have failed to adequately protect the in-stream and riparian habitat or any other characteristic of the watercourses;
- A wetland, aquatic and/or ecological specialist must be appointed to monitor the compliance to the wetland and riparian habitat management and rehabilitation plan and conditions in any issued environmental authorisation pertaining to impacts on wetlands and the riparian habitat and provide specialist advice for corrective actions and compile audit reports which must be submitted to the relevant regulatory authority.





8 CONCLUSION

8.1 Regulatory Status of Activity

Ballengeich Colliery is a defunct mining operation that requires water use authorisation in terms of the National Water Act, 1998 in order to implement rehabilitation measures to protect the Horn River from further long-term degradation. The management procedures of Ballengeich Colliery aim for the compliance with the environmental legislation and several supporting studies have been completed to achieve this purpose. This IWWMP is the culmination of the various baseline and specialist studies that formed part of the larger Environmental Management Plan and Environmental Management System documentation of Ballengeich Colliery.

8.2 Status of Water Uses requiring authorization

Following the issued Directive dated 14 August 2013, Kangra Coal has since this date actively engaged with the DWS to address the concern of “high conductivity in the Ngagane River”. Further communication on the matter dated 25 April 2014 detailed Kangra’s progress regarding implementation of mitigatory measures, amongst other actions, the application for a WUL. It eventually resulted in a WULA that was submitted during 2019 to the DWS for processing and approval.

The WULA and supporting IWWMP as compiled by GCS made provision for section 21 (a), (b), (c), (f), (g) water uses at the Ballengeich site. In a letter dated 10 December 2020 the DWS has raised several statutory contraventions as the rejected WUL (29 April 2019) has resulted in Kangra being non-compliant with Chapter 4 of the NWA.

Kangra responded to the issues in a letter dated 11 January 2021 indicating measures implemented as part of phase 1 of the Rehabilitation Plan. It further detailed the actions to be taken as part of phases 2 to 4. The Action Plan was included for departmental notification. Kangra further committed towards the re-application of a WUL based on best technology to be used to remediate the impacts on the Horn River. In a letter dated 2 June 2021, Kangra has informed the DWS with progress made towards the non-compliances at Ballengeich Operations.

A departmental letter dated 24 August 2023 refers to the Amended Implementation Plan dated 4 October 2022 that incorporates several activities (physical work to be done on site) that are subject to a Water Use License Application. Kangra was urged to expedite the WULA (within 3-month period) in order to unlock the remediation and rehabilitation process. Only monitoring is allowed to commence. The pilot scale constructed passive wetland system is subject to a WUL.

Ongoing consultation with the DWS during 2024 has resulted in the change of scope whereby the WULA that only made provision for section 21(c) and (i) water uses as part of a passive treatment process be amended to cater for the entire footprint of Ballengeich Colliery. In this instance the application needed to be amended to include all section 21(g) water uses as well as a section 21(f) for the complex. This has resulted in the situation whereby Kangra Coal has no issued Water Use License Authorisation to implement the mitigatory measures at the mine.



As an interim measure, the Risk Assessment Matrix (GN4167 dated 8 December 2023) was used and all remediation activities with a low significance rating was implemented on site to minimize impacts on the water resource.

This IWWMP covers the complete set of water uses to be authorized to allow for the implementation of all mitigatory measures to either avoid, reduce or minimize the impact of the AMD decant on the Horn River.

8.3 Recommendation

The Ballengeich Colliery rehabilitation programme is underpinned by defensible engineering principles, established passive AMD treatment methodology, and a comprehensive suite of specialist studies and signed civil engineering designs. Adherence to the Environmental Management Programme (EMP/2026/086, March 2026), the Integrated Water and Waste Management Plan, and the conditions of the Water Use Licence will ensure that impacts on water resources are effectively mitigated and progressively reduced throughout the 20-year WUL period.

The proposed passive AMD treatment system, stormwater management infrastructure, and discard dump rehabilitation collectively represent the Best Practicable Environmental Option for the Ballengeich Colliery, as confirmed by the comparative alternatives assessment (MENCO, June 2026) and endorsed by all specialist assessors. The system is designed for a service life well in excess of the 15-year Ballengeich Siding operational period, ensuring that environmental protection obligations are met and sustained long after siding operations cease. The 20-year WUL period — comprising 15 years of operational and rehabilitation implementation and 5 years of post-implementation monitoring and compliance verification — is consistent with the design service life of the GFK-engineered infrastructure and provides sufficient time to demonstrate sustained achievement of the GN 1873 Resource Quality Objectives for the V31K catchment before formal closure of WUL conditions.

It is accordingly recommended that the Department of Water and Sanitation issue the Water Use Licence to Kangra Coal (Pty) Ltd for the Ballengeich Colliery for a period of 20 years, subject to the management commitments, monitoring requirements, and WUL conditions contained in this IWWMP. Any outstanding specialist study updates required as a result of project scope refinements should appropriately be captured as post-authorisation WUL conditions rather than as prerequisites to licence issue, given that the current application represents a comprehensive and technically defensible submission supported by all relevant specialist disciplines.



9 REFERENCES

- Amajuba District Municipality, (2021). Integrated Development Plan 2021/2022, report dated June 2021
- Batty, L.C., Atkin, L. and Manning, D.A.C., (2005): Assessment of the ecological potential of mine water treatment wetlands using a baseline survey of macro-invertebrate communities. Environmental Pollution 138 (2005) pp 412 – 419
- Bhekhani Sustainable Solutions (2023), Ballengeich Colliery Preliminary Civil Design Report for Acid Mine Drainage Passive Treatment Design, Report number B120 dated February 2023
- Department of Water Affairs A (2010). Operational Guideline: Integrated Water and Waste Management Plan. Directorate Resource Protection and Waste. Pretoria.
- Department of Water Affairs and Forestry (2004). Internal Strategic Perspective – Thukela Water Management Area, version 1, DWAF Report P WMA 07/000/00/0304 dated November 2004
- Department of Water Affairs and Forestry (2006). Best Practice Guideline G1: Storm Water Management.
- Department of Water Affairs and Forestry (2006). Best Practice Guideline G2: Water and Salt Balances.
- Department of Water Affairs and Forestry (2008). Draft Operational Guideline in M-Series: Operational Guideline to assist in the compilation of an Integrated Water and Waste Management Plan.
- Department of Water and Sanitation (2021). Determination of Water Resource Classes and Associated Resource Quality Objectives in the Thukela Catchment. Report No RDM/WMA04/00/CON/CLA/0520 dated January 2021
- Department of Water and Sanitation (2022). Determination of Water Resource Classes and Resource Quality Objectives for Thukela Catchments in the Pongola-Mtamvuna Water Management Area, published 11 March 2022
- Department of Water and Sanitation, (2022). Mine Water Management Policy – May 2022
- Ezemvelo KZN Wildlife, (2014). Amajuba District Municipality Biodiversity Sector Plan (version 1.0), dated March 2014,
- GCS (2015), Kangra Coal Ballengeich Water Management Report for IWULA and IWWMP: Hydrology, Geochemistry and Hydrology. Report Number 13-445 dated February 2015
- GCS (2016), Hydrological Assessment of Ballengeich Mine, Report No 15-558 dated 2 December 2016
- GCS (2024), Aquatic Biomonitoring for Kangra Coal Kwa-Zulu Natal Operations: Ballengeich High Flow Summer 2024, Report Number 22-0801 dated 8 March 2024



GCS (2024), Aquatic Biomonitoring for Kangra Coal Kwa-Zulu Natal Operations: Ballengeich Low Flow Winter 2024, Report Number 22-0801 dated 19 September 2024

GCS (2024), Water Quality Monitoring Report for the Kangra Coal KwaZulu-Natal Operations: First Quarter, 2024 Monitoring Period. Report Number 22-0801 dated 27 June 2024

GPT (2018). Groundwater study for Ballengeich Colliery. MEMEN-18-2882.

Haupt, C.J. (1995). An explanation of the 1:500 000 General Hydrogeological Map. Vryheid 2730. DWAF.

Institute of Natural Resources, (2019). Environmental Management Framework for the Amajuba District Municipality, dated May 2019

King, G.M. (2002). An explanation of the 1:500 000 general hydrogeological map Vryheid, DWAF 2003.

Knight Piesold Consulting (2016), Kangra Coal: Discard Dumps, ROM Stockpile and Pollution Control Dams, Report Number 301-00303/03 dated 22 April 2016

MENCO (2022), Kangra Coal (Pty) Ltd: Ballengeich Colliery – Determination of the Assimilative Capacity of the V30 Catchment, Report ACD/Kangra/22/7/21 dated July 2022

MENCO (2022), Wetland Delineation and Assessment for Kangra Coal (Pty) Ltd: Ballengeich Colliery, Report No WET/KANGRA/07 dated July 2022

MENCO (2024), Rehabilitation Plan for Kangra Coal (Pty) Ltd: Ballengeich Site. Report Number EMP/2024/086 dated November 2024

Mitsch W.J. and Jørgensen S.E. (2004), Ecological Engineering and Ecosystem Restoration, 411 pp. New York: John Wiley & Sons, Inc

Mitchell, S.A. (2013), Status of wetlands, threats and the predicted effect of global climate change: the situation of Sub-Saharan Africa, Aquatic Science 75: 95- 112