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FINAL REHABILITATION, DECOMMISSIONING AND CLOSURE PLAN, INCORPORATING AN ANNUAL REHABILITATION PLAN AND ENVIRONMENTAL RISK ASSESSMENT

ELANDSFONTEIN COLLIERY (PTY) LTD

MP 30/5/1/2/2/63MR

MP 30/5/1/2/2/314MR

DOCUMENT DETAILS

EIMS REFERENCE:	1323
DOCUMENT TITLE:	FINAL REHABILITATION, DECOMMISSIONING AND CLOSURE PLAN, INCORPORATING AN ANNUAL REHABILITATION PLAN AND ENVIRONMENTAL RISK ASSESSMENT

DOCUMENT CONTROL

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REVISION AND AMENDMENTS

REVISION DATE:	REV #	DESCRIPTION
2021/05/17	ORIGINAL DOCUMENT	Financial Provision Report

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Appendix 2: Subsidence Investigation Report (Refer to Appendix D of the EIA Report).

Appendix 3: Groundwater Assessment (Refer to Appendix D of the EIA Report).

Appendix 4: Environmental Risk/ Impact Assessment Detail

Appendix 5: Post Closure Stormwater Management Plan.

Appendix 6: Existing Guarantees

List of Definitions

Care and maintenance	This involves the maintaining and corrective action as requires as well as conducting the required inspection and monitoring to demonstrate achievement of success of the implemented measures.
CHPP	Coal handling and processing plant
Closure	This involves the application for closure certificate and initiation of transfer of on-going care and maintenance to third parties.
Contingencies	This allows for making reasonable allowance for possible oversights/omissions and possible work not foreseen at the time of compilation of the closure costs. Allowance of between 10 percent and 20 percent would usually be made based on the accuracy of the estimations. The South African Department of Mineral Resources Guideline (January 2005) requires an allowance of 10 percent.
Decommissioning	This relates to the situation after cessation of operations involving the deconstruction/removal and/or transfer of surface infrastructure and the initiation of general site rehabilitation.
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
FRDCP	Final Rehabilitation, Decommissioning and Closure Plan
Generals (P&Gs)	
IWUL	Integrated Water Use Licence
LOM	Life of Mine- reflective of the current planned extent of the mining operations.
MWP	Mine works programme
NEMA	National Environmental Management Act (Act 107 of 1998)
Post-closure	The period of on-going care and maintenance, as per arrangement with third parties.

Preliminary and	This is a key cost item which is causally related to whether third party contractors are applied for site rehabilitation. This cost item comprises both fixed and time-related charges. The former makes allowance for establishment (and de-establishment) of contractors on site, as well as covering their operational requirements for their offices (electricity/water/communications), latrines, etc. Time-related items make allowance for the running costs of the fixed charged items for the contract period.
Rehabilitation:	The re-instatement of a disturbed area into a usable state (not necessarily its pre-mining state) as defined by broad land use and related performance objectives.
Remediation	To assist in the rehabilitation process by enhancing the quality of an area through specific actions to improve especially bio-physical site conditions.
Scheduled closure	Closure that happens at the planned date and/or time horizon.
Site relinquishment	Receipt of closure certificate and handover to third parties for on-going care and maintenance, if required.
Unscheduled closure	Immediate closure of a site, representing decommissioning and rehabilitation of the site in its present state.

1 EXECUTIVE SUMMARY

Elandsfontein Colliery (Pty) Ltd (hereafter referred to as the Holder) is the holder of the mineral rights (MR314 and MR63) for coal on various portions of the farm Elandsfontein 309 JS, Emalahleni, Mpumalanga (hereafter referred to as the 'site'). Elandsfontein Colliery is an existing mine with opencast and underground sections. The mine is expected to continue mining until ~2030 whereafter decommission and closure will commence.

According to the National Environmental Management Act (Act 107 of 19989) and the associated Financial Provision Regulations (2015) (NEMA GNR 1147), every mine must make financial provision for annual rehabilitation, final rehabilitation, decommissioning and closure activities at the end of mining; and remediation and management of latent or residual environmental impacts which may become known in the future. This report aims to address this requirement and includes an annual rehabilitation plan, a final rehabilitation, decommissioning and closure plan, and an environmental risk assessment report.

The closure vision for the mine is to conduct the rehabilitation, decommissioning and closure operations and manage the environmental impacts in such a manner that the long-term, post closure, land capability and environmental goods and services can continue and be utilised in a sustainable manner. In aiming to achieve this, specific objectives, targets and relinquishment criteria have been defined.

The determination of the quantum required for adequate financial provision has been determined using both the DMR Guideline (based on the DMR Rates) and the GNR1147 methods (i.e. real contractor rates). The GNR1147 quantum is significantly higher and expected to represent a realistic estimation of the required cost for effective decommissioning, rehabilitation, closure, and management of ongoing residual, and potential future latent, impacts. The DMR Guideline method is compliant with the provisions and arrangements regarding financial provisioning approved as part of the MR in terms of the MPRDA, and consequently regarded as being compliant with the provisions of GNR1147 until the 19th of June 2022. The calculated quantum of financial provision for the full consolidated Elandsfontein Colliery (including the planned new mining areas), as determined using the DMR Guideline method, is presented in Table 1 together with the current value of guarantees held by the mine.

Table 1: Summary of DMR Quantum and shortfall.

	Quantum of Financial Provisions (as determined in this report)- DMR Method-EXCL VAT	Value of existing Guarantees held by the mine[1].	Surplus
Scheduled Closure (2032)	R 93 047 365.24[2]	R 96 628 442.99	R 3 581 077.75

2 INTRODUCTION

Elandsfontein Colliery (Pty) Ltd (hereafter referred to as the Holder) is the holder of the mineral rights (MR314 and MR63) for coal on various portions of the farm Elandsfontein 309 JS, Emalahleni, Mpumalanga (hereafter referred to as the 'site'). Elandsfontein Colliery is an existing mine with opencast and underground sections. The mine produces coal for the local and the export market, at a rate of ~500 000 tons/annum. Coal has been produced historically from the No. 1 Seam (underground bord and pillar operation) and an opencast operation on the No. 4 and No 2 Seams. Run of Mine (RoM) coal is processed at the mine through an existing Coal Handling and Processing Plant (CHPP), before being hauled by trucks to the customer.

This Final Rehabilitation, Decommissioning and Closure Plan (FRDCP) is prepared in support of an application by the Holder to consolidate the two mining right areas into a single mining right with associated consolidated EMPr. In addition, the Holder wishes to expand their existing mining operations to include additional mineral

[1] As per Appendix 6 MR314 had a mine liability of R77 518 380.00 and MR63 a guarantee of R19 110 062.99.
[2] Refer to Table 36.

resource areas (i.e. new open cast and underground areas within the consolidated mining right boundary). The proposed project includes inter alia the following application processes with associated activities:

- New Integrated Environmental Authorisation and Waste Management Licence (Scoping and Environmental Impact Report (S&EIR);
- Renewal of Integrated Water Use Licence (IWUL) with new water uses applied for; and
- Section 102 consolidation of mining rights as well as consolidation of EMPr's into one holistic EMPr.

In accordance with Section 24P of the National Environmental Management Act (Act 107 of 1998-NEMA) the Holder must, before the Minister responsible for mineral resources issues a decision on the application for Environmental Authorisation, comply with the prescribed financial provision for the rehabilitation, closure and ongoing post decommissioning management of negative environmental impacts. This Final Rehabilitation, Decommissioning and Closure Plan (FRDCP) aims to meet this requirement and has been prepared in accordance with the requirements of the NEMA Financial Provisioning Regulations (2015) (NEMA GNR 1147)(hereafter referred to as 'the Regulations').

According to the regulations, financial provision must be made for annual rehabilitation, final rehabilitation, decommissioning and closure activities at the end of prospecting, exploration, mining or production operations; and remediation and management of latent or residual environmental impacts which may become known in the future. In order to address these requirements this document includes an annual rehabilitation plan, a final rehabilitation, decommissioning and closure plan, and an environmental risk assessment report. Table 1 below lists the specific requirements that must be contained in each of the three plans as per the NEMA GNR 1147 Appendices 3, 4 and 5, as well as the associated section in the report where each requirement is addressed.

Table 2: NEMA GNR 1147 Appendix 3, 4 and 5 Requirements and Associated Sections Where they are Addressed

No.	Requirement	Relevant Section
Annual Rehabilitation Plan – Appendix 3		
3 (a)	details of the person or persons that prepared the plan, and timeframes of implementation of the current, and review of the previous rehabilitation activities;	Section 3 Section 4.8
3 (b)	the pertinent environmental and project context relating directly to the planned annual rehabilitation and remediation activity;	Sections 4.1 and 4.1
3 (c)	results of monitoring of risks identified in the final rehabilitation, decommissioning and mine closure plan with a view to informing rehabilitation and remediation activities;	Section 5.1
3 (d)	an identification of shortcomings experienced in the preceding 12 months;	Section 5.2
3 (e)	details of the planned annual rehabilitation and remediation activities or measures for the forthcoming 12 months;	Section 5.4
3 (f)	a review of the previous year's annual rehabilitation and remediation activities;	Section 5.3
3 (g)	costing;	Section 5.5
Final Rehabilitation, Decommissioning and Mine Closure Plan – Appendix 4		

No.	Requirement	Relevant Section
3 (a)	details of the person or persons that prepared the plan;	Section 3
3 (b)	the context of the project, including material information and issues that have guided the development of the plan, an overview of the environmental context, the social context regarding closure activities and post-mining land use, stakeholder issues and comments, and the mine plan and schedule for operations;	Section 4.1
3 (c)	findings of an environmental risk assessment leading to the most appropriate closure strategy;	Sections 4.3 and 4.4
3 (d)	design principles, including the legal and governance framework, the closure vision, objectives and targets, alternative closure and post closure options, a motivation for the preferred closure action, details of the closure and post closure period, details associated with any on-going research on closure options, and details of assumptions made to develop closure actions;	Section 4.4
3 (e)	a proposed final post-mining land use;	Section 4.6
3 (f)	closure actions required;	Section 4.7
3 (g)	a schedule of actions for final rehabilitation, decommissioning and closure;	Section 4.8
3 (h)	an indication of the organisational capacity that will be put in place to implement the plan, including the organisational structure;	Section 4.9
3 (i)	an indication of gaps in the plan;	Section 4.10
3 (j)	relinquishment criteria for each activity or infrastructure in relation to environmental aspects with auditable indicators;	Section 4.11
3 (k)	the closure cost estimation procedure;	Section 4.12
3 (l)	monitoring, auditing and reporting requirements which relate to the risk assessment, legal requirements and knowledge gaps;	Section 4.13
3 (m)	motivations for any amendments made to the final rehabilitation, decommissioning and mine closure plan, given the monitoring results in the previous auditing period and the identification of gaps as per 2(i).	n/a
Environmental Risk Assessment – Appendix 5		
3 (a)	details of the person or persons that prepared the plan;	Section 3
3 (b)	details of the assessment process used to identify and quantify the latent risks;	Section 6.1
3 (c)	management activities;	Section 6.2
3 (d)	costing;	6.2.3
3 (e)	monitoring, auditing and reporting requirements.	Section 6.2

3 DETAILS OF THE SPECIALIST

The details of the professionals who contributed to the preparation of the annual rehabilitation plan (ARP), final rehabilitation, decommissioning and mine closure plan (FRDCP) and environmental risk assessment (ERA) are provided in Table 3.

Table 3: Details of Specialist[3]

Name	Role	Qualifications/ Experience	Professional registrations
Liam Whitlow	Environmental Scientist	BSc Hons Environmental Management. ~19 years environmental consulting experience.	South African Council for Natural Scientific Professions- Registered Professional Natural Scientist (Environmental Science). Registered Environmental Assessment Practitioner. Member of Land Rehabilitation Society of Southern Africa.
Arno van der Merwe	Pr.Eng - Final Reviewer on engineering inputs- Sign Off	BEng (Civil Engineering) - University of Pretoria / Pr. Eng, C.Eng(UK) ~20 years' experience	Professional Engineer (Pr. Eng. No. 20090273) Chartered Engineer (UK) (C.Eng. 597621) Professional Member of Project Management South Africa (PM.PMSA No. 6728) Professional Member of Association of Project Managers (UK) (MAPM No. R34216) Member South African Institute of Civil Engineers (MSAICE No 2011042) Member of the Institute Civil Engineers (UK) (MICE No 69321050) Member of the South African Institute of Steel Construction (MSAISC No ISC463)
Chris Brink	Quantity Surveyor -Cost Estimation	MSc Surveying (2017) Certificate in BIM Project Management (2012) PMP International Project Manager	Member South African Association of Quantity Surveyors (MAQS) Professional Member of Royal Institute of Chartered Surveyors (MRICS no:1190750)

[3] According to the 2015 Financial Provisioning Regulations, "specialist" means an independent person or persons who is qualified by virtue of his or her demonstrable knowledge, qualifications, skills or expertise in the mining, environmental, resource economy and financial fields.

Name	Role	Qualifications/ Experience	Professional registrations
		(2017) MRICS Member of Royal Institute of Chartered Surveyors (2020) SACPCMP – Professional Construction Project Manager ~15 years' experience	PMP (Professional Member of Project Management Institute; Membership no: 1556429) Certificate in BIM (Building Information Management) Project Management
Marisa van der Westhuizen	Environmental Engineer - responsible for cost estimation, and landform analysis	BEng (Civil Engineering)	Candidate Engineer (No. 2019201592) Associate Member South African Institute of Civil Engineers (MSAICE No 201700292) Member of Geosynthetic Interest Group of South Africa (GIGSA No 13649)
Johan Webb	3D Designer - Landform	AutoCAD, AutoCAD Civil 3D, IDAS, Technocad, Caddie, Prokon Padds & Autodesk Structural Detailing.	

4 FINAL REHABILITATION, DECOMISSIONING AND MINE CLOSURE PLAN (FRDCP)

According to the NEMA GNR 1147 the objective of the final rehabilitation, decommissioning, and closure plan, is to identify a post-mining land use that is feasible through-

- Providing the vision, objectives, targets and criteria for final rehabilitation, decommissioning, and closure of the project;
- Outlining the design principles for closure;
- Explaining the risk assessment approach and outcomes and link closure activities to risk rehabilitation;
- Detailing the closure actions that clearly indicate the measures that will be taken to mitigate and/or manage identified risks and describes the nature of residual risks that will need to be monitored and managed post closure;
- Committing to a schedule, budget, roles and responsibilities for final rehabilitation, decommissioning and closure of each relevant activity or item of infrastructure;
- Identifying knowledge gaps and how these will be addressed and filled;
- Detailing the full closure costs for the life of project at increasing levels of accuracy as the project develops and approaches closure in line with the final land use proposed; and
- Outlining monitoring, auditing, and reporting requirements.

This section of the report aims to achieve these objectives.

4.1 PROJECT CONTEXT

This section aims to provide context and focus attention on the material information and issues that have guided the development of this FRDCP. Further details on the project and environmental context can be obtained from the Environmental Impact Assessment (EIA) Report and associated Environmental Management Programme (EMPr).

The description and definition of the environmental context is critical to ensure that the ultimate closure objectives and associated end land-use are achieved. This content of this section is sourced primarily from the EIA Report (EIMS; 2021) being submitted in support of the EA Application.

The key environmental aspects related to the project area and specifically the closure and rehabilitation strategies are summarised in the remainder of this Section. The mining activities, which would require inclusion in the FRDCP are presented herein and are derived from the available information on the historic mining operations and the current conditions on site.

4.1.1 LOCATION

Elandsfontein Colliery is situated approximately 13km west of Emalahleni town, in the Emalahleni Local Municipality, immediately west of the village of Clewer. Table 4 provides a summary of the properties that fall within the mining right areas and those affected by this application.

Table 4: Locality details and property information.

<table>
<tr><th>Property Info</th><th colspan="3">Details</th></tr>
<tr><td>Farm Name</td><td colspan="3">Mining Right holder
Elandsfontein Colliery (Pty) Ltd. is the holder of a Mining Right in respect of certain properties of the farm Elandsfontein 309 JS.</td></tr>
<tr><td>Application Area (Ha)</td><td colspan="3">The mining footprint, existing and future infrastructure cover an area ~830 hectares (ha) (GIS).</td></tr>
<tr><td>Magisterial District</td><td colspan="3">The Elandsfontein Colliery is situated in the Emalahleni Local Municipality, situated in the Nkangala District Municipality.</td></tr>
<tr><td>Distance and direction from nearest town(s)</td><td colspan="3">The Elandsfontein Colliery is situated west and directly adjacent to Clewer and ~5 km south of Kwa-Guqa.</td></tr>
<tr><td rowspan="6">21-digit Surveyor General Code for each Portion</td><td colspan="3">Properties within approved Mining Right areas (MR63 and MR314)</td></tr>
<tr><td>Farm Name:</td><td>Ptn:</td><td>SG Codes:</td></tr>
<tr><td>Elandsfontein 309 JS</td><td>1</td><td>T0JS00000000030900001</td></tr>
<tr><td>Elandsfontein 309 JS</td><td>6</td><td>T0JS00000000030900006</td></tr>
<tr><td>Elandsfontein 309 JS</td><td>7</td><td>T0JS00000000030900007</td></tr>
<tr><td>Elandsfontein 309 JS</td><td>8</td><td>T0JS00000000030900008</td></tr>
</table>

	Elandsfontein 309 JS	14	T0JS00000000030900014
	Elandsfontein 309 JS	44	T0JS00000000030900044

Figure 1 illustrates the existing approved mining right area as well as the proposed future mining areas.

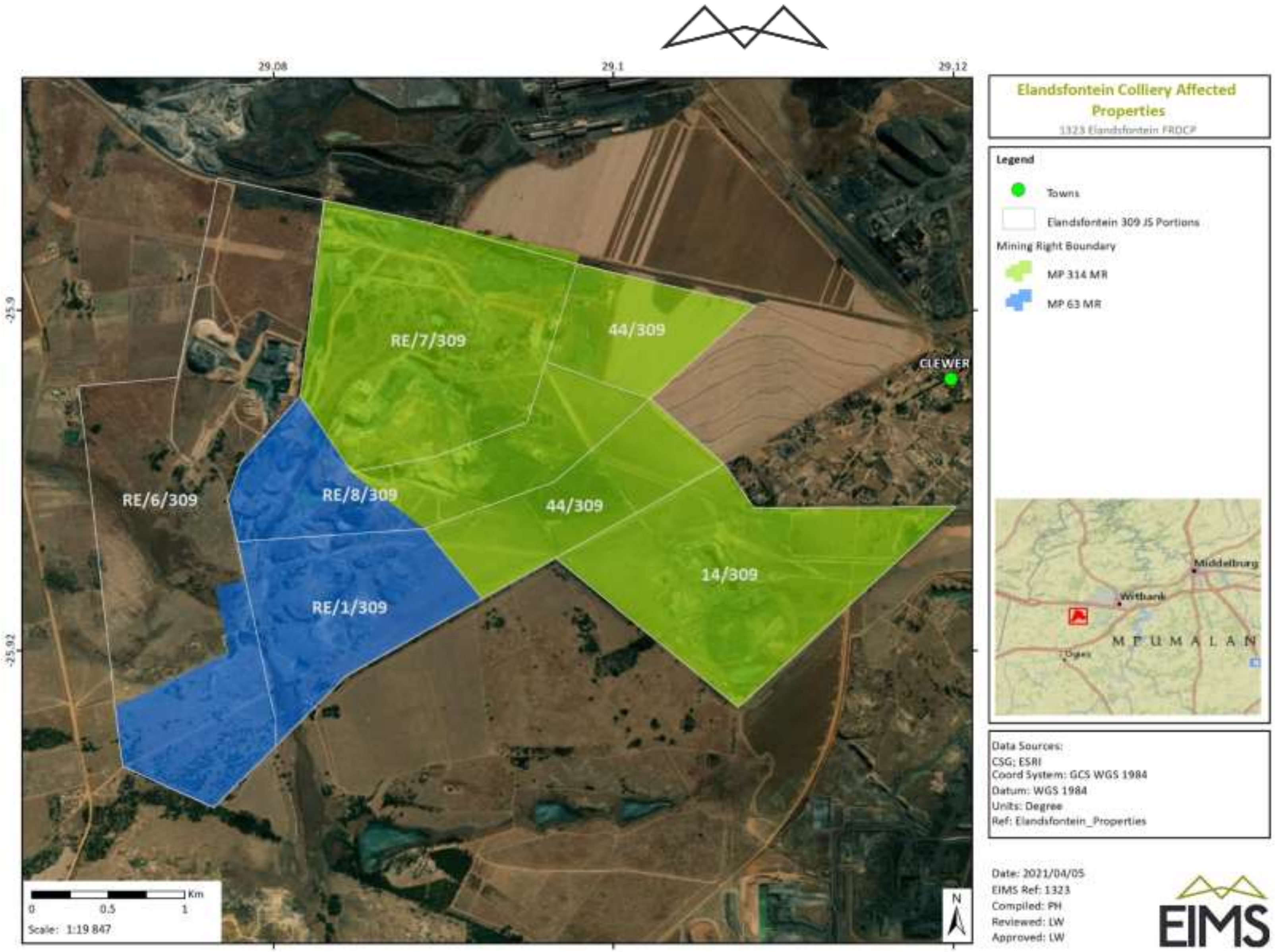


Figure 1: Aerial imagery locality map.

4.1.2 MINING OPERATIONS

This section provides a detailed description of the current and proposed future activities on the Elandsfontein Colliery. Much of the key information presented in this Section was obtained from the latest Mine Works Programme (MWP) for Elandsfontein Colliery, the updated EIAr and EMPR, as well as updated layout information provided in August 2020.

4.1.2.1 CURRENT AND HISTORICAL MINING

Elandsfontein Colliery is an existing mine with opencast and underground sections. Mining on the property commenced in the 1980's (Digby Wells and Associates (Pty) Ltd, 2017) and primarily targeted the No. 1 Seam, the No. 2 Seam and the No. 4 Seam coal resources through both opencast and underground mining methods. Elandsfontein Colliery holds two mining rights, namely MP 314 MR (~593 ha) and MP 63 MR (~237 ha).

The recent mining operations have focused on roll over opencast mining only and have included the reprocessing of historic discard material. The existing opencast operations have an approximate extent of 234 ha[4] (some of this area has already been mined and other areas are currently being mined in accordance with the previous approved mine plan).

The existing approved surface infrastructure at Elandsfontein Colliery consists of the following:

- Opencast pits;
- Underground mining areas and associated access shafts (understood that three historical shafts of which only 1 remains) and one rescue borehole;
- Stockpiles (hard/ soft overburden, topsoil, product, and discard);
- Offices;
- Beneficiation Plant area (crushing and screening);
- Contractors yard;
- Weighbridge;
- Access and haul roads;
- Security point and fencing;
- Pumps and sumps;
- Clean water trenches;
- Dirty water trenches;
- 3 PCD's; and
- Storm water control trenches.

Figure 2 to Figure 21, provides a recent visual representation of the status of the site. Figure 23 provides a layout of the existing infrastructure on the site.

[4] Area calculated from the Rehab Status Survey dated January 2021.

Figure 2: Leroy pit, western edge of ptn 7.

Figure 3: South eastern decline shaft.

Figure 4: Topsoil (foreground) and softs (background) stockpiles, eastern side of ptn 7.

Figure 5: Processing/ beneficiation plant- westside plant, ptn 7.

Figure 6: Contractors offices and yard, ptn 8/7.

Figure 7: PCD #3, centre of ptn 7.

Figure 8: Decommissioned and partially rehabilitated northern discard, south eastern edge of ptn 8.

Figure 9: Old Slurry ponds, north eastern boundary of MRA.

Figure 10: Product stockpile area.

Figure 11: Topsoil stockpiles, north eastern boundary of MRA.

Figure 12: Northern Discard dump/ void, ptn 7.

Figure 13: Northern discard dump/ void, ptn 7.

Figure 14: View of the wetland system traversing the centre of the site.

Figure 15: Remnant deposits of carbonaceous materials.

Figure 16: Main haul and access road.

Figure 17: Contractors yard.

Figure 18: Rehabilitation activities.

Figure 19: Inadequately rehabilitated western opencast.

Figure 20: Inadequately rehabilitated western opencast.

Figure 21: Historical void on eastern corner of ptn14.

4.1.2.2 PLANNED FUTURE MINING

The holder is in the processes of applying for an additional ~69.47 ha of opencast mining and ~378ha of underground mining. Future opencast mining will be carried out by conventional roll over mining and the planned underground mining will be done by bord and pillar mining using decline shafts to access the No. 1 coal seam. Figure 22 provides a layout of the historical, current and future planned mining operations.

The required infrastructure for the opencast mining at Elandsfontein Colliery is in place. For the underground mining operations existing shafts will be utilised, and where the existing shafts are not adequate new shafts will be constructed. The minimum infrastructure required are offices and workshops for the machinery and these are in place. A beneficiation plant is in operation and haul roads exist. Pumping and drainage management, plans and layouts are in operation. Access to the underground for the No. 1 Seam into Resource Block D and E will be gained from a decline to be developed from the final highwall of the opencast in Resource Block G. Access to the underground for the No. 1 Seam into Resource Block B and C will be gained from the old underground Hayford Shaft. Access to the underground for the No. 1 Seam in Resource Block A will be gained from the existing shaft and underground workings. Access to the underground for the No. 1 Upper Seam in Resource Block A will be gained from the existing No. 1 Seam workings by means of an inclined access to the No. 1 Upper Seam reserves.

The mine has also identified the need to revise the current layout and infrastructure (primarily stormwater management infrastructure). This revised plan aims to address some of the current capacity and design shortfalls in respect of managing and separating clean and dirty water systems.

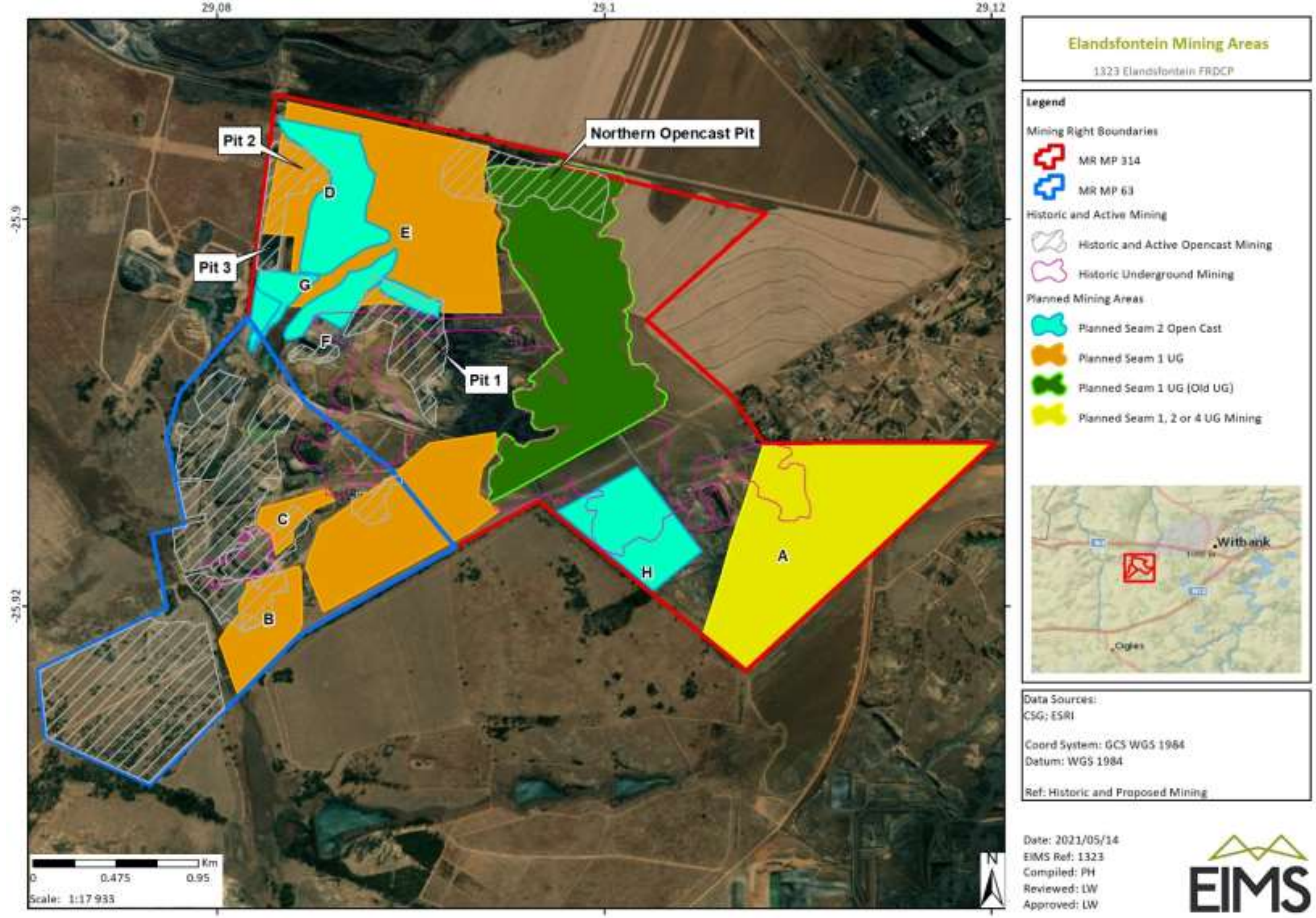


Figure 22: Historical, current, and planned future mining activities.

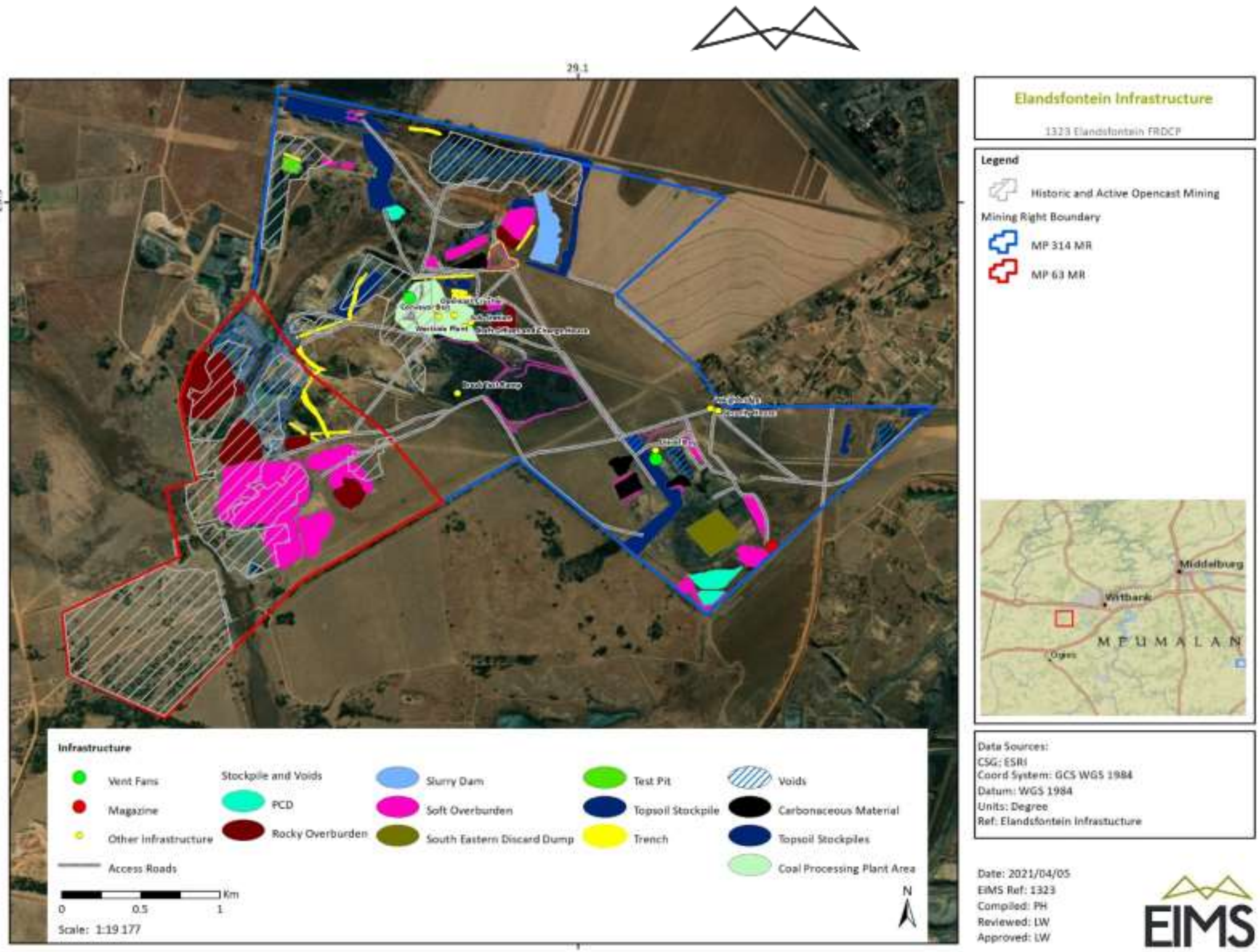


Figure 23: Existing mine layout and infrastructure.

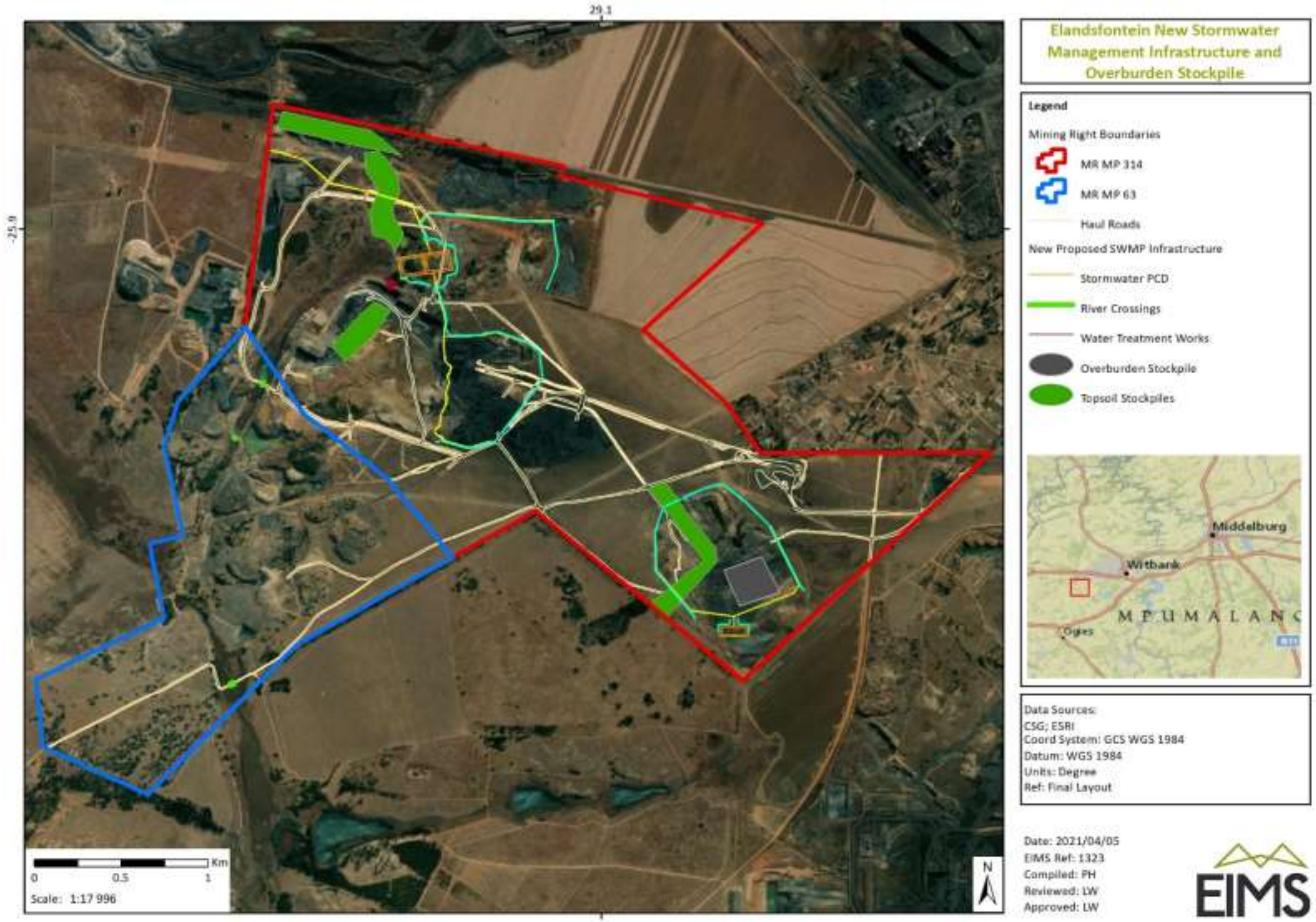


Figure 24: Updated Layout Map indicating new stormwater management infrastructure proposed as part of the Elandsfontein EA application as well as location of new overburden stockpile and topsoil stockpiles.

4.1.2.3 RELEVANT APPROVALS

The following rights, authorisations and approvals are currently in place:

- Mining Right 63 MR renewal, granted to Elandsfontein Colliery (Pty) Ltd, in terms of Section 24 (3) of the MPRDA on 6 August 2019 which covers the following portions of the farm Elandsfontein 309 JS: Portion of the RE of Portion 6, Portion of the RE of Portion 8 and RE of Portion 1.
- Mining Right 314 MR renewal, granted to Elandsfontein Colliery (Pty) Ltd, in terms of Section 24 (3) of the MPRDA on 6 August 2019 which covering the following portions of the farm Elandsfontein 309 JS: RE of Portion 7, Portion of the RE of Portion 8, Portion 44 and Portion 14;
- An amended EMPr dated August 2017 (Digby Wells Environmental, 2017);
- Approved IWUL, File No. 27/2/2/B720/17/1 granted on 22 February 2021 for various water uses (including section S21 (a), (c) and (i), (g), and (j) which covers Portions RE1, RE7, RE8, 14, and 44 of Elandsfontein 309 JS.

It is important to note that the mine is in the process of applying for an additional EA for the planned new mining areas and associated infrastructure.

4.1.2.4 CURRENT STATUS OF REHABILITATION

An updated topographical survey was undertaken in January 2021. This survey was used to define the status of rehabilitation as well as to delineate and quantify the relevant stockpiles and voids on the site as of January 2021 (refer to Figure 25 to Figure 28).

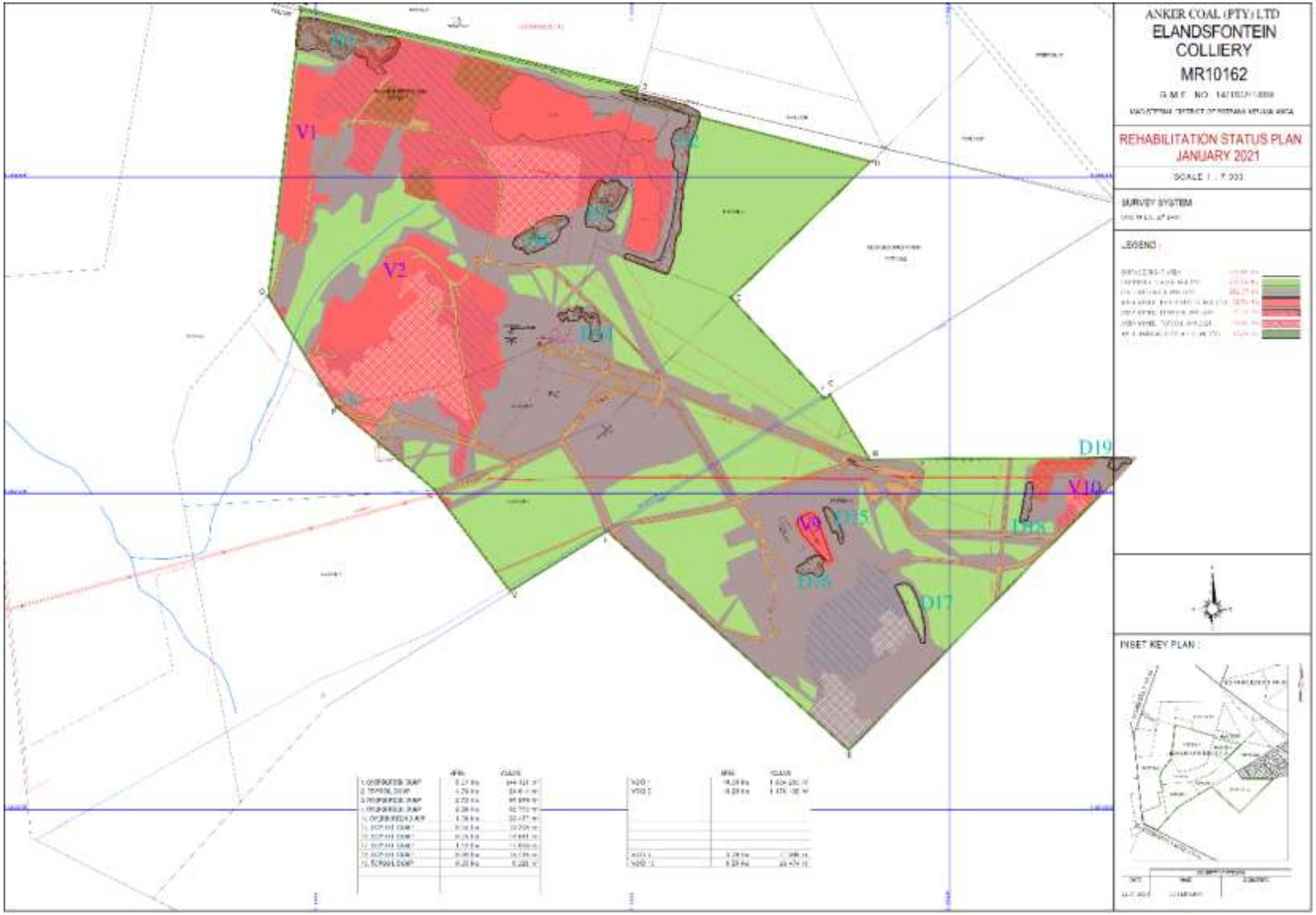


Figure 25: MR 314 quantification of stockpiles and voids as at January 2021 (Ferreira, 2021).

Figure 26: MR 314 rehabilitation status as at January 2021 (Ferreira, 2021).

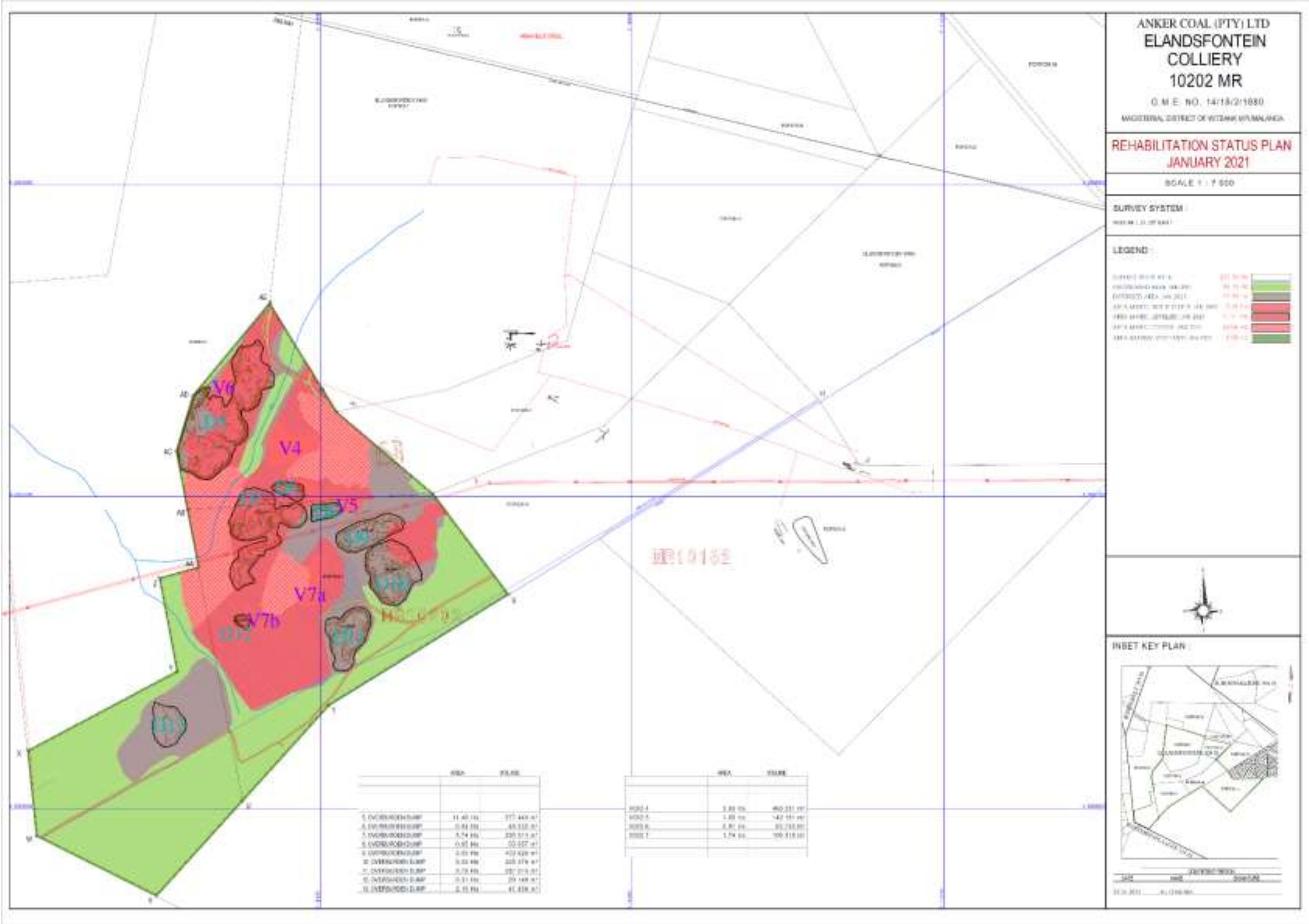


Figure 27: MR 63 quantification of stockpiles and voids as at January 2021.

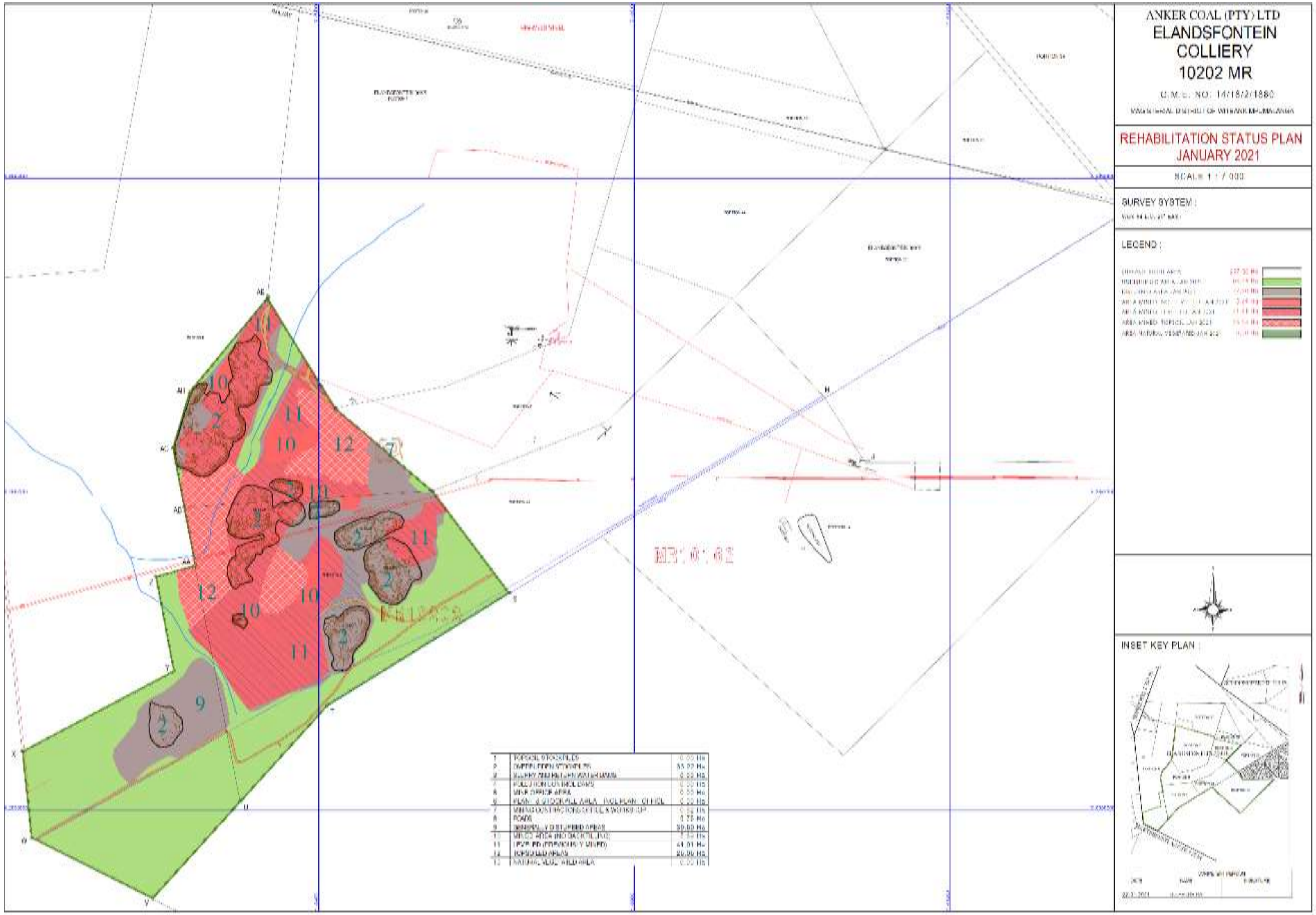


Figure 28: MR 63 rehabilitation status as at January 2021.

4.1.3 MATERIAL PROCESSING AND ASOCIATED FACILITIES

The throughput of the Elandsfontein Colliery Coal Handling and Processing Plant (CHPP) is 300 tons per hour. The plant is run at an efficiency of 70 %. The CHPP can be divided into the following different sections:

- RoM transfer point and reclaim system;
- RoM crushing system;
- Transfer conveyor to overland conveyor to plant RoM stockpile;
- RoM feed conveyor;
- Dense medium cyclone plant;
- Fines treatment plant;
- Stockpiling of final product and fines spiral plant; and
- Conveying of discard to a bin with overflow facility located at the plant.

The RoM feed material is reduced in size to <300mm diameter with a feeder breaker. Thereafter the coal is conveyed to a coal sizing station. The -300mm coal passes through a secondary sizer (roll crusher) and the coal is reduced to a 120mm top size. Only the +50mm to -120mm material is fed to the tertiary sizer. The coal is then reduced to -50mm. The material is then fed into the dense medium separation plants. The material is passed over a de-sliming screen that removes the -1.4mm fraction from the feed. The remainder is then routed to the coarse dense medium cyclones. The -1.4mm fraction reports to the fine coal processing circuit.

The overflow of the de-sliming screen reports to the primary large diameter cyclone. Here waste is removed through high density separation. The underflow reports to the discard bin. The overflow from the primary cyclone is pumped to the secondary large diameter cyclone for further beneficiation. All product and waste streams run over drain- and rinse screens to ensure maximum water and magnetite recovery. The products are placed on product stockpiles and the discard is returned to the mining void (northern discard area).

The floats of the fines reflux classifiers are passed through a filter press from where the excess moisture is removed. The sinks are thrown on the rejects belt. The ultra-fines cyclone floats are dewatered and placed on the product stockpile. The filter cake is added to the reject conveyor. All rejects are placed on the rejects conveyor that feeds the reject bin for collection to be discarded in the mining void.

The plant process described above is well-known technology used by many coal operations in South Africa. The plant is based on the premise that the coal can be separated from the waste rock by means of their respective densities. A current licensed Dense Medium Separation (DMS) Plant with a filter press is available at Elandsfontein. The existing wash plant present at the Elandsfontein Colliery and approved under the existing EMP can be utilised to process the ROM Coal. The plant has a capacity of approximately 100 000 tons per month. The plant consumes 35 000 L/hour of water. All this process water is sourced from the current dirty water storage facilities.

4.1.4 POWER SUPPLY

The open pit mining equipment does not require electrical power as it is diesel operated. The underground mining, wash plant, crushing station, conveyors, pumps and mine infrastructure area are largely electrically powered (~22MVA). Existing power supply is in place.

4.1.5 RESIDUE STOCKPILES

This section provides information on the various current residue stockpiles at Elandsfontein Colliery.

4.1.5.1 RUN OF MINE STOCKPILES

The run of mine (ROM) coal is conveyed by haul trucks to the Elandsfontein Colliery RoM tipping point. The RoM is crushed and conveyed by conveyors into the DMS plant where it is beneficiated, and the product is placed on the product stockpiles. The product is reclaimed by front end loaders and loaded on haul trucks. It is then transported either to Oosbank siding (for export market) or to the inland customers. The discard is transported by haul trucks to the existing discard dumps and dumped back into the northern discard facility. A single ROM and product stockpile area has been approved as part of the 2017 EMPr and the optimization (reduction in size) of the current stockpile area is being assessed in the current EIA and EA application for the future planned mining areas.

4.1.5.2 NON-CARBONACEOUS STOCKPILES

Overburden comprising of both hards and softs are stockpiled, mostly on top of backfilled, mined out areas. This stockpiling will continue until the face length comprises the entire resource width and all waste material can be rolled over back into the pit as part of the normal mining operation. Hards will be stockpiled separately.

4.1.5.3 CARBONACEOUS STOCKPILES

Surface carbonaceous stockpiles will be minimised as far as possible, and the aim will be to place such carbonaceous rock and discard directly back into the northern pit. The mine historically disposed of carbonaceous discard to a dedicated un-lined co-disposal facility located to the south east of MR314. No further waste material is currently being or planned to be disposed of in this location and this facility is in the final stages of being reprocessed and decommissioned. At present the mine disposes of all carbonaceous discard, slurry and wastes to the northern pit. A south eastern discard dump has previously been reclaimed via the beneficiation plant.

4.1.5.4 SOIL STOCKPILES

Stripped soils – topsoil and sub soil are stockpiled separately until the roll over mining method is in equilibrium. Separation of topsoil and subsoil ensures that the characteristics of soil stockpiles are suitable for the prevailing landscape and drainage conditions once they are replaced. Several existing topsoil stockpile areas are located at the site.

4.1.5.5 WASTE

Domestic, hazardous, industrial, mining, and sewerage waste streams are currently, and will continue to be generated at Elandsfontein Colliery. These waste streams are discussed in more detail in the subsections below.

4.1.5.5.1 DOMESTIC WASTE STREAMS

Domestic waste generated will be collected and stored onsite in clearly marked skips. All domestic waste skips will be transported offsite by a registered waste removal contractor for final disposal at a registered facility. Waste disposal certificates will be required from contractors to ensure appropriate waste disposal. Sewage is collected in septic tanks on site and there is therefore no sewage treatment plant located on site. The sewage is removed by tanker for off-site disposal on a need basis. For general waste, no authorisation is required as the waste site is kept to less than 100 m^3 and no waste is disposed of on site. The removal of waste is managed on a daily basis to ensure that the limit is not exceeded.

4.1.5.5.2 HAZARDOUS WASTE STREAMS

Hydrocarbon and other dangerous good and/or contaminated wastes generated (including used oil, diesel, grease, lubricants and explosive emulsions) will be stored in clearly marked skips for solid hazardous waste and containers for liquid waste. Hazardous waste will be stored in bunded areas or on hard, impervious surfaces. When full, the containers will be collected and transported offsite by a registered waste removal contractor for final disposal at a registered facility. Waste disposal certificates will be required from contractors to ensure appropriate waste disposal. No authorisation is required for hazardous industrial waste as the volumes on site is maintained at less than 35 m^3.

4.1.5.5.3 INDUSTRIAL AND MINING WASTE STREAMS

Industrial wastes (including metals, rubber, tyres and conveyor belt sheets) will be separated and stored in clearly marked skips. Materials may occasionally be salvaged for re-use but will generally be traded to registered recycling companies who will collect and transport material offsite for re-use or final disposal at a registered facility. Waste disposal certificates will be required from contractors to ensure appropriate waste disposal.

Two general forms of mineralised waste are currently, and will be, generated at Elandsfontein Colliery namely plant discards and coal falling off articulated dump trucks on the way to the RoM stockpile. Coal falling from trucks will be periodically collected and transported to the wash plant. Fines will be channelled to the PCDs where water will be recycled, and the fines eventually cleared from a silt trap and transported to disposal in the northern void.

4.1.6 POLLUTION CONTROL DAMS AND ASSOCIATED DIRTY WATER MANAGEMENT

The following PCDs are currently located at Elandsfontein

- PCD 1 – 25 000 m^2 Volume – 32 006 m^3;

- PCD 2 – 9 814 m^2; Volume - 19 955 m^3; and
- PCD 3 – 7 024 m^2; Volume – 19 575 m^3.

Refer to Figure 23 for a current infrastructure map indicating the position of the existing PCDs. The storm water is diverted by means of cut-off trenches around and away from the mine and berms are used to separate clean and dirty water areas. This ensures that clean water is not contaminated by mining activities and therefore removed from the catchment. Dirty water is collected in PCDs from where it is used for different activities e.g. dust suppression at the Colliery. These 3 PCDs are not lined and this has been addressed in the updated SWMP (refer to Figure 24).

4.2 ENVIRONMENTAL CONTEXT

This section aims to provide context and focus attention on the receiving environment and to highlight sensitive environmental attributes which may require consideration in planning and implementing the closure strategy. The content of this section has been extracted from the EIA Report and where applicable summarised. Further details on the environmental context can be obtained from the Environmental Impact Assessment (EIA) Report, specialist studies, and associated Environmental Management Programme (EMPr).

4.2.1 SOCIO-ECONOMIC CONTEXT

In 2015, Emalahleni's share of population was below the lower-bound poverty line was the lowest (favourable) among the municipal areas. The number of people below the lower bound poverty line was however relatively high at more than 90 000 people in 2015. According to the 2016 Community Survey of StatSA, the so-called poverty headcount (multi-dimensionally) of Emalahleni deteriorated from 8.0% in 2011 to 10.9% in 2016 and second highest in the Province and the so-called poverty intensity also increased from 43.6% to 45.4% in the same period. The unemployment rate of Emalahleni decreased from 27.3% in 2011 to 23.2% in 2015. Emalahleni's unemployment rate was the 5th lowest among all the municipal areas of Mpumalanga. Unemployment rate for females is 29.8% and that of males is 19.2%. Youth unemployment rate according to the Census figure is 36.0%.

The municipal economy is dominated by mining and therefore a high dependence on the mining industry. Other industries in the area are making contribution to the local economy; these include trade and community services. Emalahleni contribution to the Mpumalanga economy is the highest in the province at more than 20% and is the largest economy in the province. As with many parts of the Mpumalanga Province there is a need to address high levels of unemployment, as well as provide for a just transition from mining to an alternative sustainable land-use for the future.

4.2.2 HERITAGE AND PALAEONTOLOGY

This section has been extracted from the specialist heritage assessment study conducted as part of the EIA (PGS Heritage (Pty) Ltd, 2020). The surroundings of the mining right area are characterised by a long and significant history. Previous archaeological and heritage studies from this area have revealed a number of heritage sites that include mainly informal graves or burial grounds and historic farmsteads and homesteads or the remains of such structures. During the field work a total of eleven heritage resource were identified, the majority of these (eight) were graves and burial grounds, with the remaining three being structures or remains of structures. The management and where applicable preservation of these sites have been addressed in the EIA and associated EMPR.

From a palaeontological perspective, the mining right area is primarily underlain by the Ecca Group (Vryheid Formation), as well as a small portion in the Dwyka Group. According to the PalaeoMap of the South African Heritage Resources Information System the Palaeontological Sensitivity of the Vryheid Formation is Very High, while the Dwyka Group has a Moderate Palaeontological Sensitivity (Almond and Pether 2008, SAHRIS website). Rock formations of moderate to high Palaeontological Sensitivity are present in the study area. A site-specific field survey of the development footprint was conducted on 30 November 2019. No visible evidence of fossiliferous outcrops was found, although poorly preserved and unidentifiable small pockets of fossils had previously been uncovered on the Elandsfontein mining development.

4.2.3 BIODIVERSITY

The content of this section has been extracted from the specialist biodiversity study conducted as part of the EIA (The Biodiversity Company (Pty) Ltd, 2020).

The mining right area is situated within the grassland biome, and includes two vegetation types, namely the Eastern Highveld Grassland, and the Rand Highveld Grassland vegetation type according to Mucina & Rutherford (2006). These ecosystems are regarded as 'vulnerable'. Figure 29 shows the project area superimposed on the MBSP Terrestrial CBA map. Based on this, the proposed development areas will potentially overlap with:

- CBA: Irreplaceable;
- CBA: Optimal;
- Moderately Modified Old Lands; and
- Heavily Modified Areas (HMA).

Figure 30 shows the mining right area in relation to the Mpumalanga Province Protected Areas Expansion Strategy (MPAES (2013) spatial data. As can be seen in this figure, the project area impacts on an area identified as part of the protected area expansion strategy.

The project area has been altered both currently and historically. Mining has had an extensive impact on both the fauna and the flora in the area with the semi-natural areas still present being impacted on in some way or another. Both the fauna and flora diversity were low, this is most likely because of the transformed/degraded nature of the area. No faunal species of conservation concern were recorded on the site.

The only remaining natural habitats, i.e. wetland habitats, even though somewhat degraded are the most sensitive habitat within the project area. The ecological integrity, importance and functioning of these areas play a crucial role as a water resource system and an important habitat for various fauna and flora. The preservation of this system is the most important aspect to consider for the proposed project, even more so due to the sensitivity of the area according to the various ecological datasets as well as the wetland assessment completed for this project. This habitat needs to be protected and improved due to the role of this habitat as a water resource within this disturbed local area.

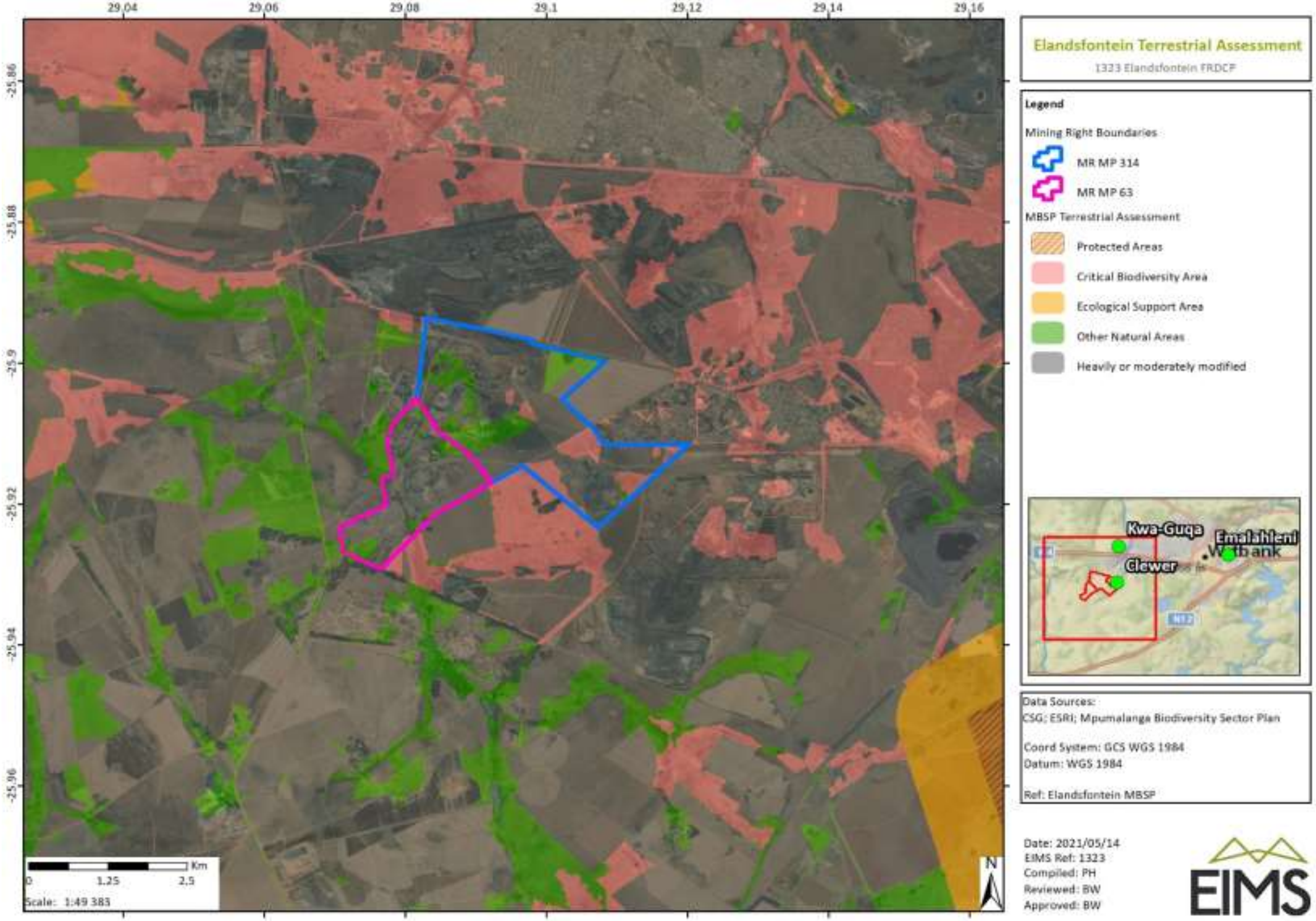


Figure 29: Mining right area and CBA's.

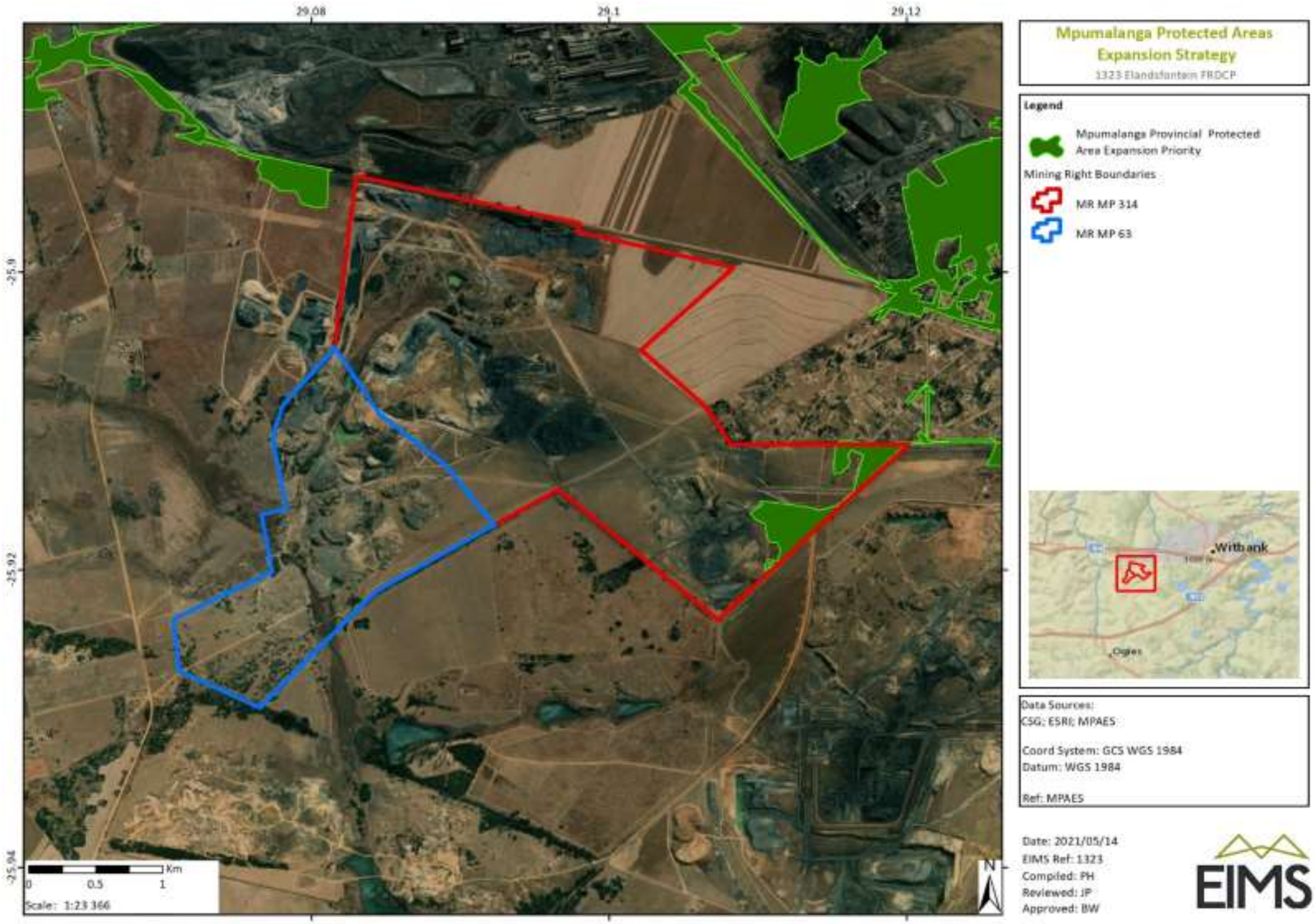


Figure 30: Project area in relation the MPAES .

4.2.4 CLIMATE

The regional area's weather pattern reflects a typical summer rainfall region, with > 85.0% of precipitation occurring as high-intensity thunderstorms from October to March. Patched rainfall and evaporation data were sourced from the WR2012 database (Rainfall zone B2C) and span a period of some 90 years (1920 – 2009). The calculated mean annual precipitation (MAP) for this rainfall zone is 530.76 mm/a, with the 5th percentile of the data set (roughly equivalent to a 1:20 year drought period) calculated at 342.74 mm/a and the 95th percentile (representing a ~1:20 flood period) 717.84 mm/a. The highest MAP for the 90 years of rainfall data was recorded as of 940.85 mm (1995) while the lowest MAP of 291.38 mm was recorded during 1965. This quaternary catchment is categorised under evaporation zone 4A which have a mean annual evaporation (s-pan) of 1689.0 mm/a, more than double the annual precipitation for the greater study area.

Based on the fact that the post closure phase of a mining project is likely to extend over decades it is important to consider the likely medium to long-term climatic changes that are anticipated. The near-future and far-future climate in Southern Africa was projected and published in a Climate Change Reference Atlas (CCRA) by the South African Weather Service (SAWS) in 2017, based on Global Climate Change Models (GCMs) projections and the Rossby Centre Regional Model (RCA4). Projected changes are defined relative to a historical 30-year period (1976 to 2005). Various climate change scenarios are presented. In general, however the local climate is predicted to change as follows:

- Low mitigation scenario (RCP8.5[5]): For the RCP8.5 trajectory the annual average near-surface temperatures are expected to increase by between 2.5°C and 3°C for the near future (2036 to 2065) and between 4.5°C and 5°C for the far future (2066 to 2095). The seasonal average temperatures are expected to increase for all seasons. The total annual rainfall is expected to decrease by between 0 mm and 10 mm for the near future and far future. For the near future, the total seasonal rainfall is expected to increase for summer and remain the same or slightly increase for autumn and spring. Winter total rainfall is expected to decrease for the near future. The total seasonal rainfall is expected to decrease for autumn and winter for the far future. Spring and summer total rainfall is expected to increase for the far future.

- Modest to high mitigation scenario (RCP4.5): Based on the median and the region in which the Elandsfontein Project and AQSRs discussed are situated, the annual average near-surface temperatures (2 m above ground) are expected to increase by between 1°C and 2.5°C for the near future and between 2.5°C and 3°C for the far future. The seasonal average temperatures are expected to increase for all seasons. The total annual rainfall is expected to decrease by between 0 mm and 10 mm for the near future and between 0 mm and 10 mm for the far future. For the near future, the total seasonal rainfall is expected to increase in summer, remain the same or slightly increase for autumn. Winter total rainfall is expected to decrease and spring to stay the same or decrease slightly for near future. The total seasonal rainfall is expected to remain the same or slightly decrease for summer, winter and spring for the far future. Autumn total rainfall is expected to increase for the far future.

4.2.5 TERRAIN AND TOPOGRAPHY

The topography of the region is characterised by moderately undulating plains and pans. The north-eastern perimeter of the mining right area is shaped by a topographical high at 1565 mamsl and forms the watershed between quaternary catchments B20G and B11K. The lowest on-site elevation is situated towards the southwest and is recorded at 1476 mamsl. On-site gradients are relatively gentle to moderate with the average slope calculated at 2.30% and –2.20% respectively.

4.2.6 SOILS AND LAND CAPABILITY

This section has been extracted from the specialist soil and land capability assessment conducted (The Biodiversity Company (Pty) Ltd, 2020). This section presents the findings of the current soil investigation. A pre-

[5] Representative Concentration Pathway 8.5 (RCP8.5) (high pathway) is based on if no interventions to reduce GHG emissions are implemented (after 2100 the concentration is expected to continue to increase).

mining soils assessment was not available for direct comparison with regards to the historically mined areas and this specialist assessment focused on the current state of the site.

4.2.6.1 SOILS

Soil profiles were sampled and studied up to a depth of 1.5 m to identify specific diagnostic horizons which are vital in the soil classification process as well as determining the agricultural potential and land capability. During the site assessment, various soil forms were identified.

4.2.6.1.1 SOIL FORM

Nine soil forms were identified within the mining right area (MRA) (Figure 31) with some areas classified as “Not Assessed” and others classified as “Disturbed”. All of the hydromorphic soils identified have similar properties and depths and has therefore been labelled as “hydromorphic soils” rather than individual soil forms. Table 5 provides a breakdown of the summarised soil survey findings.

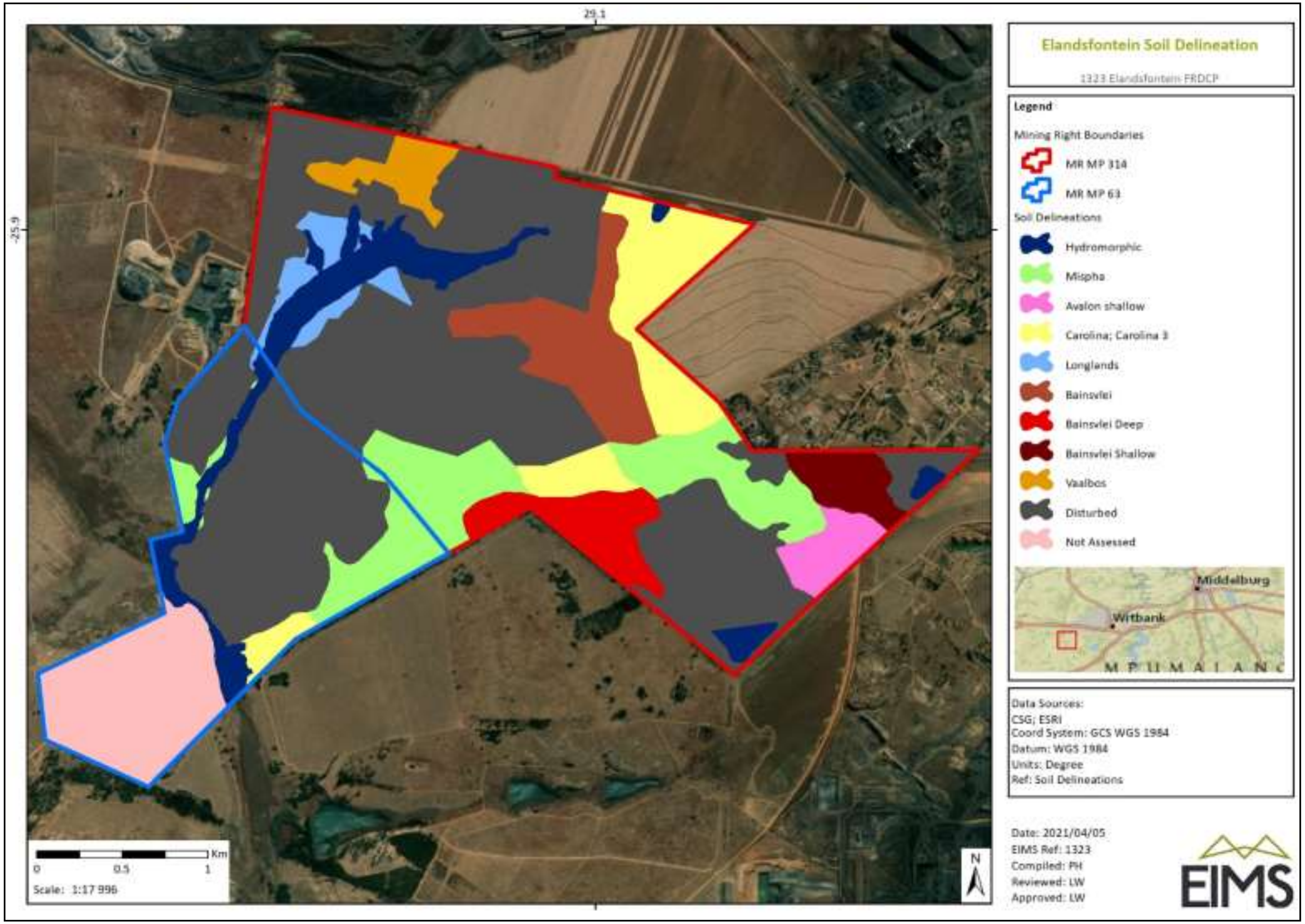


Figure 31: Soil delineations within the project area.

Table 5: Summary of soils identified within the project area.

Soil Type	A-horizon					B-horizon				B-horizon/C-horizon			
	Depth (mm)	Clay (%)	Signs of wetness	Rock %	Surface crusting	Depth (mm)	Clay	Signs of wetness	Rock %	Depth (mm)	Clay	Signs of wetness	Rock %
Mispah	300	0-15	None	0	None	N/A				N/A			
Glencoe	300	0-15	None	0	None	300 – 1 200	0 - 15	None	0	N/A			
Vaalbos	300	0-15	None	R3	None	300 - 900	0-15	None	0	N/A			
Carolina	300	0-15	None	0	None	300 – 1 200	0-15	None	0	N/A			
Longlands	300	15-35	W3	0	None	300 – 1 100	0-15	W3	0	> 1 100	15-35	W3	0
Hydromorphic soils	300	15-35	W3	0	None	300 – 600	> 35	W3	0	> 600	>35	W3	0
Avalon	300	0-15	0	0	None	300 - 600	0-15	None	0	> 600	15-35	W1	R1
Bainsvlei (Shallow)	300	0-15	0	R2	None	300 – 1 000	0-15	None	R2	> 1 000	0-15	W1	R1
Bainsvlei (Deep)	300	0-15	0	0	None	300 – 2 400	0-15	None	R1	>2 400	15-35	W1	0

R1) 2-10% Rockiness; R2) 10-20% Rockiness; R3) 20-30% Rockiness; W3) Periodically wet, mottling occurs within top 200 mm.

4.2.6.1.2 SOIL PHYSICAL AND CHEMICAL PROPERTIES

Physical properties are defined by particle size distribution (soil textural classes) which refers to the percentage clay, silt and sand. All of the samples taken were sent for analysis. The average soil texture for all the soil samples is illustrated in Table 6.

Table 6: Results for physical properties for the surrounding land uses.

Sample Site	Horizon	Clay %	Silt %	Sand %
1	Topsoil	16	2	82
	Subsoil	18	3	79
2	Topsoil	12	2	86
	Subsoil	14	3	83
3	Topsoil	16	2	82
	Subsoil	16	2	82
4	Topsoil	12	1	87
	Subsoil	12	1	87
5	Topsoil	12	2	86
	Subsoil	18	4	78
6	Topsoil	12	2	86
7	Topsoil	30	7	63
	Subsoil	38	9	53
8	Topsoil	14	11	75
	Subsoil	16	2	82
9	Topsoil	14	1	85
	Subsoil	16	4	80
10	Topsoil	14	4	82
	Subsoil	18	4	78

Collected soil samples were submitted for chemical composition analysis. The results from the chemical analysis are illustrated in Table 8, together with target guidelines as per the Fertilizer Society of South Africa (Table 7). It is vital that the disturbed area be rehabilitated in such a way that not only the reference conditions be reached but that the recommended values described below be reached. This will ensure that vegetation be established with greater ease flourish.

Table 7: Guidelines for soil chemical properties.

Guidelines (mg/kg)			
	Low Values	**Recommended Values**	**High Values**
Calcium (Ca)	<200		>3000
Magnesium (Mg)	<50		>300
Potassium (K)	<40		>250
Phosphorus (Ph)	<5		>35
Sodium (Na)	<50		>200

pH (KCl)					
Very Acidic	Acidic	Slightly Acidic	Neutral	Slightly Alkaline	Alkaline
<4	4.0-5.9	6-6.7	6.8-7.2	7.3-8	>8

Phosphate (P) Pbray 1 (mg/kg)				
Very Low	Low	Moderate	High	Very High
<5	5-10	10-17	17-25	>25

Na:K ratio	
0.001-0.9	**>0.99**

Table 8: Chemical properties.

Site	Horizon	Phosphorus (Bray 1) (mg/kg)	pH (KCl)	Exchangeable Cations				Na:K
				Na (mg/kg)	K (mg/kg)	Ca (mg/kg)	Mg (mg/kg)	
1	A	3	3,99	26	121	395	144	0,21
	B	12	3,34	12	4	85	13	3,00
2	A	4	4,04	10	38	200	38	0,26
	B	2	3,47	12	12	86	13	1,00
3	A	2	3,83	11	27	113	21	0,41
	B	2	3,78	10	19	83	9	0,53
4	A	5	4,9	12	61	387	56	0,20

Site	Horizon	Phosphorus (Bray 1) (mg/kg)	pH (KCl)	Exchangeable Cations				Na:K
				Na (mg/kg)	K (mg/kg)	Ca (mg/kg)	Mg (mg/kg)	
	B	2	5,79	11	10	190	48	1,10
5	A	1	4,82	9	25	212	40	0,36
	B	2	4,21	10	16	83	25	0,63
6	A	5	4,66	10	27	305	38	0,37
7	A	2	5,59	12	91	632	104	0,13
	B	2	4,39	15	38	319	65	0,39
8	A	2	5,44	13	93	752	116	0,14
	B	2	4,56	11	38	189	41	0,29
9	A	3	5,06	9	32	292	39	0,28
	B	2	4,47	11	10	155	35	1,10
10	A	31	5,43	10	45	316	75	0,22
	B	4	3,99	11	15	165	25	0,73

4.2.6.2 AGRICULTURAL POTENTIAL AND LAND CAPABILITY

Agricultural potential is determined by a combination of soil, terrain and climate features. Land capability classes reflect the most intensive long-term use of land under rain-fed conditions. The land capability is determined by the physical features of the landscape including the soils present. The land potential or agricultural potential is determined by combining the land capability results and the climate capability for the region.

4.2.6.2.1 CLIMATE CAPABILITY

The climate capability for this region was determined to be C2 classification. The C2 climate capability class is characterised by a local climate which is favourable for a wide range of adapted crops and year-round growing season. Moisture stress and lower temperatures increase risk and decrease yields relative to C1 (Smith, 2006).

4.2.6.2.2 LAND CAPABILITY

The land capability was determined by using the guidelines described in "The farming handbook" (Smith, 2006). The land capability for the project area is illustrated in Figure 32 and described in Table 9. It is worth noting that the hydromorphic soils have been degraded to a Class V due to wetland indicators within 200 mm from the surface.

Table 9: Land capability for the soils within the mining right area.

Soil Forms	Land Capability Class	Definition of Class	Conservation Need	Use-Suitability	Percentage Within Project Area	Land Capability Group
Glencoe	Class II				14.7	

Soil Forms	Land Capability Class	Definition of Class	Conservation Need	Use-Suitability	Percentage Within Project Area	Land Capability Group
Bainsvlei (Deep)		Slight limitations, high arable potential and low erosion hazard	Adequate run-off control	Annual cropping with special tillage or ley (25%)		Arable Land
Bainsvlei (Shallow)		Slight limitations, high arable potential and low erosion hazard	Adequate run-off control	Annual cropping with special tillage or ley (25%)		Arable Land
Vaalbos		Slight limitations, high arable potential and low erosion hazard	Adequate run-off control	Annual cropping with special tillage or ley (25%)		Arable Land
Carolina	Class III	Moderate limitations with some erosion hazard	Special conservation practice and tillage methods	Rotation of crops and ley (50%).	12.8	Arable Land
Longlands	Class III	Moderate limitations with some erosion hazard	Special conservation practice and tillage methods	Rotation of crops and ley (50%).	12.8	Arable Land
Avalon	Class III	Moderate limitations with some erosion hazard	Special conservation practice and tillage methods	Rotation of crops and ley (50%).	12.8	Arable Land
Mispah	Class IV	Severe limitations, low arable potential and high erosion hazards.	Intensive conservation practice.	Long-term leys (75%).	11	Arable Land
Hydromorphic	Class V	Watercourse and land with wetness indicators.	Protection and control of water table.	Improved pastures, suitable for wildlife.	7.5	Grazing

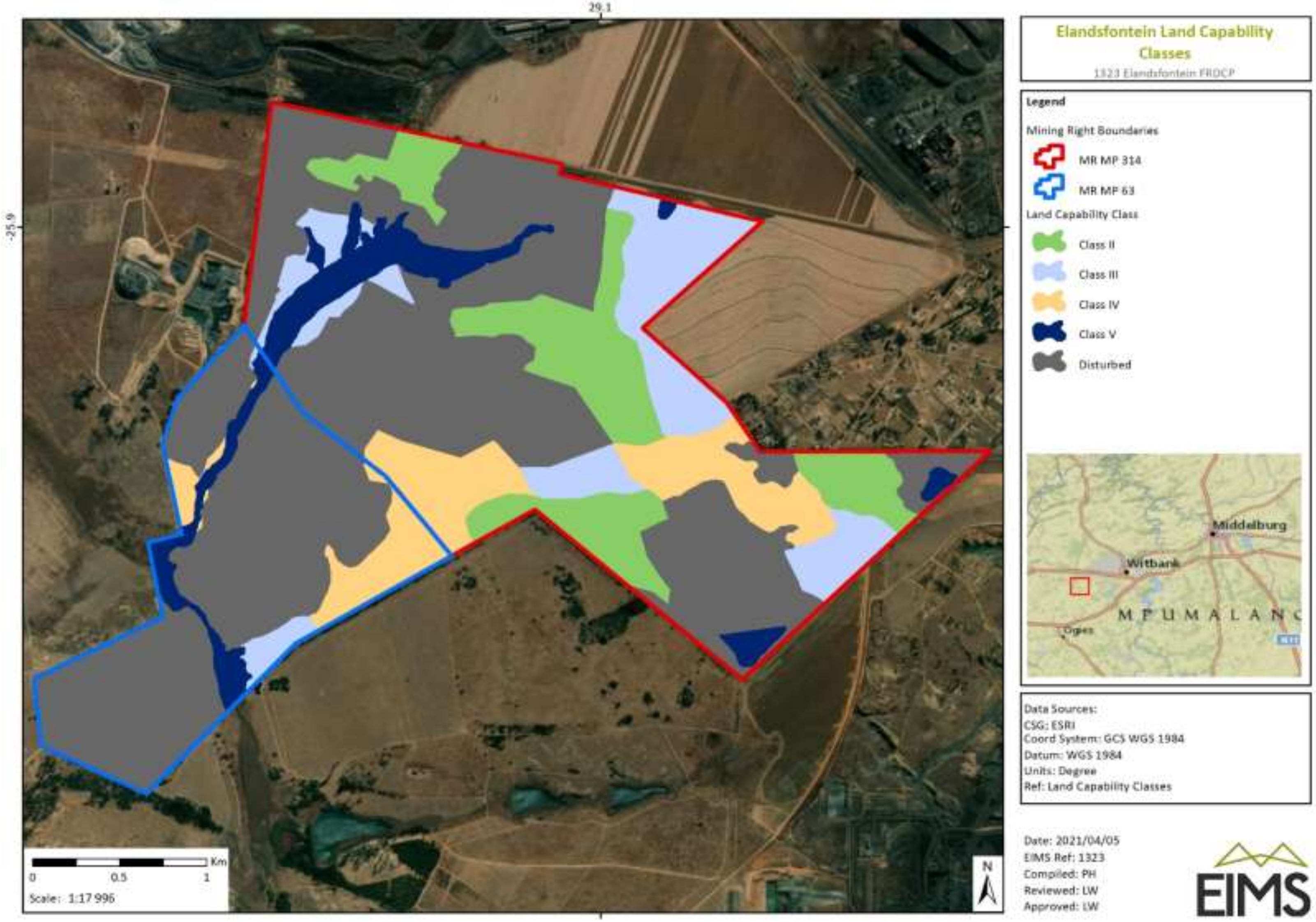


Figure 32: Land capability classes for the project area (Smith;2006).

4.2.6.2.3 LAND CAPABILITY (LARSSA)

The Coaltech/LaRSSA methodology was used in addition to the more detailed Smith (2006) methodology to determine the pre-mining land capability for the area. This has been carried out for post-mining land capability comparisons. The land capability classes as per this methodology are described in Table 10 and illustrated in Figure 33.

Table 10: Land capability for the soils within the project area.

Soil Forms	Land Capability Class	Classification Criteria (Pre-Mining)	Classification Criteria (Post-Mining)
Glencoe **Bainsvlei (Deep)** **Bainsvlei (Shallow)** **Vaalbos** **Carolina** **Longlands**	Class II: Arable	• Does not qualify as a wetland; • Has soil that is readily permeable to the roots of common cultivated plants throughout a depth of 750 mm from the surface; • Soil pH value between 4.0 and 8.4; • EC of the saturated extract must be less than 400 mS/m; • The soil depth must be greater than 750 mm; • The permeability of the soil must be at least 1.5 mm per hour; • Less than 10% of the soil volume must consist of rock; and • The product of the slope and erodibility factor must be less than 2.0.	• Soil depth >600 mm; • Soil material must not be saline or sodic; • Slope percentage will be such that when multiplied by the soil erodibility factor, the product will not be more than 2.0; and • For typical coal fields, slopes must be flatter than 1:14 and free draining.
Avalon	Class III: Grazing	• Does not qualify as a wetland or arable land; • Has soil or soil-like material, permeable to the roots of native plants, that is kore than 250 mm thick and contains less than 50% volume of rocks; and • Supports or is capable of supporting a stand of native or introduced grass species or other forage plants utilisable by domesticated livestock or game animals on a commercial basis.	• Soil depth must exceed 250 mm; and • Slopes must be between 1:7 and 1:14.

Soil Forms	Land Capability Class	Classification Criteria (Pre-Mining)	Classification Criteria (Post-Mining)
Mispah	Class IV: Wilderness	• Land that has little or no agricultural capability by virtue of being too arid, too saline, too steep or too stony to support plants of economic value; • Its uses lie I the fields of recreation and wildlife conservation. It does however also include watercourses, submerged land, built-up land and excavations; and • Defined by exclusion, namely land that does not qualify as wetland, arable or grazing.	• Soil depth between 150 and 250 mm.
Hydromorphic	Class I: Wetland	• Usually a water table present at shallow depth in soil (swamps, marches etc.); • A diagnostic organic horizon at the surface; and • A horizon that is gleyed throughout more than 50% of its volume and is significantly thick, occurring within 750 mm of the surface.	• Soil depth must exceed 250 mm; and • Specific wetland soil used, as stockpiled from pre-mining delineated wetland areas.

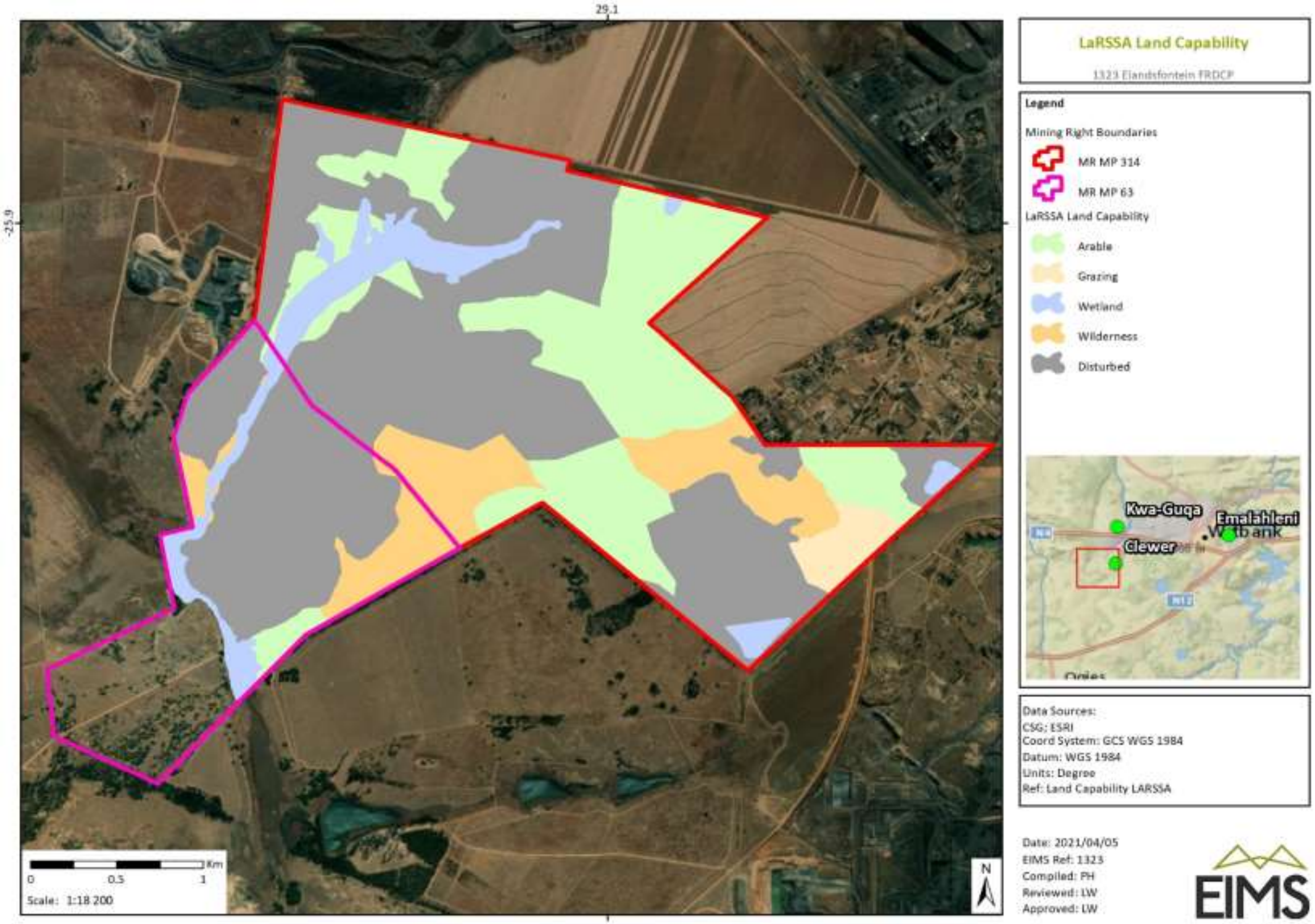


Figure 33: Land capability classes (LaRSSA methodology).

4.2.6.2.4 LAND POTENTIAL

The land potential of the project area is illustrated in Figure 34 and described in Table 11. Classes II and III have been merged into a land potential of “L2” whereas class IV has been determined to have a land potential of “L3”. Lastly, the wetland areas classified as class V have been classified as having a land potential of “Vlei”.

Table 11: Land potential for the soils within the project area.

Soil Forms	Land Capability Class	Land Potential	Size (ha)	Percentage	Description of Land Potential Class
Glencoe	Class II	L2	209	22%	High potential: Infrequent and/or moderate limitations due to the soil, slope, rainfall or temperatures. Appropriate contour protection must be implemented and inspected.
Bainsvlei (Deep					
Bainsvlei (Shallow					
Vaalbos					
Carolina	Class III				
Longlands					
Avalon					
Mispah	Class IV	L3	89	11%	Good potential: Infrequent and/or moderate limitations due to soil, slope, temperature or rainfall. Appropriate contour protection must be implemented and inspected.
Hydromorphic	Class V	Vlei	56	7%	N/A

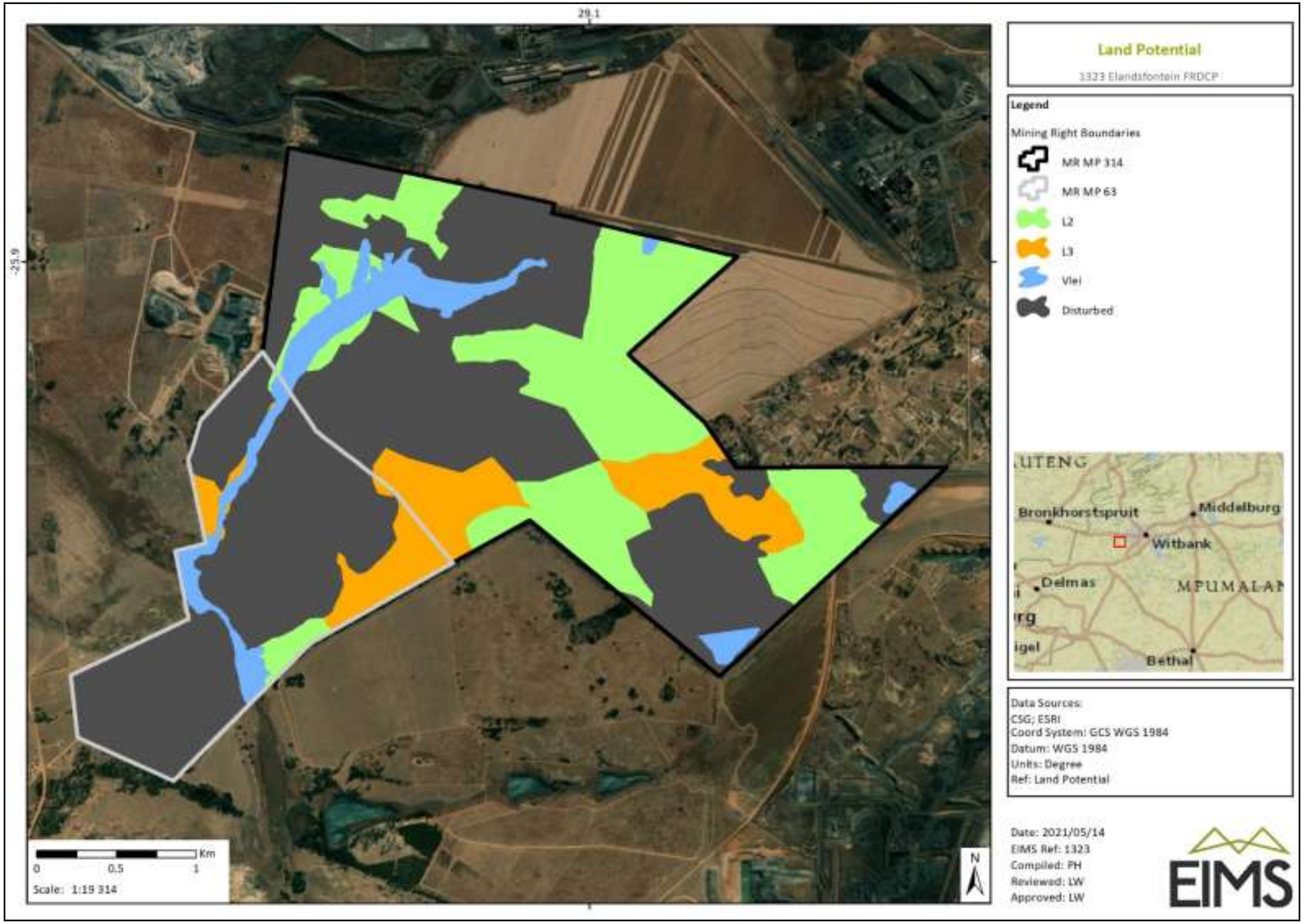


Figure 34: Land potential determined for the project area.

4.2.7 SURFACE WATER

Elandsfontein Colliery is located within the Olifants Water Management Area (WMA), within the Wilge River sub-catchment. The Colliery occurs within the B11K and B20G tertiary drainage regions. The Elandsfontein mining operations occur on both sides of the Grootspruit Tributary stream along most of its length.

Although local surface water drainage on the site is inferred to be in a general southwestern direction, the regional drainage occurs in a general north to north-western direction. The Grootspruit, transecting the project area to the southwest, convergences with the Saalboomspruit approximately 5.0 km to the northwest of the mine lease area from where it flows in a general northern direction before joining the Kromdraaispruit and Wilge River ~ 20.0 km to the north.

Refer to Figure 35 for a spatial layout of the project area in relation the water management area, quaternary catchments as well as regional drainage patterns. Major surface water features within this quaternary catchment include the Clewer dam < 1.0 km up-gradient of the mine lease boundary. The surface water sites at Elandsfontein have sulphate dominant type water and are typical of water impacted by the oxidation of pyrite and is commonly associated with mining impacts. The overall water quality of the surface water samples analysed is poor due to elevated levels of sulphate as well as heavy metals (Fe, Al and Mn) and high salt loads, indicative of coal mine pollution. There is a definite deterioration of water quality evident in a downstream direction and suggest contaminated water ingress from potentially mine decant and interflow zones.

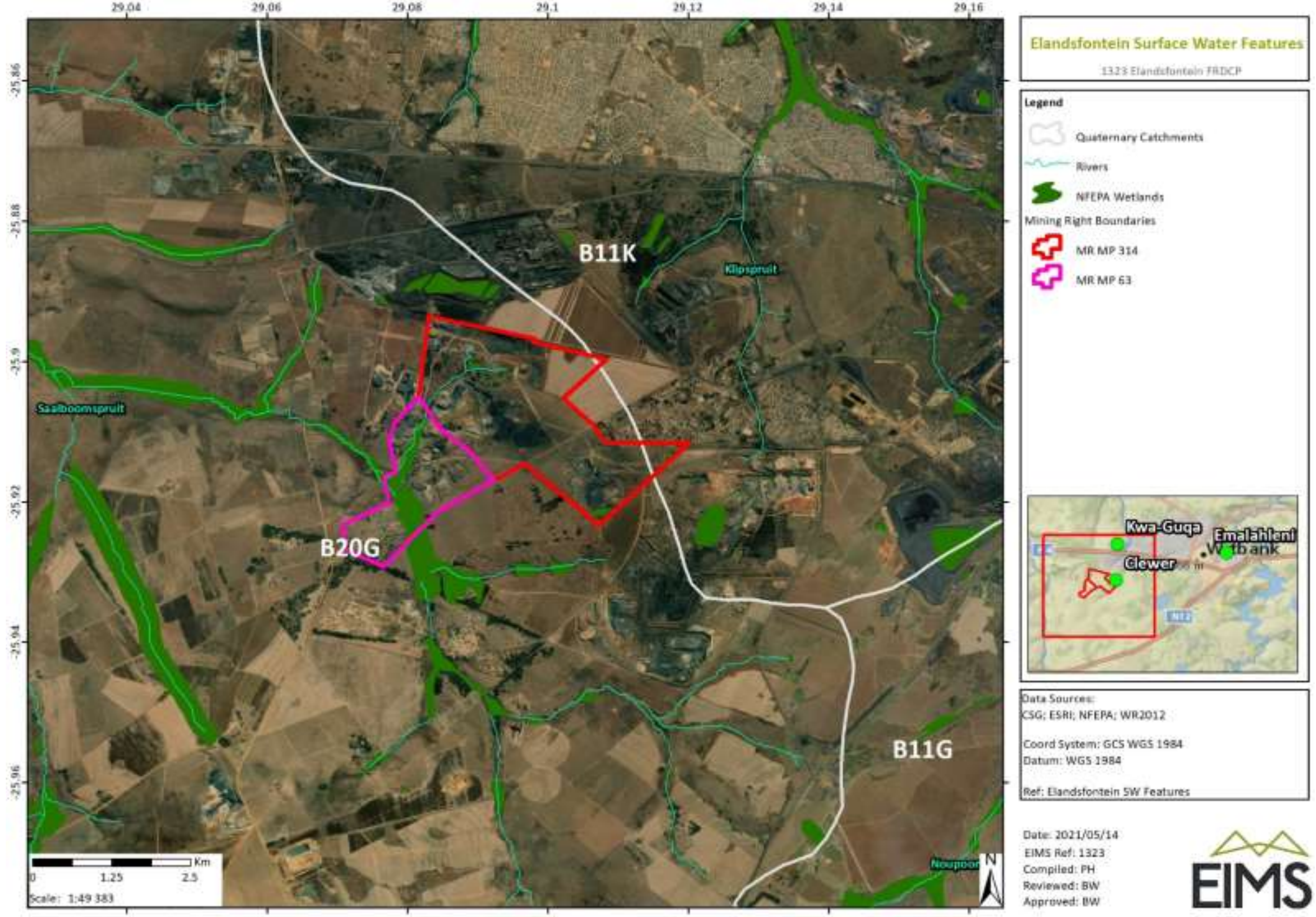


Figure 35: Surface water features.

4.2.8 WETLAND

Various non-perennial and perennial streams have been identified within the mining right area and surrounds. Two types of NFEPA[6] wetlands were identified within the MRA, namely channelled valley bottom wetlands as well as seeps. The channelled valley bottom wetlands are classified as natural and the seeps are classified as artificial. The Mpumalanga Highveld Grassland Wetland Layer indicates an additional wetland within the MRA, namely a floodplain wetland with various other wetland types located within the MRA's surroundings.

A wetland delineation and assessment was completed as part of the latest EIA (The Biodiversity Company (Pty) Ltd, 2020) and the findings thereof are presented in Figure 36 and described below. Three wetland hydro-geomorphic (HGM) units were identified, of which two have been largely modified by current and historic mining activities impeding into the wetland's buffer zones and, in some cases, into the wetland itself. Severe limitations exist in regard to wetland identification, which has resulted in a section characterised by signs of wetness to be classified as an "artificial system" given the presence of transported Technosols as well as altered surface and sub-surface flow dynamics. The delineated wetlands do provide a moderate to high level of service, especially in regard to indirect benefits (water quality and flow regulation). Significant wetland habitat degradation has taken place due to impaired water quality, which has resulted in a lack of unique species. The PES for the assessed HGM types is presented in Table 12. The overall PES classes for HGM 1, 2 and 3 has been determined to be "Critically Modified", "Largely Modified" and "Moderately Modified" respectively.

Table 12: Summary of the scores for the wetland PES.

Wetland	Hydrology		Geomorphology		Vegetation	
	Rating	Score	Rating	Score	Rating	Score
HGM 1	F: Critically Modified	8.3	E: Seriously Modified	6.5	F: Critically Modified	9.2
Overall PES Score	8.0		Overall PES Class		F: Critically Modified	
HGM 2	D: Largely Modified	5.1	C: Moderately Modified	2.3	F: Critically Modified	9.1
Overall PES Score	5.7		Overall PES Class		D: Largely Modified	
HGM 3	C: Moderately Modified	3.9	B: Largely Natural	1.8	D: Largely Modified	4.6
Overall PES Score	3.5		Overall PES Class		C: Moderately Modified	

The hydrology score for all three HGM units (especially HGM 1) has been affected by increased overland flow from the surrounding land use (mining) as well as the presence of drains and gullies. The geomorphology component of HGM 1 has been modified the most, predominantly by the presence of drains and gullies as well as wetland crossings. The vegetation component has been affected by means of the surrounding land use. Mining activities and components have resulted in a large-scale degradation and removal of vegetation. A buffer zone 106 m in size has been calculated for all the wetlands on-site due to the high level of threats associated with open cast mining.

[6] National Freshwater Ecosystem Priority Area

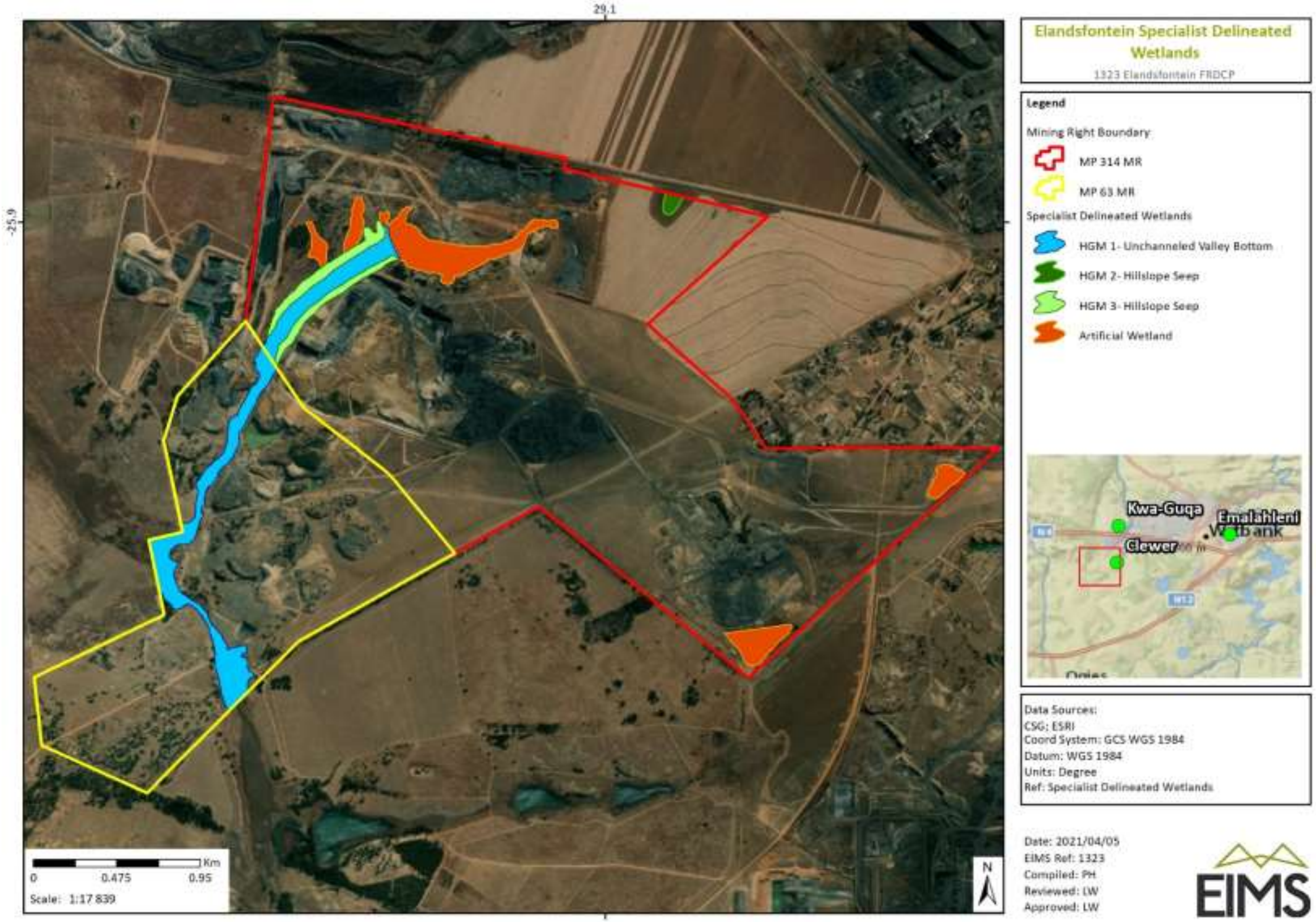


Figure 36: Delineated wetlands within the mining right area.

4.2.9 GROUNDWATER

This section has been extracted from the updated specialist hydrogeological assessment conducted (Gradient Consulting (Pty) Ltd, 2020). Please refer to the specialist study for further detail.

The resource management of the greater study area falls under the Olifants WMA and quaternary catchment B20G. Although local surface water drainage on the site is inferred to be in a general southwestern direction, the regional drainage occurs in a general north to north-western direction. The Grootspruit drainage transects the project area to the southwestern perimeter. The calculated mean annual precipitation (MAP) for this rainfall zone is 530.76 mm/a, while the mean annual evaporation accounts to 1689.0 mm/a.

The mining right area is underlain by the Ecca Group of the Karoo Supergroup and fall within the Madzaringwe Formation, consisting mainly of arenaceous strata. On a regional scale, two geological lineaments (potentially faults zones) exist in close proximity to the greater study area, striking in a general north-south and southwest-northeast orientation, respectively.

The mining right area is predominantly underlain by an intergranular and fractured aquifer system (d3) comprising mostly fractured and weathered compact sedimentary/ arenaceous rocks. Two main hydrostratigraphic units can be inferred in the saturated zone:

i. A shallow, weathered zone aquifer occurring in the transitional soil and weathered bedrock formations underlain by more consolidated bedrock.
ii. An intermediate/deeper fractured aquifer where groundwater flow will be dictated by transmissive fracture zones that occur in the relatively competent host rock.

The hydraulic conductivity of sandstone formations can range from $9e^{-05}$ – $9e^{-01}$ m/d whereas the hydraulic conductivity of denser shale formations is lower and estimated at $9e^{-09}$ – $9e^{-05}$ m/d. It should also be noted that mined out and back-filled areas may have different hydraulic properties as the inherent values have been altered and modified. An approximation of recharge for the study area is estimated at ~6.21 % of MAP i.e. ~32.93 mm/a.

Of the boreholes visited during the hydrocensus user survey, the majority are in use (>73.0%) with the groundwater application mostly for monitoring purposes as well as domestic and livestock purposes. It should be noted that there are various neighbouring boreholes in close proximity (< 1.0 km) to the mining operations. The unsaturated zone within the study area is in the order of ~2.85 to ~22.19m with a mean thickness of approximately 8.50m.

Analysed water level data for the shallow aquifer indicate that the majority of levels correlate very well to the topographical elevation and it can be assumed that the regional groundwater flow direction of the shallow aquifer is dictated by topography. Accordingly, the inferred groundwater flow direction will be in a general southwestern direction towards the lower laying drainage system of the Grootspruit drainage system.

The average groundwater gradient (i) of the shallow, weathered aquifer in the vicinity of the potential high-risk seepage areas i.e. mine discard dump and/or slurry ponds is moderately flat and calculated at approximately 0.004 with gradients increasing towards the southwestern perimeter of the mine lease area. The expected seepage rate from contamination originating at the mine discard dump is estimated at an average of 0.96 m/and will be dependent on local groundwater gradients.

The overall ambient groundwater quality of the shallow aquifer is good with the majority of macro and micro determinants below the SANS 241:2015 limits. Isolated sampling localities indicate above limits ammonium (NH_4) concentrations which may suggest nearby anthropogenic activities.

The local groundwater quality is indicative of an impacted groundwater system and suggest coal mine pollution and acid mine drainage (AMD) conditions present. The latter is characterised by a low pH environment increasing the solubility and concentrations of metals i.e. usually aluminium, iron and manganese.

The overall water quality of the upstream surface water samples is poor due to elevated levels of sulphate as well as heavy metals (Fe, Al and Mn) i.e. coal mine pollution indicators. The downstream water quality is unacceptable due to highly elevated levels of sulphate as well as heavy metals (Fe, Al and Mn) causing high salt loads. There is a definite deterioration of water quality evident in a downstream direction and suggest contaminated water ingress from potentially mine decant and interflow zones or seepage from mine discard dumps.

The majority of regional/ neighbouring boreholes suggest either a recently recharged and unimpacted water environment (Calcium-Bi-carbonate dominance), and/or area of dissolution and mixing, whereas current monitoring boreholes on the site indicate a static and disordinate environment (sulphate dominance suggesting impacts from coal mine pollution). Furthermore, groundwater sampling localities ECBH03, ELNBH03 correlate well to the hydrochemical signature of surface water sampling locality ASW01 and suggest similar water environments and potential origins.

The tailings sludge/ slurry sample analysed record intermediate sulphide content of 0.14% with a high negative NNP value of -45.0. The NPR ratio of zero suggest that the material does not consists of any buffering capacity and is likely to acid generating. The NAG pH is 1.53 with the NAG value 88.0 (at pH 7.0), indicating that the material has a high capacity for acid formation. It should be stated that although the sample does consist of oxidisable sulphides, the content is relatively low and insufficient to sustain long term acid generation.

The coal sample analysed record a high sulphide content of 1.89% with a high negative NNP value of -99.69. The NPR ratio of zero suggest that the material does not have any buffering capacity and is likely to generate acid. The NAG pH is 2.07 with the NAG values 29.80 (at pH 7.0), also indicating a high capacity for acid formation. It should be stated that the sample has high oxidisable sulphides and has the potential to sustain long-term acid generation.

The sandstone sample (non-carbonaceous) analysed record a very low sulphide content of 0.01% with a positive NNP value of 12.29. The high NPR ratio of 30.98 suggest that the material consist of adequate buffering capacity and is likely to generate acid. The NAG pH is 9.69 with a low NAG value of 0.01 (at pH 7.0) which suggest that the material is non-acid forming.

The shale sample (carbonaceous) analysed record an intermediate sulphide content of 0.15% with a high slightly negative NNP value of -1.43. The small NPR ratio of 0.79 suggest that the material does not have adequate buffering capacity and is likely to generate acid. The NAG pH is 3.74 with the NAG values 1.17 (at pH 7.0), shows that the material does have a low capacity for acid formation. It should be stated that the sample has intermediate oxidisable sulphides, however, will not sustain long-term acid generation.

A toxicity characteristic leaching procedure (TCLP) leach test was performed on composite samples of sulphide containing waste material suggest elevated concentrations of manganese (Mn) as well as sulphate ($S0_4$) for the tailings slurry sample, manganese (Mn) for the coal product sample and barium (Ba), manganese (Mn) as well as zinc (Zn) for the carbonaceous shale sample.

All waste samples analysed suggest that LCT0 < LC ≤ LCT1; and TC ≤ TCT1 and thus the material can be classed as a **Type 3 waste** (low hazardous waste) and should be managed accordingly.

A **GQM Index = 4** was estimated for the aquifer system and according to this estimate, a "**Medium**" level groundwater protection is required for this aquifer system. According to the DRASTIC index methodology applied, this mining activities and associated infrastructure's risk to groundwater pollution is rated as "**Moderate**", Di = 102.

4.2.10 LAND USE

Land use in the region includes heavy industry, residential, agriculture and conservation. Both mining rights cover an area of approximately 840 ha in total size with disturbed areas (mining) taking up approximately 48% of the space, wetlands taking up approximately 7%, crop fields taking up roughly 4% and degraded grassland areas taking up approximately 41% of the project area. A land cover map is provided in Figure 37.

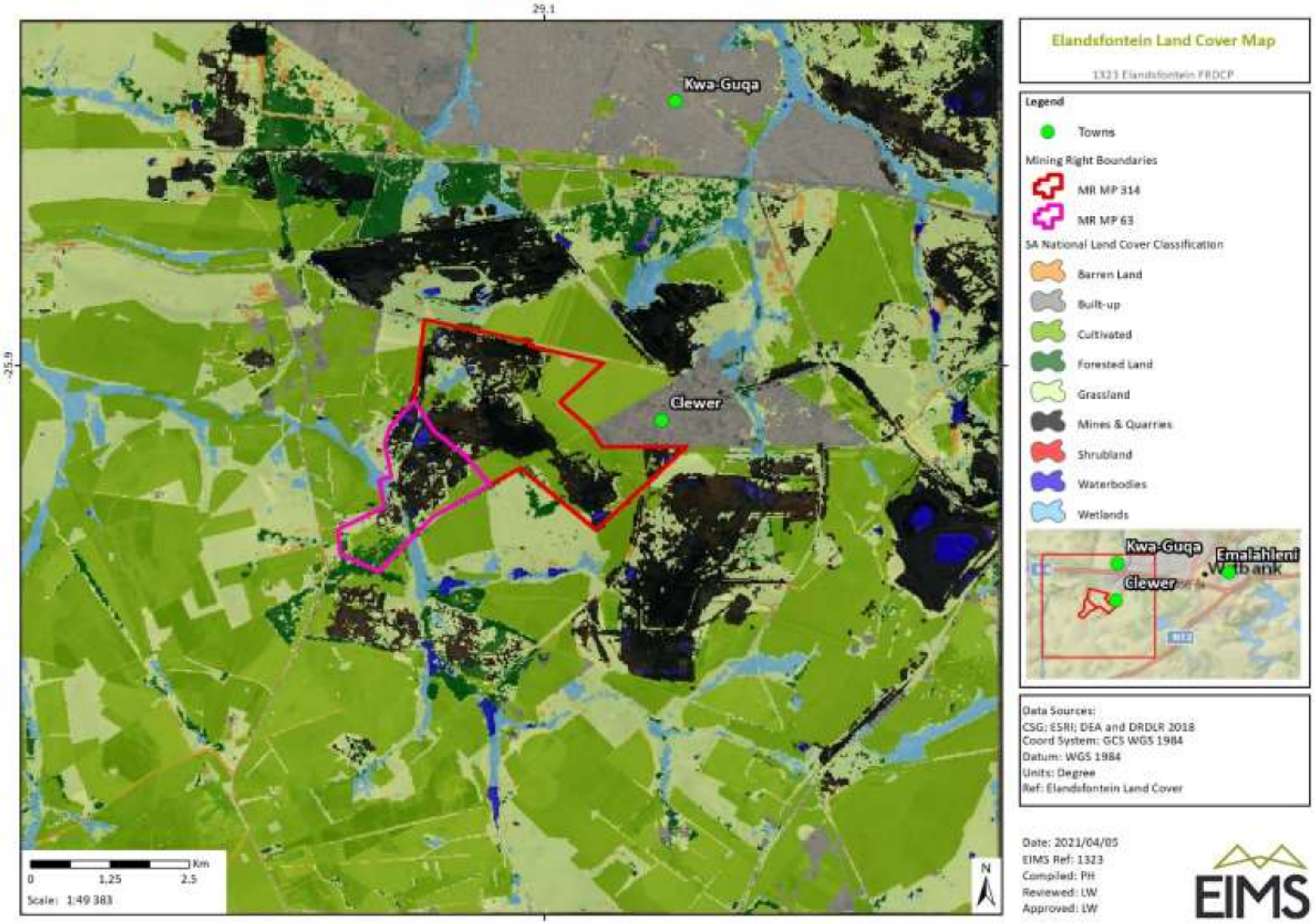


Figure 37: Regional land cover.

4.2.11 STAKEHOLDER ISSUES AND COMMENTS

A public participation process as required by the NEMA EIA regulation (GNR 982) has not been conducted. In order to achieve a practical and appropriate closure strategy and FRDCP, it is recommended that this plan be subject to public and key stakeholder review and comment. It is further suggested that the specific rehabilitation and closure actions presented in this plan be presented, discussed and comment solicited from the applicable surface rights owners prior to finalisation. Table 13 provides a summary of the stakeholder issues raised during the EIA which have a potential bearing on the decommissioning, rehabilitation, closure and post closure.

Table 13: Stakeholder issues related to decommissioning, rehabilitation and closure.

Stakeholder	Communication date	Comment relating to decommissioning and closure	Relation to decommissioning, closure and rehabilitation
Ntika Maake-Eskom Transmission Asset Management and Execution	2019/12/18	Feedback from Eskom provided a breakdown of the general requirements for work within or in proximity to an Eskom servitude. Regarding closure it is crucial to note the restrictions to excavating or construction within 20m from a servitude. Changes in ground level may not infringe on the statutory conductor or visibility clearances. After changes in ground level the surface shall be rehabilitated and stabilised. Eskoms rights i.t.o. the servitude must be respected.	The mine has a high voltage Eskom transmission line servitude and all decommissioning, closure and rehabilitation activities must comply with relevant legal requirements. Further, the subsidence risk and proximity to affected Eskom infrastructure should be investigated as a priority.
Thia Oberholzer – Environmental Manager Highveld Industrial Park	2020/08/04	Mrs Oberholzer notes the presence of a Sasol Gas Pipeline traversing the site.	While not specifically raised as a concern, the presence of the gas pipeline as well as Transnets Fuel Pipeline may pose a hazard if located above unstable past and future underground operations. Future subsidence risk must consider the pipeline.

4.3 ENVIRONMENTAL RISK ASSESSMENT

The NEMA Financial Provisioning Regulations requires that an environmental risk assessment must be undertaken for all areas of infrastructure or activity or aspects for which a holder of a right or permit has a responsibility to mitigate an impact or risk at closure. The findings of this risk assessment aim to guide the appropriate closure strategies. This FRDCP has been compiled to accompany the current application for an Environmental Authorisation to extend the mining operations. As such, the content of this section has been extracted from the associated EIA and adapted where relevant. This risk assessment will, as per the NEMA Financial Provision Regulations, be revised and amended during the future annual review process to ensure that the ongoing risk and risk ratings are relevant to the mine moving forward.

4.3.1 RISK ASSESSMENT METHODOLOGY

Environmental risks have been identified through review of the proposed and existing mining activities and the existing mine environment. The identification of risks was undertaken by a team of specialists including an Environmental Assessment Practitioner, wetland specialist, soils and land capability specialist, a hydrogeological specialist, and a team of environmental engineers. Further, if and where, risks or impacts are identified through the stakeholder engagement process these are included and assessed.

The impact significance, or risk rating methodology as presented herein is guided by the requirements of the NEMA EIA Regulations 2014 (as amended). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. The ER is determined for the pre- and post-mitigation scenario.

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and Reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$\boldsymbol{C} = \frac{(\boldsymbol{E} + \boldsymbol{D} + \boldsymbol{M} + \boldsymbol{R}) * \boldsymbol{N}}{\boldsymbol{4}}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 14 below.

Table 14: Criteria for Determining Impact Consequence

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary)
	3	Local (i.e. the area within 5 km of the site)
	4	Regional (i.e. extends between 5 and 50 km from the site)
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years)
	3	Medium term (6-15 years)
	4	Long term (15-65 years, the impact will cease after the operational life span of the project)
	5	Permanent (>65 years, no mitigation measure of natural process will reduce the impact after construction)
Magnitude/	1	Minor (where the impact affects the environment in such a way that natural, cultural, and social functions and processes are not affected)

Aspect	Score	Definition
Intensity	2	Low (where the impact affects the environment in such a way that natural, cultural, and social functions and processes are slightly affected)
	3	Moderate (where the affected environment is altered but natural, cultural, and social functions and processes continue albeit in a modified way, moderate improvement for +ve impacts)
	4	High (where natural, cultural, or social functions or processes are altered to the extent that it will temporarily cease, high improvement for +ve impacts)
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease, substantial improvement for +ve impacts)
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact.

Once the C has been determined, the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/ scored as per Table 15.

Table 15: Probability Scoring

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$ER = C \times P$$

Table 16: Determination of Environmental Risk

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5

	Probability

The outcome of the environmental risk assessment will result in a range of possible scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 17.

Table 17: Environmental Risk Scores

ER Score	Description
<9	Low (i.e. where this impact is unlikely to be a significant environmental risk/ reward).
≥9 ≤17	Medium (i.e. where the impact could have a significant environmental risk/ reward),
>17	High (i.e. where the impact will have a significant environmental risk/ reward).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

4.3.2 IMPACT AND RISK IDENTIFICATION

The identification of management and mitigation measures are guided by the hierarchy of mitigation. The ultimate aim being to avoid or mitigate detrimental impacts on the environment, and to optimise positive environmental impacts, and for matters pertaining thereto. Table 19 lists the environmental impacts and risks identified which relate to final rehabilitation, decommissioning, and closure. The relevant management and mitigation measures are listed. The applicable conceptual closure strategy to avoid, manage and mitigate the impacts and risks are also included in Table 19, together with the reassessment of the environmental risk after mitigation. The environmental risk assessment of the impacts associated with final rehabilitation, decommissioning and closure has informed the most appropriate closure strategy for the project. Impacts that are classified as high-risk post-mitigation are likely to represent either latent or residual environmental impacts and financial provision will be provided to remediate these specific impacts. Please see Section 6 for further details.

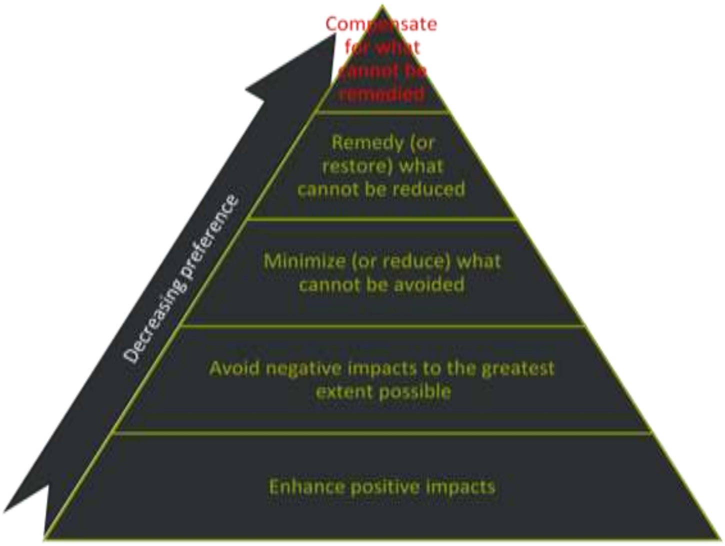


Figure 38: Hierarchy of mitigation and management.

The significance scores are defined as Low (<9); Medium (≥9; ≤17); and High (> 17) and are colour-coded as follows: Low – Green, Medium – Orange, and High – Red. Positive impacts have not been colour-coded. It is important to note that the environmental risk assessment will be revised and updated on an annual basis to ensure that this FRDCP remains applicable to the actual and predicted environmental impacts and risks.

For the purpose of report, the following broad phasing definitions apply:

- Planning/Pre-construction refers to the phase in which planning takes place, namely: exploration, environmental studies, finalising designs, etc.;
- Construction refers to the phase in which the site is prepared and infrastructure is established (e.g. vegetation clearance, access road preparation, construction camp establishment, infrastructure placement, etc.);
- Operation refers to the phase in which physical mining and production takes place – this phase will include mining and where relevant on-going progressive rehabilitation efforts;
- Decommissioning and rehabilitation refers to the inter-linked phases in which existing infrastructure is removed and final rehabilitation efforts are applied and their success monitored;
- The closure phase commences once the ore-extracting activities of a mine have ceased, and final decommissioning and mine rehabilitation is being completed. This phase usually ceases 3-5 years after physical closure activities and would culminate with the issuance of a closure certificate; and
- Post-closure refers to the phase in which maintenance and rehabilitation monitoring are undertaken to ensure that the mines closure objectives are met. Post-closure typically commences once a closure certificate has been received. The duration of the post-closure phase is defined by the duration of the applicable residual and latent environmental impacts.

4.3.3 KEY SPECIALIST STUDIES

In order to accurately define and predict certain key impacts associated with the mining operations, specialist investigations have been undertaken. This section presents the findings of the key specialist assessments which relate to the most relevant decommissioning, rehabilitation, closure and post closure impacts. The full specialist reports are included in the relevant Appendices.

4.3.3.1 UPDATED GROUNDWATER AND GEOCHEMICAL MODEL AND IMPACT ASSESSMENT

Gradient Consulting (Pty) Ltd was appointed to conduct a hydrogeological impact assessment to support the current application and provide inputs into the mine post-closure and financial provision plan. This section presents a summary of the assessment, methodologies, findings, and recommendations. The full report is attached as Appendix 3.

4.3.3.1.1 BACKGROUND AND CONTEXTUALISATION

The objective of this investigation was to determine the status quo of the regional groundwater system and quantify and qualify potential impacts of existing activities and infrastructure on the regional groundwater regime. The study included a geochemical and groundwater model.

The topography of the greater study area is characterised by moderately undulating plains and pans. The north-eastern perimeter is shaped by a topographical high at 1565 mamsl and forms the watershed between quaternary catchments B20G and B11K. The lowest on-site elevation is situated towards the southwest and is recorded at 1476 mamsl. On-site gradients are relatively gentle to moderate with the average slope calculated at 2.30% and –2.20% respectively.

The resource management of the greater study area falls under the Olifants WMA and quaternary catchment B20G. Although local surface water drainage on site is inferred to be in a general southwestern direction, the regional drainage occurs in a general north to north-western direction. The Grootspruit drainage transects the project area to the southwestern perimeter. The calculated mean annual precipitation (MAP) for this rainfall zone is 530.76 mm/a, while the mean annual evaporation accounts to 1689.0 mm/a.

The study area is underlain by the Ecca Group of the Karoo Supergroup and fall within the Madzaringwe Formation, consisting mainly of arenaceous strata. On a regional scale, two geological lineaments (potentially faults zones) exist in close proximity to the greater study area, striking in a general north-south and southwest-northeast orientation respectively.

The site is predominantly underlain by an intergranular and fractured aquifer system (d3) comprising mostly fractured and weathered compact sedimentary/ arenaceous rocks. Two main hydrostratigraphic units can be inferred in the saturated zone:

i. A shallow, weathered zone aquifer occurring in the transitional soil and weathered bedrock formations underlain by more consolidated bedrock.
ii. An intermediate/deeper fractured aquifer where groundwater flow will be dictated by transmissive fracture zones that occur in the relatively competent host rock.

The hydraulic conductivity of sandstone formations can range from $9e^{-05}$ – $9e^{-01}$ m/d whereas the hydraulic conductivity of denser shale formations is lower and estimated at $9e^{-09}$ – $9e^{-05}$ m/d. It should also be noted that mined out and back-filled areas may have different hydraulic properties as the inherent values have been altered and modified. An approximation of recharge for the study area is estimated at ~6.21 % of MAP i.e. ~32.93 mm/a.

Off the boreholes visited during the hydrocensus user survey, the majority are in use (>73.0%)) with the groundwater application mostly for monitoring purposes as well as domestic and livestock purposes. It should be noted that there are various neighbouring boreholes in close proximity (< 1.0 km) to the mining operations.

The unsaturated zone within the study area is in the order of ~2.85 to ~22.19m with a mean thickness of approximately 8.50m. Analysed water level data for the shallow aquifer indicate that the majority of levels correlate very well to the topographical elevation and it can be assumed that the regional groundwater flow direction of the shallow aquifer is dictated by topography. Accordingly, the inferred groundwater flow direction will be in a general southwestern direction towards the lower laying drainage system of the Grootspruit drainage system.

The average groundwater gradient (i) of the shallow, weathered aquifer in the vicinity of the potential high-risk seepage areas i.e. mine discard dump and/or slurry ponds is moderately flat and calculated at approximately 0.004 with gradients increasing towards the southwestern perimeter of the mine lease area.

The expected seepage rate from contamination originating at the mine discard dump is estimated at an average of 0.96 m/a and will be dependent on local groundwater gradients. The overall ambient groundwater quality of the shallow aquifer is good with the majority of macro and micro determinants below the SANS 241:2015 limits. Isolated sampling localities indicate above limits ammonium (NH_4) concentrations which may suggest nearby anthropogenic activities.

The local groundwater quality is indicative of an impacted groundwater system and suggest coal mine pollution and acid mine drainage (AMD) conditions present. The latter is characterised by a low pH environment increasing the solubility and concentrations of metals i.e. usually aluminium, iron and manganese.

The overall water quality of the upstream surface water samples is poor due to elevated levels of sulphate as well as heavy metals (Fe, Al and Mn) i.e. coal mine pollution indicators. The downstream water quality is unacceptable due to highly elevated levels of sulphate as well as heavy metals (Fe, Al and Mn) causing high salt loads. There is a definite deterioration of water quality evident in a downstream direction and suggest contaminated water ingress from potentially mine decant and interflow zones or seepage from mine discard dumps.

The majority of regional/ neighbouring boreholes suggest either a recently recharged and unimpacted water environment (Calcium-Bi-carbonate dominance), and/or area of dissolution and mixing, whereas current monitoring boreholes on site indicate a static and disordinate environment (sulphate dominance suggesting impacts from coal mine pollution). Furthermore, groundwater sampling localities ECBH03, ELNBH03 (refer to Figure 39 correlate well to the hydrochemical signature of surface water sampling locality ASW01 and suggest similar water environments and potential origins.

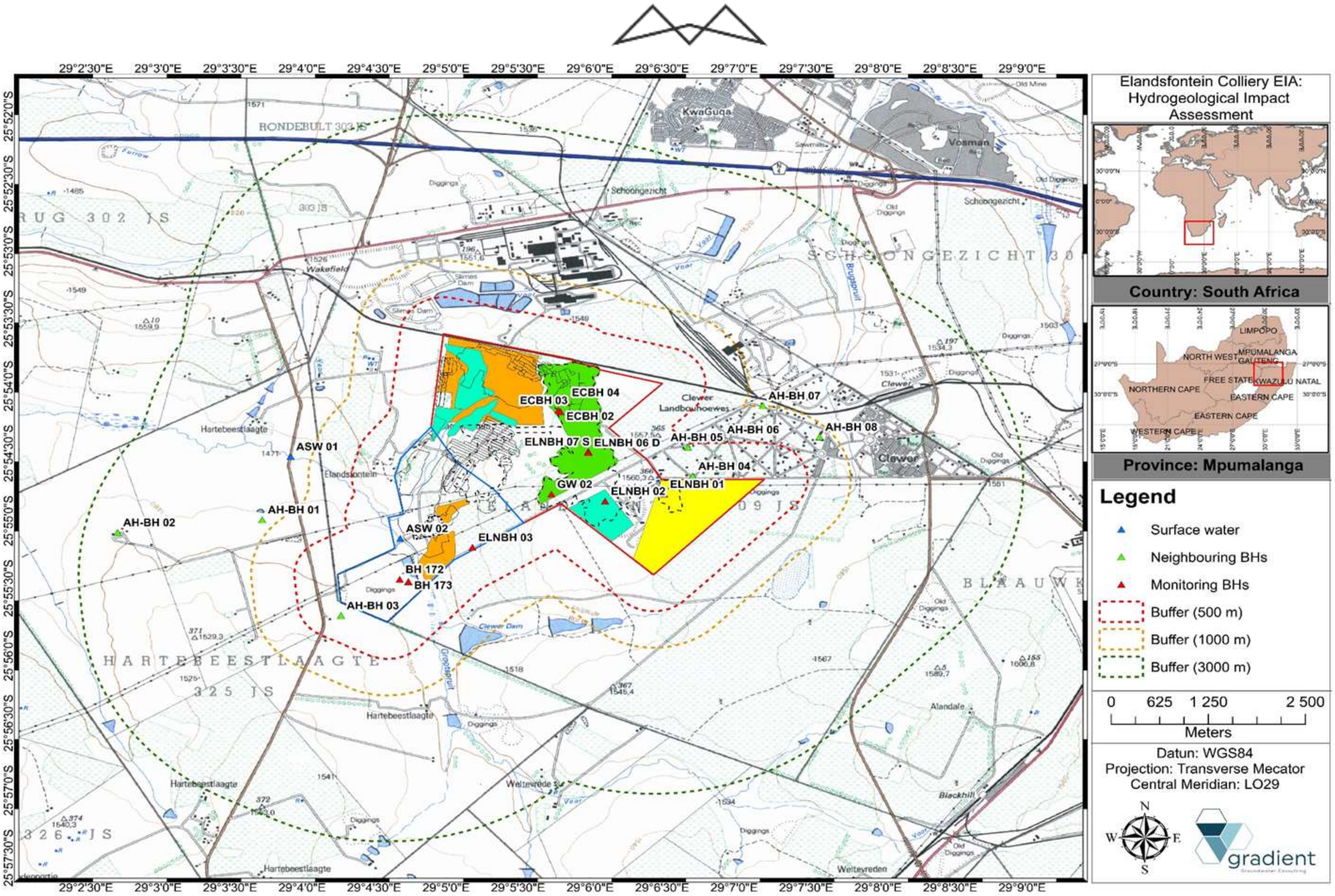


Figure 39: Spatial distribution of hydrocensus user survey geosites.

The tailings sludge/ slurry sample analysed record intermediate sulphide content of 0.14% with a high negative NNP value of -45.0. The NPR ratio of zero suggest that the material does not consists of any buffering capacity and is likely to acid generating. The NAG pH is 1.53 with the NAG value 88.0 (at pH 7.0), indicating that the material has a high capacity for acid formation. It should be stated that although the sample does consist of oxidisable sulphides, the content is relatively low and insufficient to sustain long term acid generation.

The coal sample analysed record a high sulphide content of 1.89% with a high negative NNP value of -99.69. The NPR ratio of zero suggest that the material does not have any buffering capacity and is likely to generate acid. The NAG pH is 2.07 with the NAG values 29.80 (at pH 7.0), also indicating a high capacity for acid formation. It should be stated that the sample has high oxidisable sulphides and has the potential to sustain long-term acid generation.

The sandstone sample (non-carbonaceous) analysed record a very low sulphide content of 0.01% with a positive NNP value of 12.29. The high NPR ratio of 30.98 suggest that the material consist of adequate buffering capacity and is likely to generate acid. The NAG pH is 9.69 with a low NAG value of 0.01 (at pH 7.0) which suggest that the material is non-acid forming.

The shale sample (carbonaceous) analysed record an intermediate sulphide content of 0.15% with a high slightly negative NNP value of -1.43. The small NPR ratio of 0.79 suggest that the material does not have adequate buffering capacity and is likely to generate acid. The NAG pH is 3.74 with the NAG values 1.17 (at pH 7.0), shows that the material does have a low capacity for acid formation. It should be stated that the sample has intermediate oxidisable sulphides, however, will not sustain long-term acid generation.

A Toxicity characteristic leaching procedure (TCLP) leach test was performed on composite samples of sulphide containing waste material suggest elevated concentrations of manganese (Mn) as well as sulphate (SO_4) for the tailings slurry sample, manganese (Mn) for the coal product sample and barium (Ba), manganese (Mn) as well as zinc (Zn) for the carbonaceous shale sample.

All waste samples analysed suggest that LCT0 < LC ≤ LCT1; and TC ≤ TCT1 and thus the material can be classed as a Type 3 waste (low hazardous waste) and should be managed accordingly.

A **GQM Index = 4** was estimated for the aquifer system and according to this estimate, a "**Medium**" level groundwater protection is required for this aquifer system. According to the DRASTIC index methodology applied, this mining activities and associated infrastructure's risk to groundwater pollution is rated as "**Moderate**", Di = 102.

The numerical groundwater flow model simulations for the proposed opencast operation suggest the average open pit dewatering is approximately $2.57E^{+02}$ m^3/d with a maximum pit water ingress of approximately $5.09E^{+02}$ m^3/d for the duration of the simulation period. It is noted that the opencast groundwater ingress volumes expected is much lower due to the existing groundwater drawdown caused by current dewatering activities. It is expected that the groundwater drawdown will range from 4.0m to ~ 24.0m below the static water level (mbsl) and the groundwater capture zone i.e. zone of influence extent will cover an estimated footprint of 211.0ha. It should be noted that the simulated impact zone extends slightly beyond the eastern perimeter of the mining right area, however, falls mainly within the mining properties. Baseflow discharges to the model catchment drainages, accounts to approximately 1800.0m^3/d during pre-mining conditions, whereas baseflow discharge during the operational life of mine period decreases to ~ 1750.0m^3/d. This accounts for an average loss of ~3.0% with a maximum of >10.0% during the simulation period.

4.3.3.1.2 FINDINGS

The numerical groundwater flow model simulations for the proposed opencast operation suggest the average open pit dewatering is approximately $2.57E^{+02}$ m^3/d with a maximum pit water ingress of approximately $5.09E^{+02}$ m^3/d for the duration of the simulation period. It is noted that the opencast groundwater ingress volumes expected is much lower due to the existing groundwater drawdown caused by current dewatering activities. It is expected that the groundwater drawdown will range from 4.0m to ~ 24.0m below the static water level (mbsl) and the groundwater capture zone i.e. zone of influence extent will cover an estimated footprint of 211.0ha. It should be noted that the simulated impact zone extends slightly beyond the eastern perimeter of the mining right area, however, falls mainly within the mining properties. Baseflow discharges to the model catchment drainages, accounts to approximately 1800.0m^3/d during pre-mining conditions, whereas baseflow discharge during the operational life of mine period decreases to ~ 1750.0m^3/d. This accounts for an average loss of ~3.0% with a maximum of >10.0% during the simulation period.

Model simulations for the proposed underground development suggest the average underground void dewatering is approximately 1.44E^{+03} m^3/d with a maximum underground water ingress of approximately 2.03E^{+03} m^3/d for the duration of the simulation period. It is expected that the groundwater drawdown will range from 4.0m to ~ 30.0m below the static water level (mbsl) and the groundwater capture zone i.e. zone of influence extent will cover an estimated footprint of 720.90ha. It should be noted that the simulated impact zone extends slightly beyond the eastern and south-eastern perimeters of the mining right area, however, falls mainly within the mining properties. It is not expected that the underground operations will have a significant effect on the baseflow discharge to local drainages.

A mine post-closure scenario was simulated wherein hydraulic head recovery within the proposed opencast areas was evaluated. It is calculated that the newly proposed backfilled opencast pit flooding and associated decant periods ranges between ~5.0years to >20years depending on the geometry of the backfilled pit. Expected decant volumes for the backfilled opencast pits varies from 8.0m^3/d to > 70.0m^3/d depending on the pit effective infiltration volumes. The combined decant volume is approximately ~150.0m^3/d.

It is calculated that the existing/historical backfilled opencast pits decant volumes varies from 40.0m^3/d to > 190.0m^3/d with a combined decant volume of approximately ~626.0m^3/d. It should be noted that there are various decant points potentially discharging into the wetland drainage system traversing the site.

A mine post-closure scenario was simulated wherein hydraulic head recovery within the existing underground voids as well proposed mining areas was evaluated. Simulated average groundwater ingress for the LOM underground operation was combined with the expected groundwater recharge reporting to the underground void and from these volumes it is estimated that under average rainfall conditions, the underground will be flooded in approximately 35 to 40 years after ceasing of mining activities. The proposed depth and geometry of the underground operations allows for the majority of the footprint to be flooded with a low risk of decant occurring. Expected decant volumes for the underground voids are relatively low due to the presence of confining shale and mudstone layers restricting the downward filtration of rainwater recharge into the underground mine void(s) and ranges between 0.85m^3/d to ~17m^3/d with a combined volume of approximately 50.0m^3/d. Thus the combined expected decant volume expected post-closure is approximately 870.0 m^3/d.

It is noted that sulphate concentrations for all monitoring boreholes (ECBH02, ECBH03 and ECBH04) rises above the SANS threshold reaching the LOM, where borehole ECBH03 reaches a maximum concentration of ~1 370 mg/l, correlating well to on-site monitoring results. The simulated sulphate pollution plume extent for the newly proposed mining footprints for LOM covers a total area of approximately 447.0ha (inclusive of existing opencast footprints), reaching a maximum distance of ~350.0m in a general south-western direction towards the lower laying drainage and wetland systems. The simulation indicates that no neighbouring boreholes, except on-site monitoring boreholes are impacted on during the operational LOM while the unknown tributary of the Grootspuit and associated wetland are affected. It is evident that sulphate concentrations for all monitoring boreholes is above the SANS threshold for the duration of the LOM, reaching maximum concentrations of between ~1200.0 to ~1 600.0mg/l, respectively.

A 50-year post-closure scenario was simulated and covers a total area of approximately 875.0ha, reaching a maximum distance of ~600.0 to 700.0m in a general south-western direction towards the lower laying drainage and wetland systems. The simulation indicates that, although the pollution plume extends beyond the mining properties, no neighbouring boreholes will potentially be impacted post-closure while the unknown tributary of the Grootspuit and associated wetland might potentially be impacted on.

A 100-year post-closure scenario was simulated and covers a total area of approximately 1030.0ha, reaching a maximum distance of 1100.0 to 1300.0m in a general south-western direction. The simulation indicates that, although the pollution plume extends beyond the mining properties, no neighbouring boreholes will potentially be impacted post-closure while the unknown tributary of the Grootspuit and associated wetland might potentially be impacted on. It is evident that sulphate concentrations for all monitoring boreholes stabilises to a maximum sulphate contribution load of between 1600.0 to 1800.0mg/l, which is above the SANS threshold.

Various alternative management and mitigation scenarios were simulated to evaluate the remedial options available. These included, amongst others:

- **Scenario 06a: Active (or passive) water management by establishment of scavenger boreholes down-gradient of waste facilities and backfilled opencasts:** An active (or passive) management scenario evaluating the mitigating effect of seepage capturing boreholes i.e. scavenger boreholes on the plume migration via active pumping or passive abstraction via windmills were simulated. A series of seepage capturing boreholes were established down-gradient of mine waste facilities as indicated in Figure 40. Due to the negative groundwater gradient created, the pollution plume footprint is reduced by approximately ~25.0% to ~842.0ha with an abstraction volume of ~0.15l/s per borehole. Increased abstraction will further decrease and constraint the plume footprint, however this will be highly dependent on borehole specific hydraulic parameters as well as functionality. It is recommended that constant discharge aquifer tests be conducted on newly established seepage capturing boreholes in order to optimise borehole yields. Abstracted groundwater volumes expected accounts to approximately 421.0m^3/d, which should be treated before discharge and re-established into the local groundwater catchment balance. Due to no additional management measures proposed to mitigate the impact of carbonaceous waste material to be disposed, leachate of various chemical constituents may continue indefinitely (depending on its geochemical character) and the treatment duration for
- **Scenario 06d: Active water management by establishment of scavenger boreholes down-gradient of waste facilities and implementation of a lined facility for disposal of carbonaceous waste material:** An active management scenario evaluating the mitigating effect of seepage capturing boreholes in combination with implementation of a lined facility (Class C or GLB+ containment barrier design i.e. Type 3: Low-risk waste) for disposal all carbonaceous waste material on the plume migration were simulated. A series of seepage capturing boreholes were established down-gradient of mine waste facilities as indicated in Figure 41. The combination of the mitigation effect of the negative groundwater gradient created as well as the reduction in waste footprints due to implementation of a lined facility, reduces the pollution plume footprint by approximately ~35.0% to ~738.0ha. Abstracted groundwater volumes expected accounts to approximately 421.0m^3/d[7], which should be treated before discharge and re-established into the local groundwater catchment balance. Due to separation of carbonaceous waste material to be disposed, leachate of various chemical constituents from proposed backfilled zones will be limited to a period not exceeding a 50-year duration[8].
- **Scenario 06e: Active water management by establishment of scavenger boreholes down-gradient of waste facilities in combination with disposal of carbonaceous waste material in the northern discard pit:** An active management scenario evaluating the mitigating effect on the establishment of scavenger boreholes down-gradient of waste facilities and backfilled opencasts in combination with disposal of carbonaceous waste material in the northern discard pit on the plume migration were simulated as depicted in . The combination of the mitigation effect of the negative groundwater gradient created reduces the pollution plume footprint approximately ~35.0% to ~738.0ha. Accordingly, this mitigation scenario is the most likely case and preferred scenario. It is recommended that the northern discard pit footprint be compacted and a barrier system (capping) and/or evapotranspiration cover be established in order to minimise water and oxygen ingress which is the drivers of acid rock drainage conditions. Abstracted groundwater volumes expected accounts to approximately 421.0m^3/d, which should be treated before discharge and re-established into the local groundwater catchment balance. Due to separation of carbonaceous waste material to be disposed and post-closure rehabilitation of the disposal facility, leachate of various chemical constituents from proposed backfilled zones will be limited to a period not exceeding a 50-year duration. Figure 42 indicates the simulated post-closure

[7] It should be noted that dirty surface water runoff is excluded from the intercepted water volume reported here and is not accounted for.
[8] Additional geochemical characterisation will be required in order to accurately determine duration of buffer reactions and source depletion timeframes. For the purposes of this investigation, a timeframe of 50 years has been assumed.

decant volumes for backfilled voids as well as the decant contribution of the northern discard pit when it is not rehabilitated vs. a capping and rehabilitation scenario. It is noted that the facility contributes a total volume of approximately 40.0 m^3/d if not rehabilitated while the decant volume is reduced to ~ 12m^3/d when applying a barrier system (capping) and/or an evapotranspiration cover.

- **Scenario 06f: Active water management by establishment of scavenger boreholes down-gradient of waste facilities in combination with rehabilitation of the south-eastern discard dump, placement of discard in northern discard pit, and capping the northern discard pit:** An active management scenario evaluating the mitigating effect on the establishment of scavenger boreholes down-gradient of waste facilities and backfilled opencasts in combination with rehabilitation of the south-eastern discard dump on the plume migration were simulated as depicted in Figure 43. The combination of the mitigation effect of the negative groundwater gradient created as well as the reduction in waste footprints due to removal and rehabilitation of the existing south-eastern discard damp, reduces the pollution plume footprint by >35.0% to ~717.0ha. Abstracted groundwater volumes expected accounts to approximately 408.0m^3/d, which should be treated before discharge and re-established into the local groundwater catchment balance.

The preferred mitigation scenario entails implementation of the following:

- Down-gradient seepage capturing boreholes;
- Placement of discard in northern discard pit;
- Capping and rehabilitation of the northern discard pit; and
- Removal and rehabilitation of the south eastern discard dump.

The combination of the mitigation effect of the negative groundwater gradient created reduces the pollution plume footprint by ~35.0% to ~738.0ha. Accordingly, this mitigation scenario is the most likely case and preferred scenario. The model results were incorporated into a risk rating matrix to determine the significance of potential groundwater related impacts.

During the operational phase, the environmental significance rating of groundwater quantity impacts on down-gradient receptors are rated as medium negative without implementation of remedial measure and low negative with implementation of proposed mitigation measures. Groundwater quality impacts from the discard dump, coal stockpile areas, PCD's and related waste facilities are rated as medium negative without implementation of remedial measures and medium/low negative with implementation of mitigation measures.

Post closure phase impacts resulting from seepage and leachate from mine waste facilities on down-gradient receptors are rated as medium negative without the implementation of remedial measures and low negative with implementation of mitigation measures.

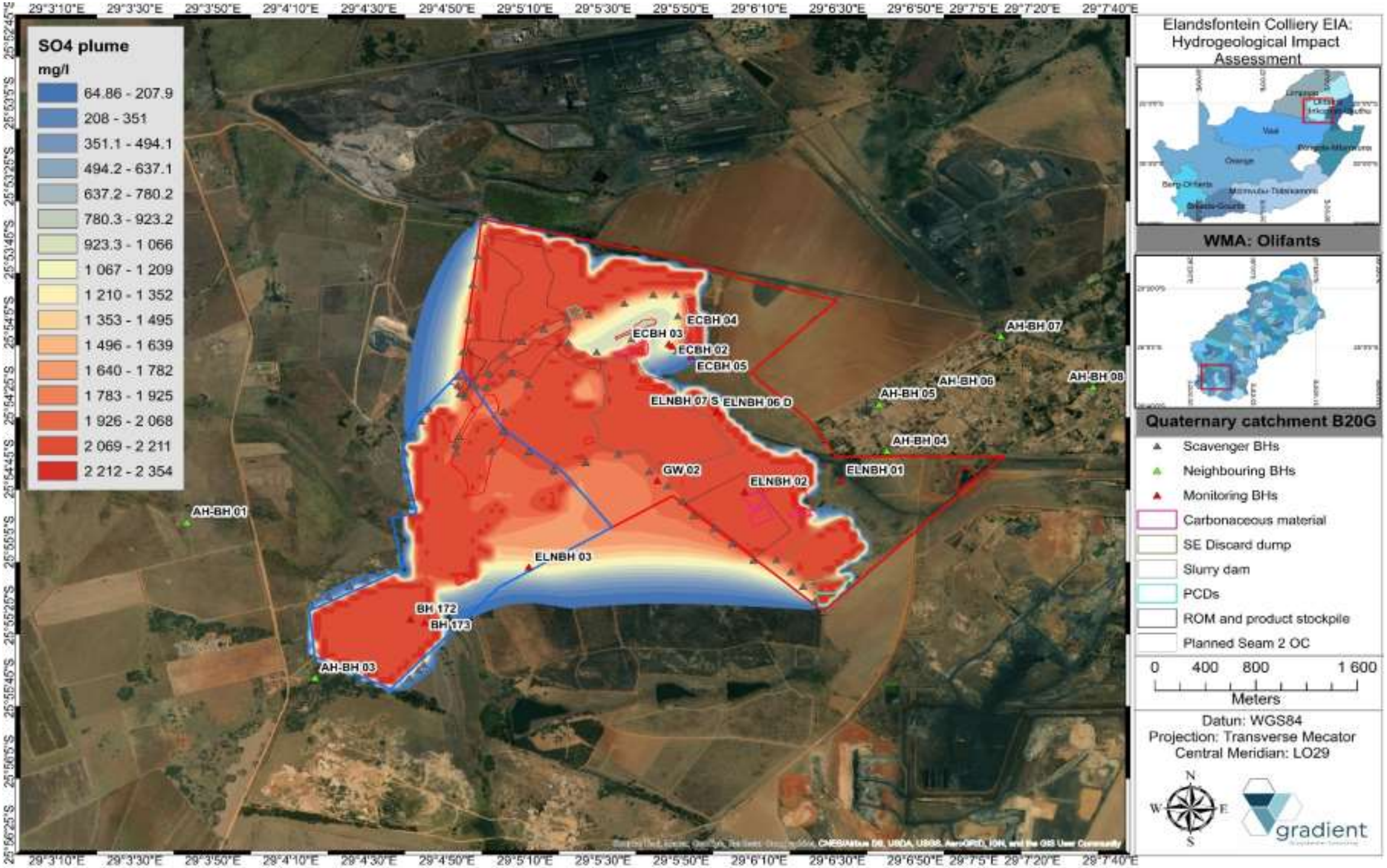


Figure 40: Scenario 06a: Mitigation alternative 01: Establishment of seepage capturing boreholes down-gradient of pollution sources.

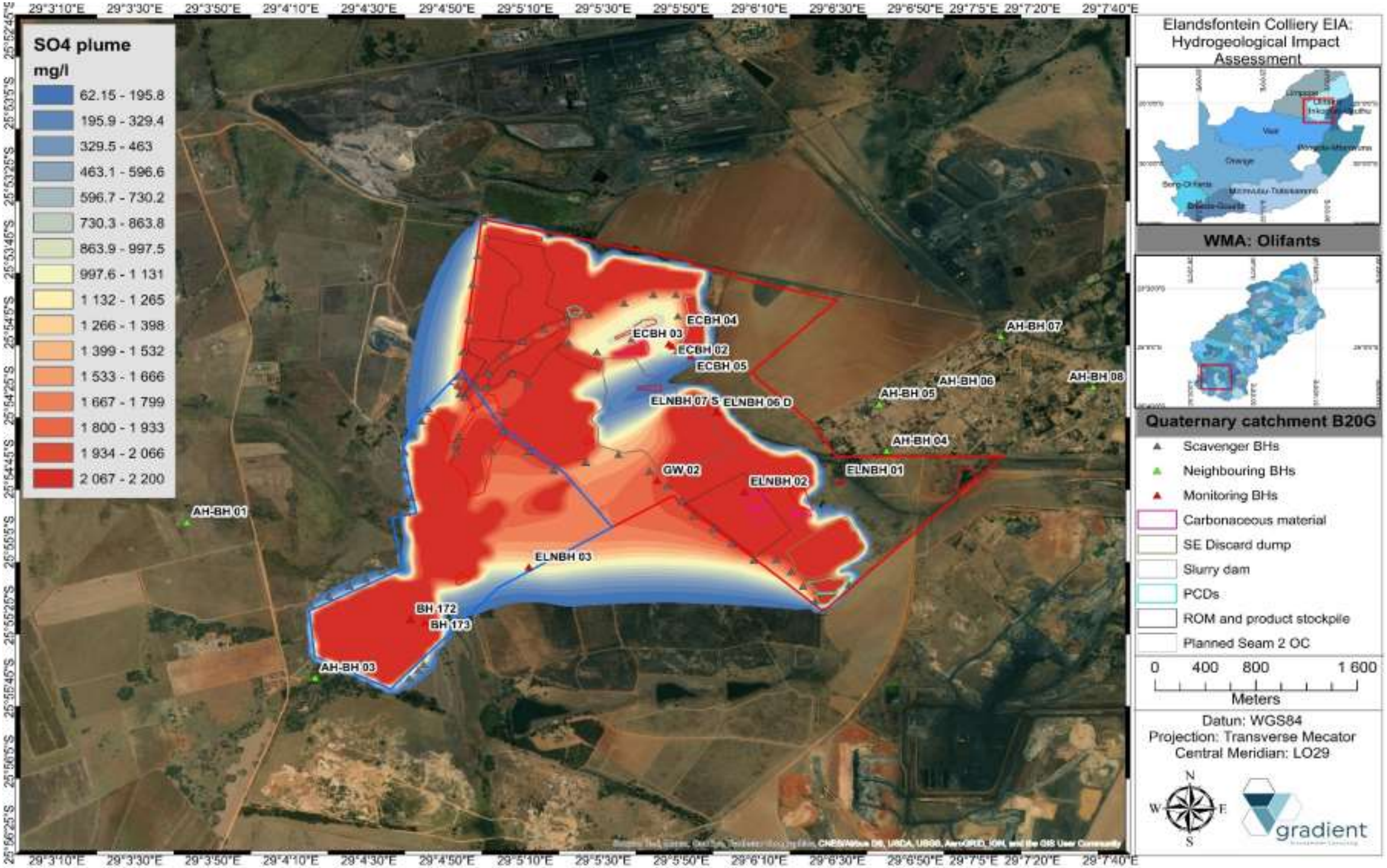


Figure 41: Scenario 06d: Mitigation alternative 04: Establishment of scavenger boreholes and lined facility for carbonaceous waste material.

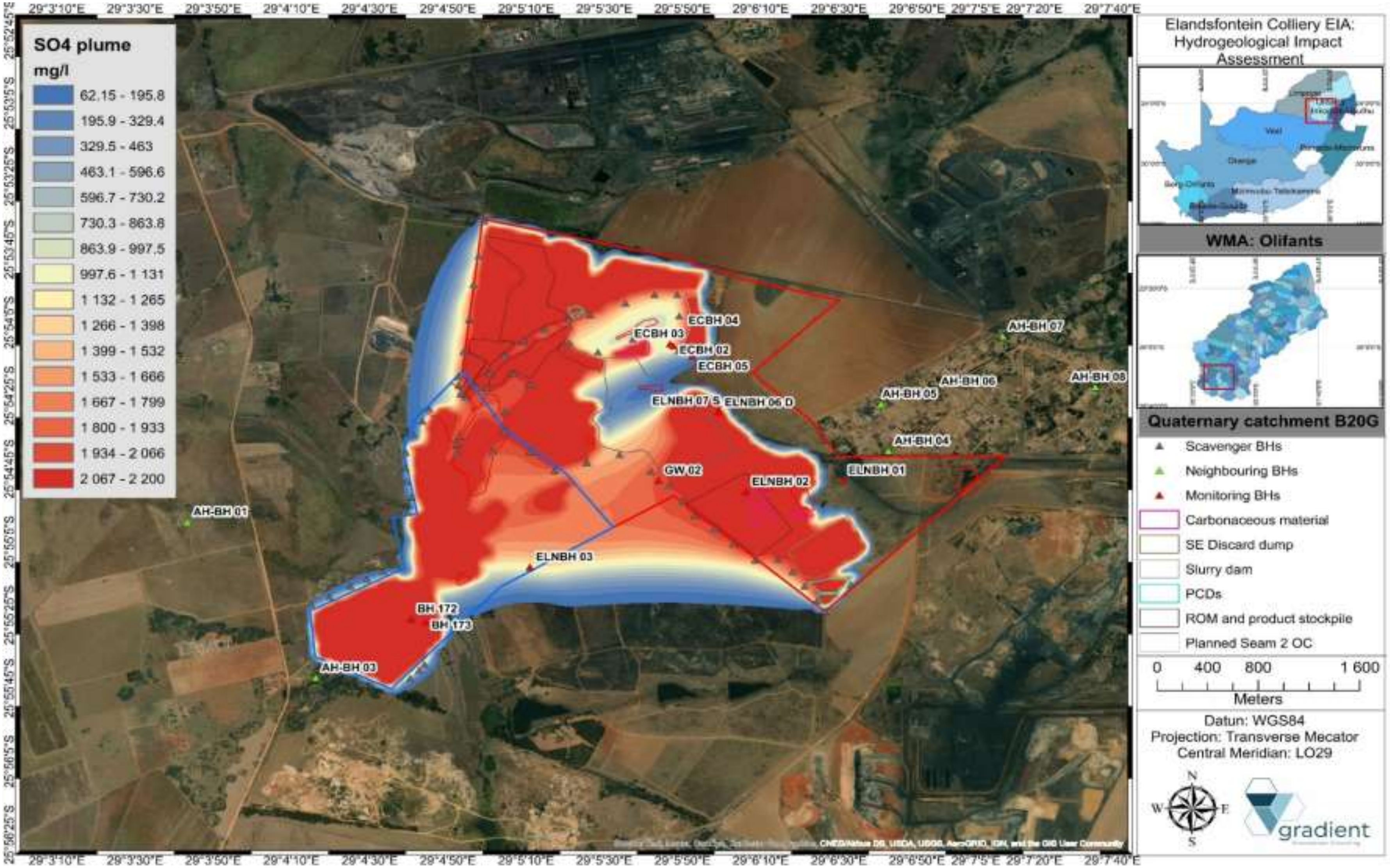


Figure 42: Scenario 06e: Mitigation alternative 05: Establishment of scavenger boreholes in combination with disposal of carbonaceous waste material in the northern discard pit.

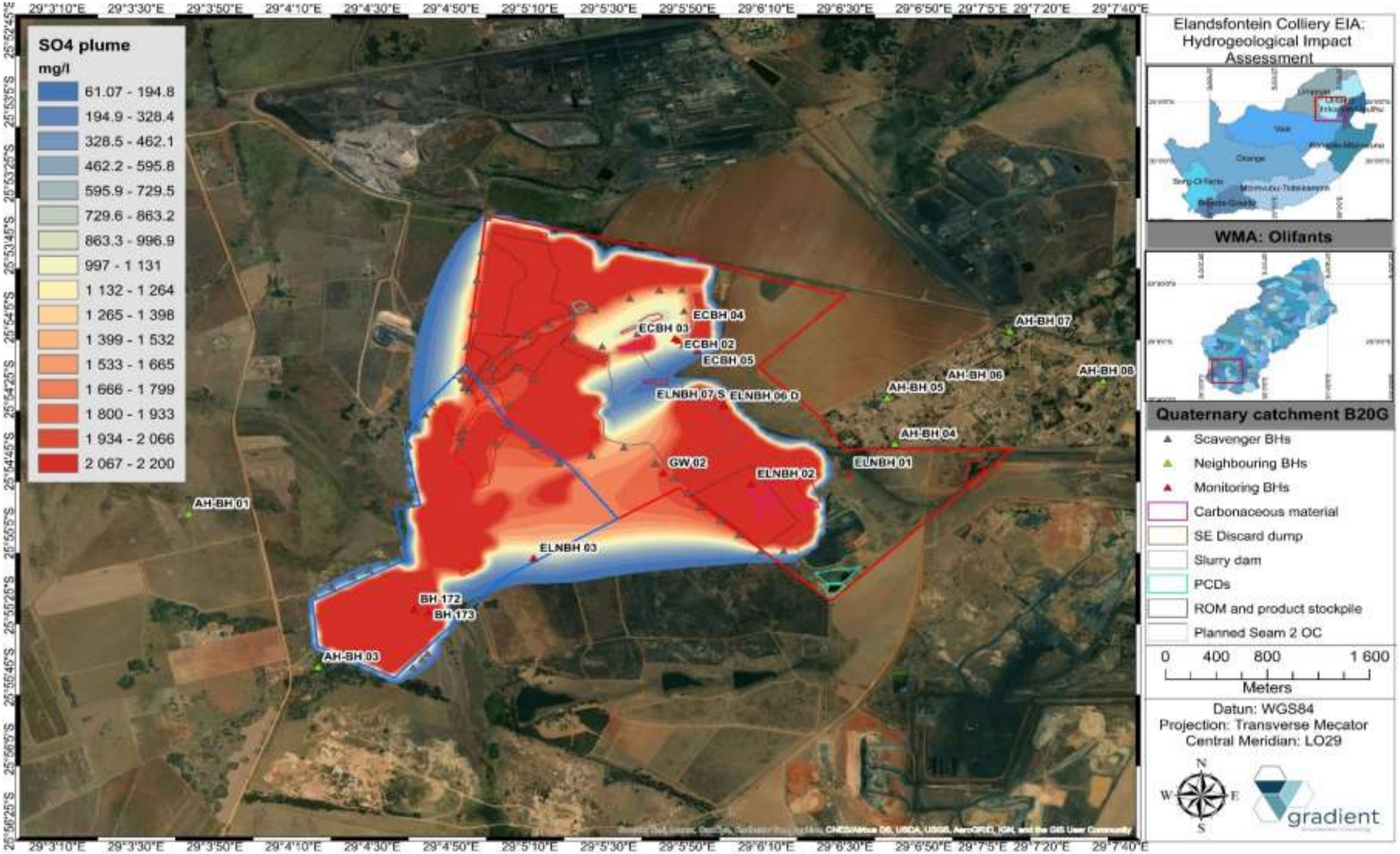


Figure 43: Scenario 06f: Mitigation alternative 06: Establishment of scavenger boreholes in combination with rehabilitation of SE discard dump.

4.3.3.1.3 CONCLUSIONS AND RECOMMENDATIONS

The model results were incorporated into a risk rating matrix to determine the significance of potential groundwater related impacts. Post closure phase impacts resulting from seepage and leachate from mine waste facilities on down-gradient receptors are rated as medium negative without the implementation of remedial measures and low negative with implementation of mitigation measures. The main impacts associated with mine post-operational phase activities include the following:

1. Mine dewatering effects lessening, post-operational re-watering and flooding of underground mine voids and potential flooding of backfilled opencast pits may occur.
2. Poor quality leachate and decant may emanate from backfilled opencast pits as well as underground mined out faces which will have a negative impact on groundwater and surface water quality.
3. Seepage of poor water quality caused by leachate of sulphide bearing minerals from mine waste facilities i.e. discard dumps, slurry dams as well as pollution control dams.

The following recommendations are proposed following the Groundwater investigation:

1. It is recommended that mitigation and management measures as set out in the groundwater report should be implemented as far as practically possible.
2. Furthermore, it is recommended that the revised monitoring program as set out in the groundwater report should be implemented and adhered to. It is imperative that monitoring be conducted to serve as an early warning and detection system. Monitoring results should be evaluated and reviewed on a bi-annual basis by a registered hydrogeologist for interpretation and trend analysis and submitted to the Regional Head: Department of Human Settlements, Water and Sanitation.
3. It is recommended that additional monitoring boreholes, as indicated in the groundwater report, be established down-gradient of potential decant zones in order to evaluate the mass load contribution of decant water to environmental receptors. Proposed monitoring boreholes should be drilled in pairs to target shallow, weathered as well as deeper, fractured aquifer units. Drilling localities should be determined by means of a geophysical survey in order to target lineaments and weathered zones acting as preferred groundwater flow pathways and contaminant transport mechanisms.
4. Due to the impact and reduction of baseflow reporting to the on-site wetland, it is recommended that a monitoring borehole(s) be drilled in order to evaluate perched water level recovery of the wetland following rehabilitation.
5. Groundwater flow modelling assumptions should be verified and confirmed. The calibrated groundwater flow model should be updated on a bi-annual basis as newly gathered monitoring results become available in order to be applied as groundwater management tool for future scenario predictions.
6. It is recommended that supplementary geochemical characterisation i.e. kinetic leach test should be performed on carbonaceous waste material to be used as backfill material i.e. northern discard pit, with a dynamic geochemical model developed to aid in calculation of source term depletion timeframes.
7. It is imperative that the water level recovery of the underground voids as well as backfilled opencast pits be monitored on a continual basis. Stage re-watering curves should be evaluated in order to aid in the management of the mine post-closure phase in terms of decanting.
8. Alternative remedial options to reduce rainfall recharge and effective infiltration, which will lead to an increase in leachate volumes, should form part of the mine closure and rehabilitation strategy. It is recommended that the northern discard pit footprint be compacted and a barrier system (capping) and/or evapotranspiration cover be established in order to minimise water and oxygen ingress which is the drivers of acid rock drainage conditions.

9. All preferred groundwater flow pathways which are in direct connection with surface topography i.e. adits, ventilation shafts and/or unrehabilitated exploration boreholes should be sealed off and rehabilitated

Mitigation and management measures associated with the post-operational phase activities include the following:

i. Monitoring of surface water and groundwater in accordance with the implemented protocol should be continued throughout the post operational phase.
ii. Ensure that rehabilitation of backfilled opencast and mine waste facility footprints areas is properly conducted and in accordance with best practise guidelines as well as approved mine closure and rehabilitation plans. Rehabilitation should allow for free draining of runoff in order to prevent any surface water ponding.
iii. The geochemical character of the non-carbonaceous spoils material i.e. sandstone and mudstone/shale are non-acid forming and will not impact on water quality. This material can thus be utilised as backfill substance as part of the rehabilitation.
iv. The geochemical character of the carbonaceous spoils material i.e. carbonaceous shale suggests a likely capacity for acid formation. However relatively low oxidisable sulphides deem the material insufficient to sustain long term acid generation. Thus, any material of carbonaceous character can also be used as backfill substance, however it is recommended that additional geochemical characterisation be conducted to confirm this.
v. Alternative remedial options such as introducing lime within the backfilling material, thus increasing the material buffering capacity, should form part of the mine closure and rehabilitation strategy.
vi. The groundwater capture zone should return back to the pre-mining equilibrium after cessation of mine dewatering and replenishment of groundwater in storage, however the lasting effect and subsequent impact on neighbouring borehole water levels and yields should be monitored with alternative water supply sources or compensation measures available for nearby users if impacted on.

4.3.3.2 SUBSIDENCE INVESTIGATION REPORT

The content of this section has been extracted from the Existing Underground Workings Subsidence Investigation Report undertaken by Geomech Consulting (Geomech Consulting (Pty) Ltd, 2019). The specialist rock engineering study was commissioned to assess the risks of surface subsidence in the Elandsfontein Colliery mining area as a result of the existing underground mine workings on the No. 1 Seam. Please refer to Appendix 2 for a copy of the full report.

4.3.3.2.1 BACKGROUND AND CONTEXTUALISATION

Underground mining has been conducted extensively at Elandsfontein to date, however, there remain significant No. 1 Seam reserve areas which may be exploited via either underground or opencast mining methods in future. The No. 1 Seam is typically overlain by the No. 2 Seam which, to date, has only be exploited via opencast mining methods due to its relatively shallow depth across the mining area as well as the weak nature of the Shale layer which typically forms the immediate roof on the No. 2 Seam.

A large number of boreholes have been drilled within the Elandsfontein mining area to date most of which were drilled at least 10 years or more ago and, as a result, the quality of the borehole information / logging was found to be moderate to poor in some cases. Based on the available geological information, a generalised stratigraphic column for the Elandsfontein mining area has been compiled and is included in Figure 44.

As can be seen from the information included in Figure 44, the No. 1 Seam (underground mining seam) is usually overlain by a Sandstone layer which is typically between 1.0 m and 14 m thick and has been found based on the available borehole information as well as routine visits to the opencast mining operations at Elandsfontein Colliery over the past Two (2) years to be competent and massive. A thin Coal / Shale layer has however been observed in some areas within the Sandstone later immediately above the No. 1 Seam which could be expected to result in localised roof instability in certain areas but would not be expected to result in extensive failures of the roof across large mining spans.

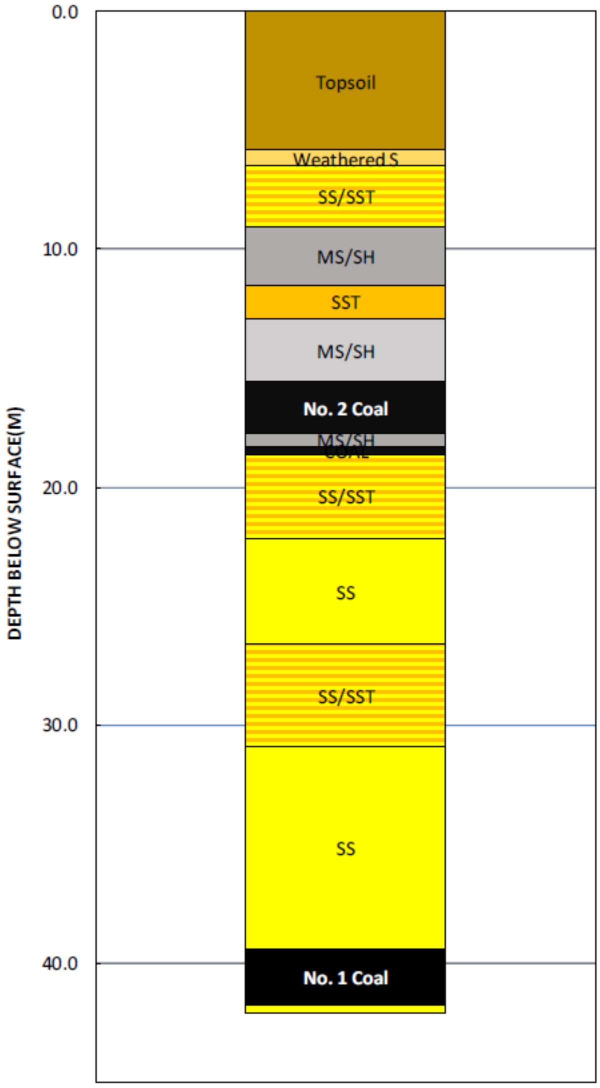


Figure 44: Generalised Stratigraphic Column for the Elandsfontein.

The Sandstone which overlies the No. 1 Seam is typically overlain by alternating layers of Siltstone / Sandstone and Sandstone which are in turn overlain by the No. 2 Seam. Generally, competent Sandstone layers have been found to constitute between 30 % and 50 % of the No. 1 Seam's overburden within the Elandsfontein mining area.

The geological logs for some of the boreholes within the Elandsfontein mining area were found to be unavailable at the time of conducting this report and, as a result, these boreholes were excluded from the various investigations detailed below. Despite the fact that some of the borehole logs were not available, a large number of borehole logs were available and therefore the findings of the rock engineering investigations included in more detail below are believed to be accurate and relevant.

Safety Factor Calculations were undertaken on the existing underground areas. For the purposes of this investigation, due to the geographical extent of the existing underground workings and the variability in pillar centres and mining depth, the existing underground workings within the Elandsfontein mining area have been sub-divided into a total of Forty-One (41) individual areas based on the geology in each area in conjunction with the underground mining layouts (pillar and bord width dimensions). These areas are depicted in Figure 45 and were generally named from South-West to North-East. In addition pillar lifespan calculations were carried out.

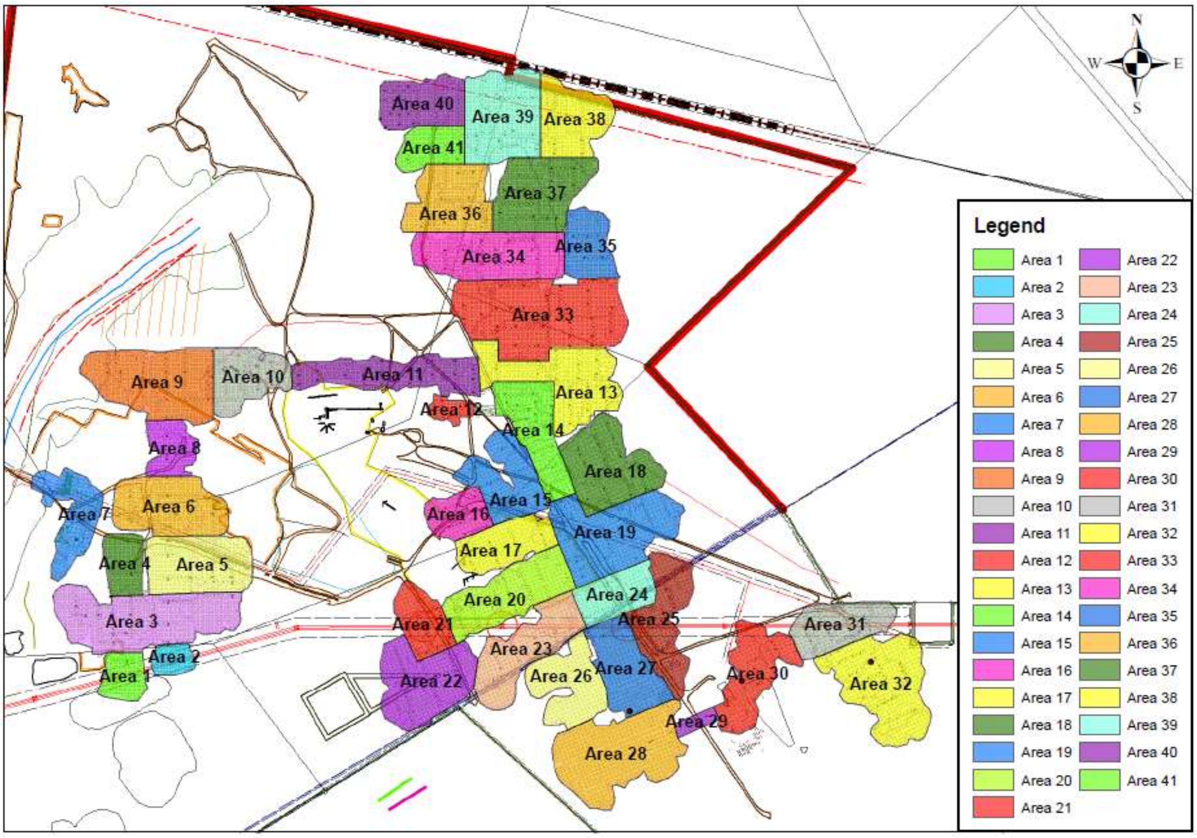


Figure 45: Identified Investigation Areas at Elandsfontein Colliery.

4.3.3.2.2 FINDINGS

Based on the results of the pillar stability investigation, safety factor calculations (included in Table 4 below) as well as the pillar life span calculations, the following can be stated:

- Due to the shallow mining depth generally at Elandsfontein Colliery, the pillar safety factors are relatively high in most areas.
- The following areas were found to have safety factors of less than 1.6 at the position of some of the boreholes when calculated using the Salamon and Munro strength formula taking into account the effect of blast damage on the pillars:
  - Area 7 (EL38/12).
  - Area 14 (EL76/96).
  - Area 18 (E75/96).
  - Area 23 (E69/96).
  - Area 33 (E05/98 & CW12/11).
  - Area 34 (E25/80, E03/98 & E02/98).
  - Area 35 (H04/94).
  - Area 37 (E04/98).
  - Area 39 (E23/80).
  - Area 40 (WEA15).

- As a result of the mining depth, the pillar safety factors were found in many areas to be relatively high despite the pillars being small to very small. In many areas the requirements of the shallow mining guidelines to have pillar widths of 6.5 m or more were often not complied with.

- As a result of the small size of the pillars in general, the pillar safety factor calculation is believed to be an optimistic assumption of the general pillar stability at Elandsfontein Colliery.

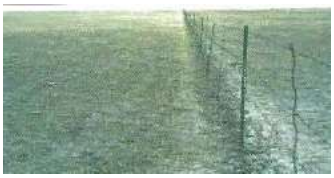
- The pillar life span calculations have indicated that the anticipated life spans of the pillars in the positions of a number of the boreholes are moderately to extremely low as a result of the underground mining dimensions. In general, the life spans of the pillars in the Elandsfontein mining area have been found to be variable (from extremely low to very high) highlighting the risk of pillar failure with time in some of the areas and the anticipated stability of the pillars in others.

- Pillar failure is believed to be possible over time in all areas in which the safety factors of the pillars are less than 2.1, the pillar widths are less than 6.5 m, the pillar width-to-height ratio is less than 2.2 and / or the pillar widths are less than 6.5 m over time.

- Life estimate for the No. 1 Seam pillars varies between 5.9 years in the vicinity of borehole D22/02, and 1 799 616 years in the vicinity of borehole CW07/11. The majority of the existing pillars at Elandsfontein Colliery have relatively short to extremely short calculated anticipated life spans as due to their small dimensions and relatively low width-to-height ratios. This indicates that there is in most areas an elevated level of risk of pillar instability over time.

The risk and possible magnitude of potential surface subsidence occurring in areas above underground workings at Elandsfontein Colliery in which pillar failure occurs as well as the risk of the formation of sinkholes in areas in which the roof above individual bords / intersections on the mining horizon fail was assessed. The assessment determined that most of the areas which have been mined at Elandsfontein Colliery to date either fall into **Class D** or **Class E** with a few panels falling into **Class C** (see Table 18).

Table 18: The Various Possible Subsidence Classes as well as the possible Surface Profile.

Class	Sm/H ratio	Description	Visual Example
A	< 0,001	Barely noticeable, smooth, continuous profile, hair-line cracks	
B	0,00–0,005	Difficult to notice, smooth profile, cracks 1 – 2 cm wide	
C	0,005–0,02	Noticeable in flat terrain, smooth, cracks 2 – 10 cm wide, compression ridges 1 to 5 cm high	

Class	Sm/H ratio	Description	Visual Example
D	0,02 – 0,05	Noticeable in most terrain, visible vertical displacements across cracks, cracks 10 – 50 cm wide, compression ridges 5 to 50 cm high	
E	>0,05	Severe profile, almost vertical sides, cracks wider than 50 cm, compression ridges higher than 50 cm high	

Sinkhole formation has been found by Hill, R. W. (1996), to be possible when mining is conducted at depths of less than 40 m which has been found to be the case in a number of areas in which underground mining has been conducted at Elandsfontein Colliery. The study found that the sandstone layers, which are present in the No. 1 Seam's overburden in the position of all of the boreholes within the Elandsfontein Colliery mining area, are expected to remain stable in the short to medium term (not taking into account the effects of jointing / weathering) over the typical mining spans in each of the Forty-One (41) areas. In the event of failure of the overburden strata in the position of boreholes L05/02, L03/02, WE36, D22/02, D17/02, D15/02 and E04/98 and progressive caving of the overburden, the caved material would not be expected to choke the void before the caving reaches the weathered zone, which may then result in the formation of sinkholes. It is for this reason that sinkhole formation is deemed possible in these areas. As indicated above, there is expected to be a significantly thick, competent Sandstone layer in the No. 1 Seam's overburden in the Elandsfontein mining area and, as a result, although sinkhole formation is deemed to be possible in these areas were the overburden material to progressively cave, the failure of the overburden strata is deemed to be unlikely and therefore the formation of sinkholes in these areas is not thought to be likely in the short to medium term[9].

4.3.3.2.3 SUBSIDENCE RISK ASSESSMENT

Based on the findings of the above investigations, a risk assessment has been conducted in an attempt to identify the areas in which the risk of pillar failure and associated surface subsidence is greatest in the short to medium term. This risk assessment can be used to highlight the immediate risk areas, but it must also be considered that some areas will be expected to become higher risk areas over time due to the relatively short life expectancy of the pillars in them as calculated above. The results of the risk assessment are illustrated on the plan included in Figure 46 below.

[9] With reference to Section 5.2 a potential existing sinkhole was observed on site. This was brought to the attention of the mine for further investigation.

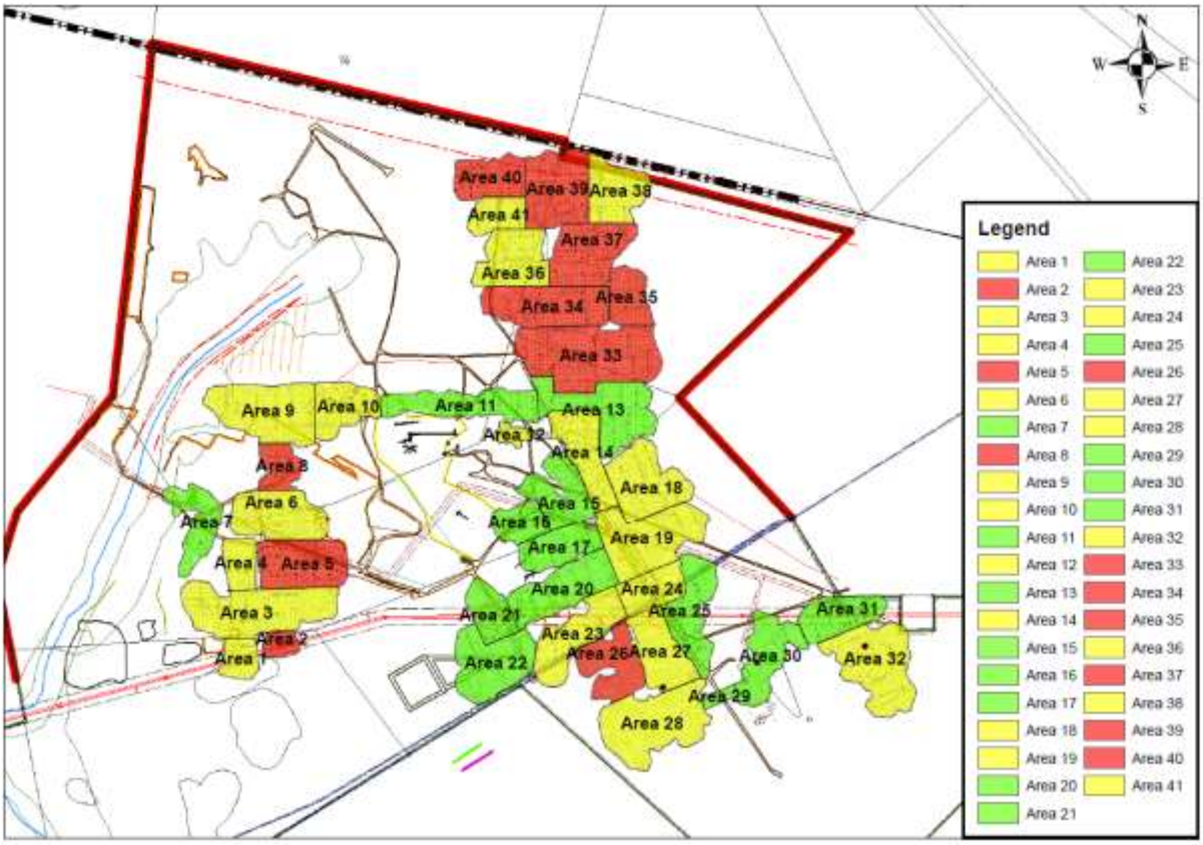


Figure 46: Illustration of the Calculated Risk Per Investigation Area.

4.3.3.2.4 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and suggestions are made, based on the investigations which have been conducted into the possibility and risk of surface subsidence as a result of failure of the existing pillars in the underground workings and / or potential sinkhole formation as a result of failure of the overburden / roof above the existing underground voids on the No. 1 Seam at Elandsfontein Colliery:

- A rock engineering investigation has been conducted to assess the risks of surface subsidence and sinkhole formation within the Elandsfontein mining area as a result of possible pillar failure in the existing workings on the No. 1 Seam.
- For the purposes of the risk assessment, the existing underground workings were sub-divided into Forty-One (41) different areas, and the stability of the existing pillars on the No. 1 Seam as well as the likelihood of sinkhole formation were assessed in all Forty-One (41) areas.
- This was done in the following manner:
  - Surface subsidence - By calculating the as mined pillar safety factors, width-to-height ratios and pillar widths and comparing them with the recommended mine design guidelines to assess their probability of failure.
  - Sinkhole formation – By using the mining parameters (i.e. pillar centers, bord widths, mining heights and mining depths) as well as the overburden strata, in each of the areas, to assess the likelihood of failure of the roof taking place underground and it potentially propagating to surface over time.
- The anticipated life spans of the pillars in the position of each of the boreholes within the project area was subsequently calculated, to assess the anticipated long-term stability / life of the existing pillars.

- Due to the variable nature of the No. 1 Seam (undulations in the floor horizon / depth and significant variations in seam thickness) in each of the Forty-One (41) areas, the worst-case scenario was assumed for this investigation based on the available borehole information for each area.
- Based on the findings of these investigations, the following can be stated:
  - Due to the shallow mining depth generally at Elandsfontein Colliery, the pillar safety factors are relatively high in most areas.
  - The following areas were found to have safety factors of less than 1.6 in the position of some of the boreholes within the area:
    - Area 7 (EL38/12).
    - Area 14 (EL76/96).
    - Area 18 (E75/96). Area 23 (E69/96).
    - Area 33 (E05/98 & CW12/11).
    - Area 34 (E25/80, E03/98 & E02/98).
    - Area 35 (H04/94).
    - Area 37 (E04/98).
    - Area 39 (E23/80).
    - Area 40 (WEA15).
  - As a result of the mining depth, the pillar safety factors were found in many areas to be relatively high despite the pillars being small to very small. In many areas the requirements of the shallow mining guidelines to have pillar widths of 6.5 m or more were not complied with.
  - As a result of the small size of the pillars in general, the pillar safety factor calculation is believed to be an optimistic assumption of the general pillar stability at Elandsfontein Colliery.
  - The pillar life span calculations have indicated that the anticipated life spans of the pillars in the positions of a number of the boreholes are moderately to extremely low as a result of the underground mining dimensions. In general, the life spans of the pillars in the Elandsfontein mining area have been found to be variable (from very low to very high) highlighting the risk of pillar failure with time in some of the areas and indicating anticipated stability of the pillars in others.
  - Pillar failure is believed to be possible in all areas in which the safety factors of the pillars are less than 2.1, the pillar widths are less than 6.5 m, the pillar width-to-height ratio is less than 2.2 and / or the pillar widths are less than 6.5 m over time.
- In addition to the assessment of the anticipated stability of the existing pillars on the No. 1 Seam, the expected magnitude of surface subsidence which may manifest were pillar failure to occur as well as the risk of sinkhole formation in each of the Forty-One (41) areas have been assessed.
- Based on the findings of the surface subsidence investigation and, as a result of the fact that mining took place on the No. 1 Seam at Elandsfontein Colliery at relatively shallow mining depths as well as the mining height and dimensions of the pillars, the magnitude and effect of the possible surface subsidence has been found to be “Moderate to Severe”.
- The investigation into the risk of the formation of sinkholes in each of the Forty-One (41) mining areas found that sinkhole formation is possible in Eight (8) of the Forty-One (41) areas which are listed below:

- Area 1,
- Area 2,
- Area 3,
- Area 5,
- Area 9,
- Area 10,
- Area 12, and
- Area 37

- While sinkhole formation is deemed to be possible in these areas as a result of the thickness of the overburden and the mining height in the underground workings (based on the borehole information) in all of the Eight (8) areas it is not deemed to be likely in the short to medium term as a result of the competency of the overburden which occurs above the No. 1 Seam within the Elandsfontein mining area.
- Taking into consideration the findings of the above investigations, a risk assessment has been conducted to identify the areas which are most at risk when it comes to pillar failure, surface subsidence and sinkhole formation in the short to medium term. These areas have been illustrated on plan and correlate directly with areas in which the pillars have been found to have low safety factors / width-to-height ratios; the No. 1 Seam was significantly thick; there is not expected to be a massive Sandstone layer in the No. 1 Seam's overburden and / or the No. 1 Seam was mined at very shallow depths. A higher risk rating (consequence) has also been applied to areas in which significant infrastructure occurs on surface (i.e. Eskom pylons and / or the railway line) which would be at risk if surface subsidence / sinkholes were to occur / form.

4.3.4 ENVIRONMENTAL RISK ASSESSMENT FOR REHABILITATION AND CLOSURE.

Elandsfontein Colliery has been in operation for a number of years and the pending EA application provides for approximately another 5-7 years of mining. This risk assessment identifies and assesses the environmental risks and potential impacts associated with the current mine. Where practical the mitigation hierarchy is applied to limit the post mitigation risk or impact significance. However certain impacts will perpetuate beyond the closure period and are identified described and assessed as residual and/or latent impacts in Section 6.

Table 19 provides a summary of the identified impacts, associated level of risk (or significance rating) both pre- and post- mitigation, the identified key management and mitigation actions, and finally the identified broad closure strategy. Please refer to Appendix 4 for a full breakdown of the risk ratings according to the scoring criteria defined in Section 4.3.1.

Table 19: Impact Assessment for Rehabilitation, Decommissioning and Closure[10].

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
Surface Water	Surface water quality deterioration – Siltation of water resource from exposed soils during active rehabilitation and until suitable cover is provided. Siltation of watercourses impacts on the water quality and the health of the downstream benthic communities. This will be especially relevant for the rehabilitation of the voids within the wetland buffers.	Decommissioning, rehabilitation, and closure phase.	-13 (Medium)	- No sediment laden water to be discharged directly to the stream or other clean water channels. - Ensure that the surface profile is rehabilitated to promote natural runoff drainage and avoid ponding of water within the rehabilitated area. - Surface inspection should be regularly undertaken to ensure that runoff is able to drain into the downstream drainage systems/rivers. - All rehabilitated terrestrial areas must be established with vegetation or alternative soil stabilisation mechanisms. - It is recommended that both berms and the drainage channels should be grass-lined to reduce erosion potential.	-9 (medium)	Free draining closure/ final landform. Closure phase monitoring and inspection- erosion and vegetation growth. Clearly defined post closure land-use plan, including relevant slope gradients applicable to different land-capabilities.
Surface Water	Surface water quality deterioration – mine water pollution. The existing surface	Decommissioning, rehabilitation,	-22.5 (high)	- Monitoring of surface water and groundwater in accordance with the proposed integrated	-16 (medium)	Intercept, contain, treat, and discharge mine affected water.

[10]The significance scores are defined as Low (<9); Medium (≥9; <17); and High (≥ 17).

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
	water features on the mine are already impacted, with coal mine pollution indicators prominent (↑SO_4, ↑heavy metals, ↓pH (acidic). The impact at most of the surface water features can be ascribed to leachate and decant of poor-quality water from backfilled opencast areas as well as flooded underground mine workings.	closure, and post closure phase.		monitoring network and protocol should be continued throughout the post operational phase. - Ensure that rehabilitation of backfilled opencast areas is properly conducted and in accordance with best practise guidelines. Rehabilitation should allow for free draining of runoff in order to prevent any surface water ponding. - Interception and treatment of mine affected water and decants.		Develop a post-closure water balance and SWMP.
Surface Water	Surface water quality impacts due to removal of infrastructure.	Decommissioning, and rehabilitation phase.	-9.75 (medium)	- Plant used during closure and rehabilitation should be well maintained to ensure that hydrocarbon spills are minimised; - Implement spills prevention and response plan; - Existing roads should be used where possible; and - New disturbed areas should be minimised.	-6.00 (low)	Spills prevention and response plan. Limit new surface disturbance.
Surface Water	Alteration to surface runoff flow volumes. It is expected that the interception of mine affected water may result in a reduction of	Decommissioning, rehabilitation,	-12.75 (medium)	- Intercept mine affected water, treat to acceptable limits, and discharge to the local tributary.	-7.5 (low)	Intercept, contain, treat, and discharge mine affected water.

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
	the interflows and other contributions to local surface water resources.	closure and post-closure phase.		- Develop and implement post closure SWMP. - Develop and implement water quality monitoring; and - Rehabilitation of all infrastructure will be implemented and will include re-vegetating, capping (where applicable) and shaping. Opencast pits and voids to be backfilled with overburden and topsoil material, shaped, and rehabilitated to promote clean runoff.		Develop a post-closure water balance and SWMP.
Groundwater	Surface and groundwater deterioration due to decant of poor-quality water from underground mine voids and backfilled opencast areas. Please refer to Section 4.3.3.1 for a detailed explanation of the impacts on groundwater.	Operation, decommissioning, rehabilitation, closure and post-closure phase.	-22.5 (high)	- Intercept mine affected water, treat to acceptable limits, and discharge. - Monitoring of surface water and groundwater in accordance with the proposed integrated monitoring network and protocol should be continued throughout the post operational phase. - Ensure that rehabilitation of backfilled opencast areas is properly conducted and in accordance with best practise guidelines. Rehabilitation should allow for free draining of runoff in	-12.75 (medium)	Free draining closure/ final landform. Recovery of any remnant coal and/or coal discard material for safe disposal. Prioritisation of carbonaceous spoils to base of pit. Collection, containment, treatment, and discharge of mine
	Hydraulic head recovery (water level rebound): During the mining operations the dewatering of the mine would have resulted in a drop in the local water table. Hydraulic head recovery and relaxation of groundwater	Decommissioning, rehabilitation, closure and post-closure phase.	+14.00 (medium positive)		+14.00 (medium positive)	

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
	gradients post cessation of mining will have a positive effect on regional groundwater levels as well as groundwater contribution to baseflow.			order to prevent any surface water ponding. - Carbonaceous materials or discard should be fully recovered and disposed of at the defined northern discard area. Rehabilitation should be conducted in accordance with best practise guidelines, including where relevant dedicated capillary layers, cover layer, evaporative covers, soil/ armouring and vegetation. - The use of any materials of carbonaceous character for backfilling should be avoided as far as possible. If unavoidable then it is recommended that disposal be prioritised and preferably form the base of newly backfilled areas to allow for saturation and reduction of oxidation. - As per the groundwater assessment further geochemical characterisation of the carbonaceous spoils material should be conducted to confirm the findings of the geochemistry tests.		affected water and decant. Management of contamination plume to prevent decant into surface water resources- options include interception, pump, and treat. Manage vertical connectivity of groundwater and surface (seal off preferential flow paths). Acceleration of pit and UG flooding. Provision of adequate post closure monitoring and rehabilitation fund. Develop and implement Post Closure Land Management and Monitoring Plan.
	Seepage from waste deposits.	Decommissioning, rehabilitation, closure and post-closure phase.	-16.00 (medium)		-5.50 (low)	
	Potential release of contamination from decommissioning of waste management facilities (incl PCD liners and sediments).	Decommissioning, and rehabilitation phase.	-21.25 (high)		-5.00 (low)	

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				- Down-gradient seepage capturing alternatives i.e. establishment of scavenger boreholes should be implemented as active mine water management techniques in order to constrain the migration of pollution plumes emanating from waste sources. - Passive treatment of decant water by establishment of functional wetland zones down-gradient of potential decant zones should also be considered. - It is recommended that excess water initially be pumped to backfilled areas to accelerate the pit flooding and leachate depletion process. However, down-gradient seepage capturing mitigation measures should be active and implemented prior to water disposal. - Treated water to be discharged to local catchments. - All material analysed can be classed as a Type 3 waste (low hazardous waste) and should be managed accordingly.		

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				- All preferred groundwater flow pathways which are in direct connection with surface topography i.e. adits, ventilation shafts and/or unrehabilitated exploration boreholes should be sealed off and rehabilitated. - It is expected that post-closure the generated pollution plume and local groundwater contamination footprint will decay and be diluted by rainfall recharge, however the lasting effect and subsequent impact on neighbouring borehole qualities should be monitored with alternative water supply sources or compensation measures available for nearby users if impacted on. - Contaminated groundwater must be contained and treated prior to release to the natural environment. If the water quality is outside of the parameters stipulated in the resource quality objectives (RQO's) a water management and treatment process should be implemented. - Monitoring of the rehabilitation of backfilled opencast areas to identify possible differential		

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				settlement and melon holes, which prevent free draining off the mine. Rehabilitate where these occur. - Kinetic leach tests must be done on the backfill materials used for the rehabilitation of the pits and the coal seams. This must determine the duration of AMD generation from these areas. The groundwater and geochemical model must be updated accordingly. - Continue operation of down-gradient seepage capturing facilities, and the consequent containment and treatment of the mine affected water until DHSWS water quality objectives are achieved. - Continued investigation into the option of alternative mine affected water treatment technologies (including passive treatment). - Due to the impact and reduction of baseflow reporting to the on-site wetland, it is recommended that a monitoring borehole(s) be drilled in order to evaluate perched water level recovery of		

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				the wetland following rehabilitation. - Contaminated wastes to be disposed of at approved facilities.		
Wetlands	Impact on wetland resources- the site has resulted in the direct and indirect impact on various wetland units and resources. This has indirect consequences for the associated ecosystem services. Degradation in riverine/wetland Present Ecological Status through water quality impairment (AMD) and loss of instream habitat and sensitive aquatic biota.	Decommissioning, rehabilitation, and closure phase.	-14.00 (medium)	- Wetlands impacted on by the site will be required to have their recommended ecological category met. These include; HGM 1, 2, and 3. - Separate clean and dirty water. Clean water must be diverted and directed around working areas, and pollution source areas, and measures or structures created to manage the discharge to avoid scouring and erosion; - Dirty water must be contained in control dams. In the event that water is required to be released, water quality must be within the target requirements for aquatic ecosystems, the DHSWS water quality objectives for the applicable catchment; - The Contractor should inform all site staff to the use of supplied ablution facilities and under no circumstances shall indiscriminate defecation and urinating be	-6.75 (low)	Implement wetland rehabilitation plan. Implement SSSPA. Develop and implement and alien invasive control and eradication management plan.

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				allowed other than in supplied facilities. A minimum of one toilet must be provided per 10 persons; - The Contractor should supply sealable and properly marked waste collection bins and all solid waste collected shall be disposed of at a licensed waste disposal facility; - Where a registered waste site is not available close to the project area, the Contractor shall provide a method statement with regard to waste management. Under no circumstances may solid waste be burned or buried; - Refuse bins will be emptied and secured; - Temporary storage of waste shall be in covered waste skips; - Riverine, wetland and drainage line areas associated buffer zones must be avoided and demarcated; - No mining must occur under rivers, wetland or drainage lines should there be a high risk for subsidence where engineering controls will not		

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				suffice to reduce the risk to a suitable rating; - Appropriate recommendations from the rock engineering study regarding pillar size must be implemented to reduce the overall risk for subsidence, particularly in regions where watercourses are undermined; - Standard surface water management must be in place, this includes clean and dirty water separation; - All surface infrastructure must be removed from the site; - Compacted areas must be ripped (perpendicularly); - A seed mix must be applied to rehabilitated and bare areas; - Any gullies or dongas must also be backfilled and rehabilitated; - The area must be shaped to a natural topography; - No grazing must be permitted to allow for the recovery of the area (only permitted under consent from rehabilitation specialist);		

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				- Attenuation ponds may be created in channels to retain water in the catchment; - An alien vegetation removal and management plan must be implemented for the from the onset of the opencast mining phase of the project to the decommissioning and closure; and - Make use of existing mining infrastructure and access routes.		
Wetlands	Subsidence potential impacts on catchment morphology and resultant modification to surface water baseflow and riverine habitat.	Decommissioning, rehabilitation, closure and post-closure phase.	-15 (medium)	- Follow the subsidence reports guidelines (Geomech Consulting (Pty) Ltd Report No. GEOM13-2019-003) on which areas can be undermined without a significant subsidence risk; and - Monitor the surface water level on a monthly basis; ensuring that the water level does not decrease substantially. - Remediate any changes in morphology as a result of subsidence.	-10.00 (medium)	Management of subsidence risks and avoid undermining of wetland and watercourses.
Air	Decline in air quality: dust from the vehicles and movement of material stockpiles.	Decommissioning, rehabilitation phase.	-6.75 (low)	- Implement effective dust control measures during rehabilitation activities. These can include	-6.00 (low)	Implement effective dust control measures.

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				limiting the speed of haul trucks; limit unnecessary travelling of vehicles on untreated roads; wetting of surfaces, application of chemical dust suppressants; or avoiding dust generating activities on windy days. - Demolition of infrastructure to have water sprays where vehicle activity is high or significant dust generated. - Rehabilitation and vegetation of mined area. - When haul trucks need to use public roads, the vehicles need to be cleaned of all mud and the material transported must be covered to minimise windblown dust. - The access road to the Project also needs to be kept clean to minimise carry-through of mud on to public roads.		Revegetation of disturbed areas.
Air / Health and safety.	Decline in air quality: combustion of carbonaceous materials. There is evidence of existing burning coal (spontaneous combustion) within the mine areas. The	Decommissioning, rehabilitation, and closure phase.	-20 (high)	- Survey, identify and remove all surface deposits of carbonaceous materials to the defined disposal location. Prevent and stop any spontaneous combustion.	-7.50 (low)	Rehabilitation of subsided areas.

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
	uncontrolled burning of this carbonaceous material results on the release of various gases including CO_2, CO, SO_2 and H_2S.			- Sealing of adits and access to underground workings. - Ensure that any sinkholes or subsidence of underground areas which propagates to surface is rehabilitated and sealed off to prevent the ingress of O_2.		Removal and disposal of carbonaceous wastes. Prevention of spontaneous combustion of wastes.
Soil Resource	Erosion of topsoil's: Erosion has a direct and indirect impact on the area. The direct impact is the removal of usable soil and the indirect is the sedimentation of water resources downslope.	Decommissioning, rehabilitation, and closure phase.	-12 (medium)	- Vehicles will be driving around on the site and must stay within the designated routes. This will prevent compaction of soils outside of the project area. If areas have been compacted the soil must be ripped to remedy the effects of compaction. - Areas where erosion is identified must be rehabilitated by creating stormwater pathways or increasing the permeability at these concentrated flow paths. - Areas identified with erosion must be rectified by replacing the topsoil and altering the erosion causing source. This can be achieved through flow dissipaters or large flat gabion structures to slow and spread flows. For steeper areas erosion berms may be constructed	-8.25 (low)	Re-instatement of vegetative cover as far as possible. Free draining closure/ final landform. Closure phase monitoring and inspection- erosion and vegetation growth.

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				3m to 5m apart to detain and slow flows		
Soils	Loss of land capability and agricultural land: The previously rehabilitated areas have been rehabilitated poorly and require supplementation.	Decommissioning, rehabilitation, and closure phase.	-16.25 (medium)	- A detailed final landform design must be undertaken, and a backfilling strategy and plan developed and implemented. - The rehabilitated area must be assessed once a year for compaction, fertility, and erosion. The soils fertility must be assessed by a soil specialist yearly (during the dry season so that recommendations can be implemented before the start of the wet season) as to correct any nutrient deficiencies; - Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; - If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; - If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;	-8.25 (low)	Implement detailed landform design and plan. Implement SSSPA. Soil rehabilitation plan to be implemented. Limit on site vehicle movements (during post operational phases) to defined routes and designated farmland areas.

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				- Only the designated access routes are to be used to reduce any further unnecessary compaction; and - Areas of subsidence must be reported and remediated as soon as possible with the best practises at the time of occurrence.		
Soils and Land Capability	Loss of soil fertility through direct disturbance and contamination (including dust suppression with dirty water).	Operation, Decommissioning, and rehabilitation.	-12.00 (medium)	- The rehabilitated area must be assessed once a year for compaction, fertility, and erosion. The soils fertility must be assessed by a soil specialist yearly (during the dry season so that recommendations can be implemented before the start of the wet season) as to correct any nutrient deficiencies; - Compaction and erosion should be monitored within the first month to gain knowledge of areas impacted upon during the decommissioning phase. - A post-mining land capability assessment should form part of a yearly monitoring program to assess the rehabilitated areas against the land capability targets set.	-3.50 (low)	Closure phase monitoring and inspection- erosion and vegetation growth. Implement SSSPA. Monitoring for surface subsidence and soil fertility.

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				- If any erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; - If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; - Only the designated access routes are to be used to reduce any unnecessary compaction; - Compacted areas are to be ripped to loosen the soil structure; - The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks; - Topsoil stockpiles are to be kept to a maximum height of 5 m; - Topsoil is to be stripped when the soil is dry, as to reduce compaction; - The subsoil approximately 0.3 – 0.8m thick will then be stripped and stockpiled separately; - The handling of the stripped topsoil will be minimised to ensure		

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				the soil's structure does not deteriorate significantly; - Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles; - The topsoil stockpiles will be vegetated in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil. - Subsidence monitoring must occur quarterly with any signs of subsidence reported; - Leaking vehicles will have drip trays place under them where the leak is occurring; and - Pipelines must be maintained. If there are leaks the pipelines must be repaired immediately.		
Soils and Land Capability	Long-term deterioration of cover through erosion and poor agricultural / land-use practice.	Decommissioning, rehabilitation, and closure phase.	-9.00 (medium)	- Maintenance of surface water management structures. - Conclude agreements with relevant surface rights holders in respect of long-term land-use restrictions and controls.	-6.00 (low)	Develop and implement Post Closure Land Management and Monitoring Plan. Rehabilitated land management and

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
						maintenance agreements.
Biodiversity	Loss of certain biodiversity sensitive areas: The regional area falls within the endangered Eastern highveld grasslands. The natural vegetation associated with the opencast areas have been destroyed and the previously rehabilitated areas poorly reinstated.	Decommissioning, rehabilitation, and closure phase.	-16 (medium)	- The areas to be rehabilitated must be accessed through the existing access routes or previously disturbed areas as far as practically possible to decrease the amount of vegetation disturbed. - The footprint area of the construction should be kept a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas. - It is recommended that a comprehensive rehabilitation plan, including a comprehensive alien vegetation management plan, be compiled, and implemented for the project; - Develop and implement a biodiversity monitoring and action plan. The monitoring and action plan must inform and guide the proposed project and prescribed clear goals and objectives that can be practically implemented and easily monitored using appropriate	-11.25 (medium)	Ensure protection of identified natural areas. Implement SSSPA. Develop and implement and alien invasive control and eradication management plan. Develop and implement a biodiversity monitoring and action plan.

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				variables. The key aspects must include the following: ○ The collation and generation of data for selected species, ecosystems and/or habitats; ○ Assess and determine the conservation status of species within specified ecosystems; ○ Prescribe aims, objectives and targets for conservation and restoration; and ○ Establish and assign budgets, timelines, reporting structures and partnerships for implementing the action plan.		
Biodiversity	Further impacts due to the continued spread and/or establishment of alien and/or invasive species: Patches of alien invasive species were noted within the unrehabilitated and previously rehabilitated areas.	Decommissioning, rehabilitation, and closure phase.	-15.00 (medium)	- Compilation and implementation of an alien vegetation management plan for the entire site, including the surrounding project area and especially the wetland areas.	-7.50 (low)	Implementation of alien invasive plant management plan. Limit on site vehicle movements to defined routes and

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				- The use of herbicide needs to be monitored and only be used by a qualified person. - Rehabilitated areas and areas not required for future activities need to be re-vegetated with indigenous vegetation to prevent erosion. This will also reduce the likelihood of encroachment by alien invasive plant species.		designated farmland areas.
Biodiversity	Displacement, direct mortalities, and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise).	Decommissioning, rehabilitation, and closure phase.	-9.00 (medium)	- Faunal species should be given the chance to escape or move away from disturbances. If any faunal species do not move off naturally then a suitably qualified specialist should be consulted to identify the correct course of action; - Staff should be educated about the sensitivity of faunal species and measures should be put in place to deal with any species that are encountered during all the phases going forward. The intentional killing of any animals including snakes, lizards, birds, or other animals should be strictly prohibited; - Restrict vehicle access outside of demarcated work areas as much as	-5.00 (low)	Limit on site vehicle movements (during post operational phases) to defined routes and designated farmland areas. Ensure free movement of small fauna into adjacent wetland/ riparian corridors. Livestock access control.

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				possible and If vehicles are to be used, make use of existing roads; - Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from the site on a weekly basis to prevent rodents and pests entering the site; - A pest control plan must be put in place and implemented; it is imperative that poisons not be used due to the likely presence of SCCs; and - All livestock must be kept out of the wetland and newly rehabilitated grassland areas in order to prevent overgrazing. Controlled (under guidance form a rehabilitation specialist) grazing can be implemented once vegetation has been established to allow for the replacement of organic carbon to the soils.		
Biodiversity	Loss/ destruction of natural habitat.	Decommissioning, and rehabilitation phases.	-9.75 (medium)	- Demarcate sensitive areas to avoid unnecessary disturbance; - Areas of indigenous vegetation, even secondary communities	-5.50 (low)	Develop and implement adequate Stormwater Management (during decommissioning,

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				outside of the direct mining footprint, should under no circumstances be fragmented or disturbed further; and - Where possible, existing access routes and walking paths must be made use of, and the development of new routes limited.		rehabilitation and closure).
Socio-economic	Increase in noise levels at surrounding receptors: The re-introduction of mining vehicles and activities within the mine areas is likely to result in increased noise and other nuisance factors.	Decommissioning, and rehabilitation phases.	-10.50 (medium)	- All employees and contractors should receive induction that includes an environmental awareness component (noise). This is to allow employees and contractors to realize the potential noise risks that activities (especially night-time activities) pose to the surrounding environment. - Ensure a good working relationship between mine management and all potentially sensitive receptors (including landowners and surrounding landowners). Communication channels should be established to ensure prior notice to the sensitive receptor if noise intensive work is to take place close to them (especially if work is to take place within 300 m	-6.00 (low)	Continuation of mechanisms for communication and engagement with local farmers/ landowner/ occupiers.

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				from them at night). Information that should be provided to potentially sensitive receptor(s) includes: ○ Proposed working dates, the duration that work will take place in an area and working times; ○ The reason why the activity is taking place; ○ The construction methods that will be used; and ○ Contact details of a responsible person where any complaints can be lodged should there be an issue of concern. - Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. Engine bay covers over heavy equipment could be pre-fitted with sound absorbing material. Heavy equipment that fully encloses the engine bay should be considered, ensuring that the seam gap		

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				between the hood and vehicle body is minimised. - In the event of consistent complaints from receptors, noise level monitoring should be initiated, and where relevant additional management and mitigation applied.		
Socio-economic	Net employment impacts: the rehabilitation activities will result in additional employment opportunities. Rehabilitation contractors may have limited opportunity for local labour (skilled or unskilled) use.	Decommissioning, and rehabilitation.	+11.00 (medium positive)	- Where possible, the mine should source labour from the local and district areas. - The mine should as far as reasonably possible employ local people to continue with the long-term closure and possible even post closure, site management and rehabilitation activities.	+13.00 (medium positive)	Utilisation of local labour.
Social	Risk of vandalism and illegal mining. The influx of illegal and informal miners to the areas has the potential to affect the success of the rehabilitation and may introduce additional mine related impacts.	Decommissioning, rehabilitation, and closure phase.	-9.75 (medium)	- Ensure that suitable site access and security is continued to prevent unauthorised access. - Monitor the rehabilitated areas to ensure that illegal/ informal mining operations do not establish. - Ensure that all open voids and underground access points are effectively decommissioned,	-4.5 (low)	Implement detailed landform design and plan. Seal all underground mine access points. Access control.

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				sealed, backfilled and rehabilitated.		
Social	Public safety: Open mine voids and underground adits can present safety risks to the landowners, livestock, and the general public.	Decommissioning, and rehabilitation phases.	-17.00 (medium)	- Seal off all remaining underground adits and access points (including open rescue boreholes/ vent shafts/ or boreholes as applicable). - Backfill and rehabilitate all voids to suitable slopes. - Restrict access to unsafe areas during the rehabilitation process. - Dismantle and remove or dispose all remnant mine infrastructure or render safe.	-7.00 (low)	Implement detailed landform design and plan. Seal all underground mine access points.
Social	Safety and security (i.e. access to properties, theft, damage to private property, fire hazards, etc.).	Decommissioning, and rehabilitation phases.	-9.75 (medium)	- All mining contractors and employees should wear appropriate identification. - Vehicles should be clearly marked for ease of identification. - Entry and exit points at the mine should also be controlled. - Avoid and control unintended burning of carboniferous materials (incl spontaneous combustion).	-6.00 (low)	Site access control Avoid and control unintended combustion of carboniferous materials.

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				- Damage to public / private infrastructure and property must be repaired or compensated for.		
Cultural and heritage	Disturbance/ destruction of historic buildings or sites; graves.	Decommissioning, and rehabilitation.	-5.50 (low)	- Maintenance of identification and demarcation of sites of heritage importance. - Mitigation measures would include fencing of the graves and burial grounds and strict avoidance of these sites.	-2.00 (low)	Demarcation and monitoring of identified heritage sites.
Subsidence and sinkholes	Instability in the underground workings may result in surface subsidence and /or sinkhole formation. This has consequent indirect impacts including: - Ponding of water on the surface; - Increased make of groundwater; - Reduction of streambed water flows; - Surface cracking at zones of expansion and contraction; - Infrastructure damage, such as cracking of walls; , damage to water pipes and electrical	Decommissioning, rehabilitation, closure, and post-closure phase.	-18.00 (high)	- Follow the subsidence reports guidelines (Geomech Consulting (Pty) Ltd Report No. GEOM13-2019-003) on which areas can be undermined without a significant subsidence risk. - Ensure that future land development over high-risk areas are informed by, and where relevant restricted. Notify the Council for Geosciences and provide subsidence risk assessment. - Undertake annual surveys of the site to determine if any subsidence has occurred and rehabilitate. Rehabilitation of subsided areas is	-12.00 (medium)	Set aside contingency material stockpile for backfilling future subsidence. Monitoring for surface subsidence.

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
	installations, damage to roadways, breaking or slackening of fences; - Risk of spontaneous combustion; - Impact on availability of surface water for fauna; - Impact on catchment morphology and resultant modification to surface water baseflow and riverine habitat; - Loss and disruption of hydropedological flow paths; - Physical alteration of surface-level leading to negative impacts on biodiversity and habitats; as well as - Increased health and safety impacts. Please refer to 4.3.3.2 for more detail on this impact. With reference to Section 4.3.3.2, it is expected that most areas an elevated level of risk of pillar instability over time			dependent on the scale of the subsidence and may include: - Interventions to reduce surface water ponding (e.g. cut off drains, trenching); - Implementing evapotranspiration to reduce groundwater make; - Repair of surface cracks through bulldozing crack and crest to more even profile, deep ripping, backfilling with inert materials, levelling to be free draining, and revegetating. - Repair and replacement of damaged infrastructure. - Surface elevation monitoring points should be installed at positions surrounding the sensitive structures such as building and road at convenient points. Annual surveys should be conducted. Survey beacons should consist of 20 mm rebar and be anchored in concrete with the anchor at least a metre deep. The protruding end of the beacon should not protrude more than 10 cm, to avoid accidental damage. Similar beacons should be installed in an		

Aspect	Impact	Applicable phase	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Closure Options/Actions
				area with similar ground conditions, more than 200 m away from any undermining to serve as control measurements. - Remove all infrastructure (not excluded due to private landowner agreement) from the mine. - Development of subsidence and settlement monitoring and response plan. - Develop management and mitigation (including contingency planning) plans for identified structures within high-risk areas. - Ensure that affected servitude rights holders are engaged with respect to the risk. - Update emergency preparedness and response plans to reflect high-risk subsidence areas. - Evaluate post closure landform design and land use for potential constraints caused by high-risk subsidence areas		

4.4 DESIGN PRINCIPLES

The principles guiding the design or the rehabilitation, decommissioning and closure plan align with those defined in the Land Rehabilitation Guidelines for Surface Coal Mines (LaRSSA, 2019). These are presented in below Table 20.

Table 20: Key principles for surface land rehabilitation.

Component	Rehabilitation principle
Regulatory compliance	• Achieving legal compliance is a minimum for appropriate rehabilitation planning. • Rehabilitation objectives and associated actions will not conflict with local legislation and will aim to complement and possibly go beyond legal compliance, where possible.
Concurrent implementation	• Concurrent, progressive rehabilitation will be undertaken throughout the operational stage of mining. • A risk-based approach will be applied to ensure concurrently implemented rehabilitation actions will achieve the desired post-mining landscape and land capability aligned with end land use targets.
Stakeholder engagement and custodianship	• Relevant mining-affected stakeholders will be identified and involved in rehabilitation planning throughout the mining lifecycle, as required. • Rehabilitation planning will leverage from local stakeholder views, experiences, cultures and/or customs, on possible uses and needs of the rehabilitated landscape, to foster a land stewardship culture from potential next land users.
Landform Management	• Rehabilitation will be undertaken and aligned to a site-specific surface landform design that will be compiled during the planning stage of an operation. • The site-specific landform design will incorporate the surface profiling needs of the target post-mining land capability and land use/s, to optimize material movement throughout the operational and decommissioning periods, and to ensure the long-term sustainability of the rehabilitated landscape. • A 'management-of-change review process' will be incorporated into the mine planning process, to ensure that changes to the mine plan do not compromise either the proposed final landform or its potential use
Land capability	• Post-mining land capability will, as far as is practically possible, be constructed to resemble the pre-mining land capability of the disturbed area. • Attention will be given to rehabilitating the site to specified land capabilities that can support a suite of mixed land uses. • Soil physical and chemical properties will be aligned to the productivity needs of the post-mining land use/s, and to support these in the long-term.
Land use	• Post-mining land use planning will consider the needs of changing regional development and planning, over time. • The site will be left in an environmentally physically safe, stable, and non-polluting condition for the defined post-mining land uses. • The defined post-mining land use/s will provide socio-economic value to next land users, as agreed with these land users (once exact post-mining land uses can be defined).
Climate uncertainty	• Predictive modelling will form the basis for longer-term environmental impact identification and risk management.
Monitoring	• Monitoring will be initiated as soon as the first ground has been moved (at construction).

Component	Rehabilitation principle
	• Monitoring will be continued progressively throughout the mining lifecycle, in parallel with concurrent rehabilitation activities. • Data obtained through ongoing monitoring will be frequently assessed for trends that could demonstrate rehabilitation success, and where corrective action may be required. • The monitoring process must be linked to a corrective action process.
Adaptive land management	• An adaptive land management approach will be adopted on-site, allowing for implementation of alternative and improved rehabilitation strategies and corrective action, where required.

4.4.1 LEGISLATIVE AND GOVERNANCE FRAMEWORK

The requirement for final rehabilitation, decommissioning, and closure stems primarily from the legislative requirements of the MPRDA and the NEMA. The relevant extracts from each of these is presented in this section.

4.4.1.1 MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT, ACT 28 OF 2002

The following extracts relate to the principle of closure for any right issued under the MPRDA:

- Section 43(1): The holder of a prospecting right, mining right, retention permit, mining permit, or previous holder of an old order right or previous owner of works that has ceased to exist, remains responsible for any environmental liability, pollution, ecological degradation, the pumping and treatment of extraneous water, compliance to the conditions of the environmental authorisation and the management and sustainable closure thereof, until the Minister has issued a closure certificate in terms of this Act to the holder or owner concerned.

- Section 43(4): An application for a closure certificate must be made to the Regional Manager in whose region the land in question is situated within 180 days of the occurrence of the lapsing, abandonment, cancellation, cessation, relinquishment or completion contemplated in subsection (3) and must be accompanied by the required information, programmes, plans and reports prescribed in terms of this Act and the National Environmental Management Act, 1998.

- Section 43 (5): No closure certificate may be issued unless the Chief Inspector and each government department charged with the administration of any law which relates to any matter affecting the environment have confirmed in writing that the provisions pertaining to health and safety, and management pollution to water resources, the pumping and treatment of extraneous water and compliance to the conditions of the environmental authorisation have been addressed.

- Section 43 (7): The holder of a prospecting right, mining right, retention permit, mining permit, or previous holder of an old order right or previous owner of works that has ceased to exist, or the person contemplated in subsection (2), as the case may be, must plan for, manage and implement such procedures and such requirements on mine closure as may be prescribed.

- Section 43 (8): Procedures and requirements on mine closure as it relates to the compliance of the conditions of an environmental authorisation, are prescribed in terms of the National Environmental Management Act, 1998.

4.4.1.2 MINERAL AND PETROLEUM RESOURCES DEVELOPMENT REGULATIONS

The following extracts from the MPRDA Regulations are specifically applicable to the preparation of this FRDCP:

- Regulation 56: Principles for mine closure: In accordance with applicable legislative requirements for mine closure, the holder of a prospecting right, mining right, retention permit or mining permit must ensure that -
    - the closure of a prospecting or mining operation incorporates a process which must start at the commencement of the operation and continue throughout the life of the operation;

- the closure of a prospecting or mining operation incorporates a process which must start at the commencement of the operation and continue throughout the life of the operation;
- risks pertaining to environmental impacts must be quantified and managed pro-actively, which includes the gathering of relevant information throughout the life of a prospecting or mining operation; in accordance with the provisions of the National Environmental Management Act, 1998, the Financial Provision Regulations, 2015 and the Environmental Impact Assessment Regulations, 2014;
- the safety and health requirements in terms of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996) are complied with;
- residual and possible latent environmental impacts are identified and quantified; in accordance with the provisions of the National Environmental Management Act, 1998, the Financial Provision Regulations, 2015 and the Environmental Impact Assessment Regulations, 2014;
- the land is rehabilitated, as far as is practicable, to its natural state, or to a predetermined and agreed standard or land use which conforms with the concept of sustainable development; in accordance with the provisions of the National Environmental Management Act, 1998, the Financial Provision Regulations, 2015 and the Environmental Impact Assessment Regulations, 2014; and
- prospecting or mining operations are closed efficiently and cost effectively.

- Regulation 61: Closure Objectives: Closure objectives form part of the environmental authorisation, as the case may be, and must-
  - identify the key objectives for mine closure to guide the project design, development and management of environmental impacts in accordance with the National Environmental Management Act, 1998 and the Environmental Impact Assessment Regulations, 2014;
  - provide broad future land use objective(s) for the site; and
  - provide proposed closure costs in accordance with the National Environmental Management Act, 1998 and the Financial Provision Regulations, 2015.
- Regulation 62: Contents of closure plan: A closure plan contemplated in section 43(3)(d) of the Act, forms part of the environmental management programme or environmental management plan, as the case may be, and must include –
  - a description of the closure objectives and how these relate to the prospecting or mine operation and its environmental and social setting;
  - a plan contemplated in regulation 2(2), showing the land or area under closure;
  - a summary of the regulatory requirements and conditions for closure negotiated and documented in the environmental authorisation, as the case may be;
  - a summary of the results of the environmental risk report and details of identified residual and latent impacts; in accordance with the National Environmental Management Act, 1998 and the Environmental Impact Assessment Regulations, 2014;
  - a summary of the results of progressive rehabilitation undertaken; in accordance with the National Environmental Management Act, 1998 and the Environmental Impact Assessment Regulations, 2014;

- a description of the methods to decommission each prospecting or mining component and the mitigation or management strategy proposed to avoid, minimize and manage residual or latent impacts;
- details of any long-term management and maintenance expected;
- details of a proposed closure cost and financial provision for monitoring, maintenance and post closure management; in accordance with the National Environmental Management Act, 1998 and the Environmental Impact Assessment Regulations, 2014;
- a sketch plan drawn on an appropriate scale describing the final and future land use proposal and arrangements for the site;
- a record of interested and affected persons consulted; and
- technical appendices, if any.

4.4.1.3 NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998)

Prior to 8 December 2014, the environmental aspects of mining activities were regulated in terms of the MPRDA. Recent legislative amendments and the drive towards a 'one environmental system' have resulted in the inclusion of the requirement for rehabilitation, decommissioning and closure planning and associated financial provisions into the NEMA. Specific sections of the Act are extracted below:

- Section 24P: Financial provision for remediation of environmental damage:

(1) An applicant for an environmental authorisation relating to prospecting, exploration, mining, or production must, before the Minister responsible for mineral resources issues the environmental authorisation, comply with the prescribed financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.

(2) If any holder or any holder of an old order right fails to rehabilitate or to manage any impact on the environment or is unable to undertake such rehabilitation or to manage such impact, the Minister responsible for mineral resources may, upon written notice to such holder, use all or part of the financial provision contemplated in subsection (1) to rehabilitate or manage the environmental impact in question.

(3) Every holder must annually-

a. assess his or her environmental liability in a prescribed manner and must increase his or her financial provision to the satisfaction of the Minister responsible for mineral resources; and

b. submit an audit report to the Minister responsible for mineral resources on the adequacy of the financial provision from an independent auditor.

(4) (a) If the Minister responsible for mineral resources is not satisfied with the assessment and financial provision contemplated in this section, the Minister responsible for mineral resources may appoint an independent assessor to conduct the assessment and determine the financial provision. (b) Any cost in respect of such assessment must be borne by the holder in question.

(5) The requirement to maintain and retain the financial provision contemplated in this section remains in force notwithstanding the issuing of a closure certificate by the Minister responsible for mineral resources in terms of the Mineral and Petroleum Resources Development Act, 2002 to the holder or owner concerned and the Minister responsible for mineral resources may retain such portion of the financial provision as may be required to rehabilitate the closed mining or prospecting operation in respect of latent, residual or any other environmental impacts, including the pumping of polluted or extraneous water, for a prescribed period.

(6) The Insolvency Act, 1936 (Act No. 24 of 1936), does not apply to any form of financial provision contemplated in subsection (1) and all amounts arising from that provision.

(7) The Minister, or an MEC in concurrence with the Minister, may in writing make subsections (1) to (6) with the changes required by the context applicable to any other application in terms of this Act.

- Section 24R: Mine closure on environmental authorisation:

(1) Every holder, holder of an old order right and owner of works remain responsible for any environmental liability, pollution or ecological degradation, the pumping and treatment of polluted or extraneous water, the management and sustainable closure thereof notwithstanding the issuing of a closure certificate by the Minister responsible for mineral resources in terms of the Mineral and Petroleum Resources Development Act, 2002, to the holder or owner concerned.

(2) When the Minister responsible for mineral resources issues a closure certificate, he or she must return such portion of the financial provision contemplated in section 24P as the Minister may deem appropriate to the holder concerned but may retain a portion of such financial provision referred to in subsection (1) for any latent, residual or any other environmental impact, including the pumping of polluted or extraneous water, for a prescribed period after issuing a closure certificate.

(3) Every holder, holder of an old order right or owner of works must plan, manage, and implement such procedures and requirements in respect of the closure of a mine as may be prescribed.

(4) The Minister may, in consultation with the Minister responsible for mineral resources and by notice in the Gazette, identify areas where mines are interconnected or their impacts are integrated to such an extent that the interconnection results in a cumulative impact.

(5) The Minister may, by notice in the Gazette, publish strategies in order to facilitate mine closure where mines are interconnected, have an integrated impact, or pose a cumulative impact.

4.4.1.4 FINANCIAL PROVISIONING REGULATIONS

On 20th November 2015, the Minister promulgated the Financial Provisioning Regulations under the NEMA (GNR1147). The regulations (as amended) aim to regulate the determining and making of financial provision as contemplated in the NEMA for the costs associated with the undertaking of management, rehabilitation and remediation of environmental impacts from prospecting, exploration, mining or production operations through the lifespan of such operations and latent or residual environmental impacts that may become known in the future. These regulations provide for, inter alia:

- Determination of financial provision: An applicant or holder of a right or permit must determine and make financial provision to guarantee the availability of sufficient funds to undertake rehabilitation and remediation of the adverse environmental impacts of prospecting, exploration, mining or production operations, as contemplated in the Act and to the satisfaction of the Minister responsible for mineral resources.
- Scope of the financial provision: Rehabilitation and remediation; decommissioning and closure activities at the end of operations; and remediation and management of latent or residual impacts.
- Regulation 6: Method for determining financial provision – An applicant must determine the financial provision through a detailed itemisation of all activities and costs, calculated based on the actual costs of implementation of the measures required for:
    - Annual rehabilitation – annual rehabilitation plan;
    - Final rehabilitation, decommission and closure at end of life of operations – rehabilitation, decommissioning, and closure plan; and

- Remediation of latent defects and residual impacts – environmental risk assessment report.

- Regulation 10: An applicant must-
  - ensure that a determination is made of the financial provision and the plans contemplated in regulation 6 are submitted as part of the information submitted for consideration by the Minister responsible for mineral resources of an application for environmental authorisation, the associated environmental management programme and the associated right or permit in terms of the Mineral and Petroleum Resources Development Act, 2002; and
  - Provide proof of payment or arrangements to provide the financial provision prior to commencing with any prospecting, exploration, mining, or production operations.
- Regulation 11: Requires annual review, assessment, and adjustment of the financial provision. The review of the adequacy of the financial provision including the proof of payment must be independently audited (annually) and included in the audit of the EMPr as required by the EIA regulations.

Appendix 4 of the Financial Provisioning Regulations provides the minimum content of a final rehabilitation, decommissioning, and closure plan. This FRDCP has been prepared to align with these requirements. Appendices 3 and 5 of the Financial Provisioning Regulations provide content requirements for the Annual Rehabilitation Plan and Environmental Risk Assessment Report, respectively. These requirements are addressed under Section 5 and 6 respectively.

4.4.1.5 OTHER GUIDELINES

The following additional guidelines which relate to financial provisioning and closure have been published in the South African context:

- Best Practice Guideline G5: Water Management Aspects for Mine Closure (Department of Water Affairs and Forestry, 2008): This guideline was prepared by the DWAF (now Department of Human Settlements, Water and Sanitation -DHSWS) and aims to provide a logical and clear process that can be applied by mines and the competent authorities to enable proper mine closure planning that meets the requirements of the relevant authorities. This guideline is aimed primarily at larger scale mine and includes certain principles related to closure and water management. The following technical factors which should be considered during closure, and those which are likely to relate to the opencast mining of coal, have been considered:
  - Broad closure principles:
    - Management measures at closure should primarily be of a passive nature with minimal long-term maintenance and operating costs;
    - The final landform must be sustainable, must be free-draining, must minimise erosion and avoid ponding;
    - Concurrent rehabilitation must be undertaken in a manner that supports the final closure landform in order to ensure/avoid that rehabilitation does not need to be redone at a later stage; and
    - Land use plan which is directly inter-linked with water management issues insofar as water is required to support the intended land use and the land use itself may have an impact on the water
  - Land use plan: directly interlinked with water management issues insofar as water is required to support the intended land use- in this regard the surrounding communities and the land uses implemented rely on available ground and surface water to be sustained. Management of water quality and quantity has been identified as an aspect to be covered in this FRDCP.

- Biodiversity plan: will address issues that are interrelated with the mine water management plan, particularly with regard to the environmental water balance and the effects that mining may have thereon.
- Social and labour plan: issues may have a bearing on water management insofar as there may be a requirement for water in implementation of these plans, e.g. use of rehabilitated mine land for agriculture.
- Cumulative impacts: from a number of sources within the same zone of impact could be an important consideration within a single mine where it refers to multiple source terms, or alternatively it could apply to the consideration of the cumulative effects of different mines.
- Risk based approach: a risk-based approach will include the risk of failure of systems or management strategies. The consequences of such failure should be taken into account and the necessary contingency and/or emergency measures should be addressed either in the management measures and/or in the financial provisions.
- Long-term water quality: For mines that exploit ore bodies containing reactive minerals (such as sulphides), the closure planning and liability assessment should pay particular attention to long-term water quality issues. Closure should not have a negative impact on other water users.
- Public participation and consultation: consultation is fundamental to closure and there is a need for full involvement of stakeholders in the development of the final closure plans, and in the agreement of closure objectives- in this regard this FRDCP has been made available through the EIA public participation process for comment by relevant stakeholders.

- Guideline for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine (Department of Minerals and Energy, 2005): The objectives of the guideline include the need to improve the understanding of the financial and legal aspects pertaining to the costing of remediation measures as a result of mining activities. Whilst this guideline predates the recent NEMA Financial Provisioning Regulations, it does contain certain principles and concepts that remain valid and have been considered in this FRDCP.
- The Land Rehabilitation Guidelines for Surface Coal Mines (LaRSSA, 2019): the guideline provides consolidated and up to date descriptions of good rehabilitation practice, and approaches to land rehabilitation specifically related to surface coal mining in Mpumalanga, South Africa. This guideline has been consulted and referenced extensively in the land rehabilitation components of the FRDCP.

4.4.2 CLOSURE VISION, OBJECTIVE AND TARGETS

The vision, and consequent objective and targets for rehabilitation, decommissioning, and closure, aim to reflect the local environmental and socio-economic context of the project, and to represent both the corporate requirements and the stakeholder expectations as well as the legislative framework and regulations.

It is important to note that mining on this site pre-dates the current environmental closure and rehabilitation regulatory requirements. As such proactive planning for a defined closure vision was not factored into the early mining and progressive rehabilitation efforts. Therefore the closure vision presented herein aims to define a realistic and practically achievable closure vision within the restrictions presented by the current state of the mining operation.

The land is currently not used for any other productive use. The surrounding area has a varied land-use character, including:

- Heavy industrial: Highveld Industrial Park, Transalloys Smelter directly adjacent to the North and north east respectively.

- Mining: There is an abandoned opencast coal mining operation located along the north western boundary of the site.
- Cultivated land: Maize plantations directly to the north-north east.
- Grazing land: Open grasslands around the site are used for livestock grazing.
- Residential: The village of Clewer is located directly to the east of the site.
- Conservation: There is a game farm and lodge located to the south of the site area.

The final closure vision must consider the current and predicted future rehabilitation opportunities and constraints. These include consideration of the following:

- Availability of adequate topsoil to achieve a sustainable and stable vegetative growth medium;
- The ability to achieve a free draining final landform;
- The suitability of the water resources to support a final post closure land use; and
- The potential for integration of the final land use with the surrounding uses.

Table 21 presents the identified threats and opportunities applicable to defining a suitable closure and rehabilitation vision.

Table 21: Closure and rehabilitation vision threats and opportunities.

Threats	Opportunities
There is currently a topsoil balance shortfall. This will restrict the ability to rehabilitate the entire mine area to allow for adequate vegetative cover substrate.	The proximity of the mine to the adjacent industrial areas and other infrastructure presents an opportunity to develop a sustainable alternative post closure land use (e.g. development of warehousing, renewable electricity, soil-less farming).
There is currently a very tight material balance. The mine will have to ensure carefule mining and rehabilitation moving foward to avoid a material shortfall.	The proximity of the mine to the adjacent residential area of Clewer provides the opportunity for land uses which can be integrated with or support the residential areas.
The predicted mine affected water plume will restrict the suitability of the groundwater resources on site for future abstraction and use.	The future mining activities can be carried out in a manner to limit the perpetuation of the restrictions listed and in so doing maximise the opportunity to develop a suitable final post closure land-capability on the site.
The findings of the subsidence risk assessment indicate that there are areas within the mining right which pose a long term subsidence and sinkhole risk. This will restrict the development of certain infrastructure on these areas.	

With reference to Section 4.2.11, the stakeholders consulted during the compilation of this closure plan raised rehabilitation and closure concerns regarding, amongst others, the following:

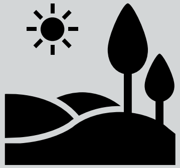
- The potential impact of activities to infrastructure including the Eskom transmission line servitude and the Sasol Gas pipeline.
- The Department of Agriculture also raised concerns regarding the potential loss of high potential agricultural soils.

With reference to both the environmental context of the project and the feedback from the consultation process the vision for closure is to:

CLOSURE VISION:
To conduct the rehabilitation, decommissioning and closure operations and manage the environmental impacts in such a manner that the long-term, post closure, land capability and environmental goods and services can continue and be utilised in a sustainable manner.

In support of achieving this post closure vision there are certain key rehabilitation, decommissioning, and closure objectives. 'Well-conceptualised rehabilitation objectives will allow assessment of the risks associated with achieving these objectives and guide the setting of suitable rehabilitation actions to be taken to mitigate these risks at every stage of the mine's life. Rehabilitation objectives describe 'what' needs to be achieved to reach the mine's rehabilitation goal. These objectives should be aligned to site-specific characteristics that are within the mine's control. Rehabilitation objectives should be as specific, measurable, achievable, and realistic as possible. They should also define a time period against which they can be measured' (LaRSSA, 2019). Driven by the closure vision and with due consideration of the project context and historical mining restrictions, the closure objectives are presented in Table 22.

Table 22: Closure Objectives, Targets and Criteria for final rehabilitation, decommissioning, and closure.

Aspect	Objective	Indicators	Target	Closure Relinquishment Criteria
Landform 	To create a planned rehabilitated landscape that meets predefined land capabilities commitments, and which has: • Suitable slope profiles for the planned land use/s and that limit the potential for erosion; and • Adequate soil cover thickness. • No remnant residue deposits post closure apart from defined northern discard facility.	Mine closure landform design. Topsoil stripping and placement register (where applicable)- topsoil source, volume stripped/ placed, depth, type, stockpile location, placement location (incl direct placement). Rehabilitated landscape slope (%). Erodibility factor of rehabilitated soils and visual erosion indicators. Topsoil cover thickness of rehabilitated landscape (mm). Land Capability class[11].	Maximise concave slopes on rehabilitated land as far as practically possible. Rehabilitated wetlands (Class I): • Soil depth must exceed 250 mm; and • Specific wetland soil used, as stockpiled from pre-mining delineated wetland areas. Rehabilitated Arable land: (Class II): • Soil depth > 600 mm • Soil material must not be saline or sodic. • Slope (%) will be such that when multiplied by the soil erodibility factor K, the product will not exceed 2,0. • Slopes must be flatter than 1:14, and free draining. Rehabilitated Grazing land (Class III): • has soil or soil-like material, permeable to the roots of native plants,	Alignment with post closure land capability plan (see Section 4.6.).

[11] The land capability classification used by LaRSSA.

Aspect	Objective	Indicators	Target	Closure Relinquishment Criteria
			that is more than 0.25 m thick and contains less than 50 % by volume of rocks or pedocrete fragments larger than 100 mm diameter. • supports or is capable of supporting a stand of native or introduced grass species or other forage plants utilisable by domesticated livestock or game animals on a commercial basis. • Soil depth ≥ 250 mm. • Slopes between 1:7 and 1:14. Rehabilitated Wilderness (Class IV): • Land that has little or no agricultural capability by virtue of being too arid, too saline, too steep or too stony to support plants of economic value. • Its uses lie in the fields of recreation and wildlife conservation. It does, however, also include watercourses, submerged land, built-up land and excavations.	

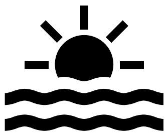
Aspect	Objective	Indicators	Target	Closure Relinquishment Criteria
			• Soil depth between 150 – 250 mm where soil cover is applicable.	
	To recreate a sustainable landform that is aligned with the long-term water management requirements, and that: • Limits ingress of water through backfilled open cast spoils that could require ongoing water management in the long-term; • Ensures adequate water availability for post-mining land use/s.	Mine closure landform design.	No unplanned ponding of water over the rehabilitated landscape. Ensure a suitable soil structure that does not have a high density or excessive blocky structure on rehabilitated pit. No unrehabilitated voids.	No unplanned ponding. Limited erosion gullies or features.
	To, as far as reasonably possible, re-create a free-draining profile across the back-filled pits, having the correct gradient for the planned land capability to support the intended land use.	Mine closure landform design. Rehabilitated landscape slope (%). Visual observations (erosion/ ponding)	Concave slopes. Slopes aligned with determine post closure land capability targets and free draining. ≥ Pre-mining drainage density. Limited erosion features (i.e. concentrated flows and unnecessary loss of topsoils). No unplanned ponding of water.	Rehabilitated areas are free draining to controlled containment and discharge points. Limited erosion gullies or features. No unplanned ponding.
	To ensure that sufficient soil (growth medium) is kept in stockpiles to backfill any areas of settlement (melon holes) so as to	Material Balance (maintained). Topsoil and softs contingency sources.	Maintain adequate contingency stockpiles (topsoil and softs) or alternative sources.	Rehabilitated areas are free draining to controlled containment and discharge points.

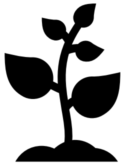
Aspect	Objective	Indicators	Target	Closure Relinquishment Criteria
	keep rehabilitated areas free-draining and to conserve land capability.			No erosion gullies or features. No unplanned ponding. Alignment with post closure land capability plan (see Section 4.6.).
	To provide long-term stabilisation of the geo-technical conditions of the disturbed mining areas.	Mine closure landform design. Slopes	Mine closure landform design to take into account: bulking factors; long-term material settlement factors. Alignment with landform design. Stable, vegetated landform slopes.	No unrehabilitated melon holes. No unplanned ponding. No erosion gullies or features.
	To limit the need for, or intensity of, long-term care-and-maintenance of recreated landforms.	Mine closure landform design.	Mine closure landform design to take into account: bulking factors; long-term material settlement factors. Alignment with landform design.	Alignment with landform design.
Soils and land capability 	Objective for soil stockpiling (where applicable): • To minimise the quantity of soil stockpiled. • To limit the time stripped soils are stockpiled. • To limit the number of times stripped soils are re-handled. • To stockpile soils by end-tipping (and increase stockpile height using	Mine closure landform design. Up to date steady state roll over mining and progressive rehabilitation. Soil stripping and handling plan-updated and monitored. Topsoil stripping and placement register- topsoil source, soil moisture, volume stripped/ placed, depth, type, stockpile location, placement location (incl direct placement).	Minimise the topsoil stockpile to the volume from box cut, operational surface preparation (e.g. roads, infrastructure, etc), and ramp up to steady state progressive rehabilitation. Limit handling of topsoils to a maximum of 2 events (i.e. stripping/stockpiling and placement). No unnecessary damage/ disruption to stockpiles.	Alignment with post closure land capability plan (see Section 3.6.). Topsoils across rehabilitated pit area (excluding defined alternative land-use areas and maintenance roads where applicable). ≥85% correlation between available soil and stripped soil. Audited compliance with soil stripping and handling plan.

Aspect	Objective	Indicators	Target	Closure Relinquishment Criteria
	shovel, if necessary), to minimise compaction. • To fertilise and revegetate stockpiled soils to maintain soil fertility and reduce soil loss via erosion.	Stockpile height. Stockpile vegetative cover and presence of invasive species. Topsoil material balance.	Ensure correlation between stockpiled soil and soil available for rehabilitation. Stockpile soils separately as defined in the soil stripping and handling plan. No domination of invasive species. Compliance with soil stripping and handling plan.	
	Objectives for soil replacement: • To minimise the loss of replaced soils. • To replace different soils types in their correct catenal position on the recreated land surface. • To minimise compaction during soil replacement. • To replace soils of the right type, to the correct depth, to achieve planned land capability targets. • To ensure sufficient soil is kept in stockpiles (or the identification of contingency sources) for longer term care-and-maintenance activities on rehabilitated land. • To ensure a planned and coordinated approach to	Mine closure landform design. SSSAP-updated and monitored. Topsoil material balance. Topsoil stripping and placement register- topsoil source, soil moisture, volume stripped/ placed, depth, type, stockpile location, placement location (incl direct placement). Level of rehabilitated soil compaction. Degree of differential settlement. Post rehabilitation soil survey.	Ensure correlation between stripped, stockpiled and replaced soil. Strip/stockpile and replace topsoils and subsoils separately as far as possible. Avoid unnecessary mixing of topsoils and subsoils. Handling of soils to be undertaken when soils are dry (i.e. >3-5% below plasticity limit). Compliance with mine closure landform design. Key soil-spoil interface (e.g. scarify compacted spoil surface prior to soil placement). Use suitable equipment for topsoil placement and levelling (e.g. dump truck and dozers).	Alignment with post closure land capability plan (see Section 3.6.). Topsoils across rehabilitated pit areas.

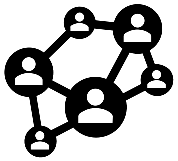
Aspect	Objective	Indicators	Target	Closure Relinquishment Criteria
	topsoil replacement and rehabilitation of previously mined areas.		Single topsoil placement and levelling-i.e. ensure accurate topsoil balance and planning. Retain 1-5% of total soil stripped for future repair work or identify a future contingency topsoil source.	
	Objectives for soil amelioration: • To optimise soil conditions conducive to improved soil structure. • To optimise soil conditions that enhance germination, facilitate root development and vegetation growth. • To improve water and nutrient use efficiency of vegetation.	Nature of the rehabilitated topsoils, including physical properties, chemical properties, and biological properties. Soil structure.	Alignment of soil condition with that required to meet the defined land capability commitments.	Alignment with post closure land capability plan (see Section 3.6.). Topsoils across rehabilitated pit areas. Soil Physical parameters: - Rock content: as low as possible (< 50 % by volume of rocks or pedocrete fragments larger than 100 mm diameter). Soil chemical parameters: - Comply with pH (KCl): between 6 and 7.5. - Salinity (as EC): <400mS/m and exchangeable sodium percentage less than 15. - Fertility: P (Bray 1); and K: Target for P – 10mg/kg to 17 mg/kg; Target for K 40 mg/kg to 250 mg/kg. - Organic Carbon: > 0.75% through depths of 250 mm.

Aspect	Objective	Indicators	Target	Closure Relinquishment Criteria
				- Major Cations: Ca= between 200-3000mg/kg-recommended ~800mg/kg; Mg= between 50-300mg/kg-recommended 150 mg/kg; Na= between 50-200mg/kg-recommended <100 mg/kg).
	To replace a soil cover of appropriate soils, permeable and with effective depth aligned with the Land Capability target.	See indicators listed for soil stripping, stockpiling, replacement, and amelioration.	See targets listed for soil stripping, stockpiling, replacement, and amelioration.	Alignment with post closure land capability plan (see Section 3.6.). Topsoils across rehabilitated pit area.
	Ensure mixed land use capabilities aligned with the planned end use and the surrounding area.	Vegetation coverage and composition.	Objective post mining land capability includes: - Class I for all wetland areas; - Class II for all planned mining areas that have a Class II pre-mining capability; - Class III for all previously mined and rehabilitated areas; and - Class IV or no functional capability for areas designated for alternative land-uses.	Alignment with post closure land capability plan (see Section 3.6.).
Water resources	To provide long-term stabilisation of the geochemical conditions of the disturbed mining areas.	- Water quality monitoring locations parameters (as defined in the water monitoring programme-see Section 4.13).	- Limit contribution of contaminated mine water (plume) to local surface water resources.	- Updated numerical groundwater model and water liability assessment.

Aspect	Objective	Indicators	Target	Closure Relinquishment Criteria
				- Updated mine water management plan (for residual and latent impacts). - Updated and secured financial provision for residual and latent impacts. - Comply with National Water Act or WUL requirements. - Compliance with GN704.
	To strive for minimal residual impact on natural water resources. Formalisation of river channels (natural and artificial).	- Water quality monitoring locations and parameters (as defined in the water monitoring programme-see Section 4.13).	- Limit contribution of contaminated mine water (plume) to local surface water resources. - Limit hydraulic connectivity between underground workings and shallow groundwater and surface water. Seal off man made preferential flow paths. - No uncontrolled and untreated release of contaminated mine decant water.	- Updated numerical groundwater model and water liability assessment. - Updated mine water management plan (for residual and latent impacts). - Compliance with GN704. - Updated and secured financial provision for residual and latent impacts. - Comply with WUL requirements.
Biodiversity	Objectives for revegetation: • To reduce soil loss to a minimum. • To optimise the efficient use of water within the rehabilitated landscape.	Mine closure plan and landform design. Vegetation structure and species composition.	Maximise concave slopes on rehabilitated land as far as practically possible.	Natural areas vegetation structure and species composition to align with local reference site: - ≥80% of the reference site species richness.

Aspect	Objective	Indicators	Target	Closure Relinquishment Criteria
	• To enable long-term functionality of the predefined land-use/s- as per section 4.6. • To form the building-blocks for a resilient ecological system (with predefined natural coverage areas), so that successional processes lead to the predefined vegetation complex.			- <10% of assessment plots failing to meet species richness target. Alien invasive plants not dominating and presence to align with, and improve on, surrounding local reference sites.
	To maintain a productive and sustainable vegetation cover within defined natural coverage areas (as per the plan in Section 4.6) that align with the surrounding references sites. Grazing land use over the rehabilitated areas (excl wetland areas) supports or is capable of supporting a stand of native or introduced grass species or other forage plants utilisable by domesticated livestock or game animals on a commercial basis. Arable land to support economic attainment of yields of adapted agronomic or horticultural crops that are at least equal to the current national average for those crops.	Vegetation structure and species composition. Arable land yields.	Sustainable natural areas. Economically sustainable and viable arable land.	Natural areas vegetation structure and species composition to align with local reference site. Presence of alien invasive plants to align with and improve on surrounding local reference sites.

Aspect	Objective	Indicators	Target	Closure Relinquishment Criteria
	To remediate the impacts to wetlands associated with the mining operation, to the target REC state and prevent further loss of ecological integrity in future through adaptive management and monitoring.	Wetland Present Ecological Status (PES). Implement wetland and watercourse rehabilitation plan.	Improve the integrity of HGM 1 to at least a PES of D (Currently Class F). Maintain, and if possible, improve, the PES Classes for HGM unit 3.	HGM 1 and 3 = Class D PES.
Infrastructure	Objectives for surface infrastructure: • To decommission, decontaminate (if necessary), dismantle and remove for safe disposal all identified surface infrastructure that has no beneficial post-mining re-use potential. • Following removal of unwanted infrastructure, to rehabilitate cleared footprint areas. • To stabilise and re-purpose remaining surface infrastructure that has a beneficial post-mining re-use potential-if any. • To identify public-private partnerships and/or new owners for the ongoing, long-term management and ownership of	Mine closure plan and landform design. Site surveys. Status of rehabilitated land. Land contamination assessments-if applicable. Conclusion of, and compliance with, post closure land-use agreements. Conclusion of, and compliance with, post closure management and maintenance plan.	Remove all unnecessary infrastructure and ensure formal handover and transfer of any remnant infrastructure. Compliance with defined land capability targets.	Alignment with post closure land capability plan (see Section 3.6.). Signed agreements for ongoing land use and management. No remnant infrastructure or waste materials remaining on surface, unless transferred in writing in the signed agreements.

Aspect	Objective	Indicators	Target	Closure Relinquishment Criteria
	remaining surface infrastructure. • To put in place formal agreements for the 'new owners' for the management and maintenance of remaining infrastructure.			
Social and economic 	To protect public health.	Public health and safety risk assessment.	Compliance with mine health and safety legislation.	Site is safe for human and animals.
	Return majority of disturbed land to useable land-uses.	Mine closure plan and landform design.	Compliance with defined land capability targets.	Alignment with post closure land capability plan (see Section 3.6.).
	To facilitate a transition from mining to viable grazing land use through effective agreements (lease/ co-operation/ sale) that promote to reinstatement of the land as a contributor to local grazing land and/or the local economy.	Conclusion of, and compliance with, post closure land-use agreements. Conclusion of, and compliance with, post closure management and maintenance plan.	Compliance with defined land capability targets.	Alignment with post closure land capability plan (see Section 3.6.). Post closure land-use agreements (covering land use, rehabilitated land management and ongoing maintenance, including where relevant management of residual impacts). No unattended public complaints. Where possible written confirmation from the affected landowner/ complainant must be solicited confirming that outstanding issues have been addressed and closed out.

Aspect	Objective	Indicators	Target	Closure Relinquishment Criteria
Climate	Ensure closure objectives and actions are climate change resilient. Ensure assessment and consideration of long-term climate change predictions in the ongoing closure planning and implementation.	Climate change predictive models. Revised and updated closure risk assessment and planning.	Obtain latest climate change predictions and ensure consideration in closure planning, risk assessments and financial provision reporting updates. Regular groundwater model updates to include climate change scenarios.	Apply latest climate change prediction to assessment of residual and latent impacts- provision of reasonable and adequate contingency funding.

4.4.3 ALTERNATIVE CLOSURE AND POST CLOSURE OPTIONS

There are various alternative closure and post closure options available. The identification and consideration of the most suitable alternatives are driven by, inter alia the following considerations:

- The ability of the selected alternative to adequately meet the specified closure vision and objectives.
- The efficiency, viability, and practicality of the selected alternative.
- The preference, where possible, for low maintenance and sustainable options.
- The alignment with the local environmental and socio-economic context and associated opportunities and constraints.

Table 23 presents some available options and alternatives related to the rehabilitation and closure process. The options in the table below that are marked with an "✓" are considered the preferred options for the purpose of this FRDCP. It is important to note that mine rehabilitation research is ongoing and consequently the available and preferred closure strategies, techniques and available technologies are developing on a continual basis which may, in the medium to long-term, lead to the identification of further closure alternatives.

Table 23: Closure alternatives

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
Opencast pits	Backfilling, shaping and levelling to achieve a sustainable post closure landform.	Backfill, shape and level all remnant voids to a free draining profile with no final voids. Please refer to 4.7.5 for more detail on the landform design. This is a feasible option for both unscheduled and scheduled closure.	Allows for maximum post closure land use potential (based on surface topography) and specifically post closure arable and/or grazing land. Slopes that minimise erosion potential, maximises slope stability and public safety. Avoidance of standing water may reduce the potential for sub-surface instability over backfilled areas and undermined areas.	Drainage from the rehabilitated landform to be discharged to natural environment. A complete backfilled and free draining landscape would in most instances mean that a final void or pit lake is not available to manage surface flows on site as well as removes the option of utilising a final void for management of AMD decant. The current material balance and landform design indicates that there is not adequate backfill material to achieve a complete free draining landscape. As such additional backfill material will need to be imported from an alternative source- there are direct and indicted financial and environmental impacts associated with such	Based on the current material balances and post closure landform designs it is anticipated that if best use of available materials is made there is likely to be adequate material to fill all voids and achieve a free draining landform. ✓

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
				alternative material source.	
		Level- free draining landform with water management voids/ pit lakes. Please refer to 3.7.5 for more detail on the landform design.	Allows for the optimisation of the landform as well as accommodating a localised water management area (evaporation). Reduced cost of loading and hauling materials. If the selected void floor contours are lower than the expected decant elevation for the high-risk areas these voids will act as permanent sinks accumulating groundwater seepage within these zones. All remaining voids (as at January 2021) have void floor contours lower that the expected decant level and as such there is no specific preference for which void is selected from a ground water perspective. Opportunity to reduce the water that requires treatment post closure as there is an increase in evapotranspiration.	The provision of a localised water containment feature (pit lake or pan) will reduce the land available for alternative land use. A final void or pit lake will result in a surface water feature that may present safety risks to humans and animals. Ponding water may contribute to the acceleration of subsurface subsidence or instability if located over undermined areas. Depending on final void morphology and limnology there may be a need to deal with long term salination and acidification of the pit water. Water will be lost from the immediate catchment through evaporation.	Considering that there is adequate backfill material, a pit lake is not the preferred alternative.

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
				Salts will be concentrated over time in the pit-lake.	
Mine pit and underground workings	AMD and Decant management (various alternatives and active management scenarios were modelled/ simulated and considered in the specialist groundwater assessment (please refer to Appendix 3 for further detail).	Numerous scenarios for post closure AMD and decant management were assessed in detail in the groundwater assessment (refer to Section 4.3.3.1 and Appendix 3). The key scenarios included: • Scenario 06a: Active (or passive) water management by establishment of scavenger boreholes down-gradient of waste facilities and backfilled opencasts; • Scenario 06d: Active water management by establishment of scavenger boreholes down-gradient of waste facilities and implementation of a lined facility for disposal of carbonaceous waste material; • Scenario 06e: Active water management by establishment of	The key differentiator used to evaluate each of the modelled scenarios was the likely change to the pollution plume footprint (against an unmitigated scenario). The findings of the modelling are summarised in Table 24. The preferred mitigation scenario 06f entails implementation of the following: • Down-gradient seepage capturing boreholes; • Placement of discard in northern discard pit; • Covering and rehabilitation of the northern discard pit; and • Removal and rehabilitation of the south eastern discard dump. The combination of the mitigation effect of the negative groundwater gradient created reduces the pollution plume footprint by ~35.0% to ~738.0ha. Accordingly, this mitigation scenario is the most likely case and preferred scenario.		Scenario 6f is selected as the preferred alternative. This alternative comparative assessment must be revised once further kinetic geochemistry results are available.

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
		scavenger boreholes down-gradient of waste facilities in combination with disposal of carbonaceous waste material in the northern discard pit; and • Scenario 06f: Active water management by establishment of scavenger boreholes down-gradient of waste facilities in combination with rehabilitation of the south-eastern discard dump, placement of discard in northern discard pit.			

Table 24: AMD and Decant Mitigation and Management Scenarios.

Mitigation and management scenarios	Plume area (pre-mitigation)(ha)	Plume area (post-mitigation)(ha)	Improvement (%)	Intercepted contact water volume (m^3/d)	Potential treatment duration (years)
Scenario 06a: Establishment of scavenger boreholes@0.15l/s	1133.00	842.00	25.68	421.00	>100.00
Scenario 06b: Implementation of a cut-off trench/ fracturing curtain	1133.00	1054.00	6.97	696.00	>100.00
Scenario 06c: Maintaining a minimum in-pit water level below decant elevation	1133.00	894.00	21.09	1491.00	>100.00
Scenario 06d: Establishment of scavenger boreholes and lined facility for carbonaceous waste material	1133.00	738.00	34.86	421.00**	50-100

Scenario 06e: Establishment of scavenger BHs, disposal of carbonaceous material in the northern discard pit including rehabilitation and capping	1133.00	738.00	34.86	421.00	50-100
Scenario 06f: Establishment of scavenger boreholes and rehabilitation of SE discard dump	1133.00	717.00	36.72	408.00	>100.00

****It should be noted that dirty surface water runoff is excluded from this volume.**

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
Mine affected water (AMD and Decant).	Water treatment options.	Several alternative active and passive treatment technologies and solutions were considered. At this stage reverse osmosis is considered as the preferred treatment option. The advantages and disadvantages are discussed.	Reverse osmosis can treat numerous types of wastewater. The process can produce an effluent that will comply with the requirements. Existing plants installed in South Africa confirm the effectiveness. Risk that effluent will not comply with the requirements is small. A modular system can be installed. Large part of the system can be salvaged for re-use elsewhere. The process is relatively easy to operate.	Certain salts will precipitate onto the membrane when their respective solubility limits are exceeded as the brine stream becomes more concentrated. The membrane may be severely affected by fouling or other scaling problems which inhibits permeability. Pre-treatment of the mine water may be required prior to the RO process. The pre-treatment process requires high quantities of lime. Large volumes of sludge/brine are produced which must be managed and disposed of. Electricity consumption is high.	Reverse osmosis selected as the preferred option due to its reliability and consistency. Once further information is available on the long term decant predictions (including findings of kinetic geochemical modelling) there may be a need to reassess the treatment options.

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
Mine waste disposal.	Waste management: The remnant mine infrastructure will need to be demolished and repurposed or disposed of.	Bury existing materials, equipment, and infrastructure in the backfilling of the pit.	Reduced cost and time.	Higher risk of contamination. Misalignment with responsible waste management practices. Potential loss of materials which may have some reuse or salvage value.	In accordance with the principles of responsible waste management practices this is not the preferred alternative.
		Assess, dismantle and dispose / salvage equipment and infrastructure.	No waste material disposed in pit. Reduced potential for pollution. Alignment with general good waste management practices.	Additional cost to drain flooded void, assess, dismantle, and dispose of materials and equipment.	Preferred alternative. ✓
	Disposal of remnant coal discard.	Disposal of discard to northern discard facility (in unlined pit).	Significantly less cost of disposal due to close proximity of pit. Reduced cost of design and establishment. Reduced risk of informal mining / vandalism and disposal to formal disposal site.	Increased pollution source term into the backfilled pits. This will result in increased pollution potential for decant. Risk of long-term spontaneous combustion.	The estimated volumes of contaminated water which will still require treatment are on the basis of the information currently available, similar whether a lined on-surface facility is established or not. The potential groundwater pollution plume associated with both

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
					options are relatively similar with disposal to a lined facility resulting in a smaller plume. Considering that polluted groundwater will require interception and treatment regardless of the waste disposal facility and the potential restriction that the surface facility may pose to achieving the closure objectives, it is suggested that the carbonaceous materials be disposed of in pit and that active water management and treatment is implemented[12]. ✓
		Disposal of discard and carbonaceous materials to a new lined co-disposal facility.	Reduced groundwater pollution potential from seepage.	Capital and operational cost for design, construction and operation of the facility.	This option is not considered as the most preferrable option. The findings

[12] It is important to note that the current model and predictions are based on the currently available data (specifically the static leach test for the discard). In order to confirm this alternative as preferrable, there is a need to undertake further investigative tests (including long term kinetic leach tests) and updating the model and risk assessment.

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
			Discard material readily available for remining or reprocessing should the need arise in the future.	Indirect environmental impacts associated with a surface waste disposal facility (e.g. visual impacts, land use sterilisation, water management, stability, security, risk of illegal remining, risk of spontaneous combustion).	of a kinetic geochemical model need to be considered in future revisions of the closure plan to confirm.
Northern Void Final Discard Dump	Capping and cover options for northern discard dump.	Design and installation of a dedicated capping layer to reduce water infiltration and oxygen ingress.	Higher likelihood of effective isolation of the waste body from oxygen and water. This is likely to reduce the volume of recharge and consequent decant volumes. Also, this is likely to result in a more effective anaerobic environment reducing risk of future spontaneous combustion.	High cost (estimated at ~R65 000 000 difference between the use of commercial cover material vs an engineered impermeable capping).	The design and installation of a capping layer is expected to be expensive in relation to the predicted benefit.
		No dedicated capping layer- this would involve preparation of the dump through levelling, dozing over with non-carbonaceous materials, compacting, and cover with evapotranspiration covers.	Reduced cost.	Additional recharge to waste materials and consequent increase in decant volumes. Section 12.6 of the Groundwater Specialist report provides decant volumes for backfilled voids as well as the decant contribution of the northern discard pit	Considering that the mine will be required to capture and treat the decant volumes and that the likely reduction in these volumes as a result of a dedicated capping is relatively small compared to the cost,

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
				when it is not rehabilitated vs. a capping and rehabilitation scenario are provided. It is noted that the facility contributes a total volume of approximately 40.0 m^3/d if not rehabilitated while the decant volume is reduced to ~ $12m^3/d$ when applying a barrier system (capping) and/or an evapotranspiration cover. Therefore the capping layer would only result in a reduction of decant volume of approximately $28m^3/d$ (~6,5% of total decant).	it is proposed that a dedicated capping system is not necessary. Proper surface preparation and compacting to reduce oxygen will be necessary to prevent future spontaneous combustion. ✓
Rehabilitated watercourse	River diversion- The lower reaches of the tributary that drains the area was canalised and diverted during 2010. This diversion remains on the mine. On the basis of historical aerial imagery it is clear that the original watercourse was directly affected by open cast mining,	Retain and formalise current river diversion. This channel would be outside of the pre-mining drainage channel location and would effectively separate clean surface water flow from the upstream catchment from reporting to the historically disturbed mine area.	This diversion has established itself and presents a basic level of ecological stability, consequently removal of the diversion will disturb the current channel with potential direct and indirect impacts on the reach and lower section of the stream. Concentrating the flow in a small channel reduces the availability of water for plant growth and therefore less	The base objective of mine closure and rehabilitation to reinstate the area to the pre-mining condition will not be achieved. There is a risk of retained flows intersecting disturbed mining areas and resulting in unnecessary pollution of the resource.	The ultimate aim is to restore the post mining landscape to align with the pre-mining environment as far as possible. It is proposed that the least impact and risk option will be to retain the existing diverted channel with the application of in-situ rehabilitation and

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
			water will be lost from the Grootspruit tributary. The channel therefore slightly increases the yield of the Grootspruit tributary.		enhancement actions. ✓
		Reinstate river hillslope seepage wetland in original position. The diversion channel will be backfilled and shaped to match the surrounding landform. The topsoil will be placed to 20cm and reseeded.	Prior to the construction of the diversion channel, the original channel appears to have been poorly-defined and would likely have been a valley bottom wetland without a channel. The diversion channel collects and concentrates the flow of the Grootspruit tributary. This robs the wetland of surface water. Reinstating the original channel provides an opportunity to reinstate the natural hydrological flows and geomorphology as close as practically possible to the pre-mining state.	The success of rehabilitation of the natural stream channel will be significantly hindered by the fact that the area was mined and the geological and soil profiles altered. It is unlikely that a stable channel will be possible over this area. The long-term management and maintenance of the efficacy of the channel will need to be accounted for. There will be short term impacts to the wetland and riparian systems due to modifications to the hydrological characteristics, loss of habitat, and sedimentation.	This is not the preferred alternative.

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
				Significant rehabilitation efforts would be required to reinstate the system functionality.	
Rehabilitated surface	Post closure land capability- This alternative is driven by the fact that at present there is a deficit of topsoil on the site. A total of 223 799 m³ of topsoil is available for use, and 227 868 m³ needs to be imported from a commercial source and stockpiled on site to achieve a 250mm topsoil cover over all applicable areas	Return entire site to the pre-mining land capability. Considering the current topsoil deficit this would likely involve importing topsoil from an external commercial source, or alternatively recreating topsoils.	Achieve the ultimate goal of restoring the post mining landscape to align with the pre-mining environment as far as possible.	Cost of importing additional topsoils. Direct and indirect environmental impacts associated with additional material sources- externalising the loss of topsoil.	The rehabilitation of the site is currently hampered by a lack of backfill material and topsoils. Taking topsoil from another site is not considered to be the preferred alternative.
		Rehabilitate site with available topsoil's. A total of 223 799 m³ topsoil is available for use for rehabilitation. If this is applied to cover the full ~180ha which requires topsoil then a topsoil thickness of ~12cm would be achievable.	This option would remove the need for the importing of additional topsoil's or the process of recreating new topsoil's in situ, and the associated additional cost.	The available topsoil would not be able to achieve a self-sustaining topsoil layer. The available topsoil is below the minimum depth for wilderness land capability, and consequently there is unlikely to be any post closure agricultural land use value. It is likely that the topsoil cover would degrade over time and result in a barren and sterile landscape.	This is not the preferred alternative.
		Develop a mixed land capability including an area	A reduction in the area of rehabilitated land that	The base objective of mine closure and	Considering the location of the mine

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
		assigned for alternative land use.	requires an arable or livestock capability will allow for more focused use of the available topsoil resources on the site. This will in turn improve the likelihood of successful rehabilitation. No additional costs associated with locating, licencing and importing additional materials for backfilling and topsoil. Potential opportunity to establish a sustainable post closure land use that can be used to diversify the local community and mine workers skill base (e.g. establishment of a solar PV facility or alternative soil-less cultivation options). The development of a solar PV facility for instance- could provide access to the electricity requirements for the long-term active water management and treatment at the mine. A soil-less cultivation option could include using alternative growth medium, hydrophonics, etc) and could provide additional or ongoing	rehabilitation to reinstate the area to the pre-mining condition will not be achieved. Specific plans and commitments will need to be made with respect to the development of the alternative land uses areas to ensure that they present a sustainable post closure land use option. Additional cost of establishing alternative post closure landuse.	(proximity to other alternative uses and markets) and the potential alternative land use options that exist, it is proposed that the feasibility of a mixed alternative land use be considered and investigated further. ✓

Mine feature	Aspect	Options	Advantages	Disadvantages	Comment
			employment in the local area.		

4.4.4 MOTIVATION FOR PREFERRED CLOSURE OPTIONS

With reference to Sections 4.4.2 and 4.4.3, the preferred closure option is as follows:

- Backfill, shape and level all voids and pits as far as practically possible. Final landform to be level- free draining.
- Ensure that future mining considers the unscheduled and scheduled closure landform designs to ensure that there is free draining landform.
- Active water management by establishment of scavenger boreholes down-gradient of waste facilities and rehabilitated pits in combination with rehabilitation of the south-eastern discard dump, placement of discard in northern discard pit, and capping the northern discard pit. These boreholes will collect mine affected water and transfer the water to a water treatment plant for treatment and discharge. At present the preferred treatment solution is reverse osmosis.
- Assess, dismantle and dispose / salvage equipment and infrastructure.
- Collect all carbonaceous wastes (including course and fine discard, coal veneers, and slurry) and dispose at the northern discard facility (pit). Once complete level to free draining, compact, cover and rehabilitate northern discard dump.
- Retain river diversion on Portion 1- with requirement to investigate the option of rehabilitation of the original channel to be undertaken.
- Investigate the feasibility of developing a mixed land use on the closed mine. This will include areas with Arable, Grazing and alternative use land capability.

Table 25 provides a list and assessment of threats, opportunities and uncertainties related to the preferred closure options. Where applicable actions to address these uncertainties are presented in Section 4.10.

Table 25: Threats, opportunities, and uncertainties associated with preferred closure option.

Item:	Description:
Threats:	Insufficient management commitment to effective rehabilitation. Landform design not implemented resulting in backfill material shortfall. Insufficient financial provision to adequately implement closure plan. Inability to identify and implement a suitable alternative land use on the defined alternative land use areas. The risk of surface subsidence and sinkholes may restrict the future development options on the site and may alter the groundwater environment modelled. SSSPA Plan not adequately implemented: The key driver for ensuring the successful rehabilitation of the area (specifically the planned future opencast areas) to functional farmland will be the management of the soils. Actual differential settlement and bulking of the rehabilitated spoils misaligned with the factors used in the landform analysis. Groundwater modelling inaccurately predicts the quantity and quality of mine affected water. Long-term climate change may result in threats (or in certain cases opportunities) for the long-term closure planning.

Item:	Description:
Opportunities:	NEMA requires annual review of the rehabilitation and closure plans and associated financial provisions- this provides an ideal opportunity to ensure that the rehabilitation process is assessed for relevance on a continual basis. The amelioration of the soils post placement, as well as ameliorating the previously rehabilitated areas, is critical to providing a good base for soil functionality morning forward. The extent of the required amelioration is defined by the condition of the placed soils. Regular soil survey can assist in predicting and providing financially for the required soil amelioration. There is opportunity for the mine to provide access of rehabilitated land to local farmers to graze or cultivate. This will provide valuable insight into the adequacy of the current closure plan. Depending on the final water treatment options selected, there may be an opportunity to make treated water available for other uses. This could be combined with the farming land uses. The development of an alternative land use may facilitate the sustainable and effective long terms use of the mine area.
Uncertainties:	There are certain criteria and parameters which are unknown which are crucial for accurate closure predictions and planning. These include actual settlement, bulking factors, site specific geological features, groundwater characteristics, etc. The recording and monitoring of these criteria based on actual conditions during rehabilitation will be critical to informing and refining the closure plans. The groundwater model should be updated based on monitoring data and the assessment of available water management and treatment options should be reviewed and revised. This report provides a cautious a risk averse approach to the management of the mine affected water and there may be opportunity to provide more refined, efficient, and cost-effective methods on the basis of detailed cost benefit analysis. An adaptive land management approach will be adopted on-site, allowing for implementation of alternative and improved rehabilitation strategies and corrective action, where required. The feasibility and preference for rehabilitating the diverted river channel to the original pre-mining channel is uncertain and should be investigated further. The actual time period and extent of potential future subsidence and sinkholes is not certain. Accurate prediction is difficult to achieve.

4.4.5 CLOSURE PERIOD AND POST CLOSURE REQUIREMENTS

The closure phase commences once the coal-extracting activities have ceased, and final decommissioning and mine rehabilitation is being completed. This phase usually ceases 3-5 years after physical closure activities are completed and the relevant relinquishment criteria are met. Once relinquishment criteria are met the holder would typically apply for a closure certificate. With reference to the defined closure vision, objectives and targets presented in Section 4.4.2 it is understood that the following key relinquishment criteria[13] are likely to affect the completion of the closure period:

- Achievement of target land capability targets, as proposed in Section 4.6.
- Rehabilitated areas are free draining to controlled containment and discharge points, and there is no unplanned ponding, or uncontrolled erosion.

[13] The detailed relinquishment criteria are presented in Table 22.

- Compliance with predetermined landform design.
- The site is safe for humans and animals.
- The high-risk subsidence and sinkhole areas are free from development and do not pose long term safety risk.
- All surface subsidence, melon holes, and sinkholes adequately rehabilitated and suitable available long term contingency material stockpiles available.
- Separation of clean and dirty water.
- Suitable topsoils and vegetative coverage without domination of alien invasive species.
- Suitably rehabilitated and functional wetland and aquatic systems- HGM 1 and 3 = Class D PES.
- Updated numerical groundwater model and water liability assessment.
- Updated mine water management plan (for residual and latent impacts).
- Updated and secured financial provision for residual and latent impacts.
- Comply with National Water Act or WUL requirements.
- Compliance with GN704.
- Post closure land-use agreements (covering land use, rehabilitated land management and ongoing maintenance, including where relevant management of residual impacts).
- No remnant infrastructure or waste materials remaining on surface, unless transferred in writing in the signed agreements.
- Apply latest climate change prediction to assessment of residual and latent impacts- provision of reasonable and adequate contingency funding.

The relinquishment criteria listed above will assist in defining the timelines for the Closure Phase and the ultimately the aim to achieve a closure certificate. Should the closure actions as stipulated in this report be implemented, then it is anticipated that the site will be ready for closure 3-5 years after the implementation of the rehabilitation actions.

There are however certain residual and latent impacts which are predicted to manifest in the post closure phase. These relate primarily to the long-term management of mine affected water and the long-term potential for subsidence. The timeframes associated with the management of post closure mine affected water are predicted as follows (Gradient Consulting (Pty) Ltd, 2020):

- A mine post-closure scenario was simulated wherein hydraulic head recovery within the proposed opencast areas was evaluated. It is calculated that the newly proposed backfilled opencast pit flooding and associated decant periods ranges between ~5.0years to >20years depending on the geometry of the backfilled pit. Expected decant volumes for the backfilled opencast pits varies from 8.0m^3/d to > 70.0m^3/d depending on the pit effective infiltration volumes. The combined decant volume is approximately ~150.0m^3/d.
- It is calculated that the existing/historical backfilled opencast pits decant volumes varies from 40.0m3/d to > 190.0m^3/d with a combined decant volume of approximately ~626.0m^3/d. It should be noted that there are various decant points potentially discharging into the wetland drainage system traversing the site.
- It is calculated that the backfilled opencast pit flooding and associated decant periods ranges between~5.0years to >20years depending on the geometry of the backfilled pit. Expected decant

volumes for the backfilled opencast pits varies from 15.0m^3/d to > 40.0m^3/d depending on the pit effective infiltration volumes. The combined decant volume is approximately 90.0m^3/d. It should be noted that there are various decant points potentially discharging into the wetland drainage system traversing the site.

The management and monitoring associated with these residual and latent risks are addressed in Section 6.

4.5 ENVIRONMENTAL INDICATORS AND MONITORING

Table 26 provides a list of the environmental impacts identified for the rehabilitation, decommissioning, and closure of the project. In addition, environmental indicators are identified for each impact, together with proposed monitoring requirements. The indicators and monitoring will aim to inform ongoing rehabilitation and remediation activities. These indicators will also inform the assessment of whether the closure objectives have been adequately met.

Table 26: Environmental Indicators and Monitoring requirements

Aspect	Impact	Phase[14]	Monitoring Requirements	Indicators	Closure Targets
Water Resources	Surface water quality deterioration – Siltation of water resource from exposed soils during active rehabilitation and until suitable cover is provided	D, R, CLO	Surface water and groundwater monitoring, water quality trend analysis (quarterly for D,R, Clo and bi-annual for PC). Water levels (Monthly). Aquatic and wetland monitoring (annual). Refer to requirements for subsidence and sinkholes below.	South African National Standards (SANS 241: 2015). WMA Resource Quality Objectives (RQO)- water quality analysis to compare with target water quality objectives. Aquatic and wetland PES.	Water quality downstream of mining area within WMA Target Water Quality Objectives. Monitoring of wetlands that have been rehabilitated by a wetland specialist to ensure the REC has been achieved (PES D for HGM 1 and 3).
	Alteration to surface runoff flow volumes.	D, R, CLO, PC			
	Surface and groundwater quality deterioration – mine water pollution/ AMD.	O, D, R, CLO, PC			
	Surface water quality impacts due to removal of infrastructure.	D, R			
	Hydraulic head recovery (water level rebound)	D, R, CLO, PC			
	Seepage from waste deposits.	D, R, CLO, PC			
	Potential release of contamination from decommissioning of waste management facilities (incl PCD liners and sediments).	D, R,			
Wetlands	Impact on wetland resources	D, R, CLO			

[14] Phase/abbreviation: Construction (Con); Operation/mining (O); Rehabilitation (R); Decommissioning (D); Closure (Clo); Post Closure (PC)

Aspect	Impact	Phase[14]	Monitoring Requirements	Indicators	Closure Targets
	Subsidence potential impacts on catchment morphology and resultant modification to surface water baseflow and riverine habitat.	D, R, CLO, PC			
Air	Decline in air quality: dust and particulate matter, and release of gases from combustion.	D,R, CL, PC	Monitor dust fallout and PM10 (if applicable). Complaints register. Visual inspections for spontaneous combustion- operational phase into post closure. Refer to requirements for subsidence and sinkholes below.	Dust fallout. Public Complaints. Incidents of spontaneous combustion.	Compliance with National Dust Control Regulations. No unattended public complaints. No spontaneous combustion.
Soils	Direct and indirect impacts on the soil resources: Erosion of topsoil's and subsoils; Loss of land capability and agricultural land; Loss of soil fertility; and long-term deterioration of cover through erosion and poor agricultural / land-use practice.	O, D, R, CLO	Surface water monitoring, water quality trend analysis. Monitoring of soils to be undertaken: • Bi-weekly visual inspections during rehabilitation phase to ensure compliance with Soil stripping, stockpiling, placement, and amelioration plan (SSSPA). • Land capability and Soil Fertility analysis annually during wet season between completion of rehabilitation and closure to inform further amelioration.	Soil loss (in m^3/ha/an). Erosion channels, gullies, donga's. Soil fertility. Contamination. Compaction. Erosion. Topsoil management and replacement procedures. Land Capability Classifications. Vegetation coverage and densities.	No uncontrolled discrete erosion occurrence. Soil loss rates to align with pre-mining rate or suitable adjacent comparative reference site. Compliance with SSSPA. Land Capability: • Class I for all wetland areas; • Class II for all planned mining areas that have a Class II pre-mining capability; • Class III for all previously mined and rehabilitated areas; and

Aspect	Impact	Phase[14]	Monitoring Requirements	Indicators	Closure Targets
			• Visual inspection (for discrete erosion incidents as well as general soil loss). • Visual inspections of depressions or erosion during all phases up until end of closure- bi-weekly during rehabilitation; quarterly during closure phase; every 5 years during post-closure. • Visual inspection of vegetative growth (monthly during closure period).		• Class IV or no functional capability for areas designated for alternative land-uses.
Biodiversity	Loss of certain biodiversity sensitive areas.	D, R, CLO	Aquatic and wetland monitoring (annual).	Aquatic and wetland PES.	Monitoring of wetlands by a wetland specialist to ensure the REC has been achieved (PES D for HGM 1 and 3).
	Spread and/or establishment of alien invasive species.	D, R, CLO	Visual inspection of vegetative growth (monthly during closure period) and compliance monitoring with alien vegetation eradication control and management plan.	Extent and composition of alien invasive.	Alien invasive extent does not exceed pre-mining state or state of adjacent comparative land.
	Displacement, direct mortalities, and disturbance of faunal community.	D, R, CLO	Visual inspections (monthly during closure period). Faunal Observation register.	#'s and type of faunal observations.	Maintain and sustain defined natural biodiversity to align with pre-mining state or appropriate reference site.
	Loss/ destruction of natural habitat.	D, R	Visual inspection of demarcated sensitive areas.	Status of habitat-vegetation coverage.	

Aspect	Impact	Phase[14]	Monitoring Requirements	Indicators	Closure Targets
Socio-economic	Increase in noise levels at surrounding receptors.	D, R	Monthly sound level measurements at noise sensitive receptors if required- noise monitoring to be triggered by complaints. Complaints register.	Environmental noise level (L_{Aeq}). Public complaints.	Compliance with noise control regulations for a rural noise district. No unattended public noise complaints.
	Net employment impacts.	D, R	Annual Social and Labour Plan Monitoring and Report.	Employment/ Unemployment statistics. SLP Compliance scores.	Compliance with SLP requirements.
	Risk of vandalism and illegal mining.	D, R, CLO	Visual inspections- security and access control, any signs of unauthorised activities- monthly during decommissioning, rehabilitation, and closure period.	Signs of unauthorised activities on site.	No unauthorised activities, or illegal mining.
	Public safety.	D, R, CLO, PC	Visual inspections- monthly during decommissioning and rehabilitation.	Safety risk assessments and site hazards.	No unrehabilitated mine voids/ shafts/ boreholes. Rehabilitated slopes to be safe and not pose hazard to humans or animals. No un-controlled human and animal safety risks.
	Safety and security.	D, R	Visual inspections- monthly during decommissioning and rehabilitation.	Signs of non-compliance with specified management and mitigation measures. Presence of unauthorised persons	Compliance with closure actions and stipulated management and mitigation measures.

Aspect	Impact	Phase[14]	Monitoring Requirements	Indicators	Closure Targets
				on site (incl illegal miners).	
Cultural and Heritage	Disturbance/ destruction of historic buildings or sites; graves.	D, R	Visual inspections- monthly during decommissioning and rehabilitation.	Signs of non-compliance with specified management and mitigation measures.	No disturbance to identified and defined cultural and historic resources.
Subsidence and sinkholes	Instability in the underground workings may result in surface subsidence and /or sinkhole formation.	D, R, CLO, PC	Annual surface elevation monitoring surveys of the site (including relevant reference locations) to determine if any subsidence has occurred, or ponding is taking place, and rehabilitate. Baseline and closure topographic survey comparison. Visual inspections for surface cracks.	Surface elevation comparisons. Sinkholes and surface depressions.	No un-repaired surface subsidence or cracks. Available contingency backfill and topsoil stockpiles- or alternative financial provision for importing material.

4.6 FINAL POST CLOSURE LAND USE

The ultimate aim of most closure and land rehabilitation is to return the land to the same or similar state to what it was pre-mining. In order to inform this target it is important to have a clear understanding of what the pre-mining land-use and land capability was. Land-use is the way land is used by people for a defined purpose and may comprise one or more land uses. In most instances, one landscape can support numerous land-uses within the constraints of land capability, creating a multifunctional landscape.

The greater majority of the land is currently not used for any productive agricultural use. There is a small portion of land on Portion 44 (north east corner of the mining right) where maize is being cultivated and the remainder of the natural veld areas are being used for informal grazing.

No detailed land capability assessment was undertaken prior to mining of the historic mine pits and therefor no objective basis for establishing the post-mining land use is available. The description of the land capability was included in the 2017 EIA (Digby Wells Environmental, 2017) and the results of this broad regional assessment indicated that roughly the western half of the study area was classified as Class II Intensive Agriculture, and the remaining eastern half was Class III Moderate Cultivation.

A detailed site-specific land capability assessment was undertaken as part of the soil specialist assessment in the latest EIA focusing on the remaining undisturbed areas on the site. The Coaltech/LaRSSA methodology was used in addition to the more detailed Smith (2006) methodology to determine the pre-mining land capability for the area (refer to Section 4.2.6.2). This has been carried out for post-mining land capability comparisons. The land capability classes as per this methodology are described in Table 10 and Figure 33.

Table 27 provides a description and designation for the proposed post closure and rehabilitation land capability. The spatial extent of this is presented in the final closure plan (Figure 47). The land capability classes presented herein align with the typical land capability classes utilised in the South African mining industry and presented in the Land Rehabilitation Guideline for Surface Coal Mines (LaRSSA, 2019).

Table 27: Post-closure land capability objectives

Proposed Land-capability class	Description of land-capability class	Areas of applicability:
Class I: Wetland	Class 1 land capability has the following characteristics: • Soil depth must exceed 250 mm; and • Specific wetland soil used, as stockpiled from pre-mining delineated wetland areas.	All identified and delineated wetland areas affected by the mining activities.
Class II Arable Land	Class II land capability has the following characteristics: • Soil depth > 600 mm • Soil material must not be saline or sodic. • Slope (%) will be such that when multiplied by the soil erodibility factor K, the product will not exceed 2,0. • Slopes must be flatter than 1:14, and free draining.	Class II for all planned opencast mining areas (i.e. primarily pit H) that have a Class II pre-mining capability. All areas which have a pre-mining land capability of Class II and which are not planned for mining related disturbance to be maintained as Class II.
Class III: Grazing Land	Class III Grazing land conforms to all of the following requirements: • has soil or soil-like material, permeable to the roots of native plants, that is more than	Class III for all planned opencast mining areas (i.e. primarily pits F and G) that have a Class III pre-mining capability.

Proposed Land-capability class	Description of land-capability class	Areas of applicability:
	0.25 m thick and contains less than 50 % by volume of rocks or pedocrete fragments larger than 100 mm diameter. • supports or is capable of supporting a stand of native or introduced grass species or other forage plants utilisable by domesticated livestock or game animals on a commercial basis. • Soil depth ≥ 250 mm. • Slopes between 1:7 and 1:14.	All areas which have a pre-mining land capability of Class III and which are not planned for mining related disturbance to be maintained as Class III. All previously mined and rehabilitated areas.
Class IV: Wilderness and/or developed land	Class IV Wilderness confirms to the following requirements: • Land that has little or no agricultural capability by virtue of being too arid, too saline, too steep or too stony to support plants of economic value. • Its uses lie in the fields of recreation and wildlife conservation. It does, however, also include watercourses, submerged land, built-up land and excavations. • Soil depth between 150 – 250 mm where soil cover is applicable. The potential alternative land-use options (e.g. Solar PV facility; or soil-less cultivation options) would be located on this area.	The area developed for alternative land use. Watercourses. Remaining areas which are not developed to include limited soils surface.

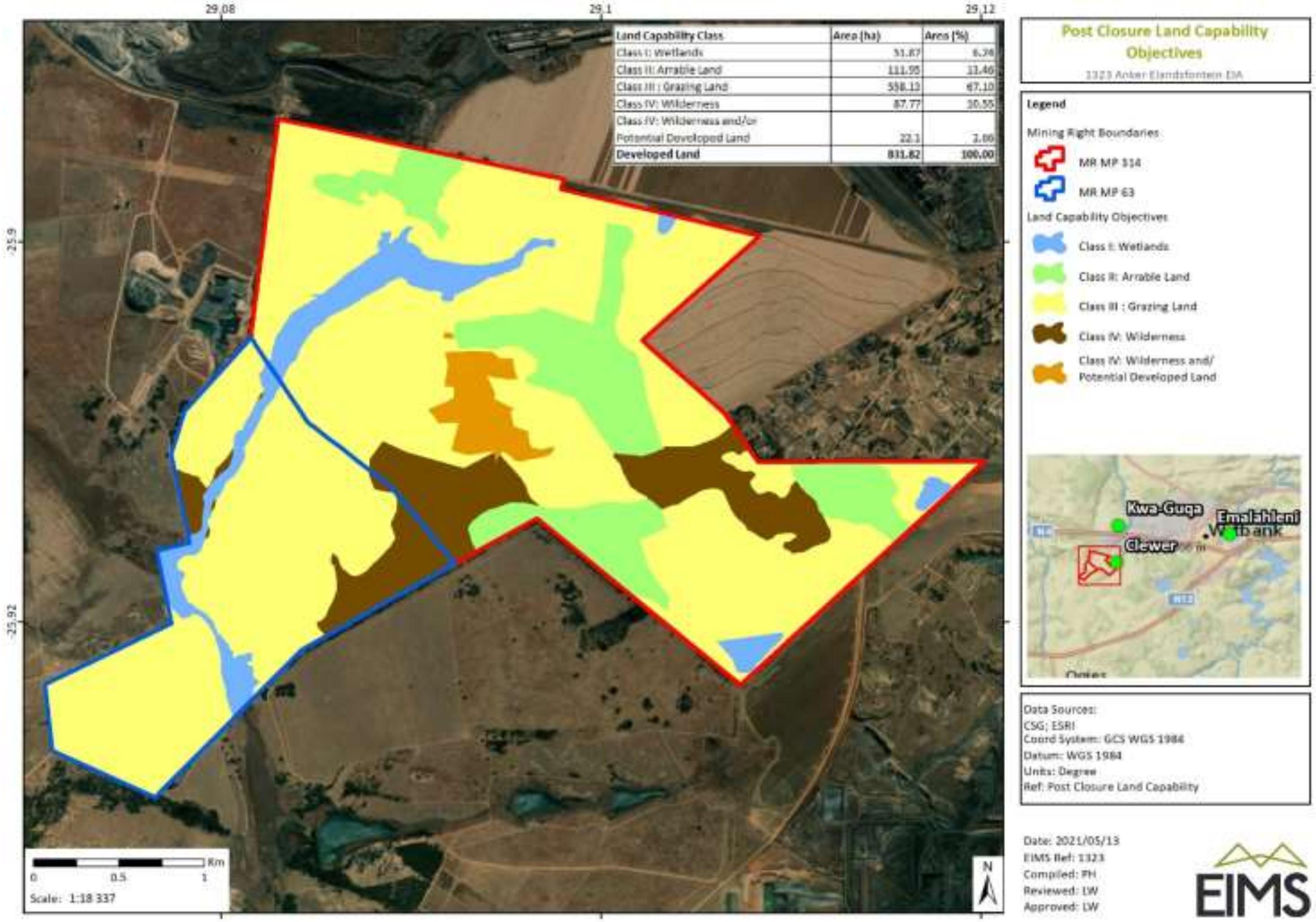


Figure 47: Proposed final post closure land use plan.

4.7 CLOSURE ACTIONS

In order to align with the defined closure plan and final land use objectives, the mine will need to implement a series of actions which addresses the mines infrastructure, facilities, and rights area, as well as ongoing maintenance and management thereof. These actions and obligations apply to all infrastructure, activities, and aspects both within the mine lease area and off the mine lease area which were associated with the mining activities and over which the mine has responsibility.

The closure components which are applicable to the Elandsfontein Colliery include the following:

- Preparation and planning for closure- This includes all of the tasks leading up to the finalisation of the closure plan for implementation.
- Dismantling and removal of any on site infrastructure- this will include remnant mine infrastructure which is not to be retained and handed over for future use by the landowner. This specifically includes but is not limited to: Steel buildings and structures; reinforced concrete and brick buildings and structures; offices; workshops, weight bridges; stores and related structures and infrastructure.
- Rehabilitation of access roads- except for roads to be retained for use by the landowner or to monitor and maintain the rehabilitated landscape.
- Rehabilitation of the open cast areas and mining voids.
- Sealing and rehabilitation of shafts, adits and inclines.
- Removal and safe disposal of remnant wastes including coal, discard, or carboniferous deposits.
- The removal and placement of stockpiles (including overburden and spoils) not utilised as topsoil.
- Removal and safe disposal of processing waste deposits, including PCD's and evaporation ponds/ dams.
- General surface rehabilitation- including soil bed preparation, erosion control, soil placement, soil amelioration, planting of vegetative covers, and alien invasive species removal and control.
- Rehabilitation of current and future subsided areas (to be dealt with as a latent impact on Section 6).
- Wetland and watercourse rehabilitation.
- Ongoing Monitoring required to monitor the rehabilitation progress, compliance, and success (refer to Section 4.13).
- Management of water within the site- this will include the management and maintenance of surface water controls, as well as ongoing closure phase monitoring of the water resources. The management of polluted mine water into the post-closure phase will be included and dealt with as a residual and latent impact in Section 6.
- Maintenance and aftercare- Maintenance and aftercare is typically applied during the closure period (i.e. once active rehabilitation and closure is completed and ending once a closure certificate is obtained). Typically, aftercare and maintenance include general maintenance activities including, soil amelioration (incl fertilization), ongoing monitoring, control of alien invasive, and surface stability and settlement actions. It should be noted that for the purposes of this report and the associated financial provisions, that the relevant monitoring and maintenance/ aftercare actions are included in the other closure components listed above.

Table 28 provides a breakdown of the key closure actions applicable to the mine. All actions listed in the post closure phase will be addressed and accommodated as residual and latent impacts. It is also important to note that the actions listed in Table 28 are aimed at achieving the objectives and targets specified in Table 22. It is also critical to reduce the impacts and disturbance to the environment as far as possible by implementing the mines operational EMPr.

Table 28: Key closure actions applicable to the life of mine phases.

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
Planning and preparation for Closure	- Develop FRDCP. - Application for EA, WML and/or WUL (as applicable to implement closure plan) for decommissioning and closure activities (at least 18 months prior to scheduled closure). - Appointment of dedicated rehabilitation specialist to ensure ongoing implementation of rehabilitation and closure actions and plans. - Ensure that sensitive environmental areas and soil stockpile areas are clearly demarcated to prevent unnecessary disturbance. - Develop a change management procedure to manage the impact of any changes to the mine plan. - Develop local stakeholder and public communication forum/ mechanisms to communicate rehabilitation progress and facilitate grievances. - Develop a site-specific temporary stormwater management plan for rehabilitation phase. - Develop closure and cover design for northern discard area.	- Implementation of final FRDCP. - Develop a post closure water balance and SWMP. - Implementation and assessment of environmental monitoring as defined in this FRDCP. - Annual review and update to FRDCP- including review of monitoring data and updated risk assessment. - Regular consultation with I&AP's on closure planning and rehabilitation progress, and any intrusive activities. - Regular awareness training on rehabilitation and closure commitments to all site staff and contractors- including sensitivity of flora and faunal species, noise control, sensitive areas, etc.	- Implementation of final FRDCP. - Implementation of Closure SWMP. - Prepare final closure groundwater model update to inform post closure residual and latent impacts.
Dismantling and removal of any on site infrastructure	Pre-emptive planning for post closure land-use including development of surface infrastructure inventory and the identification of infrastructure	- Removal of all services, structures, machinery, and infrastructure unless these are specifically required for post-mining land-use, post-mining	- Ongoing rehabilitation monitoring and maintenance until relinquishment.

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
	which is available for reuse and repurposing post closure.	projects or have been requested by the post-mining landowner. - Establish formal agreements for any infrastructure handed over for third party use, and management. - All identified infrastructure should be broken down to natural ground level. Inert materials to be buried in the final voids, shafts, or at a suitably licenced facility. - Remove all power lines, except the main feed lines leading to Eskom's substations. - Dismantle and dispose of all fences that do not form part of post-closure property boundaries, as defined by the post mining land use plan. - Dismantle and dispose of all conveyor belts. - Areas where infrastructure was demolished should be assessed through a risk-based system to determine if there is any residual contamination or risk and appropriate remediation measures implemented. Where contaminated material is detected, this should be removed and disposed of. - Profile the area to be free draining. - Remove and rehabilitate all Stormwater management infrastructure not required in the final closure plan. - Apply SSSPA to areas that are to be rehabilitated.	

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
		- Implementation of the waste management plan. - A waste and infrastructure hierarchical principal should be applied to all decommissioned infrastructure or wastes, as follows: Reduce, re-use, recycle, dispose. - Topsoil rehabilitation as per the SSSPA. - Monitor and manage dust generated from decommissioning activities to relevant standards.	
Rehabilitation of access roads	Develop mine rehabilitation phase traffic/ transport layout plan to utilise existing access routes where possible and minimise unnecessary access roads.	- Restrict vehicular movements to designated access and haulage routes to avoid unnecessary soil compaction. - Conclude final closure layout plan defining access roads required for ongoing monitoring, management, and maintenance. - Retained access roads to be designed in accordance with relevant engineering standards and specifications- including specific management of stormwater. - Closure, decommissioning, and rehabilitation of all access roads (incl associated structures, signage, culverts, etc) unless these are specifically required for post-mining land-use, post-mining projects, or have been requested by the post-mining landowner.	- Ongoing rehabilitation monitoring and maintenance until relinquishment. - Restrict vehicular movements to designated access routes to avoid unnecessary soil compaction.

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
		- Remove 100 mm of contaminated soil from haul roads, dispose in the Northern Discard Pit and rehabilitate - Deep rip all compacted areas prior to rehabilitation. - Topsoil rehabilitation as per the SSSPA. - Revegetation as per the revegetation plan. - Apply dust suppression (e.g. water sprays) where necessary.	
Rehabilitation of the open cast areas	Develop a post-mining surface landform design (considering defined objectives and targets) for rehabilitated box-cuts, mine pits, and voids. The landform design must consider: - Volumes of coal removed. - Expected bulking factors. - Long-term material settlement factors. - Reduce slope length on rehabilitated areas with excessive slope length by increasing drainage density, where possible. - Land capability commitments (refer to Section 4.6): ○ Class I: wetland areas. ○ Class II (arable): all planned opencast mining areas (i.e. primarily pit H) that have a Class II pre-mining capability	- Reduce slope length on rehabilitated areas with excessive slope length by increasing drainage density, where possible- to be accommodated and provided for in the final landform design. - Monitoring, including measurement of real bulking, settlement, assessment of material balances, rehabilitated soil surveys, drainage patterns and densities. Assess findings of monitoring (incl bulking, settlement, and soil surveys) and where relevant amend landform design to comply with defined objectives. - Manage erosion and sedimentation. - Manage the effects of surface settlement on the re-profiled landscape. - Develop a post closure landform stormwater management plan. - Ensure that the final landform is safe for humans and animals.	- Ongoing rehabilitation monitoring and maintenance until relinquishment. - Manage erosion and sedimentation.

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
	and Class II areas not directly affected by mining; ○ Class III: all planned opencast mining areas (i.e. primarily pits F and G) that have a Class III pre-mining capability; all previously mined and rehabilitated areas; and Class III areas not directly affected by mining . ○ Class IV: the area developed for alternative land use; and remaining areas which are not developed to include limited soils surface. - Water management requirements: ○ Increased infiltration to pit area up to recovery of natural water level. ○ Reduced surface water infiltration to pit area once natural ground water levels have recovered. ○ Post closure stormwater management. - Implement ongoing progressive backfill and rehabilitation during operational roll over mining. - Implement rehabilitation actions related to current rehabilitation backlog- refer to Section 5.3 and 5.4. - Pit Lake/ Final Void (if required following material balance and landform design):	- Ensure that rehabilitation of backfilled opencast areas is properly conducted and in accordance with best practice guidelines as well as approved mine closure and rehabilitation plans. - Carbonaceous discard to be collected and disposed of at the northern pit. - Carbonaceous shales or carbonaceous waste rock should be used to backfill the pits first, followed by the overburden and then soils. - Rehabilitation should allow for free draining of runoff in order to prevent any unplanned surface water ponding and must be implemented in accordance with the approved landform design. - Comply with the SSSPA and revegetation plan. - The soils underlying the stockpiles that are to be used for backfilling must be assessed (physical and chemical) and ameliorated where applicable. The relevant sections of the SSSPA and revegetation plan must be implemented on these areas.	

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
	○ Design of pit lake to flood as much of the connected backfill areas as possible. ○ Avoid excessive variation in pitlake levels (to avoid higher salt levels). ○ Shallow and elongated pitlakes are more conducive to wind-induced mixing dissolved oxygen through the whole water column and the reduction in the solubility of some heavy metals. ○ Oxygenated water is also beneficial for pitlake ecological systems, such as algae growth, biota and aquatic vegetation. ○ Ensure pit lake is fenced until water level has recovered, to prevent safety risks to humans and animals.		
Sealing and rehabilitation of shafts, adits and inclines.	-	- All preferred groundwater flow pathways which are in direct connection with surface topography i.e. adits, ventilation shafts and/or unrehabilitated exploration boreholes should be sealed off and rehabilitated. - Shaft sealing designs must be developed by a suitably qualified engineer and would typically include: ○ Deposition of inert building rubble into shaft- backfilled materials should be	- Ongoing monitoring of shaft area for settlement or compromised plug- rectify where necessary.

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
		allowed to settle or be compacted prior to plugging/ capping. ○ Placement of a concrete plug/ cap of >1m. ○ Provision of methane venting if applicable. ○ Shaft sealing to be designed to prevent future access to the underground workings or vertical migration of groundwater.	
Removal and safe disposal of remnant wastes including coal, discard, or carboniferous deposits.	- Undertake thorough site survey to identify and inventory waste residues sources and final disposal locations. - Undertake further investigative tests on the discard materials and update the groundwater model, risk assessment, and closure alternative options assessment. This must include long term kinetic leach tests to determine the long-term pollution potential of the discard, piezometric tests of the backfilled areas to confirm the recharge values. - Develop an engineered cover solution to limit recharge to the Northern Pit discard site.	- A waste and infrastructure hierarchical principal should be applied to all decommissioned fencing or materials, as follows: Reduce, re-use, recycle, dispose. - Removal and disposal of waste streams as follows: ○ General: Sort and screen waste, and reuse/recycle or dispose at licenced facility. ○ Concrete / inert demolition waste: Dispose to pit. ○ Steel: Dispose of steel at licenced recycling or disposal facility. ○ General waste: Transport and dispose of general waste at a licenced facility.	- Ensure no remnant wastes present on site. - Ongoing monitoring and measurement of discard facility water qualities, levels, and recharge rates.

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
		○ Hazardous waste: Transport hazardous waste to the licenced hazardous waste disposal facility. ○ Coal (including coal veneers on mine areas and access routes), discard, old slurry ponds, and carboniferous wastes: remove and dispose at Northern pit (within current licence provisions) or alternative licenced facility. - Placement of coal, discard or carboniferous materials into unlicenced facilities is prohibited. - Remove slurry from slurry dam basin and dispose in the Northern Discard Pit. - Test sediment and residues in the PCD's and dispose accordingly. - Implement a cover solution to limit recharge to the Northern Pit discard site and reduce backfill porocity. This may include liming of the discard, compacting, placement of a suitable evapotranspirative cover.	
The removal and placement of stockpiles (including overburden and spoils) not utilised as topsoil.	- Prepare material balance and associated landform design. - Implement rehabilitation actions related to current rehabilitation backlog- refer to Section 4.3 and 4.4.	- Placement and levelling of stockpiles as per the landform design. - Soil replacement to take place once backfilled landform is complete, shaped, and stable. - Preparation, placement, and amelioration of the topsoil must be done in compliance with the soil stripping, stockpiling, placement, and amelioration plan (SSSPA).	

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
		- No driving will be permissible on any rehabilitated areas as this will compact the topsoil and all efforts to reduce the impacts previously would be rendered null and void. - Any contamination of the topsoil on surrounding areas must be avoided by ensuring machinery is well maintained and leak free. If contamination has occurred the area must be remediated and ameliorated immediately. - Stockpile footprints following removal of all soils for rehabilitation, must be landscaped (shaped and levelled) to natural contours, ripped to loosen all soil, and revegetated. - Fertility of the topsoil would need to be assessed and rectified/ ameliorated if required. - The rehabilitated area must be re-vegetated in accordance with the post closure mine plan and monitored for success. - Manage and remediate surface erosion.	
Removal and safe disposal of processing waste deposits, including PCD's and evaporation ponds/ dams.	-	- Pump and treat remnant polluted water from PCD's. - Remove liners and residue and dispose at suitably licenced facility or northern discard pit. - Remove and dispose of associated structure and infrastructure (e.g pipelines, etc) at suitably licenced facility. - Breach dam wall and shape to a minimum of 1:5 (V:H).	Ongoing monitoring to ensure no erosion, ponding and adequate revegetation.

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
		- Backfill, and shape PCD area to allow free drainage. - Comply with the SSSPA and revegetation plan.	
General surface rehabilitation (incl backfilled open cast areas and voids, stockpile areas, compacted areas, etc).	- Undertake detailed soil survey of future mining areas and update the soil stripping, stockpiling, placement, and amelioration plan (SSSPA)(refer to 4.7.1) and associated topsoil balances. - Develop revegetation plan. - Develop alien vegetation eradication control and management plan (AVECMP)	- The removal and/or disturbance of previously unaffected topsoil's must be avoided as far as possible and limited to the existing areas of disturbance. - Implement SSSPA. - Implement AVECMP. - Implement revegetation plan. Seeding and planting to be done at, or immediately after, the first rains in spring, and into freshly prepared, fine-tilled seedbeds (where soils are not prone to crusting). - Annual audit of SSSPA. - Placement of topsoil cover as per defined closure land use plan. - Placement of supplementary topsoil on preciously rehabilitated areas which have inadequate cover. Where replacement topsoil is not available, the existing topsoils must be supplemented and ameliorated as per the SSSPA. - Where practically possible, black soils (in stockpiles or incorrectly rehabilitated areas) should be used for rehabilitation of low-lying areas and/or drainage systems.	- Implement defoliation on established grasses and vegetation under direction of rehabilitation specialist- to allow for reintroduction of organic matter. - Ongoing rehabilitation monitoring (including soil surveys) and maintenance until relinquishment. - Ongoing rehabilitation of eroded areas through a root cause investigation and rectification approach. - Annual soil fertility assessment. - Soil amelioration activities based on the findings of fertility assessments. - Comply with land capability commitments. - Implement AVECMP. - No driving will be permissible on any rehabilitated areas. - Implement controlled livestock grazing once vegetation is

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
		- No driving will be permissible on any rehabilitated areas. - Implement amelioration as per the SSSPA. - Any contamination of the topsoil on surrounding areas must be avoided by ensuring machinery is well maintained and leak free. If contamination has occurred the area must be remediated and ameliorated immediately. - No dust suppression with dirty/ contaminated water. - Monitoring, including review and assessment of soil balances, soil surveys (stripped, stockpiles, and placed). - Large boulders and rocks must be removed from rehabilitated areas and added to the backfilled voids.	established. Restrict access of livestock newly rehabilitated unless specifically required for defoliation as instructed by a suitably qualified rehabilitation specialist. - Ongoing rehabilitation monitoring and maintenance until relinquishment. Including but not limited to: Alien invasive monitoring and management, erosion control and remediation, vegetation growth and supplementation).
Rehabilitation of current and future subsided areas	- Development of subsidence and settlement monitoring and response plan. This will include a risk inventory and risk mitigation plan for all infrastructure which may be affected by high-risk subsidence areas. - Develop management and mitigation (including contingency planning) plans for identified structures within high-risk areas. - Ensure that affected servitude rights holders are engaged with respect to the risk. - Update emergency preparedness and response plans to reflect high-risk subsidence areas.	- Implementation of subsidence and settlement monitoring and response plan.	- Implementation of subsidence and settlement monitoring and response plan. - Repair and rehabilitate subsidence and sinkholes.

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
	- Evaluate post closure landform design and land use for potential constraints caused by high-risk subsidence areas.		
Wetland and watercourse rehabilitation	- Develop a wetland and watercourse rehabilitation plan- to be developed by wetland specialist and hydrologist. Aim to achieve PES D for HGM 1 and 3.	- Implement wetland and watercourse rehabilitation plan. - Where possible the replaced soil profiles (i.e. sequence and depth), and the compaction in each horizon, should aim to mimic the pre-mining conditions. - Prevent direct disturbance to the wetland and riparian areas including overgrazing or vehicular movement. - Removal of concrete structures. - Fill culvert voids. - The steep river channel banks (including river diversion on portions 1 and 8) must be reshaped to a gentle gradient (35 degrees or less) to allow for natural revegetation while avoiding erosion of the banks. - Revegetation of all exposed river banks must take place. Plants must carefully be removed from the river banks designated for reshaping, and must be stored for replanting post reshaping; - River bank reprofiling activities (where watercourse and wetland has had direct impacts-including river diversion) should take place with a downstream approach, beginning with upstream areas and moving in a	- Ongoing rehabilitation monitoring and maintenance until relinquishment. Including but not limited to: Alien invasive monitoring and management, erosion control and remediation, vegetation growth and supplementation). - Establish and maintain relevant buffer areas around rehabilitated wetlands and watercourses.

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
		downstream direction. Construction should only excavate, complete the rehabilitation (with revegetation) for small sections of project area at a time, rather than the entire river at once, to curb the level of erosion and sedimentation of downstream areas at once. This will further allow the recovery process to begin immediately, without further disturbance from upstream construction works; - Signs of erosion must be addressed immediately to prevent further erosion of the watercourse banks; - Additionally, measures must also be considered to implement constructed wetlands at likely decant areas, and the planting of trees to reduce groundwater recharge; - Decommission cut-off berms and drains last; - Uncontaminated debris must be placed in preferential flow paths where required to avoid erosion; - Implement landform design, SSSPA and revegetation plan.	
Rehabilitation Monitoring	- Develop a monitoring plan for decommissioning, rehabilitation, closure, and post closure.	- Implement monitoring plan	- Implement monitoring plan
Water Management	- Existing decant must be intercepted, collected, treated and discharged.	- Comply with GN704. - All preferred groundwater flow pathways which are in direct connection with surface	- Comply with GN704.

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
	- Update numerical groundwater model. Utilise model to define and assess: ○ Extent and timing of groundwater cone of depression. ○ Extent and timing of mine affected water pollution plume. ○ Extent and timing of potential decant of mine affected water. - Additional monitoring boreholes, as indicated in the groundwater report should be established down-gradient of potential decant zones in order to evaluate the mass load contribution of decant water to environmental receptors. Proposed monitoring boreholes should be drilled in pairs to target shallow, weathered as well as deeper, fractured aquifer units. Drilling localities should be determined by means of a geophysical survey in order to target lineaments and weathered zones acting as preferred groundwater flow pathways and contaminant transport mechanisms - Undertake supplementary geochemical characterisation i.e. kinetic leach test should be performed on carbonaceous waste material to be used as backfill material with a dynamic geochemical model developed to aid in calculation of source term depletion timeframes. - Monitor water level recovery of the underground voids as well as backfilled	topography i.e. adits, ventilation shafts and/or unrehabilitated exploration boreholes should be sealed off and rehabilitated. - Ensure that rehabilitation of backfilled opencast areas is properly conducted and in accordance with best practice guidelines as well as approved mine closure and rehabilitation plans. - Removal and disposal of coal and discard materials as described above. - Any material of carbonaceous character (incl carbonaceous shales) can only be used to form the base of newly backfilled areas to allow for saturation and reduction of oxidation. - Revegetate as soon as reasonably possible. - Continue monitoring including general water quality and water levels in surrounding areas, water inflow volumes to the rehabilitated voids. - Material most likely to generate acidic leachate should be placed in the deepest parts of the voids, or at least below the pre-mining groundwater elevation to minimise the oxidation of metal sulphides (pyrite). - Update numerical groundwater model – every 3 years. Amend the mine closure plan where necessary based on the results. - Installation of down-gradient seepage capturing alternatives i.e. establishment of	- Develop and implement a closure stormwater management plan. - Ongoing rehabilitation monitoring and maintenance until relinquishment. Including but not limited to erosion control, water monitoring. - Ongoing operation of mine affected water collection, treatment, and disposal solutions. - Update and implement groundwater management plan. - Update numerical groundwater model. Specific attention to be placed on long-term water liability assessment. - Amend the residual and latent impacts risk assessment and closure plan associated financial provisions. - Manage and remediate the effects of surface settlement on the re-profiled landscape- maintain free draining surface.

Closure component	Planning (pre-commencement of rehabilitation)	Decommissioning and Rehabilitation (1-3 years)	Closure (up to relinquishment (3-5 years)
	opencast pits on a continual basis. Stage re-watering curves should be evaluated in order to aid in the management of the mine post-closure phase in terms of decanting. - Re-evaluation of final discard disposal options on the basis of the findings of the kinetic leach tests. - Groundwater flow modelling assumptions should be verified and confirmed. The calibrated groundwater flow model should be updated on a bi-annual basis as newly gathered monitoring results become available in order to be applied as groundwater management tool for future scenario predictions - Develop a predicted post-closure water balance. - Apply relevant climate change predictions to post closure groundwater model and predictions and update risk assessment.	scavenger boreholes or seepage capturing cut-off trenches should be implemented as active mine water management techniques in order to constrain the migration of pollution plumes emanating from waste sources. - Where a pit lake is unavoidable, ensure that pitlake is flooded as rapidly as possible in order to exclude further sulphide oxidation from occurring	
Social and economic change management	- Determine status of SLP and associated commitments. - Update SLP where relevant. - Public review and comment on rehabilitation, decommissioning, and closure planning.	- Regular consultation with I&AP's on closure planning and rehabilitation progress, and any intrusive activities. - Implement SLP obligations. - Develop final land management and maintenance plan with relevant landowners.	- Implement land management and maintenance plan.

4.7.1 TOPSOIL STRIPPING, STOCKPILING AND PLACEMENT PLAN

This section presents a management plan and guide for the stripping (where applicable), stockpiling (where applicable) and placement and amelioration of topsoils. This soil stripping, stockpiling, placement, and amelioration plan (SSSPA) applies to the future management of soils on the project site. Strict adherence to this plan will assist in ensuring successful and sustainable rehabilitation.

4.7.1.1 SOIL STRIPPING GUIDE

The stripping of topsoil and vegetation (and stockpiling) is by far the most important steps to reduce or mitigate some of the impacts associated with the loss of soil as a resource and land capability.

In the event that soils (topsoil and subsoil) must be stripped then it must be ensured that stripping and consequent handling and stockpiling must be separated according to the topsoil and the subsoil. Handling of soils to be undertaken when soils are dry (i.e. >3-5% below plasticity limit).

Topsoil will be stripped with the current vegetation cover unless the vegetation is dominated by alien vegetation. The stripping of the vegetation along with the topsoil will ensure that there is organic matter as well as a seed bank carried into stockpiling these soils. This will assist in the soil chemical and biological properties being maintained for a longer period than if the vegetation was removed before stripping. The area to be cleared must be cleared as late as possible to reduce any erosion of the remaining bare area, which could lead to sedimentation into the surrounding environment.

The stripping of the topsoil must be done by using a bucket excavator (tracked not wheeled excavator to be used) and loaded onto the back of dump trucks to be moved to their allocated stockpile locations. This reduces the compaction and disturbance of soil profiles (Bulldozers compact and disturb soil profiles) and will assist in the rehabilitation efforts. The soil must also only be moved once to where the stockpile is allocated, and the trucks are to dump the soil to a maximum of 5m high. No driving will be permissible on any topsoil stockpiles as this will compact the topsoil and all efforts to reduce the impacts previously would be rendered null and void.

Any contamination of the topsoil must be avoided by ensuring machinery is well maintained and leak free. If contamination has occurred the area must be ameliorated immediately.

A detailed soil plan has not been developed for Elandsfontein Colliery. On the basis of the high-level soil survey undertaken for the EIA it is expected that a topsoil cover ranging between ≥250mm (for Class III) to ≥600mm (Class II) occurs on the undisturbed areas. The measured B-horizon is fairly varied depending on the landscape position ranging from 300mm to 2.4mm below surface level. It is recommended that a site-specific detailed soil survey and associated stripping plan be developed for the site prior to the stripping of future opencast areas. With respect to the soil stripping plan the following should be noted:

- Soil stripping must take place a considerable distance from mining activities before the extension of mining boundaries to avoid degradation;
- Delineated soil boundaries must be demarcated;
- Cut-off horizons must be defined in simple terms in order for all stripping operators to understand;
- Soil stripping activities must be supervised to ensure that soils aren’t mixed;
- Soil stripping must take place when moisture content minimises compaction;
- Strip and replace in one action where possible; and
- Shovel (excavator) and truck must rather be used than bowl scrapers.

4.7.1.2 SOIL STOCKPILING

In the event that any new soil stockpiling is required then the requirements and specifications of this section should be adhered to.

The impacts to consider are those relating to when the soil is stockpiled, the soil's chemical properties will deteriorate unless effectively managed. The soil beneath the stockpiles are also impacted through compaction of the soil and also the generation of anaerobic conditions in the soil below the stockpile. This changes soil chemistry altering the soil health. This all leads to the loss of the topsoil layer as a natural resource. Soil is considered a slowly regenerating resource due to the fact that it takes hundreds of years for a soil profile to gain 10cm of additional soil through natural processes. During a single rainfall event on unprotected bare soil (e.g. unvegetated soils, or unprotected stockpiles), erosion could remove that same amount of soil if not more.

If the topsoil and subsoil are stripped and stockpiled as one unit, the topsoil's seed bank and natural fertility balance is diluted. This will affect the regrowth of vegetation on the stockpiles as well as the regrowth of vegetation when the soils have been replaced during the rehabilitation process. Therefore soils should be handled with care from the construction phase through to the decommissioning phase.

The stockpiles themselves must, where possible, be placed in locations of land capability lower than the target rehabilitation capability. The stockpiles must be placed in their final location and must not be moved until the time comes to use the soil for rehabilitation. The topsoil is to be no higher than 5m and dumped off the back of the dump truck into its final location. No shaping of the topsoil stockpile is allowed, and no vehicles are allowed to drive on top of the stockpiles at any time. This will lead to compaction and hinder the success of rehabilitation. Handling of soils to be undertaken when soils are dry (i.e. >3-5% below plasticity limit). Stockpiles must be phytostabilised and revegetated, and fertility must be monitored and corrected once a year to improve rehabilitation success.

Topsoil stockpile contamination must be prevented by avoiding the dumping of hazardous material next to stockpiles, as well as avoiding any contamination through the pumping of mine water to flow near the stockpiles.

4.7.1.3 EROSION CONTROL DURING STRIPPING AND STOCKPILING

Erosion can remove topsoil which cannot be replaced and therefore erosion must be avoided, controlled, and mitigated. The stripping of vegetation and topsoil must be left as late as possible to reduce the amount of time that the area is bare. The bare area will increase runoff potential and with it there is an increased risk of erosion. Erosion has a direct and indirect impact on the area. The direct impact is the removal of usable soil and the indirect is the sedimentation of water resources downslope.

Topsoil stockpiles which are to remain in place for longer than 12 months (e.g. the contingency stockpiles for long terms rehabilitation and remediation), must be revegetated as soon as possible and monitored once a year to assess fertility and erosion risks. Vehicles driving around on site must stay within the designated routes. This will prevent compaction of soils outside of the project area. If areas have been compacted the soil must be ripped to remedy the effects of compaction.

Stormwater management structures must be used to control natural water flows and to reduce flow velocity where possible. Stormwater discharge points must utilise erosion control measures specific to the situation required.

4.7.1.4 TOPSOIL PLACEMENT

Once final landform design has taken place and all other stockpiled material has been placed and levelled (or disposed) soils (topsoil and subsoil) can be placed. The recommended depth of topsoil across the site is as follows, based on the post closure land-use plan (refer to Section 4.6):

- Class I wetland: >250mm wetland soils;
- Class II arable: >600mm;
- Class III grazing: >250mmArable land capability; and
- Class IV: Wilderness and/or developed land: where soil placed, must be >150mm.

For adequate topsoil to be placed and consequently for rehabilitation to succeed it is crucial that adequate topsoil depth is placed. On the basis of rough calculations done based on the January 2021 Survey (refer to Section 4.1.2.4) it is expected that there will not be adequate stockpiled topsoil's to be able to achieve the minimum cover (~250mm) across the current areas that require rehabilitation. For the future mining it is anticipated that if the SSPA is adhered to, that there will be adequate topsoil to achieve the rehabilitation targets for these future areas. There may be an opportunity, depending on the findings of a detailed soil survey on the future areas, to reallocate a portion of the newly stripped topsoil to assist in reducing the overall topsoil shortfall.

A total of 223 799 m³ topsoil is available for use, leaving a shortfall of 227 868 m³. Provision has been made in the financial provision to import the deficit from a local commercial source and stockpiled on site to achieve a 250mm topsoil cover over all applicable areas.

Considering the possibility that importing topsoils from an external commercial source is likely to result in externalising the topsoil impact, it is recommended that the option of supplementing the existing available topsoils be investigated. This may include the following:

- Select suitable subsoil, saprolite or other earthy material (avoid >35% clay and 70% sand);
- Mix in chicken litter, manure, or mulch at 1 part organic matter to 9 parts soil material (by mass);
- Apply the mixed organic matter and soil material to site;
- Determine lime and fertilizer requirements and apply;
- Establish to, and maintain as, grass using conventional grassing procedures; and
- Undertake intensive aftercare (maintain fertility and repeatedly top-dress with N fertilizer, allow grass to grow, cut and remove cuttings) until soil function is established.

The placement of the topsoil must be done by using a bucket excavator (parked adjacent to the topsoil stockpile and NOT on top of the stockpile) and loaded onto the back of dump trucks to be moved to their allocated final rehabilitation locations. This reduces the compaction and disturbance of soil profiles and will assist in the rehabilitation efforts. Placement of soils should be done by direct dumping according to a calculated volume. Topsoils should, as far as possible, be placed on the backfilled areas in the same or similar landscape position to that of the source (i.e. red/yellow soils in high lying landscape positions and black soils on low-lying areas). The placement of topsoils should be planned and executed in consultation with a soil specialist. Dumped soil should be spread by using a tracked dozer. Handling of soils to be undertaken when soils are dry (i.e. >3-5% below plasticity limit). No driving will be permissible on any rehabilitated areas as this will compact the topsoil and all efforts to reduce the impacts previously would be rendered null and void. The topsoil will be ripped and reseeded.

Once topsoils have been placed then the following can commence:

- Monitoring (Section 4.13);
- Soil amelioration (Section 4.7.1.5); and
- Revegetation and biodiversity re-establishment (Section 4.7.2).

Any other mine impacted areas which have been compacted must be landscaped to natural contours and ripped to loosen all soil. Fertility of the topsoil would need to be assessed and rectified if required. The rehabilitated area must be re-vegetated and monitored for success. The rehabilitated area must be monitored for compaction and erosion and these must be rectified.

4.7.1.5 SOIL AMELIORATION

The placed rehabilitated soils are most likely inferior to the natural soil profiles, and consequently are less suitable as a plant growth medium. This section aims to present the plan to attempt to reinstate the greatest possible soil functionality within the rehabilitated soils through effective and targeted soil amelioration. The majority of this section has been informed by and extracted from the land rehabilitation guidelines (LaRSSA, 2019).

4.7.1.5.1 SOIL RIPPING

Following soil placement, lime and superphosphate fertiliser should be applied and all the soils ripped to the full depth of the replaced soil layer. The correct ripping depth and spacing between rip lines must be determined in consultation with a soil specialist, prior to commencement of ripping. In general, cross slope ripping of flat surfaces should be carried out. It is necessary that the ripping must penetrate through the soil into the underlying overburden material to ensure free drainage and ensure root penetration.

Due to the extreme levels of compaction encountered, ripping normally requires the use of a dozer with one or (at a maximum) two ripper tines, operating to a depth of 0.5 m (to avoid surfacing waste rock). These tines are usually mounted directly behind the dozer tracks – which again raises an issue, as the spacing between dozer tracks is usually in excess of the desirable width between rip lines. The desirable rip pattern will be determined by the "breakout" pattern of the disturbance caused by each ripper tine. The breakout usually radiates outwards and upwards at an angle of some 450 from the ripper tine, but the zone of soil affected (the breakout zone) can be increased by fitting wings to the ripper tines. Ripping must penetrate through soil into the underlying overburden materials in order to ensure free drainage and to ensure root penetration. This may result in contamination of the overlying soils by large rock fragments dragged up from the spoil layers and a number of these may end up on surface. For those rehabilitated areas that must be returned to row-crop production, the removal of large rocks, usually by hand, will be necessary. The benefit derived from decompaction and improved root penetrability far outweighs the inconvenience of stone-picking. For those areas due to revert to natural grazing, the presence of loose rock on surface should not pose a problem.

Once the ripping is complete the areas demarcated in the final closure plan as arable or grazing land must be cleared of large rocks. The bulk density factors of the soils must be determined and acceptable target bulk density values defined in consultation with a soil specialist.

4.7.1.5.2 APPLICATION OF CHEMICAL AMELIORANTS

Soil amelioration will be required on the newly placed topsoil sections as well as the areas which will be determined to have insufficient fertility (i.e. the unsuccessfully rehabilitated areas).

Guidelines and targets for relevant soil chemical properties are illustrated in Table 7 (Fertilizer Society of South Africa, 2007). It is vital that the disturbed area be rehabilitated in such a way that not only the reference conditions be reached but that the recommended values described below be reached. This will ensure that vegetation be established with greater ease flourish.

For the newly rehabilitated areas, once the soil is ripped and uncompacted, the soil must be sampled and submitted for laboratory analysis to determine the current profile of the soil chemistry (referred to as the initial sampling). The following sampling for the post placement event is recommended:

- The initial topsoil samples must be taken after levelling, ripping and <u>prior</u> to basal fertilising and lime application.
- The area to be sampled must first be assessed for its uniformity. If there are obvious differences in replaced soil type, slope or plant growth, the target area should be split into uniform sampling units. This will be guided by the soil placement plan, together with the soils tracking register, and the final land use plan land capability targets.
- Once the uniform units are defined one composite sample (comprised of ~20 individual sub-samples at random locations) must be taken. Obvious atypical situations (e.g. depressions or drainage lines) must be avoided.
- Samples to be taken 0-150mm depth.
- Sub-samples are most conveniently taken by means of a beater sampler, bulked, thoroughly mixed after breaking up clods, spread thinly on clear paper or plastic sheeting and portions scooped representatively from the whole area into a plastic bag, sufficient to give at least 500g of composite sample.

- The composite sample to be labelled and submitted to an accredited laboratory for analysis.
- The range of analysis must align with the pre-mining survey done and should include as a minimum: pH, P, K, Na, Ca, Mg, and sulphur.

Depending on the findings of the soil samples, the following typical amelioration actions may be implemented:

- Lime, if required, should be applied at least one to two months before planting. It is assumed that the lime will be incorporated to a depth of 20 cm. Thorough incorporation is essential: disc'ing followed by ploughing is recommended.
- All recommended P should be incorporated into the soil at establishment.
- Where soil test P levels are considered adequate, but are less than 120 mg/L, a starter application of 20 kg P/ha has been recommended to promote initial plant growth.
- Where the soil P test of a sample is abnormally high (>120 mg/L), and the sample is truly representative of the whole field, no fertilizer P should be applied until test levels indicate a P requirement.
- K requirement is related to the method of pasture utilization: the K recommendation above assumes utilization by permanent grazing. Under cutting-and-removal or intermittent grazing one or more additional K topdressings during the course of the growing season may be required.
- 50 kg N/ha should be applied at or soon after establishment. The remainder of the total N recommended should be applied in split dressings of 30 to 50 kg N/ha over the growing season.
- The last N dressing should be before mid-March in frost areas; in frost-free areas it should be applied six weeks before the end of the productive season.
- Pasture N requirement is closely related to moisture supply. The highest N recommendation is applicable only where annual rainfall exceeds 750 mm or irrigation is practised.
- Pastures generally require 30-40 kg/ha per annum of sulphur. In many situations this can be supplied from the atmosphere and by the mineralization of organic S in soils, but supplementary S fertilizer may be necessary, especially on sandy soils (sample density > 1.35 g/mL), where sulphate is lost by leaching.

Based on the considerations above a defined fertilizer specification and programme must be implemented. It should be noted that the initial application of fertiliser is likely to be significantly greater that future maintenance applications. As the rehabilitated landscape changes and improves over time, regular follow-up assessments should be undertaken to inform follow-up care-and-maintenance needs.

Annual maintenance fertiliser application and amelioration must then be undertaken on all rehabilitated areas. An effort must be made to ensure that sampling and subsequent fertiliser applications should be done to align with the same time of year that the initial sample/ application was carried out. The annual maintenance sampling must by, and large, align with the procedure listed above for the initial sample event, except for the following:

- Defining sample areas – each sample area or unit must not exceed 20ha.
- Composite samples will be created from at least 20 sub-samples for each defined unit.
- For sampling in areas where there is natural grass cover, samples should be taken to a depth of 100mm. Sampling in arable cultivated areas should extend to 150mm.

The annual sampling should be undertaken until the required target P and K status has been achieved. It is recommended that annual sampling and amelioration extend up to the point that the soil nutrient supplementation and fertiliser applications align with that typically required for a similar land unit.

4.7.1.5.3 SOIL TILLING

A suitable seedbed tilth will need to be created. Once initial fertilisation has taken place the areas should be fine tilled using conventional agricultural equipment and methods. Disk and harrow the soil surface to 0.3m depth to ensure a bare fallow condition with no weeds, and to produce a good tilth (Mentis, 2019). Roll with a Cambridge roller.

4.7.1.5.4 TOP DRESSING

A nitrogen budget must be determined in consultation with an agricultural/ soil specialist. On the basis of the chemical state of the soils applicable nitrogen supplements must be added to encourage active growth. The nitrogen supplementation should commence approximately 1 month after plant emergence an continue until six weeks prior to the end of the determined growing season.

4.7.1.5.5 ONGOING SOIL FERTILITY ASSESSMENTS

As noted in Section 4.7.1.5.2, there is a need to ensure that the suitability of the replaced soils are monitored and assessed, and where necessary supplemented to achieve the defined closure objectives. In addition to the sampling noted it is further recommended that annual sampling also includes soil compaction testing and any other parameters specifically required to align with the land capability targets and closure objectives, including:

- Physical parameters:
    - Rock content;
    - Soil texture;
    - Soil Aggregation;
    - Bulk Density; and
    - Available rooting depth.
- Soil fertility based on:
    - pH;
    - Salinity;
    - Fertility/ Bray 1;
    - Organic carbon; and
    - Major cations: Ca, Mg and Na.

4.7.2 REVEGETATION PLAN

Seeding and planting is most successful when done at or immediately after the first rains in spring, and into freshly prepared, fine-tilled seedbeds (where soils are not prone to crusting). To stimulate germination, water retention in the seed zone is essential and can be aided by the application of light vegetation mulches and/or scattering of light woody debris. Woody debris and grass mulch have the added benefits in that they increase organic carbon in the soils as they decompose and create micro-habitats for invertebrate and faunal colonisation. However, the application of woody debris and mulches can be labour intensive and costly, and care must be taken not to use species that could increase the risk of introduction of invasive species (such as wattle in the Mpumalanga Province). Some areas within the mines rehabilitated areas and areas unaffected by mining have shown healthy growth of grass and these can be cut to a height of 15cm and the cuttings can be spread across areas that are not as well established. This will promote the incorporation of organic matter as well as increase the seedbank of areas.

For the majority of South African situations, where the re-establishment of the full range of native species is not the prime objective, seeding is the commonly used method. Appropriate commercially available seed mixes have been developed for various climatic and soil combinations and these have proved effective in generating a rapid erosion controlling cover that is sustainable under normal management conditions. These seed mixes must be guided by a grassland specialist to ensure the correct composition for the area.

Most commercially available seed mixes generally have a good initial response within the first few seasons, where after one or more species normally dominate. This can result in a monoculture pasture which, if this is not the desired end product, will require unnecessary re-seeding. In addition, commercial grass species (improved pastures species) that have been bred for high production, typically require high levels of fertiliser input in order to maintain adequate production and cover. Commercially available seed is relatively cheap and easily accessible and, if managed properly, can produce sustainable pastures supporting a predefined land use on a rehabilitated landscape.

Table 29 presents a revegetation guide for Elandsfontein. This must be used as a base and must be assessed, amended, and refined by a seeding and rehabilitation specialist contractor.

Table 29: Revegetation guide.

Planned Land Capability Class/ site type:	Guide for revegetation (Mentis, 2019):
Class I: Wetland	'Herb' transplanting is generally the appropriate method. Donor plants will need to be sourced either from commercial nurseries or locally cultivated from the surrounding natural areas (without disturbing the existing ecosystem and depleting the natural supplies). Applying organic and inorganic fertilizers to wetlands and aquatic areas below the 1:2 year floodline should be avoided to limit eutrophication of the aquatic systems. The vegetation within a watercourse, wetland ecosystem (including the buffer zone) plays various important roles, one of which is to slow water velocities, disperse flows and increase the retention time of water within a wetland. Furthermore, the ground cover protects the wetland from erosion resulting from intense and concentrated flows. It is imperative that seed be sowed in a mix to avoid oversaturation or monospecificity of species within an area. Seed should be sowed towards the end of the dry season so as to begin vegetation establishment before the heavy rains during the wet season. Only a few species have been recommended to avoid saturation and competition of species; it is expected that the natural seed bank will re-establish itself over time; should it not, seed may be dispersed at a later stage to promote diversity. A rehabilitation specialist must be consulted to provide a recommended plant species list for the buffer zone. It is imperative that seed be sowed in a mix to avoid oversaturation or monospecificity of species within an area. Seed should be sowed towards the end of the dry season so as to begin vegetation establishment before the heavy rains during the wet season. Only a few species have been recommended to avoid saturation and competition of species; it is expected that the natural seed bank will re-establish itself over time; should it not seed may be dispersed at a later stage to promote diversity.
Class II (arable) and III (grazing) land	Conventional grassing for pasture establishment can be applied. Pasture reinforcement should be applied to the previously unsuccessfully rehabilitated areas. This will firstly include reducing the competition posed by existing grass / vegetation species. This is done through mowing grazing and trampling or burning or a combination thereof. Secondly the vegetative carrying capacities should be increased through the amelioration techniques presented in Section 4.7.1.5, together with localised and targeted clarifying of bare patches. An applicable seed mix can then be placed aiming to balance the existing vegetation composition- this should be determined in consultation with a grassland/ seeding specialist. On condition that grazing is managed and controlled it is possible to have a vegetation mix dominated by Rhodes grass (*Chloris gayana*) and Smuts Finger grass (*Digitaria eriantha*). If effective grazing control cannot be implemented, then the mix should be dominated by Oulandsgras (*Eragrostis curvula*). For the purposes of this preliminary revegetation plan,

Planned Land Capability Class/ site type:	Guide for revegetation (Mentis, 2019):
	it is suggested that a mix dominated by Rhodes and Smuts be utilised on condition that livestock grazing is prevented during the early establishment phase. Commercially available seed is relatively cheap and easily accessible and, if managed properly, can produce sustainable pastures supporting a predefined land use on a rehabilitated landscape. Once again, a rehabilitation specialist must be consulted to provide a recommended plant species lists.

4.7.3 WETLAND REHABILITATION AND MANAGEMENT PLAN

A wetland and watercourse rehabilitation plan must be developed by a wetland specialist and hydrologist. The following preliminary management and mitigation measures must be considered and where applicable (as determined by the specialist) included in the plan:

- For the river diversion the steep river channel banks must be reshaped to a gentle gradient (35 degrees or less) to allow for natural revegetation while avoiding erosion of the banks;
- Revegetation of all exposed river banks must take place. Plants must carefully be removed from the river banks designated for reshaping, and must be stored for replanting post reshaping;
- River bank reprofiling activities should take place with a downstream approach, beginning with upstream areas and moving in a downstream direction. Construction should only excavate, complete the rehabilitation (with revegetation) for small sections of project area at a time, rather than the entire river at once, to curb the level of erosion and sedimentation of downstream areas at once. This will further allow the recovery process to begin immediately, without further disturbance from upstream construction works;
- Signs of erosion must be addressed immediately to prevent further erosion of the watercourse banks;
- Rehabilitation of the area and shaping of the topography must minimise the ingress of water into the mining area;
- Additionally, measures must also be considered to implement constructed wetlands at likely decant areas, and the planting of trees to reduce groundwater recharge;
- Decommission cut-off berms and drains last;
- Uncontaminated debris must be placed in preferential flow paths;
- Compacted areas must be ripped (perpendicularly) to a depth of 300 mm;
- A seed mix must be applied to rehabilitated and bare areas;
- Any gullies or dongas must also be backfilled; and
- The area must be shaped to a natural topography.

4.7.4 GROUNDWATER MANAGEMENT PLAN

This section summarises the key impacts associated with the mine decommissioning, closure and rehabilitations phase as well as the associated management and mitigation measures. Please refer to Appendix 3 for further detail. Post closure phase impacts resulting from seepage and leachate from mine waste facilities on down-gradient receptors are rated as medium negative without the implementation of remedial measures and low negative with implementation of mitigation measures. The main impacts associated with mine post-operational phase activities include the following:

1. Mine dewatering effects lessening, post-operational re-watering and flooding of underground mine voids and potential flooding of backfilled opencast pits may occur.
2. Poor quality leachate and decant may emanate from backfilled opencast pits as well as underground mined out faces which will have a negative impact on groundwater and surface water quality.
3. Seepage of poor water quality caused by leachate of sulphide bearing minerals from mine waste facilities i.e. discard dumps, slurry dams as well as pollution control dams.

Mitigation and management measures associated with the operational and post-operational phase activities include the following:

1. Operational Phase:
    a. Due to mine inflow and dewatering anticipated, depletion of groundwater in storage, hence the formation of a zone of depression, is inevitable. Development and implementation of an integrated groundwater monitoring program assessing regional groundwater levels will serve as early warning mechanism to implement mitigation measures. Should neighbouring water levels and yields be affected, necessary actions such as provision of alternative water supply and/or compensation should be taken to ensure continual water supply.
    b. Development and implementation of an integrated groundwater monitoring program evaluating hydrochemistry as well as water levels will serve as early warning mechanism to implement mitigation measures such as seepage capturing boreholes down-gradient of the waste facilities in order to constrain the contamination plume migration as well as manage the groundwater cone of depression.
    c. The geochemical character of the non-carbonaceous spoils material i.e. sandstone and mudstone/shale are non-acid forming and will not impact on water quality. This material can thus be utilised as backfill substance as part of the rehabilitation.
    d. The geochemical character of the carbonaceous spoils material i.e. carbonaceous shale suggests a likely capacity for acid formation. However relatively low oxidisable sulphides deem the material insufficient to sustain long term acid generation. Thus, any material of carbonaceous character can also be used as backfill substance, however it is recommended that additional geochemical characterisation be conducted to confirm this.
    e. All material analysed can be classed as a Type 3 waste (low hazardous waste) and should be managed accordingly.
    f. All preferred groundwater flow pathways which are in direct connection with surface topography i.e. adits, ventilation shafts and/or unrehabilitated exploration boreholes should be sealed off and rehabilitated.
    g. It is expected that post-closure the generated pollution plume and local groundwater contamination footprint will decay and be diluted by rainfall recharge, however the lasting effect and subsequent impact on neighbouring borehole qualities should be monitored with alternative water supply sources or compensation measures available for nearby users if impacted on.
    h. The existing groundwater flow model should be recalibrated with time-series monitoring data on a biannual basis in order to be applied as water management tool. Scenario predictions and model simulations should be conducted and interpreted by an external and independent specialist.
    i. Mining vehicles and machinery must be serviced and maintained regularly in order to ensure that oil spillages are limited. Spill trays must be provided if refuelling of operational vehicles is

done on site. Further to this spill kits must be readily available in case of accidental spillages with regular spot checks to be conducted.

j. Hazardous substance containment facilities to be used during operational phase should comply with the relevant hazardous substance storage legislation in order to ensure spillages are contained.

k. Develop a stormwater management plan in accordance with GN704 in order to separate dirty/contact water from clean water circuits. All water retention structures, process water dams; storm water dams, retention ponds etc. should be constructed to have adequate freeboard to be able to contain water from 1:50 year rain events.

l. Any water use activity exercised in terms of Section 21 of the National Water Act (Act 36 of 1998) should be authorised.

m. Stockpiling of material shall not be done within a 1:100-year flood line.

n. The Licensee shall appoint a suitably qualified and responsible person to give effect to all recommendations as stipulated in specialist reports to ensure compliance to licence conditions pertaining to activities in order to ensure that potential impact(s) are minimised, and mitigation measures proposed are functioning effectively.

o. Monitoring results should be evaluated and reviewed on a biannual basis by a registered hydrogeologist for interpretation and trend analysis for submission to the Regional Head of Department. Based on the water quality results, the monitoring network should be refined and updated every three to five years based on hydrochemical results obtained to ensure optimisation and adequacy of the proposed localities.

p. Annual external audits should be conducted to ensure that waste facilities are maintained and functioning effective and according to licence conditions.

2. Closure and post closure:

a. Monitoring of surface water and groundwater in accordance with the implemented protocol should be continued throughout the post operational phase.

b. Ensure that rehabilitation of backfilled opencast and mine waste facility footprints areas is properly conducted and in accordance with best practise guidelines as well as approved mine closure and rehabilitation plans. Rehabilitation should allow for free draining of runoff in order to prevent any surface water ponding.

c. The geochemical character of the non-carbonaceous spoils material i.e. sandstone and mudstone/shale are non-acid forming and will not impact on water quality. This material can thus be utilised as backfill substance as part of the rehabilitation.

d. The geochemical character of the carbonaceous spoils material i.e. carbonaceous shale suggests a likely capacity for acid formation. However relatively low oxidisable sulphides deem the material insufficient to sustain long term acid generation. Thus, any material of carbonaceous character can also be used as backfill substance, however it is recommended that additional geochemical characterisation be conducted to confirm this.

e. Alternative remedial options such as introducing lime within the backfilling material, thus increasing the material buffering capacity, should form part of the mine closure and rehabilitation strategy.

f. The groundwater capture zone should return back to the pre-mining equilibrium after cessation of mine dewatering and replenishment of groundwater in storage, however the lasting effect and subsequent impact on neighbouring borehole water levels and yields should be monitored with alternative water supply sources or compensation measures available for nearby users if impacted on.

g. The preferred mitigation scenario entails establishment of scavenger boreholes down-gradient of waste facilities and backfilled opencasts in combination with disposal of carbonaceous waste material in the northern discard pit. It is recommended that constant discharge aquifer tests be conducted on newly established seepage capturing boreholes in order to optimise borehole yields.

h. Additional geochemical characterisation (including kinetic Geochem) will be required in order to accurately determine duration of buffer reactions and source depletion timeframes. For the purposes of the current assessment a timeframe of 100 years has been estimated.

i. It is recommended that the northern discard pit footprint be compacted and a barrier system (capping) and/or evapotranspiration cover be established in order to minimise water and oxygen ingress which is the drivers of acid rock drainage conditions.

4.7.5 FINAL LANDFORM DESIGN AND PLAN

Landform re-creation is the process by which the mined overburden materials are placed and moved to create the desired final topography. Ideally landform design should be undertaken at the onset of a mining project to inform the roll over mining and progressive rehabilitation for a site. For this project, the landform design has been carried out on the remaining open voids within the mining right area. The key objective of this landform design process is to:

- To create a final rehabilitated landscape that meets the land capabilities commitments, and which has:
    - Suitable slope profiles for the planned land use/s and that limit the potential for erosion; and
    - Adequate soil cover thickness.
    - No remnant residue deposits post closure.
    - To recreate a landform that is aligned with the long-term water management requirements, and that:
        - Limits ingress of water through backfilled open cast spoils that could require ongoing water management in the long-term; and/or
        - Ensures adequate water availability for post-mining land use/s.
- To re-create a free-draining profile across the back-filled pits and voids, having the correct gradient for the planned land capability to support the intended land use (i.e. wetland/ watercourse and grazing land).
- To confirm that sufficient soil (growth medium) is available in stockpiles to backfill any areas of settlement (melon holes) so as to keep rehabilitated areas free-draining and to conserve land capability.
- To provide long-term stabilisation of the geo-technical conditions of the disturbed mining areas.
- To limit the need for, or intensity of, long-term care-and-maintenance of recreated landforms.

In order to achieve the objectives listed above and in Section 4.4.2 a specialist landform design was commissioned. The remainder of this section presents the findings of this assessment.

4.7.5.1 LANDFORM DESIGN ASSUMPTIONS AND QUALIFICATIONS

In terms of the landform design the following is assumed:

- Bulking factors for hards/interburden are excluded as it is assumed that the stockpiles would have settled for the most part, therefore the final landform design will correspond with the stockpiles' current state considering no bulking factor;

- All historic and existing voids will be rehabilitated before scheduled closure, as per the discussions between BEAL and EIMS, the mine will be implementing an improved stormwater management plan to rectify the current deficiencies on the site stormwater management. The plan includes a phased rectification of historical backfilling and rehabilitation backlog and aims to reduce unnecessary dirty water areas and catchments;
- Allowance was made to seal one decline shaft, rehabilitate one ventilation shaft and one rescue borehole. It is understood that all other shafts and boreholes are sealed and rehabilitated. Shaft sealing designs should still be developed by a suitably qualified engineer. Taking this into consideration, a conservative view for the costing estimation is taken on the shaft sealing requirements;
- As per the Mining Works program (Georock Consulting, Janaury 2020) the mining is done in a roll over operation (mining and backfilling concurrently). Based on the LOM schedule all opencast pits are considered mined out with only the underground decline shaft at Block A left for schedule closure;
- The depth of the slurry dam is unknown. A depth of 1.5m have been assumed in the calculations. Remnant slurry and carbonaceous wastes will be removed and disposed of in the Northern Discard Pit. The slurry dam will be rehabilitated before scheduled closure and will form part of the ongoing rehabilitation;
- Based on the topsoil shortage on site it is assumed that there is topsoil underneath the stockpiles. The soil underneath the stockpiles will most likely be degraded. Amelioration and ripping will most likely be required. It is recommended that the soil underneath the stockpile be observed and sampled before decommissioning, to determine how much amelioration will be required. Some allowance for amelioration has been made, pending final confirmation;
- It is assumed that topsoil amelioration will be required. Allowance was made for lime and superphosphate fertiliser. Soil improvement fertilizers are to be applied as per a soil analysis report and there is a need to ensure that the suitability of the replaced soils is monitored, assessed and rectified if required; and
- It is assumed that the material next to the slurry dam can be utilised as topsoil. It is recommended that this material be tested, before closure, to confirm the suitability.

4.7.5.2 UNSCHEDULED AND SCHEDULED POST-MINING LANDFORM

The landform design was based on recent high resolution aerial photography and a detailed topographical survey undertaken in January 2021. Table 30 provides a breakdown of the available material stockpiles on the site (as at January 2021). The general arrangement map provided in Appendix 1 shows the orientation and location of the identified stockpiles.

Table 30: Material stockpile volumes (as at January 2021).

Stockpile	Volume (m^3)	Material
D1	636 001	Overburden
D2	128 937	Topsoil
D3	203 669	Overburden
D4	104 061	Overburden
D5	656 420	Overburden
D6	51 735	Overburden

Stockpile	Volume (m³)	Material
D7	250 033	Overburden
D8	66 930	Topsoil
D9	189 783	Overburden
D10	310 010	Overburden
D11	289 616	Overburden
D12	22 560	Overburden
D13	42 609	Overburden
D14	26 009	Overburden
D15	13 259	Topsoil
D16	23 216	Topsoil
D17	27 349	Topsoil
D18	16 920	Topsoil
D19	10 121	Topsoil

High-level models were set up for the respective post-mining landforms. The assumptions, considerations and findings are listed below:

- A Free draining topography with slopes that limit erosion potential and are consistent with the surrounding topography;
- All stockpile material will be suitable for backfill and the entire stockpile will be used for backfilling. It is recommended that the stockpiles be sampled to determine the suitability;
- Maximum design slopes are 14.29 % (1 in 7). This takes up a 5 % of the overall slope configuration whereas the rest of the slope configuration consists out of flatter slopes;
- No final voids/pit lakes will be left post-closure; and
- The conceptual profile is to top of topsoil level.

The landform design for unscheduled closure and scheduled closure are shown in Figure 48 and Figure 49 respectively. Please refer to Figure 50 to Figure 57 for the freedrain topography of the unscheduled closure. Please refer to Figure 58 to Figure 60 for the freedrain topography of the scheduled closure. The available borehole data was considered in all pit landforms to ensure that the post-mining landform exceeds those elevations . This is to ensure that the boreholes do not decant into the free draining localised low points created as a result of the landform design

All measurements and calculations were done with Civil3D modelling to ensure realistic values. Refer to Appendix 1 for drawings derived from the modelling.

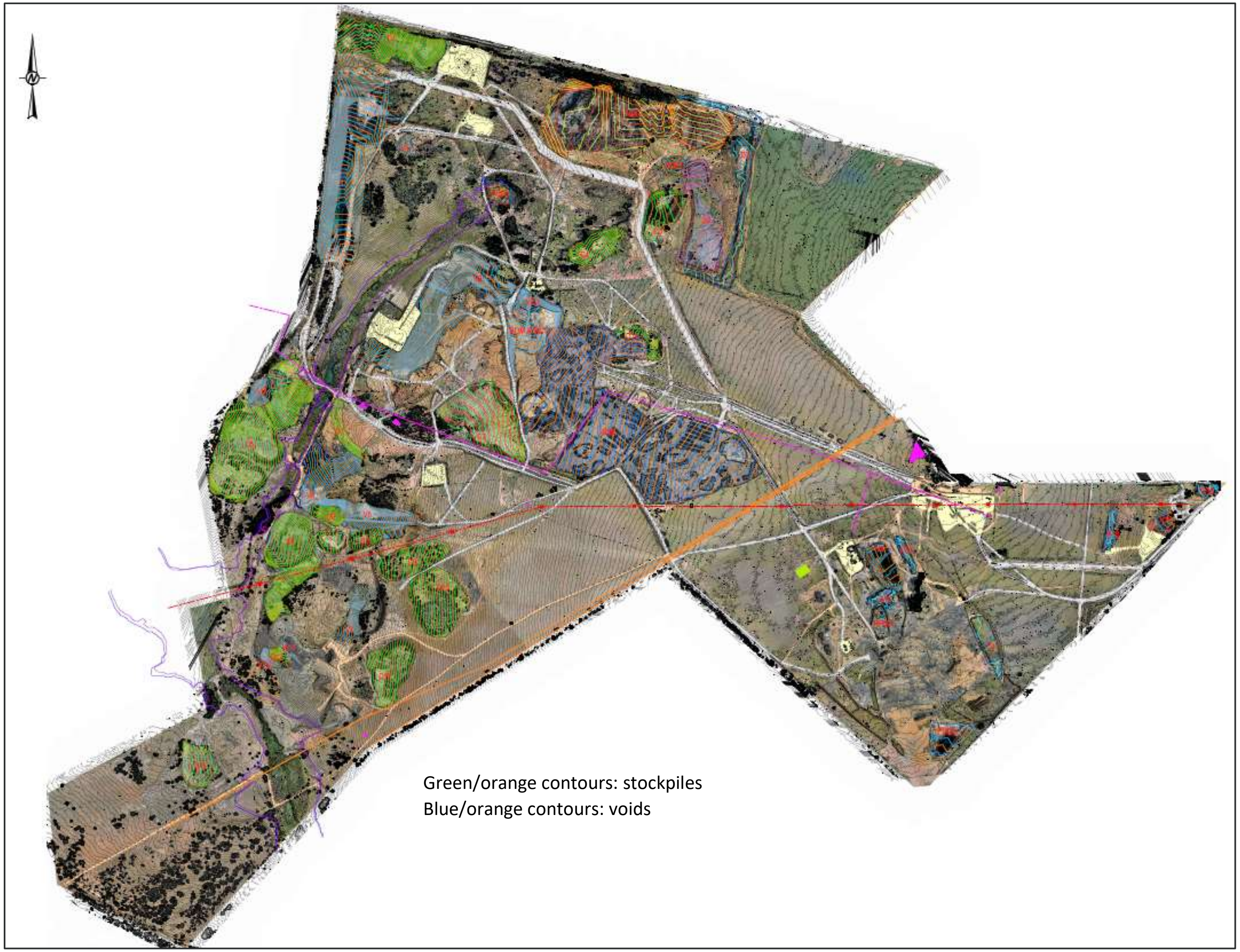


Figure 48: Landform Design for Unscheduled Closure.

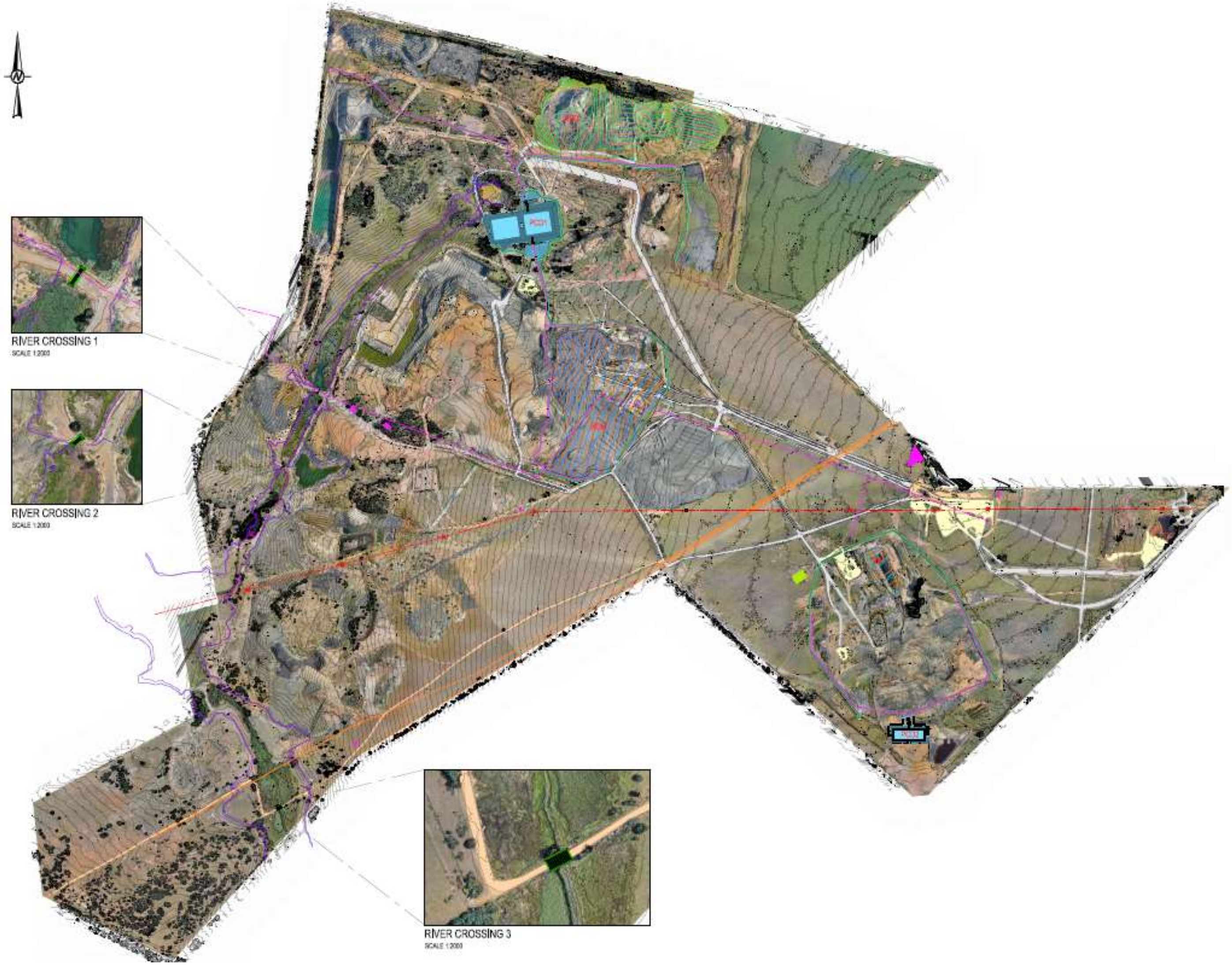


Figure 49: Landform Design for Scheduled Closure.

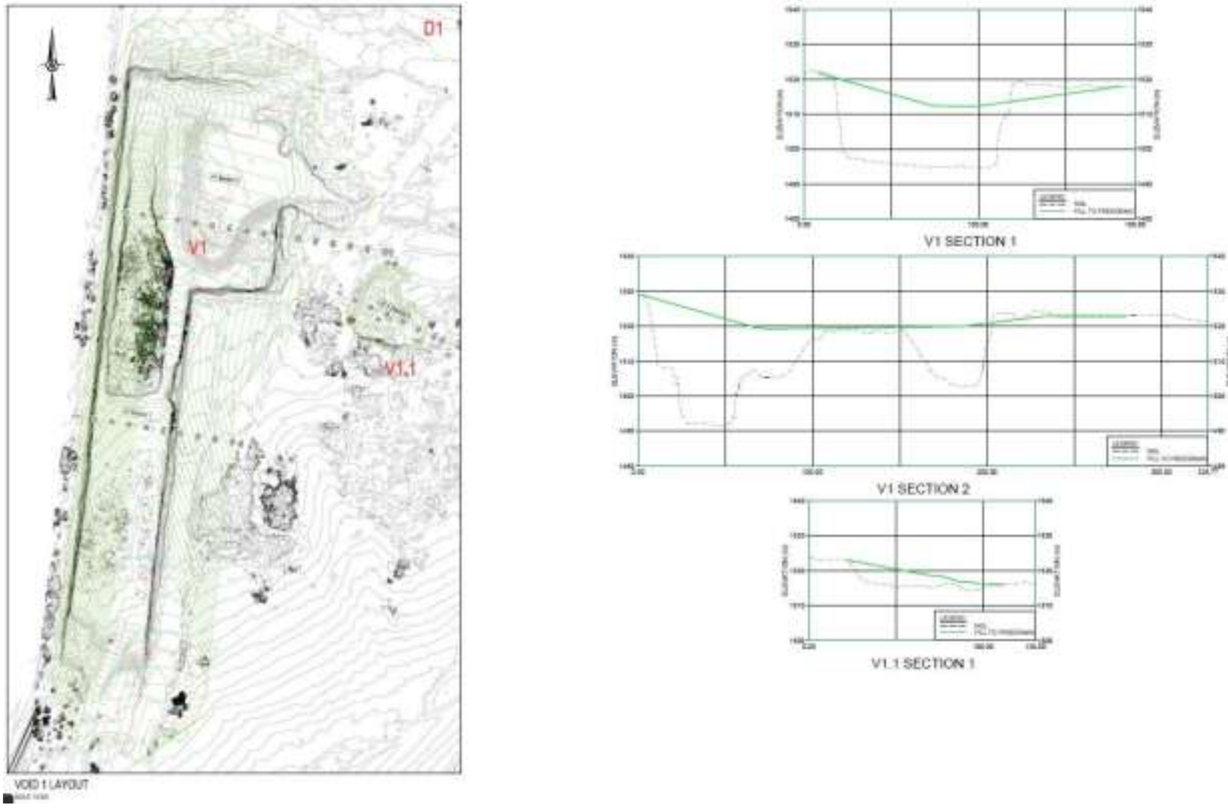


Figure 50: : Freedrain Topography at Void 1.

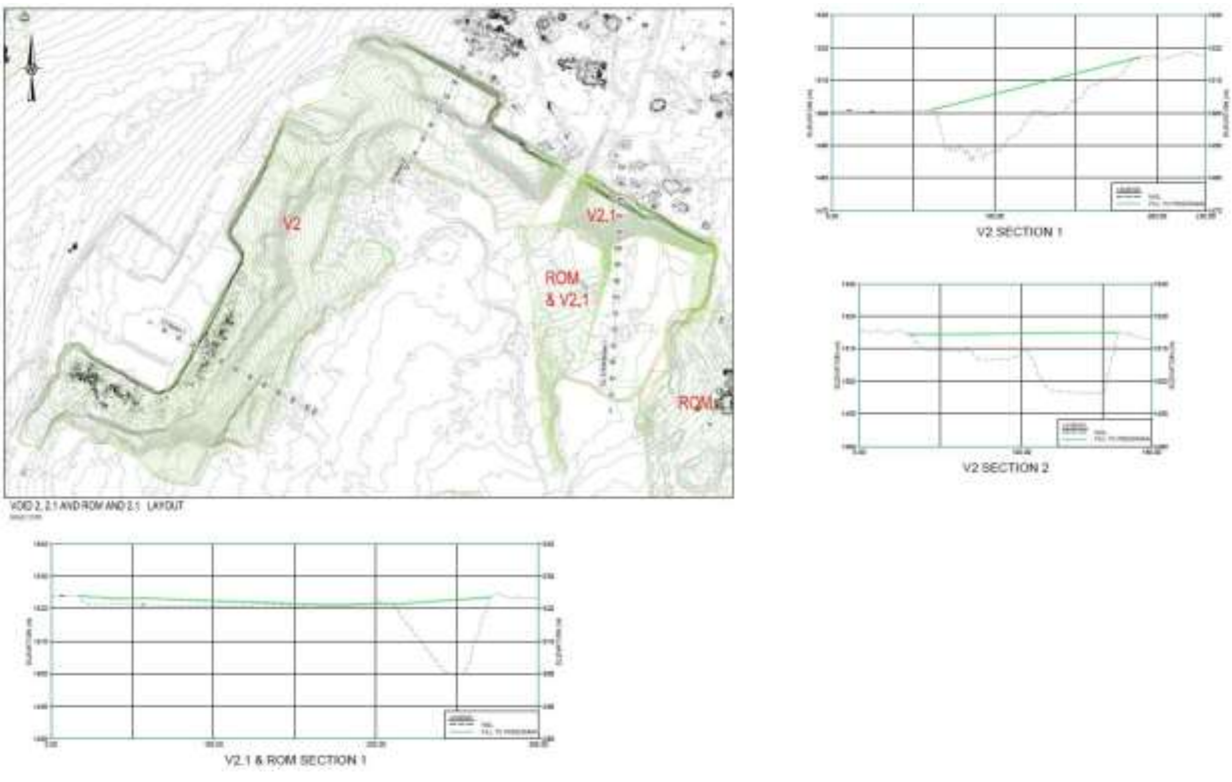


Figure 51: Freedrain Topography at Void 2.

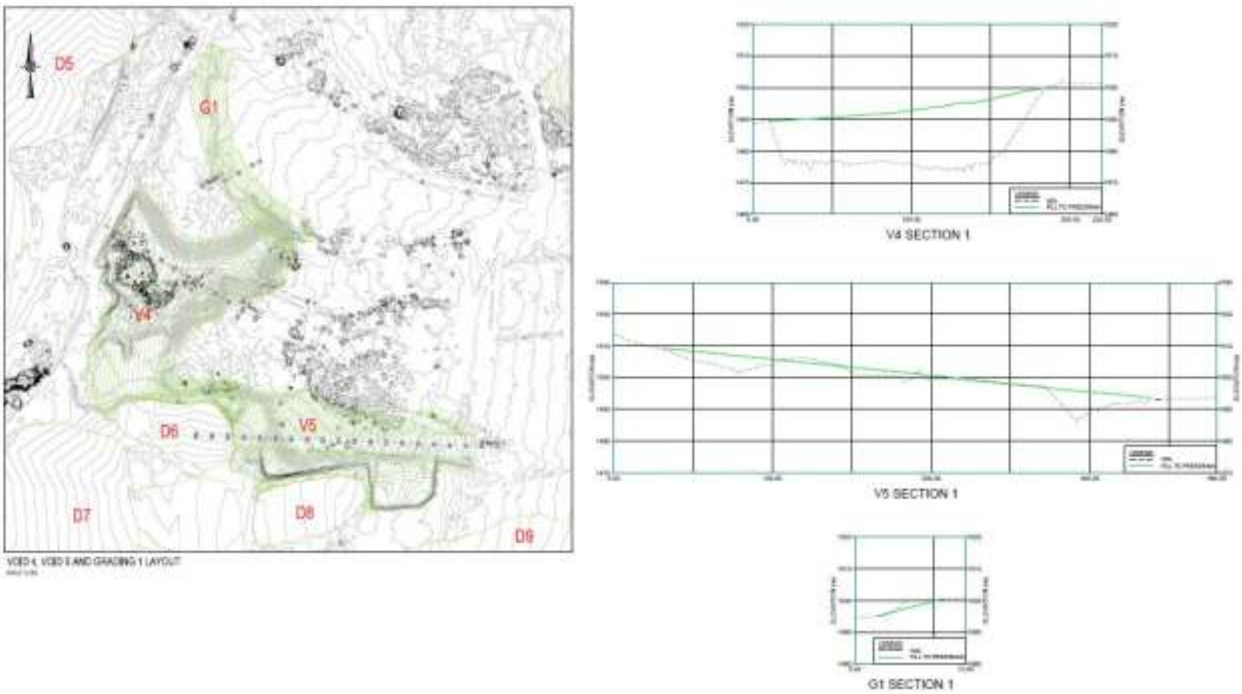


Figure 52: Freedrain Topography at Void 4 and Void 5.

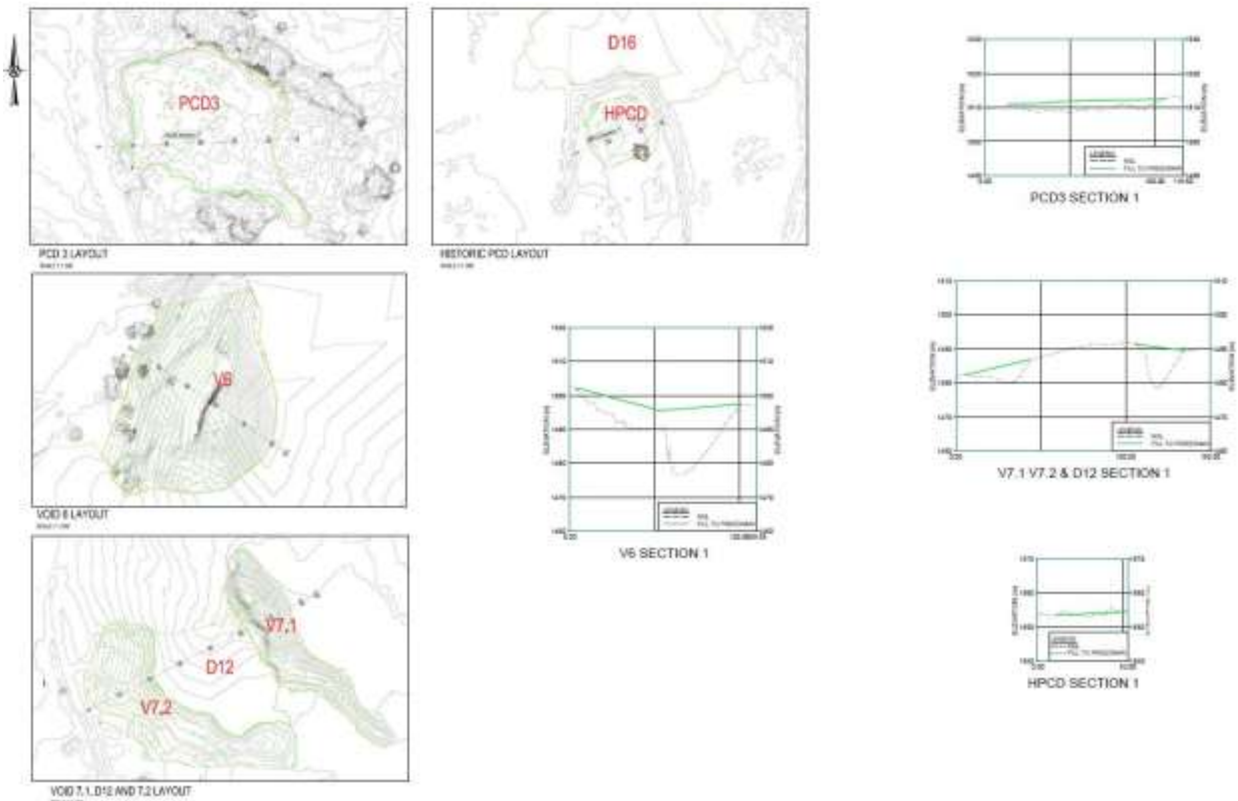


Figure 53: Freedrain Topography at Void 6, Void 7, PCD 3 and Historic PCD.

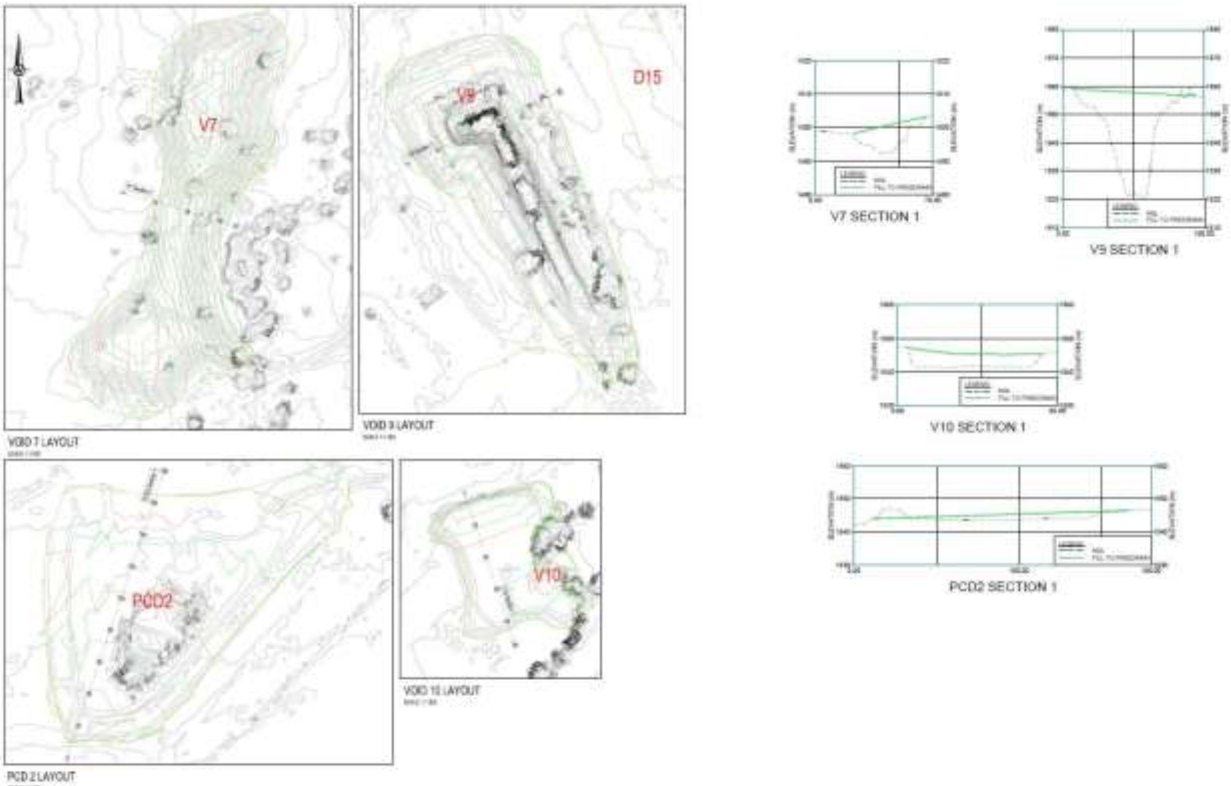


Figure 54: Freedrain Topography at Void 7, Void 9, Void 10 and PCD 2.

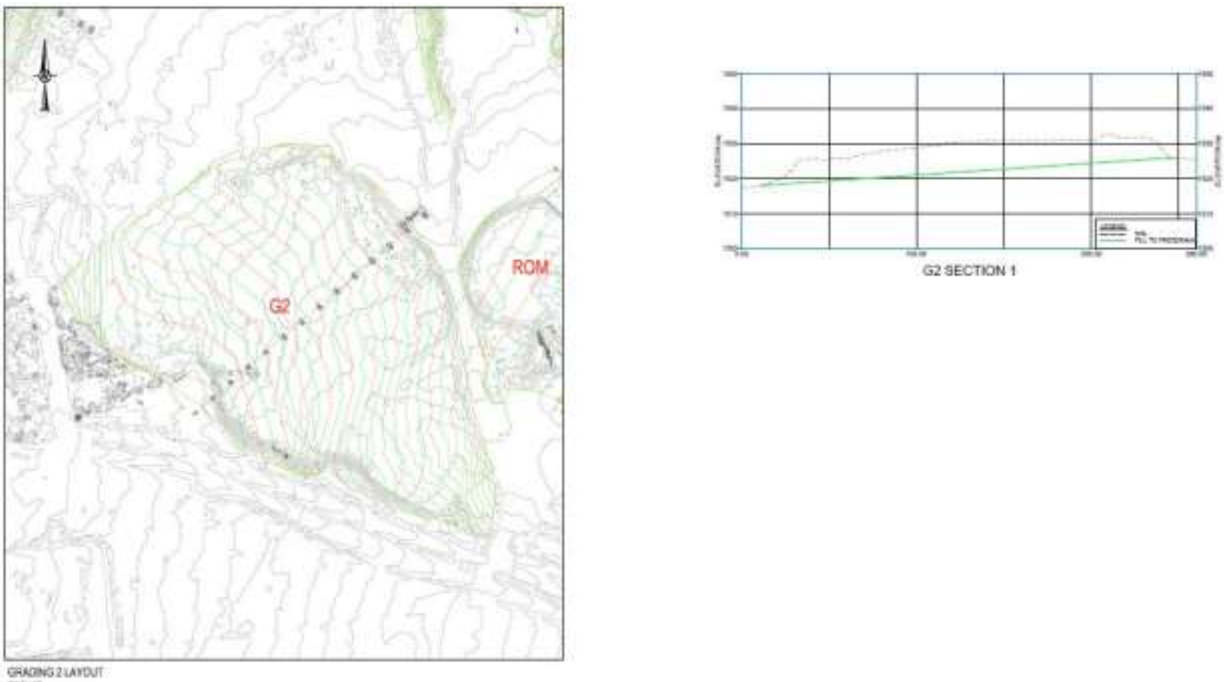


Figure 55: Freedrain Topography at G2.

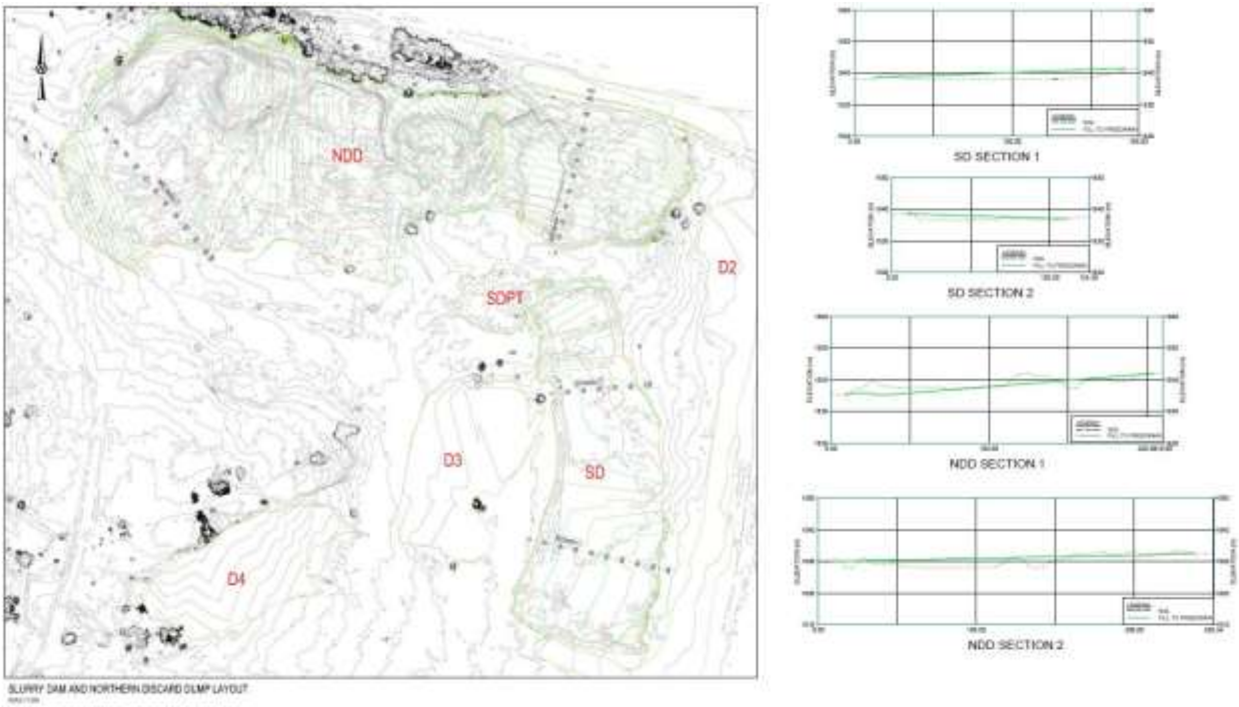


Figure 56: Freedrain Topography at Historic Slurry Dam and Northern Discard Pit.

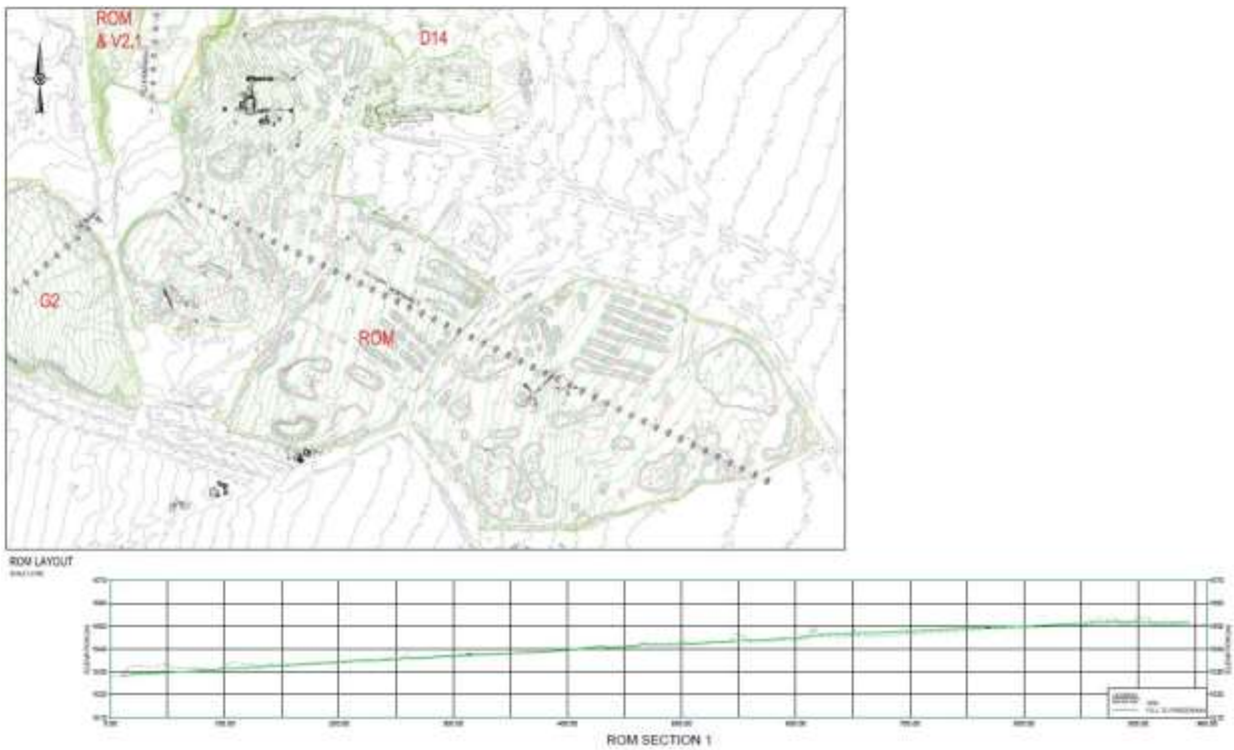


Figure 57: Freedrain Topography at ROM.

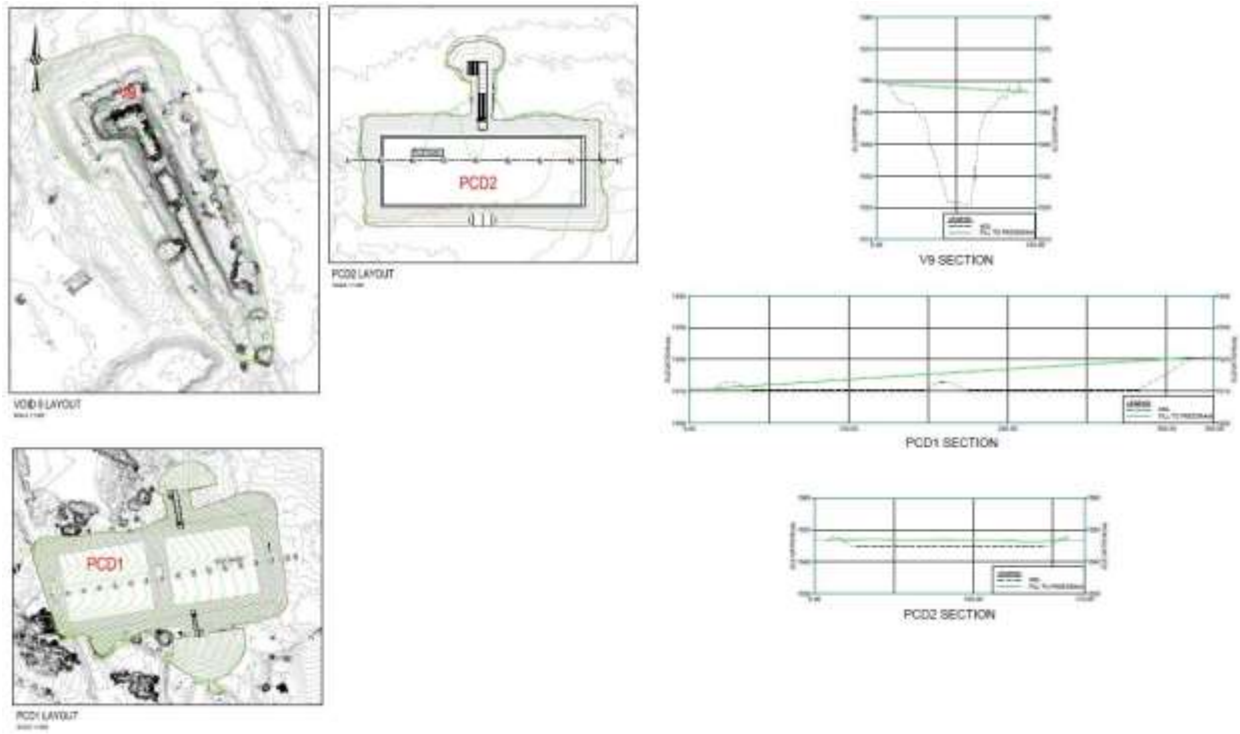


Figure 58: Freedrain Topography of PCD 1, PCD 2 and Void 9 (Decline shaft) at Scheduled Closure.

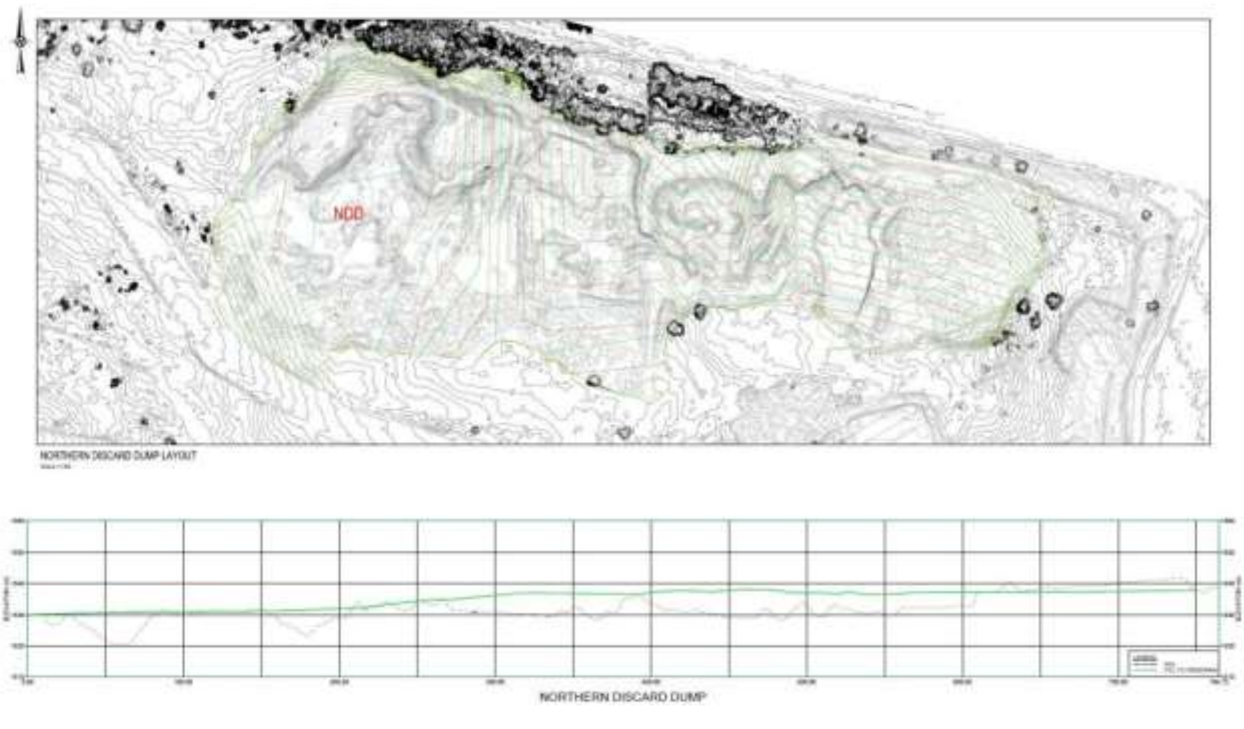


Figure 59: Freedrain Topography of Northern Discard Pit at Scheduled Closure.

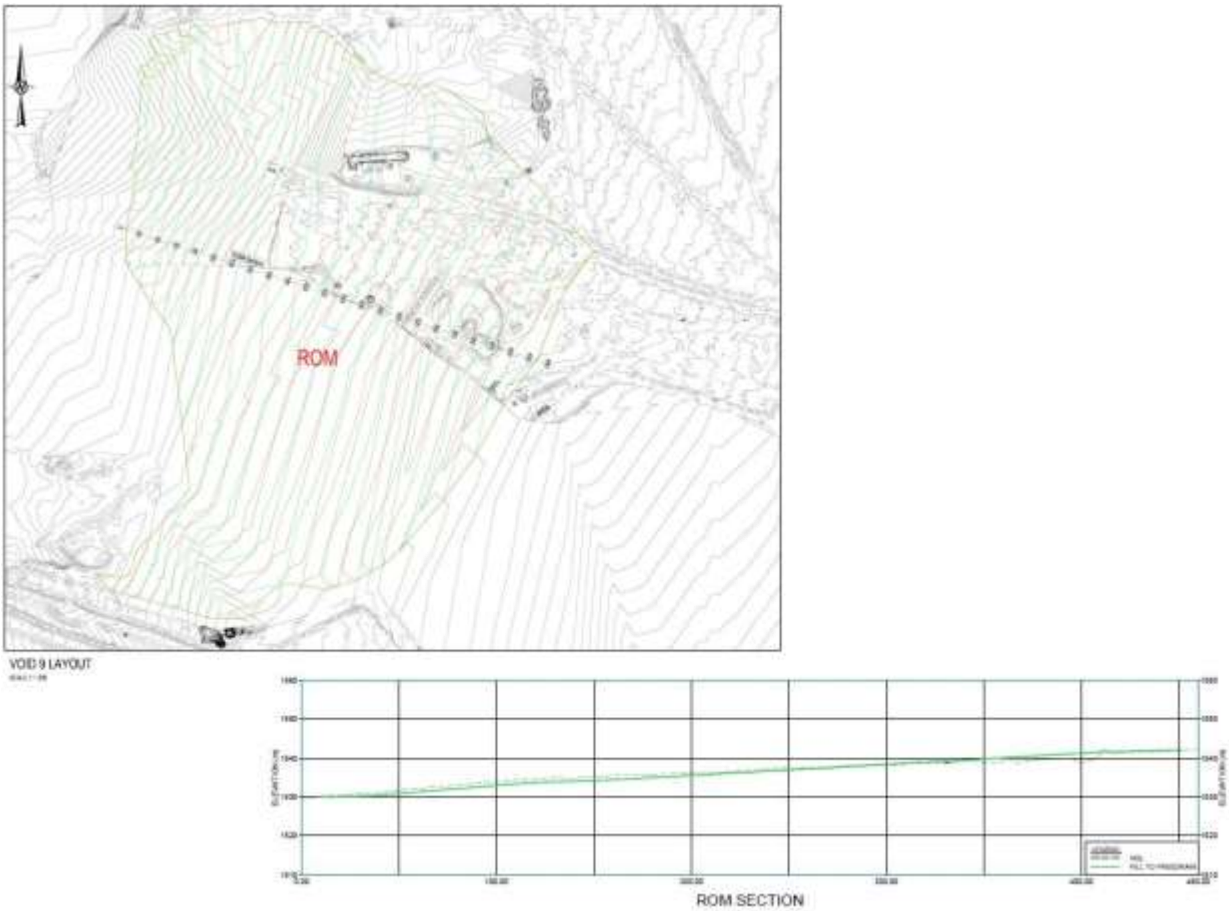


Figure 60: Freedrain Topography of ROM at Scheduled Closure.

4.7.5.3 TOPSOIL BALANCES

The adjacent topsoil stockpiles will be used as the cover material at the respective landforms. A 250mm cover will be required over all applicable areas. A total of 223 799 m³ topsoil is available for use, and 227 868 m³ shortfall exists. The financial provision currently makes provision for this deficit to be imported from a commercial source and stockpiled on site to achieve a 250mm topsoil cover over all applicable areas. The landform design assumes that all stockpiles on site still have suitable topsoil material at the bottom.

The landform areas and achievable topsoil thickness is listed in Table 3 below.

Table 31: Topsoil depth

Description	Area (m²)	Topsoil thickness (m)
Void 1	170 899,25	0,25
Void 1.1	6 189,72	0,25
Void 2	110 851,10	0,25
Void 2.1	8 900,21	0,25
Void 4	42 703,67	0,25
Void 5	29 062,39	0,25

Description	Area (m²)	Topsoil thickness (m)
Void 6	9 118,71	0,25
Void 7	15 517,61	0,25
Void 7.1	3 101,67	0,25
Void 7.2	4 572,04	0,25
Void 9	14 313,83	0,25
Void 10	5 145,60	0,25
PCD 2	18 683,56	0,25
PCD 3	6 844,86	0,25
Historic PCD	1 327,11	0,25
ROM & V2.1	38 830,33	0,25
Northern Discard Pit	169 589,78	0,25
ROM and Stockpile area	362 225,02	0,25
Slurry Dam	63 692,25	0,25
Laydown Areas	135 979,00	0,25
Access Roads	104 285,00	0,25
Haul Roads	299 939,82	0,25
South Eastern Discard Area	152 322,42	0,25
G1	7 680,00	0,25
G2	24 894,40	0,25

**The assumption is made that all stockpiles on site still have suitable topsoil material at the bottom*

4.7.6 STORMWATER MANAGEMENT PLAN

A preliminary high level post closure stormwater management plan (SWMP) has been prepared to inform and compliment the post closure landform analysis.

4.7.6.1 NORTHERN PORTION

The northern portion consist of opencast pits, dumps, PCD, ROM, historic slurry dam and the Northern discard pit. The approximate location of the floodlines is shown in Figure 61. It should be noted that a detailed flood hydraulics analysis should be executed to confirm the floodlines for a more accurate location. It is recommended that should any development of the higher laying areas take place, the floodlines be re-calculated and certified by a hydrologist every 4 years so as to ensure accuracy.

The opencast pits, dumps, PCD, ROM, historic slurry dam and the Northern discard pit has been backfilled and a free draining landform has been created in conjunction with the closure plan. The entire Northern portion has further been analysed and confirmed to be free draining as can be seen in Figure 61 below.

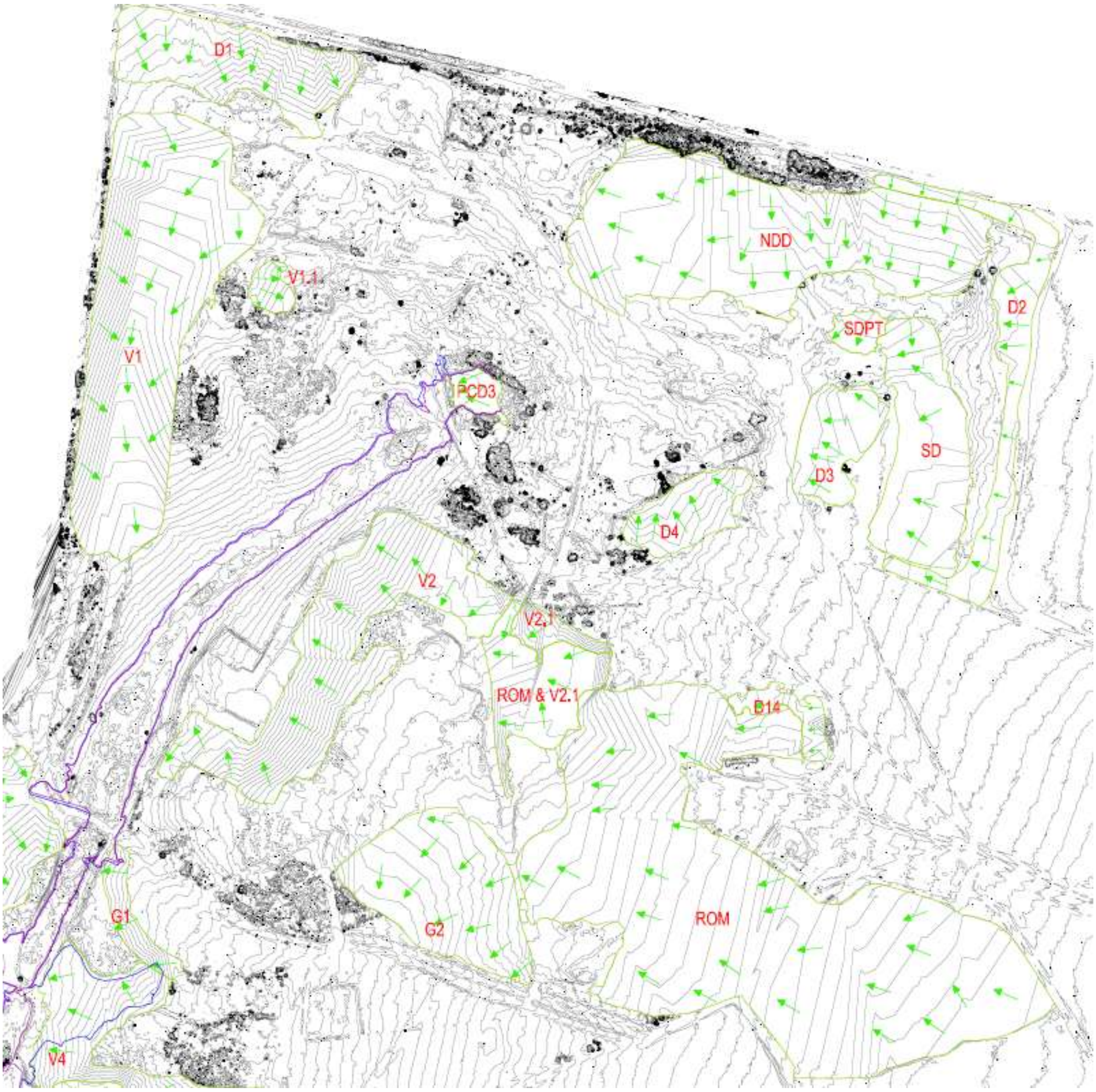


Figure 61: Northern portion general SWMP.

4.7.6.2 SOUTH WESTERN PORTION

This portion consists of voids, one void (Void 4) within the watercourse, stockpiles and clean areas over the remainder of the portion. Void 4 will be backfilled to form a free draining landform. It should be noted that Void 4 is located within the 100-year floodline. This will be mitigated once the proposed landform has been completed. For a more accurate location of the floodlines a detailed flood hydraulics analysis needs to be performed. It is recommended that should any development of the higher laying areas take place, the floodlines be re-calculated and certified by a hydrologist every 4 years so as to ensure accuracy.

Rehabilitation of pits focuses on limiting infiltration, maximising runoff and limiting erosion. This is so that the pits will have the lowest possibility of decanting, and if decant will occur the decant flows will be minimised. Long term pit decant is the most significant surface water risk that must be adequately addressed in any closure plan.

On the South Western portion, the 1:100 year floodline, from the water course, falls within the mined-out pit (Void 4). This pit will be backfilled as part of the closure plan, with ground levels above the flood levels. The floodlines will therefore be pushed out of Void 4. The floodlines should therefore be closer to the 1:50 year floodlines thus doing so attempting to return the floodlines to their original state pre-development and mining activity. Please refer to Figure 62 for the general SWMP for this portion.

The entire South Western portion has further been analysed and confirmed to be free draining as can be seen in Figure 62 below. All areas need to be ripped, topsoiled (at least 250mm depth) and vegetated, as per the closure plan, to ensure that the portion can be rehabilitated to grazing land.

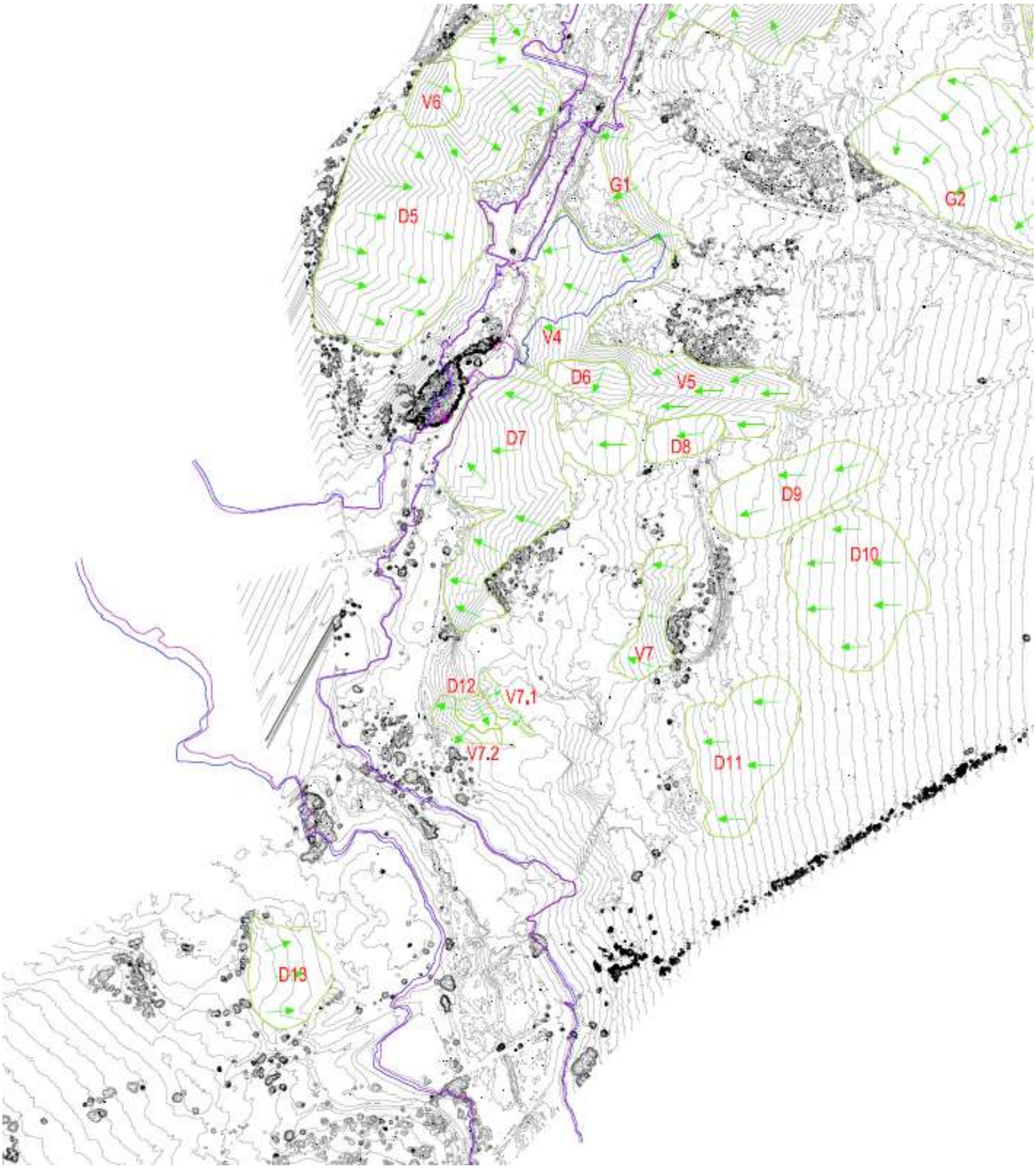


Figure 62: South Western portion general SWMP

4.7.6.3 SOUTH EASTERN PORTION

The South Eastern portion consists of a historic adit, voids, dumps, PCD's and a historic discard dump. As can be seen in Figure 63, the historic adit, pits, and PCD's have been backfilled and a free draining landform has been created in conjunction with the closure plan. No floodlines are located in this area.

The entire south eastern portion has further been analysed and confirmed to be free draining. As per the closure plan all areas need to be ripped, topsoiled to at least 250mm depth and vegetated to ensure that the portion can be rehabilitated to grazing land.

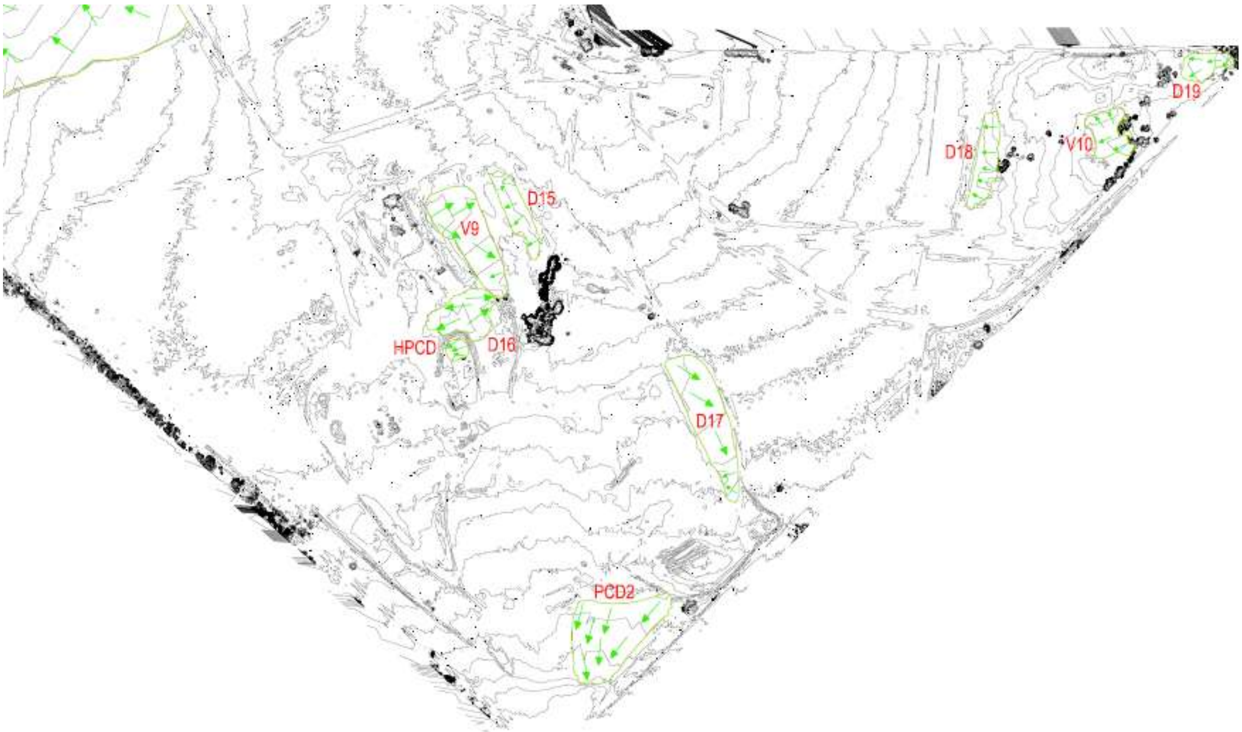


Figure 63: South Eastern portion general SWMP

4.7.6.4 CONCLUSIONS

All infrastructure will be removed and the area will be rehabilitated as per the closure costing and landform design. There will be no final void and all surface water will therefore be considered clean. No stormwater management infrastructure will be required due to the free draining landform design.

4.8 FINAL REHABILITATION, DECOMMISSIONING AND CLOSURE SCHEDULE

This section presents a high-level list of rehabilitation and closure components and the key actions related to the final rehabilitation, decommissioning, and closure. When scheduling rehabilitation and closure it is important to consider the following:

- The timeframes associated with the management of post closure mine affected water are predicted as follows (Gradient Consulting (Pty) Ltd, 2020):
  - A mine post-closure scenario was simulated wherein hydraulic head recovery within the proposed opencast areas was evaluated. It is calculated that the newly proposed backfilled opencast pit flooding and associated decant periods ranges between ~5.0years to >20years depending on the geometry of the backfilled pit.
  - A mine post-closure scenario was simulated wherein hydraulic head recovery within the existing underground voids as well proposed mining areas was evaluated. Simulated average groundwater ingress for the LOM underground operation was combined with the expected groundwater recharge reporting to the underground void and from these volumes it is

estimated that under average rainfall conditions, the underground will be flooded in approximately 35 to 40 years after ceasing of mining activities.

- The timeframes associated with pillar life and consequent surface subsidence is as follows:
  - The pillar life span calculations have indicated that the anticipated life spans of the pillars in the positions of a number of the boreholes are moderately to extremely low as a result of the underground mining dimensions. In general, the life spans of the pillars in the Elandsfontein mining area have been found to be variable (from extremely low to very high) highlighting the risk of pillar failure with time in some of the areas and the anticipated stability of the pillars in others.
  - Life estimate for the No. 1 Seam pillars varies between 5.9 years in the vicinity of borehole D22/02, and 1 799 616 years in the vicinity of borehole CW07/11. The majority of the existing pillars at Elandsfontein Colliery have relatively short to extremely short calculated anticipated life spans as due to their small dimensions and relatively low width-to-height ratios. This indicates that there is in most areas an elevated level of risk of pillar instability over time.

The key schedule drivers for each activity are presented in Table 32. It is important to note that there are potentially permits and licences which may be required prior to initiating closure activities these may include water use licences and/or environmental authorisations. These should be initiated as soon as practically possible as the timeframes for these processes can be extensive.

Table 32: Closure schedule drivers

Activity	Closure schedule driver
Ongoing mining activities	Ongoing progressive rehabilitation as roll over mining progresses. Rehabilitation of backlog (including rehabilitation of slurry dam, backfilling and rehabilitation of historic voids, supplementation of inadequate rehabilitation on historic rehabilitated areas).
Planning and preparation for Closure	Updated FRDCP and compliance with the Financial Provision Regulations. Obtain relevant closure related environmental authorisations, licences, and permissions.
Dismantling and removal of any on site infrastructure	Progressively as infrastructure is no longer required. Final dismantling of all infrastructure not to be retained at cessation of mining activities.
Rehabilitation of access roads	Cessation of mining activities and where relevant rehabilitation activities.
Rehabilitation of the open cast areas	Where practically possible handling and placement of sub-soils and topsoils should be undertaken in late winter (when their soil moisture content is at least 3 – 5% below their plastic limit), to provide a margin of 'safety' in preventing soil damage/compaction. Seeding and revegetation efforts should be done in spring or early summer.
Sealing and rehabilitation of shafts, adits and inclines.	Cessation of underground mining activities.

Activity	Closure schedule driver
Removal and safe disposal of remnant wastes including coal, discard, or carboniferous deposits	The site includes areas that have remnant carbonaceous wastes. These should be identified, collected and disposed of as soon as possible. The south eastern discard facility is in the process of being rehabilitated. The plan is that this site should be removed and the area rehabilitated by April 2021. Cessation of mining.
The removal and placement of stockpiles not utilised as topsoil	Cessation of mining.
Removal and safe disposal of processing waste deposits, including PCD's and evaporation ponds/ dams.	South eastern discard facility PCD (PCD1) is in the process of being removed and is scheduled to be completed by April 2021. PCD's to be decommissioned once dirty water areas and need for PCD's ends (i.e. once pollution source terms are removed)- most likely at the end of decommissioning and rehabilitation.
General surface rehabilitation (incl backfilled open cast areas and voids, stockpile areas, compacted areas, etc).	Rehabilitation of backlog. Completion of backfilling and shaping. Seeding and planting is most successful when done at or immediately after the first rains in spring, and into freshly prepared, fine-tilled seedbeds (where soils are not prone to crusting).
Rehabilitation of current and future subsided areas (to be dealt with as a latent impact on Section 5).	Pillar collapse and consequent subsidence (refer to pillar life predictions is Section 4.3.3.2).
Wetland and watercourse rehabilitation	Completion of backfilling and shaping.
Rehabilitation Monitoring	Ongoing throughout rehabilitation activities and into the closure and post closure periods.
Water Management	Ongoing throughout rehabilitation activities and into the closure and post closure periods.
Social and economic change management	Ongoing throughout rehabilitation activities and into the closure period.
Maintenance and aftercare.	Cessation of mining and completion of decommissioning and rehabilitation activities.

4.9 ORGANISATIONAL CAPACITY

It is critical that roles and responsibilities for the effective planning, implementation, monitoring and revision of the closure process are clearly defined and provided for. The Holder of the Mining Right is ultimately responsible for ensuring compliance with all the provisions of the Right and associated plans, as well as other relevant legal requirements. The Holder must ensure knowledge and understanding of the applicable legislation, guidelines, and industry best practices. The following organisational capacity is required:

- Internal Closure champion: a suitably qualified person(s) who will be accountable for the following:

- Driving the ongoing development, refinement, and implementation of the closure plan;
- Resourcing and implementing the plan;
- Ongoing management and monitoring requirements to support the closure plan;
- To ensure the integration of the rehabilitation and closure activities with general operational activities; and
- Ensure legal compliance and deliver on commitments.

- Internal Social champion: a suitably qualified person(s) who will be accountable for the following:
  - Develop and implement training strategies for internal training;
  - Develop and implement effective communication with all stakeholders;
  - Develop and implement a stakeholder forum to promote information and idea sharing regarding closure related aspects and/or ensuring meaningful contributions to existing forums; and
  - Continually develop the relationship with I&APs, to promote the social licence to operate and close and decommission.
- Independent Environmental Assessment Practitioner: This individual will be appointed to ensure compliance with the requirements of the FRDCP and specifically to undertake the following tasks:
  - Undertake the prescribed independent auditing; and
  - Undertake period review and assessment of accumulated monitoring data and provide recommendations for review and amendment of the closure planning where applicable.
- Internal or external specialists: The monitoring of the implementation of the closure process and the subsequent revisions, adjustments and alterations will in many cases need to be conducted by suitably qualified specialists (e.g. soils and agricultural specialist, biodiversity and wetland specialist, ground and surface water specialists, engineering and landform design specialists). Relevant specialists should be identified and budgets provided for the scope of work to align with the obligations presented in this closure plan.

Further education, training and capacity building is critical to ensure that the rehabilitation and closure activities align with evolving internationally accepted best practice and research. In this regard the Holder must ensure that regular review of international best practice is undertaken and where applicable implemented throughout the project programme. It is recommended that the internal resource responsible for managing and implementing the closure and rehabilitation activities join available peer networks, affiliations, and organisations (e.g. LaRSSA, Minerals Council bodies, etc).

4.10 IDENTIFICATION OF CLOSURE PLAN GAPS

The key gaps applicable to this closure plan are as follows:

- Soil fertility and final volumes: The mine conducts regular aerial surveys of the site to determine stockpile volumes and rehabilitation profiles. These surveys provide a high-level indication of the amount of topsoil available for rehabilitation but do not provide an indication of the suitability and viability of this topsoil. It is recommended that regular testing of the topsoil stockpiles be undertaken to confirm the current physical and chemical characteristics of these stockpiles. These results are to be used in the annual updates of the Annual Rehabilitation Plan and the FRDCP to inform amelioration measures and the designation of specific stockpiles to specific rehabilitation areas in line with the final post closure land use objectives.

- Backfill settlement and bulking: The landform design is based on certain forecast input values (including bulking factors, settlement factors, etc). The determination of actual values will be measured and monitored. The landform assessment and design must be revised should the actual measured values differ materially from the predictions.
- The exact time and extent of future pillar failure and consequent subsidence is not known. The subsidence risk assessment report provides a prediction based on the available information. It is noted that Area 42 is an area in the South-Western portion of the mining area for which there was no underground survey information (mining layouts) available at the time of the assessment. The subsidence report takes a conservative approach and recommended that it be classified and managed as a "High Risk" area when it comes to the possibility of surface subsidence and sinkhole formation until such time as additional information has been obtained for it and these risks assessed in more detail.
- With respect to the groundwater assessment and model the following gaps and recommendations are suggested:
    - It is recommended that the revised monitoring program as set out in the Groundwater report should be implemented and adhered to. It is imperative that monitoring be conducted to serve as an early warning and detection system. Monitoring results should be evaluated and reviewed on a bi-annual basis by a registered hydrogeologist for interpretation and trend analysis and submitted to the Regional Head: Department of Human Settlements, Water and Sanitation.
    - It is recommended that additional monitoring boreholes, as indicated in the groundwater report (Gradient Consulting (Pty) Ltd, 2020), be established down-gradient of potential decant zones in order to evaluate the mass load contribution of decant water to environmental receptors. Proposed monitoring boreholes should be drilled in pairs to target shallow, weathered as well as deeper, fractured aquifer units. Drilling localities should be determined by means of a geophysical survey in order to target lineaments and weathered zones acting as preferred groundwater flow pathways and contaminant transport mechanisms.
    - Due to the impact and reduction of baseflow reporting to the on-site wetland, it is recommended that a monitoring borehole(s) be drilled in order to evaluate perched water level recovery of the wetland following rehabilitation.
    - Groundwater flow modelling assumptions should be verified and confirmed. The calibrated groundwater flow model should be updated on a bi-annual basis as newly gathered monitoring results become available in order to be applied as groundwater management tool for future scenario predictions.
    - It is recommended that supplementary geochemical characterisation i.e. kinetic leach test should be performed on carbonaceous waste material to be used as backfill material i.e. northern discard pit, with a dynamic geochemical model developed to aid in calculation of source term depletion timeframes.
    - It is imperative that the water level recovery of the underground voids as well as backfilled opencast pits be monitored on a continual basis. Stage re-watering curves should be evaluated in order to aid in the management of the mine post-closure phase in terms of decanting. This must include the western opencast area (west of Grootspruit).
    - Alternative remedial options to reduce rainfall recharge and effective infiltration, which will lead to an increase in leachate volumes, should form part of the mine closure and rehabilitation strategy. It is recommended that the northern discard pit footprint be compacted and a barrier system (capping) and/or evapotranspiration cover be established in order to minimise water and oxygen ingress which is the drivers of acid rock drainage conditions.

- It is recommended that a detailed wetland and watercourse rehabilitation plan be developed for the area. This plan must be used to update and inform the final closure actions and associated cost provisions.

- A grassland specialist should be consulted to provide a proposed seed mix for the areas to be revegetated. This mix should provide suitable mixes for the rehabilitated wetland areas, buffer/ transition areas, and the grassland areas.

- A site-specific alien vegetation eradication control and management plan (AVECMP) must be developed. This plan should include management of alien invasive during the operational phase and the closure phase.

- Much of the success of final rehabilitation is linked to the climatic conditions at the site. In this regards no predictive modelling has been done to consider the likely climate change scenarios for the site and how these may affect rehabilitation actions and targets. It is recommended that available climate change scenarios be included in future groundwater models to determine the range of potential water liability scenarios.

- It is understood that the mine plans to continue generating discard material from the wash plant for the foreseeable future (including possibly processing coal from other mines). This is likely to generate additional discard material. The northern discard area is already close to natural ground level. The mine should prepare a forecast material quantum for the likely final discard volumes and the final closure and rehabilitation strategy for this facility amended accordingly.

- Uncertainties exist around the availability of suitable material to establish an appropriate cover for the Northern Discard Pit. A cover design process still needs to be followed, by specialists, to determine the volume of available material and design of an appropriate cover. Taking this into consideration a conservative estimate view on the cover requirements is taken. The costing is done with the following cover in mind: Topsoil; and Cohesive soil (linear shrinkage and PI content to be confirmed by specialist).

- The extent to which the current closure actions for the northern discard dump (i.e. cover, compact, cover, vegetation) is likely to be adequate for the purposes of preventing future spontaneous combustion within the dump is uncertain. It is recommended that monitoring of this area (or a test area) for heating and burning be undertaken to inform final closure.

- The current topsoil deficit supports the development of an alternative land-use. At present it is suggested that such alternative land-use could include a renewable energy facility (solar PV or soil-less cultivation options). The feasibility of this suggestion and option should be investigated.

- Shaft sealing designs should still be developed by a suitably qualified engineer closer to the closure date and the financial provisions updated accordingly.

- Unrehabilitated exploration boreholes should be sealed off and rehabilitated. However, no information is available on the rehabilitation status of these boreholes. Therefore, no allowance was made for the rehabilitation of exploration boreholes. It is recommended that this information be obtained and allowed for in future closure costings.

Further the financial provisioning regulations requires that the FRDCP be revisited, assessed, and revised on an annual basis. This annual review must aim to ensure that the gaps identified above are addressed, as applicable, and the relevant financial provisioning updated.

4.11 RELINQUISHMENT CRITERIA

Relinquishment can be defined as the formal approval by the relevant regulating authority indicating that the completion criteria for the mining activity have been met to the satisfaction of the authority. In this regard the relinquishment criteria are driven by the objectives of closure and consequently the indicators applicable to each impact associated with the closure and decommissioning. In this regard reference is made to Table 26 and

Table 22, which present each identified environmental impact, the associated indicators and proposed closure targets. The identified relinquishment criteria are presented in Table 33.

Table 33: Defined relinquishment criteria.

Aspect	Relinquishment criteria
Final closure landform	- Alignment with post closure land capability and land use plan (see Section 4.6). - No unplanned ponding. - Rehabilitated areas are free draining to controlled containment and discharge points. - Safe for humans and animals. - No evidence of slope instability or erosion. - Effective separation of clean and dirty water. - No unrehabilitated melon holes. - Alignment with landform design.
Soils and land capability	- Alignment with post closure land capability and land use plan (see Section 3.6). - Topsoils across rehabilitated pit areas (excluding defined alternative land-use area and maintenance roads where applicable). - ≥85% correlation between available soil and stripped soil. - Audited compliance with soil stripping and handling plan - Soil Physio-chemical parameters: o Rock content: as low as possible (< 50 % by volume of rocks or pedocrete fragments larger than 100 mm diameter). o Comply with pH (KCl): between 6 and 7.5. o Salinity (as EC): <400mS/m and exchangeable sodium percentage less than 15. o Fertility: P (Bray 1); and K: Target for P – 10mg/kg to 17 mg/kg; Target for K 40 mg/kg to 250 mg/kg. o Organic Carbon: > 0.75% through depths of 250 mm. o Major Cations: Ca= between 200-3000mg/kg- recommended ~800mg/kg; Mg= between 50-300mg/kg- recommended 150 mg/kg; Na= between 50-200mg/kg- recommended <100 mg/kg).
Water Resources	- Updated numerical groundwater model and water liability assessment. - Updated mine water management plan (for residual and latent impacts). - Updated and secured financial provision for residual and latent impacts. - Comply with National Water Act or WUL requirements. - Compliance with GN704.
Biodiversity	- Natural areas vegetation structure and species composition to align with local reference site: o ≥80% of the reference site species richness. o <10% of assessment plots failing to meet species richness target.

Aspect	Relinquishment criteria
	- Alien invasive plants not dominating and presence to align with, and improve on, surrounding local reference sites. - Natural areas vegetation structure and species composition to align with local reference site. - Presence of alien invasive plants to align with and improve on surrounding local reference sites. - Wetlands- HGM 1 and 3 = Class D PES. - Rehabilitated channel over portion 13/26: Class C PES.
Infrastructure	- Alignment with post closure land capability plan (see Section 4.6). - Signed agreements for ongoing land use and management. - No remnant infrastructure or waste materials remaining on surface, unless transferred in writing in the signed agreements.
Social and Economic	- Site is safe for human and animals. - Alignment with post closure land capability plan (see Section 3.6). - Post closure land-use agreements (covering land use, rehabilitated land management and ongoing maintenance, including where relevant management of residual impacts). - No unattended public complaints. Where possible written confirmation from the affected landowner/ complainant must be solicited confirming that outstanding issues have been addressed and closed out.
Climate change resilience	- Apply latest climate change prediction to assessment of residual and latent impacts- provision of reasonable and adequate contingency funding.

4.12 CLOSURE COST AND FINANCIAL PROVISION- FRDCP

The closure cost estimation was determined by BEAL Consulting Engineers and was based on the requirements of GNR1147. A separate quantum was determined using the DMR Guideline method. The GNR1147 quantum is expected to represent a realistic estimation of the required cost for effective decommissioning, rehabilitation, closure, and management of ongoing residual, and potential future latent, impacts. The DMR Guideline method is compliant with the provisions and arrangements regarding financial provisioning approved as part of the MR in terms of the MPRDA, and consequently regarded as being compliant with the provisions of GNR1147 until the 19th of June 2022.

On the basis that the mine is not at present required to comply with the provisions of GNR1147 for the determination of the quantum of financial provision, this section only shows the quantum determined based on the DMR Guideline method. The mine has been provided the GNR1147 quantum determination for future planning and preparation purposes, and for implementation as and when required.

4.12.1 CLOSURE COST ESTIMATION

In accordance with Regulation 17B of the Financial Provisioning Regulations: "*Unless regulation 17A applies, a holder, or holder of a right or permit, who applied for such right or permit prior to 20 November 2015, regardless of when the right or permit was obtained-*

(a) *must by no later than 19 June 2022 comply with these Regulations; and*

(b) *shall, until 19 June 2022, be regarded as having complied with the provisions of these Regulations, if such holder has complied with the provisions and arrangements regarding financial provisioning,* *approved as part of the right or permit issued in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).*

On the basis of these transitional arrangements it is understood that Elandsfontein Colliery is currently compliant with the financial provisioning arrangements associated with the current mining rights (MR63 and MR314). As such at present the mine may continue to determine quantum and provide for associated financial provisions according to the DMR Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision' provided by a Mine (DMR Guidelines). This section presents the quantum calculations for the consolidated mining areas (i.e. MR63 and MR314) according to the DMR Guideline.

This section presents the basis of the closure cost component and the outcome of the closure cost estimation. Table 34 presents the closure cost components, descriptions, and associated assessment for unscheduled closure and scheduled closure, respectively.

Table 34: Closure cost components and associated assessment.

Closure cost component	Closure cost assessment	
	Unscheduled (2021)	Scheduled (2032)
Infrastructure Areas		
Steel structures, reinforced concrete and brick structures, offices, workshops, weigh bridges, stores and related structures and infrastructure	• Demolish all steel structures; • Demolish all concrete and reinforced concrete buildings/structures to a depth of 1 m below ground level; • Remove 100mm contaminated soil from certain identified areas and dispose in the Northern Discard Pit; • Rip the disturbed footprint area; • Profile the area to be free draining; • Import topsoil in certain identified areas; and • Vegetate the disturbed infrastructural surface areas.	
River crossings	Rehabilitate River crossings as follows: • Removal of concrete structure; • Fill culvert voids; • Import and spread 250 mm topsoil; and • Establish vegetation.	
Access and haul roads	• Remove 100 mm of contaminated soil from haul roads, dispose in the Northern Discard Pit and rehabilitate; • Rip to alleviate compaction; • Re-establish natural drainage; • Amelioration of soils; • Import topsoil in certain identified areas; and • Prepare for the natural re-establishment by keystone pioneer species.	
Linear infrastructure	• Powerlines: Remove all power lines, except the main feed lines leading to Eskom's substations. • Fences: Dismantle and dispose of all fences that do not form part of post-closure property boundaries, as defined by the post mining land use plan. • Conveyor belts: Dismantle and dispose of all conveyor belts.	
Dirty water impoundments	Rehabilitate pollution control dams as follows: • Remove contaminated soil/sediment from dam basin, and dispose in the Northern Discard Pit; • Remove all liners; • Breach dam wall and shape to a minimum of 1:5 (V:H); • Shape and level the disturbed area to facilitate free drainage;	

	• Import topsoil; and • Establish vegetation.	
Stormwater management infrastructure	Rehabilitate channels and berms as follows: • Remove topsoil to nominal depth of 150mm from berms and stockpile; • Remove contaminated soil/sediment from channels, and dispose in the Northern Discard Pit; • Doze berm into channel to level surface area; • Import from topsoil stockpile and spread 250 mm topsoil; • Establish vegetation. Rehabilitate culverts as follows: • Doze to remove road layerworks from culvert; • Removal of concrete structure; • Doze to level surface area; • Import from topsoil stockpile and spread 250 mm topsoil; • Establish vegetation.	Rehabilitate channels and berms as follows: • Remove topsoil to nominal depth of 150mm from berms and stockpile; • Remove contaminated soil/sediment from channels, and dispose in the Northern Discard Pit; • Removal of concrete drains; • Doze berm into channel to level surface area; • Import from topsoil stockpile and spread 250 mm topsoil; • Establish vegetation. Rehabilitate culverts as follows: • Doze to remove road layerworks from culvert; • Removal of concrete structure; • Doze to level surface area; • Import and spread 250 mm topsoil; • Establish vegetation. Rehabilitate silt traps as follows: • Remove contaminated soil/sediment from silt traps, and dispose in the Northern Discard Pit; • Removal of concrete structure; • Doze to level surface area; • Import and spread 250 mm topsoil; • Establish vegetation.
Waste management	• General: Sort and screen waste. • Concrete/inert demolition waste: Dispose concrete in the pit. • Steel: Dispose of steel in Emalahleni at licenced recycling or disposal facility • General waste: Transport and dispose of general waste at a registered landfill facility • Hazardous waste Transport hazardous waste to the Holfontein hazardous waste disposal facility	
Mining Areas		
Open Pits	• Allowance was made to seal 1 decline shaft; • Rehabilitate 1 ventilation shaft; • Rehabilitate 1 rescue borehole; • Shaping of the footwall wall to a 1 in 14 slope; • Shaping of the highwall wall to a 1 in 7 slope; • Fill to free drainage with surrounding stockpiles; • Allowance was made for the importing of available topsoil from surrounding stockpiles on the landform area; and	

	• Allowance was made for the establishment of vegetation on the topsoiled areas.
Stockpiles	• It is assumed that all stockpiles will be used for the final landform topography; • Re-establish natural drainage; • All stockpile areas will be ripped up and down and across. It will be rehabilitated by adding of lime (10ton/ha), disked and vegetated.
ROM and Stockpile area	• Remove contaminated soil and dispose in the Northern Discard Pit; • Remove all liners at scheduled closure; • Shape and level the disturbed area to facilitate free drainage; • Allowance was made for the importing of available topsoil from surrounding stockpiles on the landform area; and • Allowance was made for the establishment of vegetation on the topsoiled areas.
Historic Slurry Dam	• Remove slurry from dam basin and dispose in the Northern Discard Pit. Assume a depth of 1.5m will be removed; • Cut to fill; • Fill to free drainage with surrounding stockpiles; • Allowance was made for the importing of available topsoil from surrounding stockpiles on the landform area; and • Allowance was made for the establishment of vegetation on the topsoiled areas.
Northern Discard Pit	• Shaping and levelling; • Compaction; • Placing of capping material; • Allowance was made for the importing of available topsoil from surrounding stockpiles on the landform area; and • Allowance was made for the establishment of vegetation on the topsoiled areas.
South Eastern Discard Area	• Remove 300mm contaminated soil and dispose in the Northern Discard Pit; • Shape and level the disturbed area to facilitate free drainage; • Allowance was made for the importing of available topsoil from surrounding stockpiles on the landform area; and • Allowance was made for the establishment of vegetation on the topsoiled areas.
General Surface Rehabilitation	
Subsidence	Allowance was made for repair of surface cracks through bulldozing crack and crest to more even profile, deep ripping, backfilling with inert materials, levelling to be free draining, and revegetating.
River diversion	Allowance was made for general surface rehabilitation of banks, formalising certain portions of the river diversion.
ROM, Southern Discard Dump, Laydown Areas, Haul Roads, etc.	• 300mm of contaminated soil will be removed from the ROM area as well as from the Southern Discard Dump and will be discarded at the Northern Discard Pit; • 100mm of contaminated soil will be removed on the identified contaminated areas and disposed of in the Northern Discard Pit; • Therefore, the identified haul roads will be cleaned and rehabilitated by removing 100mm of the contaminated soil and disposing of it in the Northern Discard Pit prior to its rehabilitation.
Water Management	

Re-instatement of drainage lines	Re-instate natural drainage lines over the site (excluding the areas included under the rehabilitation of final voids, ramps, spoils and residue deposits).
Pre-Site Relinquishment Monitoring and Aftercare	
Surface water and groundwater monitoring	Annual monitoring over a 50-year period at 13 surface water monitoring points - Table 14.1 (Mostert, 2021); Annual monitoring over a 50-year period at 11 groundwater monitoring points - Table 14.1 (Mostert, 2021); and Mine to execute water level check monthly and keep record for registered hydrogeologist 's annual report.
Rehabilitation monitoring	Annual monitoring over a 50-year period on all areas rehabilitated at closure.
Subsidence monitoring	Assumed yearly survey over a 50-year period on all areas rehabilitated at closure; Assumed yearly monitoring over a 50-year period on all areas rehabilitated at closure.
Care and maintenance	Assumed care and maintenance once a year over a 50-year period on all areas rehabilitated at closure.
Additional Allowances	
Preliminary and general	An additional allowance of 12% of the total infrastructural, mining areas and related aspects has been made.
Contingencies	An additional allowance of 10% of the total for infrastructure, mining areas and related aspects has been made.
Water Treatment	
Post-closure water treatment	The following information was gathered from the hydrogeological study: • Scavenger boreholes water treatment. • Volume: 421m³/day. • 50 years post-closure. • One plant will be constructed for the 50-year period.
Contingencies	An additional allowance of 10% of the total for infrastructure, mining areas and related aspects has been made.

4.12.1.1 UNSCHEDULED CLOSURE

The quantum of financial provisions required for un-scheduled closure using the DMR Master Rates and the DMR Guidelines was calculated and aligns with the combined quantum presented for the existing mine (MR63 and MR314) as submitted to the DMRE in 2021. For the purposes of the quantum for unscheduled closure it is assumed that un-scheduled closure represents the state of the mine at present, based on the January 2021 Survey. Please refer to Table 35 for a breakdown of the quantum based on the DMR Guidelines.

The following parameters and weighting characteristics were applied:

Project Details:		
Project Risk Class:	A	Coal
Project Area Sensitivity:	High	Located in an area on which the local people make a living.
Weighting Factor 1:	1.1	Undulating terrain

Weighting Factor 2:	1.05	Peri-urban: Less than 150 km from a developed urban area

The DMR Guideline does not specifically provide for long term water treatment or other long term environmental liability. The NEMA based quantum should be consulted for the estimated cost of addressing the long term latent and residual liability.

4.12.1.2 SCHEDULED CLOSURE

Scheduled closure relates to the activities required as and when the mine ceases mining activities. For the purposes of this DMR Scheduled Closure quantum the following assumptions apply:

- It is assumed that all historic rehabilitation backlog will be completed and therefore that there will be no final voids or stockpiles to be rehabilitated. As per the Mining Works program (Georock Consulting, January 2020) the mining is done in a roll over operation (mining and backfilling concurrently). Based on the LOM schedule all opencast pits are considered mined out with only the underground decline shaft at Block A left for schedule closure.
- Scheduled closure will primarily comprise of:
    - Decommissioning, dismantling and disposal of the beneficiation plant and associated infrastructure;
    - Decommissioning, dismantling and disposal of all surface infrastructure, including buildings, powerlines, roads, stormwater infrastructure, etc.
    - Cover and cap the northern discard dump (it is assumed that the slurry ponds are decommissioned as part of the current rehabilitation backlog).
    - General surface rehabilitation of all disturbed areas.
- As discussed earlier in the document, there is expected to be a shortfall in topsoil available for rehabilitation. No cost provision has been made in the DMR Closure quantum for obtaining topsoil from an external source.
- The DMR Guideline does not specifically provide for long term water treatment or other long term environmental liability. The NEMA based quantum should be consulted for the estimated cost of addressing the long term latent and residual liability.

Please refer to Table 35 for a breakdown of the quantum based on the DMR Guidelines.

Table 35: DMR Master Rates based quantum- Unscheduled Closure.

No	Sub-Task	Unit	A. Quantity	B. Master Rate	C. Multiplication factor	D. Weighting Factor 1	E. = A*B*C*D
1	Dismantling of processing plant and related structures (including overland conveyors and power lines).	m3	42888	R 16.16	1.00	1.10	R 762 361.92
2A	Demolition of steel buildings and structures.	m2	1917	R 225.10	1.00	1.10	R 474 664.49
2B	Demolition of reinforced concrete buildings and structures.	m2	10985.18	R 331.72	1.00	1.10	R 4 008 447.88
3	Rehabilitation of access roads.	m2	273200	R 40.28	1.00	1.10	R 12 105 163.07
4A	Demolition and rehabilitation of electrified railway lines.	m	0	R 390.96	1.00	1.10	R 0.00
4B	Demolition and rehabilitation of non-electrified railway lines .	m	0	R 213.25	1.00	1.10	R 0.00
5	Demolition of housing and facilities.	m2	2122	R 450.20	1.00	1.10	R 1 050 848.26
6	Opencast rehabilitation including final voids and ramps .	ha	37.25	R 229 126.23	1.00	1.10	R 9 388 447.44
7	Sealing of shafts, adits and inclines.	m3	71845	R 120.84	1.00	1.10	R 9 550 096.35
8A	Rehabilitation of overburden and spoils.	ha	45.06	R 157 331.77	1.00	1.10	R 7 798 306.40
8B	Rehabilitation of processing waste deposits and evaporation ponds (basic, salt-producing waste).	ha	0	R 195 953.87	1.00	1.10	R 0.00
8C	Rehabilitation of processing waste deposits and evaporation ponds (acidic, metal-rich waste).	ha	21.61	R 569 142.93	1.00	1.10	R 13 529 096.60
9	Rehabilitation of subsided areas.	ha	31.475	R 131 741.66	1.00	1.10	R 4 561 225.65
10	General surface rehabilitation, including grassing of all denuded areas.	ha	364.88	R 17 375.01	1.00	1.10	R 6 973 771.49
11	River diversions.	ha	4.0546	R 124 633.30	1.00	1.10	R 555 871.99
12	Fencing.	m	0	R 142.17	1.00	1.10	R 0.00
13	Water management (Separating clean and dirty water, managing polluted water and managing the impact on groundwater, including treatment, when required).	ha	371.72	R 47 389.09	1.00	1.10	R 19 377 018.42

No	Sub-Task	Unit	A. Quantity	B. Master Rate	C. Multiplication factor	D. Weighting Factor 1	E. = A*B*C*D
14	Maintenance and Aftercare (2-3 years)	ha	502.78	R 16 586.18	1.00	1.10	R 9 173 119.72
15A	Specialist Study: Updated Geotechnical assessment and risk assessment	Sum	1	R 300 000.00	1.00	1.10	R 330 000.00
15B	Specialist Study: Updated Geohydrological model	Sum	1	R 700 000.00	1.00	1.10	R 770 000.00
15C	Specialist Study: NEMA EIA and Closure Plan	Sum	1	R 300 000.00	1.00	1.10	R 330 000.00
	SUB-TOTAL						**R 100 738 439.68**
	SUB-TOTAL 1		**Weighting Factor 2 (Step 4.4)**			**1.05**	**R 105 775 361.67**
	Time, Fee and Contingencies						
1	Preliminary and general			6% of Sub-total 1 if >R100 000 000		R 6 346 521.70	
	SUB-TOTAL 2						**R 112 121 883.37**
2	**Contingencies**			Add 10% of Sub-total 1		R 10 577 536.17	
	SUB-TOTAL 3						**R 122 699 419.53**
	VAT			at 15% of Sub-total 3		R 18 404 912.93	
	GRAND TOTAL						**R 141 104 332.46**

Table 36: DMR Master Rates based quantum- Scheduled Closure.

No	Sub-Task	Unit	A. Quantity	B. Master Rate	C. Multiplication factor	D. Weighting Factor 1	E. = A*B*C*D
1	Dismantling of processing plant and related structures (including overland conveyors and power lines).	m3	42888	R 16.16	1.00	1.10	R 762 361.92
2A	Demolition of steel buildings and structures.	m2	1917	R 225.10	1.00	1.10	R 474 664.49
2B	Demolition of reinforced concrete buildings and structures.	m2	11061.68	R 331.72	1.00	1.10	R 4 036 362.42
3	Rehabilitation of access roads.	m2	273200	R 40.28	1.00	1.10	R 12 105 163.07
4A	Demolition and rehabilitation of electrified railway lines.	m	0	R 390.96	1.00	1.10	R 0.00
4B	Demolition and rehabilitation of non-electrified railway lines .	m	0	R 213.25	1.00	1.10	R 0.00
5	Demolition of housing and facilities.	m2	2122	R 450.20	1.00	1.10	R 1 050 848.26
6	Opencast rehabilitation including final voids and ramps .	ha	0.00	R 229 126.23	1.00	1.10	R 0.00
7	Sealing of shafts, adits and inclines.	m3	71845	R 120.84	1.00	1.10	R 9 550 096.35
8A	Rehabilitation of overburden and spoils.	ha	0	R 157 331.77	1.00	1.10	R 0.00
8B	Rehabilitation of processing waste deposits and evaporation ponds (basic, salt-producing waste).	ha	0	R 195 953.87	1.00	1.10	R 0.00
8C	Rehabilitation of processing waste deposits and evaporation ponds (acidic, metal-rich waste).	ha	18.54	R 569 142.93	1.00	1.10	R 11 607 100.93
9	Rehabilitation of subsided areas.	ha	31.475	R 131 741.66	1.00	1.10	R 4 561 225.65
10	General surface rehabilitation, including grassing of all denuded areas.	ha	60	R 17 375.01	1.00	1.10	R 1 146 750.41
11	River diversions.	ha	4.0546	R 124 633.30	1.00	1.10	R 555 871.99
12	Fencing.	m	0	R 142.17	1.00	1.10	R 0.00
13	Water management (Separating clean and dirty water, managing polluted water and managing the impact on groundwater, including treatment, when required).	ha	617	R 47 389.09	1.00	1.10	R 32 162 973.11

No	Sub-Task	Unit	A. Quantity	B. Master Rate	C. Multiplication factor	D. Weighting Factor 1	E. = A*B*C*D
14	Maintenance and Aftercare (2-3 years)	ha	502.78	R 16 586.18	1.00	1.10	R 9 173 119.72
15A	Specialist Study: Updated Geotechnical assessment and risk assessment	Sum	1	R 300 000.00	1.00	1.10	R 330 000.00
15B	Specialist Study: Updated Geohydological model	Sum	1	R 700 000.00	1.00	1.10	R 770 000.00
15C	Specialist Study: NEMA EIA and Closure Plan	Sum	1	R 300 000.00	1.00	1.10	R 330 000.00
	SUB-TOTAL						**R 88 616 538.32**
	SUB-TOTAL 1			**Weighting Factor 2 (Step 4.4)**		**1.05**	**R 93 047 365.24**
	Time, Fee and Contingencies						
1	Preliminary and general					R -	
	SUB-TOTAL 2						**R 93 047 365.24**
2	**Contingencies**			Add 10% of Sub-total 1		R 0.00	
	SUB-TOTAL 3						**R 93 047 365.24**
	VAT			at 15% of Sub-total 3		R 13 957 104.79	
	GRAND TOTAL						**R 107 004 470.03**

4.12.2 ASPECTS REQUIRING FURTHER ATTENTION

Aspects that require further attention have been identified. These aspects may improve the accuracy of future closure cost estimates and could result in some significant reduction in costs:

- Due to the shortage of topsoil on the existing site it might be a worthwhile exercise to consider the use of a topsoil replacement product;
- Based on the topsoil shortage on site it is assumed that there is useable topsoil underneath the stockpiles. The soil underneath the stockpiles will probably be degraded, amelioration and ripping will most likely be required. It is recommended that the soil underneath the stockpile be observed and sampled before decommissioning, to determine how much amelioration will be required;
- It is assumed that the material next to the slurry dam can be utilised as topsoil. It is recommended that this material be tested, before closure, to confirm the suitability;
- Fertility of the topsoil would need to be assessed and rectified if required;
- Shaft sealing designs should still be developed by a suitably qualified engineer;
- There is a high voltage Eskom transmission line servitude on site. All decommissioning, closure and rehabilitation activities must comply with relevant legal requirements. The subsidence risk and proximity to affected Eskom infrastructure should be investigated;
- A targeted wetland and watercourse rehabilitation plan with the associated costs should be developed by a wetland specialist and hydrologist. No allowance was made for wetland rehabilitation. Only limited allowance was made for general surface rehabilitation of banks, formalising certain portions of the river diversion;
- While not specifically raised as a concern, the presence of the gas and Transnet petroleum pipeline may pose a hazard if located above unstable past and future underground operations. The pipeline must be considered in future subsidence risk;
- A mine rehabilitation phase traffic/transport layout plan should be developed to utilise existing access routes where possible and minimise unnecessary access roads;
- The depth of the slurry dam is unknown. A depth of 1.5m has been assumed in the calculations. Remnant slurry and carbonaceous wastes will be removed and disposed of in the Northern Discard Pit. It is recommended that more detailed contour data be obtained once the slurry dam has been emptied and these calculations revised where necessary before closure, as this has a major impact on the material balance;
- It is assumed that all stockpile material will be suitable for backfill and the entire stockpile will be used for backfilling. It is recommended that the stockpiles be sampled to determine the suitability for backfill;
- Uncertainties exist around the availability of material to establish an appropriate cover for the Northern Discard Pit. A cover design process still needs to be followed to determine the volume of available material and design of an appropriate cover;
- The closure strategy at present is to ensure that all carbonaceous waste is disposed of at the Northern Discard Pit, up to natural ground level, and then capped and covered;
- Based on information received from the client (refer to Appendix D for the relevant communication), the remaining void space in the Northern Discard Pit would be adequate to accommodate future discard and provision does not need to be made for a future surface discard facility. There would be a need to ensure regular reassessment of the actual and revised predicted volumes of discard to verify this understanding. If necessary adequate time should be allowed to develop an alternative solution should there be excessive discard volumes;

- It is recommended that constant discharge aquifer tests be conducted on newly established seepage capturing boreholes in order to optimise borehole yields;
- Further investigative test should be conducted on the discard materials to update the groundwater model, risk assessment, and closure alternative options assessment. This must include long term kinetic leach tests to determine the long-term pollution potential of the discard and piezometric tests of the backfilled areas to confirm the recharge values;
- Unrehabilitated exploration boreholes should be sealed off and rehabilitated. However, no information is available on the rehabilitation status of these boreholes. Therefore, no allowance was made for the rehabilitation of exploration boreholes. It is recommended that this information be obtained and allowed for in future closure costings.
- It is recommended that the residue from the PCDs be tested to determine if it should be disposed of in a suitably licenced facility or if pit disposal will suffice;
- Some of the previously rehabilitated voids are showing signs of possible settlement. Allowance was made for repair of surface cracks through bulldozing crack and crest to more even profile, deep ripping, backfilling with inert materials, levelling to be free draining, and revegetating; and
- There is evidence of a possible sinkhole formation North of the slurry dam. The mine should investigate the origin of this hole to further inform management and mitigation measures.

4.13 MONITORING, AUDITING AND REPORTING

The requirement for monitoring and auditing should be carried through all phases of the mine lifecycle. The financial provision regulations require that monitoring, auditing and reporting requirements which relate to the risk assessment (see section 4.3), legal requirements (see section 4.4.1) and knowledge gaps (see section 4.10) as a minimum and must include-

(i) a schedule outlining internal, external, and legislated audits of the plan for the year, including-

   a. the person responsible for undertaking the audit(s);

   b. the planned date of audit and frequency of audit;

   c. an explanation of the approach that will be taken to address and close out audit results and schedule;

(ii) a schedule of reporting requirements providing an outline of internal and external reporting, including disclosure of updates of the plan to stakeholders;

(iii) a monitoring plan which outlines-

   a. parameters to be monitored, frequency of monitoring and period of monitoring; and

   b. an explanation of the approach that will be taken to analyse monitoring results and how these results will be used to inform adaptive or corrective management and/or risk reduction activities.

This section aims to present the monitoring plan which will need to be implemented in the rehabilitation and decommissioning, and closure phases. For detail on the monitoring requirements during the mining and progressive rehabilitation phase, and the post-closure phase, please refer to Sections 5 and 6 respectively.

For the purposes of this closure plan the monitoring and auditing is separated into two distinct categories namely, compliance monitoring and environmental monitoring. The compliance monitoring will typically align with, and be a continuation of, the requirements of compliance monitoring and reporting as specified in the EMPr. Table 37 and Table 38 provide the compliance monitoring and reporting plan and the environmental monitoring and reporting plan respectively, applicable to the decommissioning, rehabilitation, and closure phase.

In accordance with Regulation 11 of the NEMA Financial Provisioning Regulations the Holder must ensure annual review of the annual rehabilitation plan, the final rehabilitation decommissioning and closure plan, as well as the environmental risk assessment. This annual review must be audited by an independent auditor.

Table 37: Compliance monitoring and reporting plan.

Type	Functional Requirement	Responsibility	Frequency	Reporting Mechanism
Daily site inspections	- Undertake site inspections. - Photographic record of site activities. - Data capturing for record and compliance verification purposes. - Daily site inspection diary.	Environmental Officer	Daily	No routine reporting. Ad hoc as necessary.
Weekly Inspection Report	- Ensure compliance with soil stripping, stockpiling and placement plan. - Consolidate daily diary findings. - Verification and update daily diary findings. - Weekly compliance report.	Environmental Officer	Weekly	Weekly compliance report.
Monthly Compliance Report	- Monitor and report on compliance with the requirements of the EA, EMPr, and closure plan and general environmental performance. - Include the results of all relevant environmental monitoring. - Include status of rehabilitation activities. - Include records of: ○ Waste manifests. ○ Incident registers. ○ Complaints registers. ○ Site Fauna Observation Register. ○ Topsoil stripping and placement register.	Environmental Manager/ ECO	Monthly	Monthly compliance report

Type	Functional Requirement	Responsibility	Frequency	Reporting Mechanism
	○ Relevant corrective action reports.			
Annual Independent Audit	- Site inspection and photographic record. - Audit and report on compliance with EA, EMPr and FRDCP. - Monitoring compliance with Annual rehabilitation Plan - Alignment with requirements of Appendix 7 of GNR982 (as amended), NEMA.	Independent Environmental Auditor	Annual	Annual Environmental Compliance Audit Report
Annual review of financial provisioning reports in accordance with the requirements of Regulation 11 of the Financial Provision Regulations.	- Review, assess and adjust: ○ Annual Rehabilitation Plan; ○ FRDCP; and ○ Environmental Risk Assessment. - Ensure on-going compliance with the requirements of the Annual Rehabilitation Plan and the FRDCP.	Independent Specialist.	Annual	Annual Financial Provision Assessment and update.

Table 38: Monitoring plan- FRDCP

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism
Air	- Decommissioning and rehabilitation - Closure	Monitor dust fallout and PM10 if applicable- dust monitoring will be triggered by public complaints or on instruction from EAP. Standards: National Environmental Management: Air Quality Act, 2004 (Act 39 of 2004) (NEMA: AQA): National Dust Control Regulations 2013 (NDCR, 2013). Measured by the ASTM D1739 method. Locations: - Decommissioning and rehabilitation Dust fallout monitoring at sensitive receptors. - Closure: At receptor or closest boundary point.	The dustfall rates as specified in the NDCR (600 mg/m²/day for residential areas and 1200 mg/m²/day for non-residential areas) are applicable for dust fallout	- Decommissioning and rehabilitation Phase: Monthly - Closure Phase: Initiate monitoring if complaints received and registered. Continue monitoring until at least 2 successive sample events within acceptable limits.	- Monthly dust report. - Ad hoc report (closure phase). - Included in monthly compliance report where applicable.
Groundwater	- Decommissioning and rehabilitation. - Closure	Objectives: - To provide reliable groundwater data that can be used for management purposes. - The early detection of changes in groundwater quality and quantity.	- Monitoring network must comply with the risk-based source-pathway - receptor principle. - Compliance with WUL water quality thresholds. - Water quality downstream of mining area within WMA	Groundwater monitoring i.e. quality analysis should be conducted on a quarterly basis. Water level monitoring is conducted on a monthly basis.	- Quarterly Monitoring Report- submitted as part of WUL conditions. - Included in monthly compliance report where applicable.

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism
		- Provide an on-going performance record on the efficiency of the Water Management Plan. - Obtain information that can be used to redirect and refocus the Water Management Plan. - Determine compliance with environmental laws, standards and the water use licence and other environmental authorizations. Standards: - Groundwater Sampling (Water Research Commission T303/07-Weaver et al, 2007). - DWAF Best Practice Guideline – G3: Water Monitoring Systems (DWA, 2006). - SANS 5667-1:2008/ISO 5667-1:2006 Water Quality – Sampling Part 1: Guidance on the design of sampling programmes and sampling techniques. - SANS 5667-3:2006/ISO 5667-3:2003 Water Quality	Target Water Quality Objectives.		- Monitoring reports submitted to the Regional Head: DWS.

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism
		– Sampling Part 3: Guidance on the preservation and handling of water samples. - SANS 5667-11:2015/ISO 5667-11:2009 Water Quality – Sampling Part 11: Guidance on sampling of groundwater. - Use of SANAS Accredited analytical laboratory. Parameters: - Refer to monitoring sites defined in the groundwater assessment (Gradient Consulting (Pty) Ltd, 2020). - Groundwater level. - A calibrated mechanical or electronic flow meter must be installed at all underground/opencast sumps and abstraction points in order to monitor and record abstraction volumes. - Volumes of water used for dust suppression (if applicable). Locations:			

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism
		- Refer to monitoring sites defined in the groundwater assessment (Gradient Groundwater Consulting , 2020).			
Surface Water	- Decommissioning and rehabilitation. - Closure	Standards: - DWAF Best Practice Guideline – G3: Water Monitoring Systems (DWA, 2006). - SANS 5667-1:2008/ISO 5667-1:2006 Water Quality – Sampling Part 1: Guidance on the design of sampling programmes and sampling techniques. - SANS 5667-3:2006/ISO 5667-3:2003 Water Quality – Sampling Part 3: Guidance on the preservation and handling of water samples. - SANS 5667-4:1987/ISO 5667-4:1987 Water Quality – Sampling Part 4: Guidance on sampling of lakes, natural and man-made. - SANS 5667-6:2006/ISO 5667-6:2005 Water Quality – Sampling Part 6:	- Compliance with defined Resource Water Quality Objectives. - Compliance with WUL water quality thresholds.	Quarterly	- Quarterly Monitoring Report- submitted as part of WUL conditions. - Monitoring reports submitted to the Regional Head: DWS.

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism
		Guidance on sampling of rivers and streams. - Use of SANAS Accredited analytical laboratory Parameters: - Refer to parameters defined in the groundwater assessment (Gradient Consulting (Pty) Ltd, 2020). - Set of parameters as defined in WUL. Locations: - Refer to monitoring sites defined in the groundwater assessment (Gradient Groundwater Consulting , 2020).			
Wetland and Aquatic	- Decommissioning and rehabilitation. - Closure	Standards: - Standard River Ecosystem Monitoring Programme (Ecostatus) methods. - Wetland WET-Series Parameters: - Biomonitoring. - Overall Aquatic PES. - Wetland PES, functioning and EIS.	- Wetlands: ○ Recommended Ecological Category PES D for HGM 1 and 3.	Bi-annual	Water use licence reporting requirements. Included in monthly compliance report where applicable.

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism
		Locations: - Wetlands: units identified in the wetland assessment (The Biodiversity Company (Pty) Ltd, 2020).			
Noise (if required)	- Decommissioning and rehabilitation. - Closure	Standards: SANS 10103:2008 for a minimum duration of 10 minutes. Parameters: - LAeq,i (National Noise Control Regulation requirement). - LA90,f (background noise level as used internationally). - LAeq,f (Noise level used to compare with IFC noise limit). Locations: At receptor or closest boundary point.	Compliance with National Noise Control Regulations (GN R154 of 1992) and SANS 10103:2008, for rural noise district.	Initiate monitoring if complaints received and registered or on instruction from the EAP. When a noise complaint is being investigated, measurements should be collected during a period or in conditions similar to when the receptor experienced the disturbing noise event.	- Ad hoc report. - Included in monthly compliance report where applicable.
Biodiversity	- Decommissioning and rehabilitation. - Closure	Standards: - Timed random meander method. - Faunal surveys: camera trapping, visual	- Flora: ○ Acceptable cover[15] achieved in areas where natural	Quarterly.	Included in monthly compliance report where applicable.

[15] Acceptable cover ' means re-establishment of pioneer grass communities over the disturbed areas at a density similar to surrounding undisturbed areas, non-eroding and free of invasive alien plants.

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism
	• Monthly monitoring on the emergence of the species and the effectivity of the alien management plan, and action taken where needed in regard to alien invasive plant species	observation, small mammal trapping. Parameters: - Site Fauna Observation Register (date, time, location, description, photo evidence). - Flora and Fauna Surveys: ○ Floristic diversity. ○ Floristic coverage. ○ Faunal diversity. Locations: Random meanders within all defined natural areas.	vegetation is being re-established. ○ Natural areas vegetation structure and species composition to align with local reference site: ≥80% of the reference site species richness; <10% of assessment plots failing to meet species richness target. ○ Alien invasive plants not dominating, and presence to align with, and improve on, surrounding local reference sites. Monitoring on the emergence of the species and the effectivity of the alien management plan, and action taken where needed in regard to alien invasive plant species - Faunal diversity similar of better than pre-mining surveys.		

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism
Final Landform	- Decommissioning and rehabilitation. - Closure.	Standards: - Land Rehabilitation Guidelines for Surface Coal Mines (LaRSSA, 2019). Parameters: - Settlement and subsidence (incl measured settlement factors, settlement in cm/annum, deviation from final post closure landform design, surface water ponding). - Material balance (topsoil/overburden/ interburden). - Ha's of corrected/ remediated settlement areas- in order to update financial provisions. - Slope. - Visual observations: Ponding, erosion, Locations: - Settlement: at installed in pit boreholes; annual surface topographical survey of rehabilitated pit.	Alignment with post closure landform design.	Visual observations for settlement features (ponding, erosion, etc) to be included in ongoing environmental inspections. Annual dedicated survey and measurement to allow for update of landform analysis.	- Included in monthly compliance report where applicable. - Annual landform assessment report to inform and be considered in Annual Independent Environmental Audit and/or annual review of financial provision reports.

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism
Soils	- Progressive rehabilitation during operation. - Decommissioning and rehabilitation. - Closure.	Standards: - Land Rehabilitation Guidelines for Surface Coal Mines (LaRSSA, 2019). Parameters: - Land capability. - Soil loss- m^3/ha/annum. - Soil depth. - Topsoil balances from topsoil stripping and placement register- topsoil source, volume, depth, type, stockpile location, placement location (during rehabilitation). - Soil survey: ○ Physical parameters: Rock content; Soil Texture; Soil aggregation; Water holding Capacity; Bulk density; Available rooting depth. ○ Soil Chemistry: pH (KCl); Salinity (as EC); Fertility: P (Bray 1), and K;	- Soil loss rates to align with pre-mining rate or suitable local reference site. - Refer to Section 4.11 for the target relinquishment values for the soil survey parameters.	- Monthly survey for compaction and erosion during decommissioning and rehabilitation. - Soil survey and land capability: Within first month after rehabilitation is complete and thereafter annual during dry season. - Continuous update of topsoil stripping and placement register.	- Annual soil survey report to inform and be considered in Annual Independent Environmental Audit and/or annual review of financial provision reports. - Topsoil stripping and placement register to be reported together with monthly and annual compliance reporting.

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism
		Organic Carbon; Major Cations (Ca ; Mg ; and Na); and Cation exchange capacity. Locations: - Soil survey locations: ○ All areas subject to topsoil placement to be split into Sample units <20ha. ○ Composite samples will be created from at least 20 sub-samples for each defined unit. - Sampling in areas where there is natural grass cover, samples should be taken to a depth of 100mm. Sampling in arable cultivated areas should extend to 150mm.			

5 ANNUAL REHABILITATION PLAN

The annual rehabilitation plan (ARP) aims to:

- Review concurrent rehabilitation and remediation activities already implemented;
- Establish rehabilitation and remediation goals and outcomes for the forthcoming 12 months, which contribute to the gradual achievement of the post-mining land use, closure vision and objectives identified in the holder's final rehabilitation, decommissioning, and mine closure plan;
- Establish a plan, schedule, and budget for rehabilitation for the forthcoming 12 months;
- Identify and address shortcomings experienced in the preceding 12 months of rehabilitation; and
- Evaluate and update the cost of rehabilitation for the 12-month period and for closure, for purposes of supplementing the financial provision guarantee or other financial provision instrument.

The purpose of an ARP report is to provide a record containing the relevant information regarding concurrent rehabilitation and remediation activities for the site for the forthcoming 12 months and how these relate to the operation’s closure vision, as detailed in the final rehabilitation, decommissioning and mine/production closure plan. The ARP also indicates what closure objectives and criteria are being achieved through the implementation of the plan.

5.1 STATUS OF ENVIRONMENTAL MONITORING

This section presents the key findings of the environmental monitoring carried out on the site. The monitoring is done in accordance with the current obligations and requirements as specified in the EMPR (Digby Wells Environmental, 2017). The mine also undertakes other environmental monitoring and measurement for operational aspects. These are specifically excluded from this report as they relate to the day-to-day operations and not the rehabilitation (progressive or final) and closure aspects.

Table 39 presents the summary of the most recent monitoring reports. Detailed description of monitoring undertaken and consequent findings are available in the following source documents:

- Annual Water Quality Report 1-2020 01 September 2019 to 30 August 2020 (Geosoil and Water (Pty) Ltd, 2020);
- Annual Wetland Monitoring Report (The Biodiversity Company (Pty) Ltd, 2020);
- Elandsfontein Aquatic Biomonitoring Assessment 2020 Low Flow (The Biodiversity Company (Pty) Ltd, 2020); and
- Soil Contamination Assessment for the Elandsfontein Colliery (The Biodiversity Company (Pty) Ltd, 2020)

The mine also undertakes other environmental monitoring and measurement for operational aspects. These are specifically excluded from this report as they relate to the day-to-day operations and not the rehabilitation (progressive or final) and closure aspects.

Table 39: Status of environmental monitoring.

Report	Key findings	Relevant Rehabilitation, Decommissioning and Closure Considerations
Annual water quality (1 September 2019 to 31 August 2020).	Wastewater: - Water quality from the mine water/pollution control dams recorded acidic pH levels and elevated concentrations of EC, TDS, SO4 (dominant) and metals (Al, Fe and Mn), typically associated with coal washing/mining activities. SO4 is dominant in terms of composition. Storm and Surface Water Runoff: - Midstream and downstream monitoring points recorded elevated concentrations, typically associated with coal washing/mining activities which indicate several impacts entering the drainage lines. The upstream monitoring point (TCM-SW02) recorded a neutral pH and low mining polluter indicator concentrations, with a deterioration of water quality (more so from SW01, Farm dam and TCM SW05) towards the downstream monitoring point (TCM-SW01), indicating pollution from Elandsfontein. Groundwater: - The following monitoring points recorded elevated concentrations: o GW-01: Plant area, o GW-05: Downstream of the partially rehabilitated discard area in the south eastern corner, o ECBH-02, 03, 04 and 05: Northern, partially rehabilitated area, o Eland 11: Northern boundary with Highveld steel, o Eland 03: Central historical mining and rehabilitated area, o Eland 1:Truck wating area, and o BH 172 and BH 173: South western rehabilitated area. - A decant point (ESD S25.92386 E29.08016) in relatively close proximity to BH 172 and BH 173 was identified during July and should be closely monitored. - Eland 10 recorded relatively good water quality, despite exceeding a few IWUL limits and Olifants River RQO's. - Groundwater levels: Groundwater levels recorded seasonal fluctuations with the levels of Eland 3 and ECBH-05 stabilising in the second half of the reporting period. Water levels at GW05 and Eland 10 are possibly impacted by the direct upgradient activities.	- Mining activities are having an impact on the local ground and surface water qualities. - The south eastern discard facility is currently being decommissioned and rehabilitated. Pollution emanating from this area should cease one complete- to be verified by future monitoring. - Previously mined areas are showing evidence of groundwater pollution (including western opencast, northern opencast)- decant of these zones to the regional water resources must be monitored and relevant interception and treatment implemented prior to decant. - The current stormwater management on the site is not adequately separating dirty and clean water catchments and is consequently resulting in pollution of surface water resources. The mine has recently developed a revised SWMP which is scheduled to be implemented over the next 3 years (please refer to Section 5.4 for more details on this aspect). -

Report	Key findings	Relevant Rehabilitation, Decommissioning and Closure Considerations
Annual Wetland Monitoring Report	- HGM 1 and 3 showed significant impacts from the mining activities on Elandsfontein. - 14 specific areas of concern were identified during the annual monitoring site visit, these included the following main issues: o Development of erosion gullies. o Placement of overburden and other excavated materials within wetland areas. o Localised concentrated flows and erosion channels. o Uncontrolled and disfunctions stormwater channels and controls. o Establishment of alien invasive plant species (*Acacia mearnsii* and *Populus alba*).	- Develop and commence implementation of a wetland rehabilitation plan. - Implementation of the AVECMP.
Elandsfontein Aquatic Biomonitoring Assessment 2020 Low Flow	- The conditions of the aquatic systems within the Elandsfontein project area are critically modified. - Deterioration of water quality is occurring between the upstream T1 site, and the T2, and T3 sites, as indicated by a decrease in pH, resulting in acidic conditions, and elevated dissolved solids. - Water quality deteriorated from the upstream reference sites which had relatively unmodified water quality parameters. - Contaminated water is stemming from the Elandsfontein tributary, as indicated by results from the upstream E Dam, E Seep, E1 and E2, and E3 sites, which contributes to the deterioration of downstream resources. - Extensive stands of alien invasive plant species occur, reducing riparian habitat integrity. - The water quality perturbations stemming from the Elandsfontein project area requires immediate remediation as the poor water quality is impacting on downstream reaches. Biomonitoring should continue to determine ecological trends and further impacts stemming from the Elandsfontein project area.	- Continue periodic biomonitoring. - Implementation of the AVECMP. - Previously mined areas are showing evidence of groundwater pollution (including western opencast, northern opencast)- decant of these zones to the regional water resources must be monitored and relevant interception and treatment implemented prior to decant. - The current stormwater management on the site is not adequately separating dirty and clean water catchments and is consequently resulting in pollution of surface water resources. The mine has recently developed a revised SWMP which is scheduled to be implemented over the next 3 years (please refer to Section 5.4 for more details on this aspect).
Soil Contamination Assessment for the Elandsfontein Colliery.	This study was commissioned to assess the results from soil samples tested for potential degradation/contamination via dust suppression at the Elandsfontein Colliery.	The rehabilitation of the haul roads must include adequate amelioration during rehabilitation.

Report	Key findings	Relevant Rehabilitation, Decommissioning and Closure Considerations
	- The pH levels for all sites are Acidic, which is likely to cause aluminium and iron toxicity, which is emphasised by high concentrations of these parameters. - 2 Sites are characterised by sulphate contamination, most likely from acidic water being sprayed on the roads during dust suppression. Additionally, salinity is of concern for the areas subject to dust suppression. - High EC levels and Na:K ratios indicate “Slight” to “Moderate” salinity which could be a result of various salts entering the dust suppression water resource. - The concerns can be rectified by using treated water from a Pollution Control Facility (PCF) for dust suppression.	

5.2 SHORTCOMINGS IDENTIFIED DURING THE PRECEDING PERIOD

It is important to identify shortcomings in the rehabilitation activities from the preceding period, so as to ensure that a rehabilitation backlog does not develop. The following specific shortcomings on the rehabilitation undertaken are specifically noted, and should be identified for rectification during the upcoming annual cycle:

- There is a significant rehabilitation backlog associated with historic opencast mining activities. This backlog relates to the fact that certain historic opencast voids have not yet been backfilled, levelled and rehabilitated and the associated rock dumps unnecessarily retained. The following historical voids still require backfilling and rehabilitation: Voids 4, 5, 6, 7, 8, and 10 (refer to Figure 25 and Figure 27). This backfilling backlog has resulted in excessive dirty catchments that should be managed. The rehabilitation of these areas forms a component of the planned new SWMP for the mine and are planned to be completed over a 3-year timeframe.

- There are areas of the previously rehabilitated voids that are showing signs of potential settlement (refer to Figure 64).

Figure 64: Possible settlement of backfilled areas.

- There is evidence of a potential sinkhole (Figure 65)- the origin of this feature could not be confirmed. The mine should investigate the origin of this hole and if applicable the potential for expansion in the future.

Figure 65: Potential sinkhole formation north of old slurry ponds.

- The slurry ponds located in the north eastern edge of the mine area are not in use. The planning for the decommissioning and rehabilitation of these ponds should commence. Remnant slurry and carbonaceous wastes should be removed and disposed of in the dedicated waste facility.
- The rehabilitation of the western opencast (west of Grootspruit) requires further attention- refer to Figure **19** and Figure 20.
- The possible presence of existing decant of mine affected water identified needs to be confirmed. If decant is occurring then the contaminate mine affected water must be collected and treated prior to discharge. This relates specifically to the following identified locations:
    - Western opencast- S-25.92386°; E29.08016°; and
    - Northern opencast- S-25.899410°; E29.088809°.

5.3 CURRENT REHABILITATION AND REMEDIATION

Figure 66 provides the comparison of key rehabilitation status indicators between March 2020 to January 2021. The information presented herein was obtained from the rehabilitation status plans provided by the mine (Ferreira, 2021).

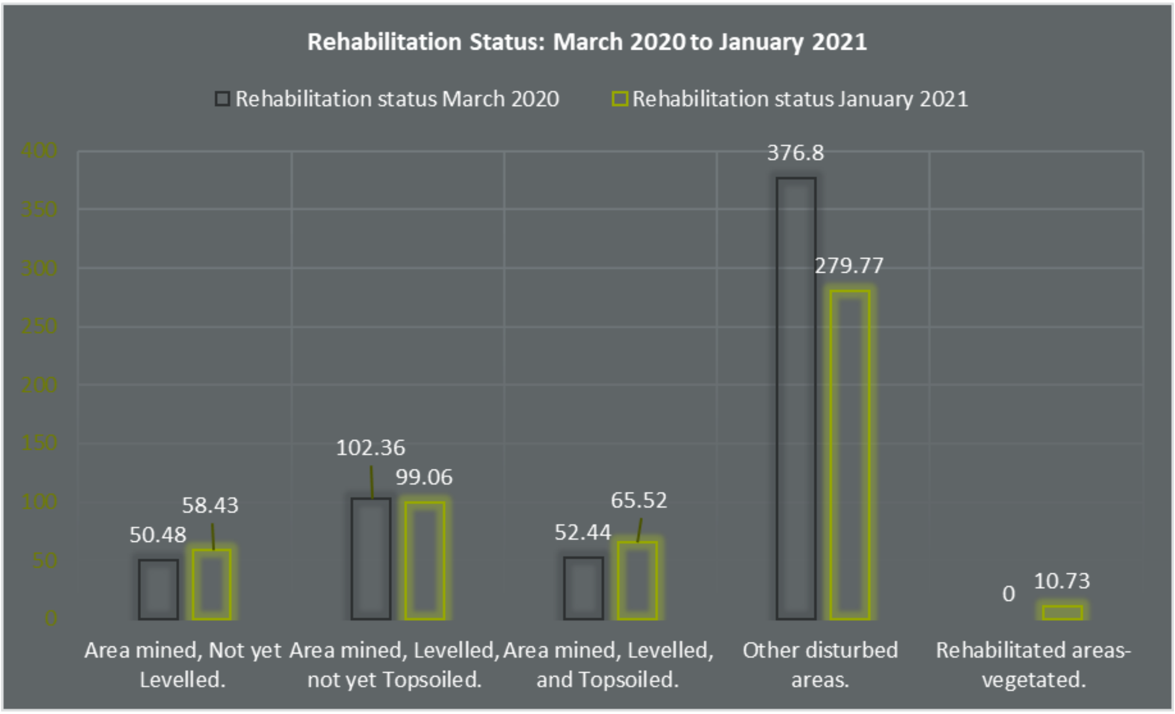


Figure 66: Rehabilitation Status: March 2020 to January 2021.

Of specific note was the efforts taken by the mine during the preceding 12 months to decommission and rehabilitate the south eastern discard facility. Figure 67 shows the extent of the south eastern discard facility as at March 2020 and Figure 68 shows the same area as at January 2021. The mine has removed the majority of the discard material removed to either the processing plant for reprocessing or alternatively disposed at the northern discard facility. Portions of the area have been levelled and topsoiled.

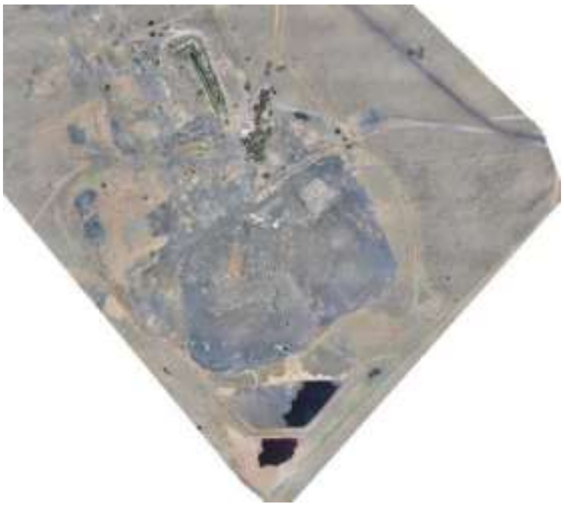


Figure 67: South eastern discard facility as at March 2020.

Figure 68: South eastern discard facility as at January 2021.

5.4 PLANNED REHABILITATION AND REMEDIATION

Planned rehabilitation is divided into two main categories, namely: Addressing accumulated rehabilitation backlog; and progressive rehabilitation associated with ongoing mining operations. Each of these is discussed further in this section.

The following activities are planned to address the rehabilitation backlog during the forthcoming 12 months:

- Planned construction of new SWMP and Run of Mine (ROM) and product stockpile areas:
    - The mine will be implementing an improved SWMP to rectify the current deficiencies on the site stormwater management. This SWMP plan aims to reduce unnecessary dirty water areas and catchments including the phased rectification of the historical backfilling and rehabilitation backlog. The rehabilitation involves filling of voids with overburden stockpile material, selecting material from these overburden stockpiles for use as layerworks for the ROM and product stockpile area and the disposal off excess bad material in northern opencast pit. The excess material will be loaded and hauled to the northern pit to render the area as rehabilitated, resulting in a reduced number of PCDs. The planned phasing of the revised SWMP is presented in :

Table 40: Phase SWMP Infrastructure plan (Delta Built Environment Consultants (Pty) Ltd, 2020).

Period	Infrastructure/ activities	Backfill/ Rehab activities
Year 1	• Construct PCD 1 • Construct PCD 1 stormwater channels and road crossings/culverts • Partially construct ROM and product stockpile area with sub-soil drainage system	• Portions of D3 and D4 will be used for the G7 sacrificial layer works for the ROM and product stockpile area.
Year 2	• Construct PCD 2 stormwater channels and road crossings/culverts • Partially construct ROM and product stockpile area with sub-soil • drainage system • Partially rehabilitate voids and overburden stockpiles • Construct river crossing 1 and 2	• Continued use of D3 and D4 for ROM/ Product stockpile layer works. • Backfill of V7 and V8.
Year 3	• Construct PCD 2 • Finish construction of ROM and product stockpile area with subsoil • drainage • Complete rehabilitation of voids and overburden stockpiles • Construct river crossing 4	• Continued use of D3 and D4 for ROM/ Product stockpile layer works. • Backfill of V3, 4, 5, and 6.

- Rehabilitation of south eastern discard facility:
    - Complete removal of carbonaceous materials from old discard facility footprint and surrounds:
        - Load and haul remnant discard from south eastern dump to Westside processing plant of Northern Discard.
        - Undertake soil sampling and survey of the discard footprint. This must inform the topsoil replacement and management plan moving forward.
        - Once the discard is removed the footprint should be limed (under guidance from soil specialist) to minimize the residual acid generating potential. Depending on the findings of basal layer soil sampling, the entire discard footprint may be covered with 1m of soft overburden material.
    - General surface rehabilitation:
        - Removal of any remnant overburden (softs and hards) from the footprint area. These should be hauled to other localized stockpiles which may be used for future rehabilitation of remaining mine areas.

- The footprint of the discard facility should be shaped and levelled to at least 1:7 slope. The rehabilitated surface must be free draining.
- Topsoil must be placed in the rehabilitated discard footprint as per the defined land capability plan (Section 4.6) and the SSSPA. The footprint will be ripped and reseeded.
- Contaminants have also accumulated on some of the haul roads. Therefore, the identified roads which will no longer be required by the mine for future use, will be cleaned and rehabilitated by removing 10cm of the contaminated soil / veneer and disposing it in the northern discard dump. After the contaminated soil is removed the area must be ripped and the soils ameliorated.
- All stockpile areas (relating to stockpiled materials within the footprint area and material sources utilized for the rehabilitation) will be ripped and vegetated.
- Any other mine impacted areas within the discard facility footprint which have been compacted must be landscaped to natural contours and ripped to loosen all soil. Fertility of the topsoil would need to be assessed and rectified if required.
- The rehabilitated area must be seeded / re-vegetated and monitored for success. The rehabilitated area must be monitored for compaction and erosion and these must be rectified. Seeding activities to take place in the wet months or alternatively actively watered during dry months to allow for effective germination.

- Complete removal of PCD#1 and 2:
  - Only once adequate vegetative cover is present within the rehabilitated discard footprint and the rick of contaminated runoff is removed, with the PCD's be decommissioned and rehabilitated.
  - Dewater and discharge of remnant contaminated water to mines functioning dirty water system.
  - Desilt PCD and disposal of contaminated materials to northern discard.
  - Backfill the PCD's with available overburden and level to be free draining.
  - Implement SSSPA, revegetate and monitor.

- Address uncertainties and gaps in FRDCP: Section 4.10 provides a list of uncertainties and gaps in the information used to define the FRDCP. The following key gaps should as far as reasonably possible be addressed in the next annual cycle and where necessary the closure objective and associated planning amended:
  - The revised monitoring program as set out in the Groundwater report (Gradient Consulting (Pty) Ltd, 2020) should be implemented and adhered to. Monitoring results should be evaluated in order to inform the update to the FRDCP;
  - Additional monitoring boreholes, as indicated in the Groundwater Report (Gradient Consulting (Pty) Ltd, 2020), be established down-gradient of potential decant zones in order to evaluate the mass load contribution of decant water to environmental receptors. Proposed monitoring boreholes should be drilled in pairs to target shallow, weathered as well as deeper, fractured aquifer units. Drilling localities should be determined by means of a geophysical survey in order to target lineaments and weathered zones acting as preferred groundwater flow pathways and contaminant transport mechanisms.
  - Supplementary geochemical characterisation i.e. kinetic leach test should be performed on carbonaceous waste material to be used as backfill material i.e. northern discard pit, with a

dynamic geochemical model developed to aid in calculation of source term depletion timeframes.

  - The current topsoil deficit supports the development of an alternative land-use. At present it is suggested that such alternative land-use could include a renewable energy facility (solar PV or soil-less cultivation options). The feasibility of this suggestion and option should be investigated.

- Ongoing progressive rehabilitation: The mine will continue with progressive and concurrent backfilling, levelling, and rehabilitation of the current active pits in accordance with standard roll over mining methods. The progressive rehabilitation will be done with specific reference to and compliance with the planned final post closure land-use and capability (Section 4.6), as well as the defined post closure land form levels.

- Addressing rehabilitation backlog: The mine has numerous existing remnant voids related to historic mining activities which should as far as possible be backfilled and rehabilitated. This retrospective rehabilitation will aim in reducing the current unscheduled rehabilitation liability.

5.5 ANNUAL REHABILITATION COSTING

The primary rehabilitation action for the 12-month period relates to the rehabilitation of the south eastern discard dump. Table 41 provides a breakdown of the expected rehabilitation cost associated with the rehabilitation of the south eastern discard dump. The items, quantities and associated costs are based on the January 2021 survey and are itemised in the financial provision calculation under the Mining Areas component.

Table 41: Itemised rehabilitation costs for the south eastern discard dump (based on GNR1147).

South Eastern Discard Area	
Doze surface area to remove 30cm of contaminated soil (~45696.9m^3)	R 757 654.60
Load and haul remnant discard to northern void (~45696m^3)	R 2 146 840.36
Load and haul material from topsoil stockpile (~38081m^3)	R 853 776.02
Revegetation (~15.23ha)	R426 501.60
Deep rip surface area (~15.23ha)	R 1 578 267.50
Shaping and levelling of topsoil (~7616m^3)	R 47 295.36
Sub-total 1	**R 5 810 335.44**
Preliminary and general (6%)	R 348 620.13
Contingencies (10%)	R 581 033.54
Total	**R 6 739 989.11**

6 ENVIRONMENTAL RISK ASSESSMENT – LATENT AND RESIDUAL ENVIRONMENTAL IMPACTS

According to the Financial Provisioning Regulations (2015) the objective of the environmental risk assessment report that relates to latent and residual impacts is to:

- ensure timeous risk reduction through appropriate interventions;
- identify and quantify the potential latent environmental risks related to post closure;
- detail the approach to managing the risks;
- quantify the potential liabilities associated with the management of the risks; and
- outline monitoring, auditing, and reporting requirements.

This section of the report aims to address these objectives separately. In certain cases, these objectives have been discussed and presented in the preceding sections of this report.

6.1 THE ASSESSMENT PROCESS USED AND DESCRIPTION OF LATENT ENVIRONMENTAL RISK

Section 4.3 of this report provides a detailed description of the environmental impact/risk identification and assessment (including the methodology and findings) undertaken. Section 4.3 also includes identified mitigation measures which, once implemented successfully, will result in the avoidance or acceptable reduction of the associated impact. The primary latent and residual risks identified to potentially occur are listed below:

- Surface water quality deterioration – mine water pollution.
- Surface and groundwater deterioration due to decant of poor-quality water from underground mine voids and backfilled opencast areas.
- Hydraulic head recovery (water level rebound).
- Instability in the underground workings may result in surface subsidence and /or sinkhole formation resulting in a range of other impacts.

Table 42, presents the identified latent and residual risks; the assessment of the impacts; the recommended management and mitigation measures; the impact drivers, timeframes, and triggers; as well as the suggested closure options and actions.

Table 42: Latent and residual risks.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Impact Drivers	Impact Timeframes	Impact Triggers	Closure Options/Actions
Surface Water	Surface water quality deterioration – mine water pollution. The existing surface water features on the site are already impacted, with coal mine pollution indicators prominent (↑SO_4, ↑heavy metals, ↓pH (acidic). The impact at most of the surface water features can be ascribed to leachate and decant of poor-quality water from backfilled opencast areas, and poor separation of clean and dirty catchments. Poor quality leachate may also emanate from flooded underground workings.	-22.5 (high)	- Monitoring of surface water and groundwater in accordance with the proposed integrated monitoring network and protocol should be continued throughout the post operational phase. - Ensure that rehabilitation of backfilled opencast areas is properly conducted and in accordance with best practise guidelines. Rehabilitation should allow for free draining of runoff in order to prevent any surface water ponding. - Interception and treatment of mine affected water and decants.	-16.00 (medium)	Recharge and flooding of mine workings leading to decant of mine affected water from opencast and underground workings. Quality of resultant decant.	Possible decant already occurring. Impact commences once decant occurs. Estimated ~5 years after cessation of opencast mining, and ~35-40 years after cessation of underground mining. Duration of decant exceeding RWQO's. The duration of the pollution potential of the backfilled and underground areas is unknown. A dynamic kinetic	Decant of mine affected water exceeding the RWQO's or WUL conditions.	Intercept contain, treat, and discharge mine affected water. Develop a post-closure water balance and SWMP.

Aspect	Impact	Pre-mitigation risk	Suggested Measures	Mitigation	Post-mitigation risk (post-mitigation)	Impact Drivers	Impact Timeframes	Impact Triggers	Closure Options/Actions
							geochemical model and updated groundwater model is recommended to address this uncertainty.		
Surface Water	Alteration to surface runoff flow volumes. It is expected that the interception of mine affected water may result in a reduction of the interflows and other contributions to local surface water resources. The potential for a final void due to a backfill balance deficit would also introduce a long-term evaporation area which would effectively remove water from the catchment.	-12.75 (medium)	- Intercept mine affected water, treat to acceptable limits, and discharge to the local tributary. - Develop and implement post closure SWMP. - Develop and implement water quality monitoring; and - Rehabilitation of all infrastructure will be implemented and will include re-vegetating, capping (where applicable) and shaping. Opencast pits and voids to be backfilled		-7.50 (low)	Volumes of polluted mine affected water removed from the system for treatment. The volume of treated mine affected water returned to the natural system. Volumes of evaporation removed from catchment.	Duration of decant exceeding RWQO's and consequently requiring treatment. Evaporation areas will remain indefinitely.	Inadequate stream ecological flow requirements.	Intercept contain, treat, and discharge mine affected water. Develop a post-closure water balance and SWMP.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Impact Drivers	Impact Timeframes	Impact Triggers	Closure Options/Actions
			with overburden and topsoil material, shaped, and rehabilitated to promote clean runoff. - Minimise the size of evaporative areas where possible.					
Groundwater	Surface and groundwater deterioration due to decant of poor-quality water from underground mine voids and backfilled opencast areas. Please refer to Section 4.3.3.1 for a detailed explanation of the impacts on groundwater.	-22.5 (high)	- Intercept mine affected water, treat to acceptable limits, and discharge. - Monitoring of surface water and groundwater. - Ensure that rehabilitation of backfilled opencast areas is properly conducted and in accordance with best practise guidelines. Rehabilitation should allow for free draining of runoff in order to prevent any	-12.75 (medium)	Recharge and flooding of mine workings leading to decant of mine affected water from opencast and underground workings. Quality of resultant decant. The geochemical characteristics of the pit backfilled material and	Possible decant already occurring. Impact commences once decant occurs. Estimated ~5 years after cessation of opencast mining, and ~35-40 years after cessation of underground mining. Duration of decant exceeding RWQO's. The	Decant of mine affected water exceeding the RWQO's or WUL conditions.	Free draining closure/ final landform. Recovery of any remnant coal and/or coal discard material for safe disposal. Prioritisation of carbonaceous spoils to pit base. Collection, containment, and treatment of mine affected water and decant. Management of contamination

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Impact Drivers	Impact Timeframes	Impact Triggers	Closure Options/Actions
			surface water ponding. - Carbonaceous materials or discard should be fully recovered and disposed of at the defined northern discard area. Rehabilitation should be conducted in accordance with best practise guidelines, including where relevant dedicated capillary layers, cover layer, evaporative covers, soil/ armouring and vegetation. - The use of any materials of carbonaceous character for backfilling should be		the discard material.	duration of the pollution potential of the backfilled and underground areas is unknown. A dynamic kinetic geochemical model and updated groundwater model is recommended to address this uncertainty For the purposes of this closure assessment it is assumed that the mine affected water will continue to be of an unacceptable		plume to prevent decant into surface water resources- options include interception, pump, and treat. Manage vertical connectivity of groundwater and surface (seal off preferential flow paths). Acceleration of pit and UG flooding. Provision of adequate post closure monitoring and rehabilitation fund. Develop and implement Post

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Impact Drivers	Impact Timeframes	Impact Triggers	Closure Options/Actions
			avoided as far as possible. If unavoidable then it is recommended that disposal be prioritised and preferably form the base of newly backfilled areas to allow for saturation and reduction of oxidation. - As per the groundwater assessment further geochemical characterisation of the carbonaceous spoils material should be conducted to confirm the findings of the geochemistry tests. - Down-gradient seepage capturing			quality for 50 years[16].		Closure Land Management and Monitoring Plan.
	Hydraulic head recovery: During the mining operations the dewatering of the mine would have resulted in a drop in the local water table. Hydraulic head recovery and relaxation of groundwater gradients since cessation of mining will have a positive effect on regional groundwater levels as well as groundwater contribution to baseflow.	+14.00 (medium positive)		+14.00 (medium positive)	Rate of pit recharge/ flooding.		Water level in rehabilitated pits reach decant elevations. The actual quality of the decant water exceeding acceptable limits.	
	Seepage from waste deposits.	-16 (medium)		-5.50 (low)				

[16] Additional geochemical characterisation will be required in order to accurately determine duration of buffer reactions and source depletion timeframes. For the purposes of this investigation, a timeframe of 50 years has been assumed.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Impact Drivers	Impact Timeframes	Impact Triggers	Closure Options/Actions
	Potential release of contamination from decommissioning of waste management facilities (incl PCD liners and sediments).	-21.25 (high)	alternatives i.e. establishment of scavenger boreholes should be implemented as active mine water management techniques in order to constrain the migration of pollution plumes emanating from waste sources. - Passive treatment of decant water by establishment of function wetland zones down-gradient of potential decant zones should also be considered. - It is recommended that excess water be pumped to backfilled areas as to accelerate the pit flooding and leachate depletion process. However, down-gradient	-5.00 (low)				

Aspect	Impact	Pre-mitigation risk	Suggested Measures	Mitigation	Post-mitigation risk (post-mitigation)	Impact Drivers	Impact Timeframes	Impact Triggers	Closure Options/Actions
			seepage capturing mitigation measures should be active and implemented prior to water disposal. - All material analysed can be classed as a Type 3 waste (low hazardous waste) and should be managed accordingly. - All preferred groundwater flow pathways which are in direct connection with surface topography i.e. adits, ventilation shafts and/or unrehabilitated exploration boreholes should be sealed off and rehabilitated. - Contaminated groundwater must be contained and treated prior to release to the						

Aspect	Impact	Pre-mitigation risk	Suggested Measures	Mitigation	Post-mitigation risk (post-mitigation)	Impact Drivers	Impact Timeframes	Impact Triggers	Closure Options/Actions
			natural environment. If the water quality is outside of the parameters stipulated in the resource quality objectives (RQO's) a water management and treatment process should be implemented. - Monitoring of the rehabilitation of backfilled opencast areas to identify possible differential settlement and melon holes, which prevent free draining off the site. Rehabilitate where these occur. - Kinetic leach tests must be done on the backfill materials used for the rehabilitation of the pits and the coal seams. This must						

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Impact Drivers	Impact Timeframes	Impact Triggers	Closure Options/Actions
			determine the duration of AMD generation from these areas. The groundwater and geochemical model must be updated accordingly. - Continue operation of down-gradient seepage capturing facilities, and the consequent containment and treatment of the mine affected water until DHSWS water quality objectives are achieved. - Continued investigation into the option of alternative mine affected water treatment technologies (including passive treatment). - Due to the impact and reduction of					

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Impact Drivers	Impact Timeframes	Impact Triggers	Closure Options/Actions
			baseflow reporting to the on-site wetland, it is recommended that a monitoring borehole(s) be drilled in order to evaluate perched water level recovery of the wetland following rehabilitation. - Contaminated wastes to be disposed of at approved facilities.					
Subsidence and sinkholes	Instability in the underground workings may result in surface subsidence and /or sinkhole formation. This has consequent indirect impacts including: - Ponding of water on the surface; - Increased make of groundwater;	-18.00 (high)	- Follow the subsidence reports guidelines (Geomech Consulting (Pty) Ltd Report No. GEOM13-2019-003) on which areas can be undermined without a significant subsidence risk. - Ensure that future land development over high-risk areas	-12.00 (medium)	Underground workings pillar safety factors. Rate of pillar scaling and pillar life. Nature of overlying rock strata. Nature of surface land-use.	Based on the predicted pillar lifespans in the Subsidence assessment it is expected that pillar life will range between ~5 years and 1 799 616 years depending on the specific area.	Pillar collapse and associated surface subsidence.	Set aside contingency material stockpile for backfilling future subsidence. Monitoring for surface subsidence. Ensure restrictive future surface land use controls- i.e.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Impact Drivers	Impact Timeframes	Impact Triggers	Closure Options/Actions
	- Reduction of streambed water flows; - Surface cracking at zones of expansion and contraction; - Infrastructure damage, such as cracking of walls; , damage to water pipes and electrical installations, damage to roadways, breaking or slackening of fences; - Risk of spontaneous combustion; - Impact on availability of surface water for fauna; - Impact on catchment morphology and resultant modification to		is informed by and where relevant restricted. Notify the Council for Geosciences and provide subsidence risk assessment. - Undertake annual surveys of the site to determine if any subsidence has occurred and rehabilitate. Rehabilitation of subsided areas is dependent on the scale of the subsidence and may include: - Interventions to reduce surface water ponding (e.g. cut off drains, trenching); - Implementing evapotranspiration to reduce groundwater make; - Repair of surface cracks through					prevent development of sensitive land use over risk areas.

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Impact Drivers	Impact Timeframes	Impact Triggers	Closure Options/Actions
	surface water baseflow and riverine habitat; - Loss and disruption of hydropedological flow paths; - Physical alteration of surface-level leading to negative impacts on biodiversity and habitats; as well as - Increased health and safety impacts. Please refer to 4.3.3.2 for more detail on this impact. With reference to Section 4.3.3.2, it is expected that most areas an elevated level of risk of pillar instability over time		bulldozing crack and crest to more even profile, deep ripping, backfilling with inert materials, levelling to be free draining, and revegetating. - Repair and replacement of damaged infrastructure. - Surface elevation monitoring points should be installed at positions surrounding the sensitive structures such as building and road at convenient points. Annual surveys should be conducted. Survey beacons should consist of 20 mm rebar and be anchored in concrete with the anchor at least a metre deep. The protruding end of the beacon should					

Aspect	Impact	Pre-mitigation risk	Suggested Mitigation Measures	Post-mitigation risk (post-mitigation)	Impact Drivers	Impact Timeframes	Impact Triggers	Closure Options/Actions
			not protrude more than 10 cm, to avoid accidental damage. Similar beacons should be installed in an area with similar ground conditions, more than 200 m away from any undermining to serve as control measurements. - Remove all infrastructure (not excluded due to private landowner agreement) from site.					

6.2 MANAGEMENT ACTIVITIES, COSTING AND MONITORING REQUIREMENTS

Prevention through accuracy of implementation is the key to addressing and reducing possible latent and residual impacts. This section aims to define the actions required during the post closure phase to manage, address, and monitor residual and latent risks.

6.2.1 MONITORING REQUIREMENTS AND CORRECTIVE MANAGEMENT

Section 4.13 provides a breakdown of the monitoring and auditing requirements for the operation, rehabilitation and decommissioning, and closure phase. Certain of these monitoring requirements will be extended in some form through into the post closure phase. The post closure phase monitoring will aim primarily to monitor key drivers and parameters which causally relate to the predicted latent and residual impacts, and where applicable to trigger management and mitigation activities associated with these. Table 43 presents the proposed monitoring requirements post closure, as well as the relevant mechanisms for adaptation.

Table 43: Post closure monitoring requirements.

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism	Adaptive management action
Groundwater	- Decommissioning and rehabilitation. - Closure	Objectives: - To provide reliable groundwater data that can be used for management purposes. - The early detection of changes in groundwater quality and quantity. - Provide an on-going performance record on the efficiency of the Water Management Plan. - Obtain information that can be used to redirect and refocus the Water Management Plan. - Determine compliance with environmental laws, standards and the water use licence and other environmental authorizations. Standards: - Groundwater Sampling (Water Research Commission T303/07-Weaver et al, 2007). - DWAF Best Practice Guideline – G3: Water Monitoring Systems (DWA, 2006).	- Monitoring network must comply with the risk-based source-pathway - receptor principle. - Compliance with WUL water quality thresholds. - Water quality downstream of mining area within WMA Target Water Quality Objectives.	Annual- alternating seasons.	- Annual water quality report.	Undertake a final groundwater model update as and when the following is achieved: - Indicator parameters reach trigger values. - The revised groundwater model to be used to refine and revise the long-term water management/ treatment actions.

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism	Adaptive management action
		- SANS 5667-1:2008/ISO 5667-1:2006 Water Quality – Sampling Part 1: Guidance on the design of sampling programmes and sampling techniques. - SANS 5667-3:2006/ISO 5667-3:2003 Water Quality – Sampling Part 3: Guidance on the preservation and handling of water samples. - SANS 5667-11:2015/ISO 5667-11:2009 Water Quality – Sampling Part 11: Guidance on sampling of groundwater. - Use of SANAS Accredited analytical laboratory. Parameters: - Refer to monitoring sites defined in the groundwater assessment (Gradient Consulting (Pty) Ltd, 2020). - Groundwater level. - A calibrated mechanical or electronic flow meter must be installed at all underground/opencast sumps and abstraction points in order				

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism	Adaptive management action
		to monitor and record abstraction volumes. - Volumes of water used for dust suppression (if applicable). Locations: - Refer to monitoring sites defined in the groundwater assessment (Gradient Groundwater Consulting , 2020).				
Surface Water	- Decommissioning and rehabilitation. - Closure	Standards: - DWAF Best Practice Guideline – G3: Water Monitoring Systems (DWA, 2006). - SANS 5667-1:2008/ISO 5667-1:2006 Water Quality – Sampling Part 1: Guidance on the design of sampling programmes and sampling techniques. - SANS 5667-3:2006/ISO 5667-3:2003 Water Quality – Sampling Part 3: Guidance on the preservation and handling of water samples. - SANS 5667-4:1987/ISO 5667-4:1987 Water Quality – Sampling Part 4: Guidance on	- Compliance with defined Resource Water Quality Objectives. - Compliance with WUL water quality thresholds.	Annual- alternating seasons.	- Annual water quality report.	Adaptation of water management plan (incl treatment where necessary).

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism	Adaptive management action
		sampling of lakes, natural and man-made. - SANS 5667-6:2006/ISO 5667-6:2005 Water Quality – Sampling Part 6: Guidance on sampling of rivers and streams. - Use of SANAS Accredited analytical laboratory Parameters: - Refer to parameters defined in the groundwater assessment (Gradient Consulting (Pty) Ltd, 2020). - Set of parameters as defined in WUL. Locations: - Refer to monitoring sites defined in the groundwater assessment (Gradient Groundwater Consulting , 2020).				
Landform and subsidence	- Post closure	Standards: - Land Rehabilitation Guidelines for Surface Coal Mines (LaRSSA, 2019). Parameters:	Alignment with post closure landform design.	Visual observations for settlement features (ponding, erosion, etc) to be included in ongoing environmental inspections.	Annual subsidence monitoring report.	If subsidence encountered undertake risk assessment and implement control and rehabilitation actions.

Aspect	Applicable phase	Functional Requirement	Performance indicator/ target	Frequency	Reporting Mechanism	Adaptive management action
		- Settlement and subsidence (incl measured settlement factors, settlement in cm/annum, deviation from final post closure landform design, surface water ponding). - Material balance (topsoil/overburden/ interburden). - Ha's of corrected/ remediated settlement areas- in order to update financial provisions. - Slope. - Visual observations: Ponding, erosion, Locations: Settlement: at installed in pit boreholes; annual surface topographical survey of rehabilitated pit.		Annual dedicated survey and measurement to allow for update of landform analysis.		

6.2.2 MANAGEMENT AND MITIGATION ACTIVITIES

The monitoring plan described above will provide invaluable insight into the likelihood that the risk will materialise and the expected timeframes and durations of the impacts. On the basis of the current risk assessment and predictive methods, it is expected that certain post closure management activities and mitigation measures will be required. Table 44 presents the impacts and associated mitigation measures identified once the impact is manifest. The alternatives considered and the motivation for the proposed alternatives are also presented. Please refer to Table 23 for a more detailed explanation of each alternative and the associated advantages and disadvantages.

Table 44: Post closure management activities and mitigation measures.

Impact	Alternative	Selected Alternative
Management of AMD and decant.	The following water management and mitigation alternatives were investigated (refer to the Groundwater report for further detail): • Scenario 06a: Seepage capturing/ scavenger boreholes down-gradient of waste facilities and backfilled opencasts. • Scenario 06b: Cut-off seepage capturing trench down-gradient of waste facilities and backfilled opencasts. • Scenario 06c: Maintaining a minimum in-pit water level below decant elevation by establishment of in-pit abstraction facilities. • Scenario 06d: Scavenger boreholes down-gradient of waste facilities and implementation of a lined facility for disposal of carbonaceous waste material. • Scenario 06e: Active water management by establishment of scavenger boreholes down-gradient of waste facilities in combination with rehabilitation of the south-eastern discard dump. • Scenario 06f: Active water management by establishment of scavenger boreholes down-gradient of waste facilities in combination with disposal of carbonaceous waste material in the northern discard pit	Scenario 06f: Active water management by establishment of scavenger boreholes down-gradient of waste facilities in combination with disposal of carbonaceous waste material in the northern discard pit.
	Disposal of discard to pit.	

Impact	Alternative	Selected Alternative
Disposal of waste discard and resultant pollution potential.	Disposal of discard to new lined co-disposal facility.	Collect all carbonaceous wastes (including course and fine discard, coal veneers, and slurry) and dispose at the northern discard facility (pit). Once complete cover, level to free draining, cap and rehabilitate northern discard dump. There remains some uncertainty regarding the long-term water treatment implications for this option. It is recommended that additional kinetic geochemistry tests are done on the discard materials to be able to conduct an informed cost benefit analysis on whether this is the best long-term solution.
	Disposal of discard at closest hazardous waste facility.	
Capping and cover options for northern discard dump.	Design and installation of a dedicated capping layer to reduce water infiltration and oxygen ingress.	The design and installation of a capping layer is expected to be expensive in relation to the predicted benefit. Considering that the mine will be required to capture and treat the decant volumes and that the likely reduction in these volumes as a result of a dedicated capping is relatively small compared to the cost, it is proposed that a dedicated capping system is not necessary. Proper surface preparation and compacting to reduce oxygen will be necessary to prevent future spontaneous combustion.
	No dedicated capping layer- this would involve preparation of the dump through levelling, dozing over with non-carbonaceous materials, compacting, and cover with evapotranspiration covers.	
Pollution of water resources and treatment of AMD.	Several alternative active and passive treatment technologies and solutions were considered.	Reverse osmosis was most effective with regards to cost and solving the problem at hand.

6.2.3 COSTING ESTIMATION

Please refer to the assumptions and limitations, and associated unit rates applicable to the residual and latent impacts presented in Section 4.12. The closure cost estimation for the identified residual and latent impacts was determined by BEAL Consulting Engineers and was based on the requirements of GNR1147. A separate quantum was determined using the DMR Guideline method (refer to Section 4.12.1). The GNR1147 quantum is expected to represent a realistic estimation of the required cost for effective decommissioning, rehabilitation, closure, and management of ongoing residual, and potential future latent, impacts. The DMR Guideline method is compliant with the provisions and arrangements regarding financial provisioning approved as part of the MR in terms of the MPRDA, and consequently regarded as being compliant with the provisions of GNR1147 until the 19th of June 2022.

On the basis that the mine is not at present required to comply with the provisions of GNR1147 for the determination of the quantum of financial provision, this report excludes the itemised cost determination associated with the identified residual and latent impacts. The mine has been provided the GNR1147 quantum determination (including the estimated costs for addressing residual and latent impacts) for future planning and preparation purposes, and for implementation as and when required.

Appendix 1: Landform analysis drawings

Appendix 2: Subsidence Investigation Report (Refer to Appendix D of the EIA Report).

Appendix 3: Groundwater Assessment (Refer to Appendix D of the EIA Report).

Appendix 4: Environmental Risk/ Impact Assessment Detail

Appendix 5: Post Closure Stormwater Management Plan.

Appendix 6: Existing Guarantees