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ENVIRONMENTAL IMPACT ASSESSMENT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME

PROPOSED KALGOLD EXPANSION PROJECT

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REVISION AND AMENDMENTS

REVISION DATE:	REV #	DESCRIPTION
2022/02/02	**ORIGINAL DOCUMENT**	**Report for Public Review**

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EXECUTIVE SUMMARY

Harmony Gold Mining Company (hereafter referred to as Harmony), has appointed Environmental Impact Management Services (Pty) Ltd. (EIMS) as the Environmental Assessment Practitioner (EAP) to assist with compiling the necessary reports and undertaking the statutory consultation processes, in support of the proposed expansion of the Kalgold production operation - hereafter referred to as the proposed Kalgold Expansion Project. The existing Harmony Kalgold operation wishes to expand its current production from the current production rate of 130 000 tons per month to 300 000 tons per month. A pre-feasibility study has been undertaken. The findings of the pre-feasibility study have concluded that the following new activities and expansions must be provided for:

- The pit footprint will increase.
    - A-Zone and Water Tank Pits will be combined and total footprint increased. Total footprint will be 127 ha for both pits combined.
    - Windmill pit: Total footprint will be 13 ha.
- Larger dewatering pipelines (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s).
- Extension to Spanover waste rock dump (expand the waste rock dump with another 140 ha)
- New ROM pad.
- New processing plant.
- Recommission old TSF at low deposition rate (an average deposition rate of 74 000 tonnes/month)
- Increase deposition rate at D-Zone pit (from 136 000 tonnes/month to 240 000 tonnes/month)
- Install pipeline from Central dam to the new plant (Internal diameter of approximately 450mm and peak throughput of approximately 230L/s).
- Install a tailings pipeline from the new plant to old TSF and D-zone pit (pipelines for both deposition and also another for return water). The Internal diameter of the pipelines will be of approximately 350mm and peak throughput of approximately 150L/s.
- Install pipeline from old plant raw water pond to the new plant (D-Zone return water, Internal diameter of approximately 450mm and peak throughput of approximately 230L/s).
- Install two 22kv power lines from Ferndale substation to the new plant.
- Install a water treatment plant at the new plant (treat up to 12000m^3/day)
- Relocate and expand the explosives magazine.
- Additional new road from the plant to the N18 and from the old plant to the N18 (approximately 13m wide).
- New road from pit to ROM pad (approximately 28m wide).
- New road to Spanover waste rock dump extension.
- Instal a 350mm diameter pipeline for the discharge of treated water to the Morokwa River.
- Increase the size of the water pipe from A-Zone to Central dam (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s).
- Increase the size of the water pipe from Watertank pit to Central dam. (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s).

Kalgold mine is an open pit mining operation located approximately 55km southwest of the town Mafikeng and 60km northeast of the town Stella in the Ratlou Local Municipality within the North West Province of South

Africa. The mine is owned and operated by Harmony Gold. The mine is located in the Kraaipan Greenstone Belt, which is part of the large Amalia-Kraaipan Greenstone terrain. The largest ore body is found in the D-Zone, which was mined out by a single pit operation along a strike length of 1 300m and to a depth of approximately 290m below surface. Mining at Kalgold Mine continued at the A-Zone, Windmill and Watertank Open Pits.

Several listed activities contained in the National Environmental Management Act (Act 107 of 1998) (NEMA), National Water Act (Act 36 of 1998) (NWA), the National Environmental Management Air Quality Act (Act 39 of 2004) and the National Environmental Management Waste Act (Act 59 of 2008) (NEMWA) are triggered by the proposed Kalgold Expansion Project. In this regard the Kalgold Expansion Project requires an Integrated Environmental Authorization, amendment of the Water Use License, an Atmospheric Emissions License for the new processing plant as well as an amendment of the approved Environmental Management Programme (EMPr) and Mine Works Programme (MWP) for Kalgold mine.

Based on previous public inputs into the Scoping Phase and EIA Phase, various comments have been received and a summary of the comments is presented below:

- Correspondence from SAHRA requesting that a case be created on the SAHRIS website;
- Letter of Objection received from Chief GH Phoi on a separate application that has been lodged by the applicant for Kalgold Mine;
- Request for registration from the local business;
- I&AP requesting to be removed from the project's database;
- Statutory comment from Transnet stating that their pipelines were not affected by the proposed project;
- Request for a copy of the report to be delivered to the SANRAL offices for comment;
- Local organisation requesting support;
- Land claims enquiry;
- Request for the applicant to develop the surrounding communities socially and economically;
- Statutory comment from SAHRA.

This EIA phase report will be made available for further public comment which will inform the final EIA report to be submitted to the Department of Mineral Resources and Energy (the Competent Authority) for review and decision making.

A preliminary impact assessment was undertaken during the Scoping Phase in which all impacts were identified and based on the assessment, certain impacts were identified for future assessment in the EIA Phase (this report). Specialist studies were undertaken to inform relevant impacts and the results of these studies are included in this report. The findings of the Impact assessment and specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented.

It is the opinion of the EIA project team that the significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. Despite the impacts caused by the mine, it must be considered that there are positive impacts as well, mostly based on the economic contributions, skills development and SLP initiatives. The mine employs a number of people in the community, and the mine closure would result in them losing their jobs.

Based on the nature and extent of the predicted impacts as a result of the construction, operation and closure of the facility, the findings of the EIA, and the understanding of the mostly low - moderate post-mitigation significance level of potential environmental impacts, it is the opinion of the EIA project team that the environmental impacts associated with the application for the proposed Kalgold expansion project can be mitigated to an acceptable level and the project should be authorized.

1 INTRODUCTION

Harmony Gold Mining Company (hereafter referred to as Harmony), has appointed Environmental Impact Management Services (Pty) Ltd. (EIMS) as the Environmental Assessment Practitioner (EAP) to assist with compiling the necessary reports and undertaking the statutory consultation processes, in support of the proposed expansion of the Kalgold production operation - hereafter referred to as the proposed Kalgold Expansion Project.

Harmony wishes to expand the existing Kalgold production from 130 000 tons per month to 300 000 tons per month. A pre-feasibility study has been undertaken. The findings of the pre-feasibility study have concluded that the following new activities and expansions must be provided for:

- The pit footprint will increase.
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- Increase the size of the water pipe from Watertank pit to Central dam. (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s).

Kalgold mine is an open pit mining operation located some 60km southwest of Mahikeng in the North West Province. The mine is owned and operated by Harmony, who acquired the mine in 1999. The mine is located in the Kraaipan Greenstone Belt, which is part of the large Amalia-Kraaipan Greenstone terrain. The largest ore body is found in the D-Zone, which was mined out by a single pit operation along a strike length of 1 300m and to a depth of approximately 290m below surface. Mining at Kalgold Mine continued at the A-Zone, Windmill and Watertank Open Pits, which are all relatively new opencast operations.

Kalgold has been mining gold for several years and as such holds a number of licenses and authorisations in this regard. The following rights, licenses, authorisations and permits are currently in place and have been considered in the compilation of this report (Table 1).

Table 1: Rights, licenses, authorisations and permits held by Kalgold Mine.

Document	Applicable Properties	Reference Number
Mining Right (dated 09 November 2010)	Portions of portion 2, 3 (portion of portion 1), and the remaining extent of portion 1 of the farm Spanover 284 HN, a certain portion of the farm Spanover 387NH, portion of portion 3 (a portion of portion 1) of the farm Ferndale HN, portions of the farms Goldridge 632 JO (formerly Spanover 287 IO) and Ferndale 554 IO	NW30/5/1/2/2/77 MR
Environmental Management Programme (amended in 2014)	RE of the farm Spanover 552 IO, Spanover 549 IO, Ferndale 554 IO, Goldridge 632 IO	NW/6/2/2/241
S102 Addendum to approved EMPR for new mining areas	Spanover 552 IO, Spanover 549 IO, Ferndale 554 IO, and Goldridge 632 IO	(NW) 30/5/1/2/3/2/1/77 EM
2013 Environmental Authorization (and 2015 amendment of this authorization) for mine optimization project	Portion 0 of farm Spanover 552 IO	NWP/EIA/15/2013
2019 AEL for various refining processes	Ferndale 554 IO, Goldridge 632 IO, portion 11 of Ferndale 551 IO, Ferndale 564 IO, RE of Koedoerand 569, portion 4 of Spanover 549 IO, portion 5 of Spanover 549, Spanover 552 IO.	KALGOLD/AEL/4.17/OCT 2019
2021 Water Use License for applicable water uses at the mine	Portion 0 of Goldridge 632 IO, Ferndale 554 IO, Ferndale 564 IO, portion 13 of Ferndale 551 IO, RE of Koedoerand 569 IO, Portion 1 and 5 of Spanover 549 IO, Portion 0 of Spanover 552.	07/D41B/ABCGIJ/4754

In addition to the authorisations and licenses listed in Table 1, Harmony wishes to apply for an integrated EA in accordance with the National Environmental Management Act (NEMA) 2014 and National Environmental Management: Waste Act 59 of 2008 for the relevant listed activities associated with the proposed Kalgold Expansion Project. An application for a Water Use Licence (WUL) is also being lodged with the Department of Water and Sanitation (DWS) for the water use triggers.

1.1 REPORT STRUCTURE

This report has been compiled in accordance with the 2014 NEMA EIA Regulations, as amended. A summary of the report structure, and the specific sections that correspond to the applicable regulations, is provided in Table 2 below.

Table 2: Report structure

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
Appendix 3(a):	Details of – i. The Environmental Assessment Practitioner (EAP) who prepared the report; and ii. The expertise of the EAP, including a curriculum vitae;	Section 1.2
Appendix 3(b):	The location of the activity. Including – i. The 21-digit Surveyor General code of each cadastral land parcel; ii. Where available, the physical address and farm name; iii. Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Section 2
Appendix 3(c):	A plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is – i. A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; or ii. On a land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Section 2 Appendix B: Maps
Appendix 3(d):	A description of the scope of the proposed activity, including – i. All listed and specified activities triggered; ii. A description of the activities to be undertaken, including associated structures and infrastructure;	Section 3
Appendix 3(e):	A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	Section 4
Appendix 3(f):	A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report;	Section 5
Appendix 3(g):	A motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;	Section 5

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
Appendix 3(h):	A full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including: – (i) details of the development footprint alternatives considered; (ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; (iii) a summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them; (iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts- • (aa) can be reversed; • (bb) may cause irreplaceable loss of resources; and • (cc) can be avoided, managed or mitigated; (vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks; (vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (viii) the possible mitigation measures that could be applied and level of residual risk; (ix) if no alternative development footprints for the activity were investigated, the motivation for not considering such; and (x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report;	Section 6, Section 7 Section 7.6 Section 8, Section 9 Section 3
Appendix 3(i)	A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including- (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	Section 9

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
	(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	Section 10.3
Appendix 3(j)	An assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated;	Section 10.3
Appendix 3(k):	Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	Section 8
Appendix 3(l):	An environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment: (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives	Section 12.1 Section Section 9
Appendix 3(m)	Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation;	Section 12.2
Appendix 3(n)	The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Section 6
Appendix 3(o)	Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation;	Section 12.2

Environmental Regulation	Description – NEMA Regulation 982 (2014) as amended	Section in Report
Appendix 3(p)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 13
Appendix 3(q)	A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;	Section 12
Appendix 3(r)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	N/A
Appendix 3(s)	An undertaking under oath or affirmation by the EAP in relation to- (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	Section 14
Appendix 3(t)	Where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	Section 11
Appendix 3(u)	An indication of any deviation from the approved scoping report, including the plan of study, including- (i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) a motivation for the deviation;	N/A
Appendix 3(v)	Any specific information that may be required by the competent authority; and	N/A
Appendix 3(w)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.	N/A

1.2 DETAILS OF THE EAP

EIMS has been appointed by Harmony as the Independent EAP and to assist in preparing and submitting the EA application, Scoping and EIA Reports, and undertaking a Public Participation Process (PPP) in support of the proposed Kalgold Expansion Project. The contact details of the EIMS consultant who compiled this Report are as follows:

- Name of the consultant: Bongani Khupe
- Tel No.: 011 789 7170
- Fax No.: +27 86 571 9047
- E-mail address: kalgold@eims.co.za

In terms of Regulation 13 of the EIA Regulations (GN R. 982) as amended, an independent EAP, must be appointed by the applicant to manage the application. EIMS is compliant with the definition of an EAP as defined in Regulations 1 and 13 of the EIA Regulations, as well as Section 1 of the NEMA. This includes, inter alia, the requirement that EIMS is:

- Objective and independent;
- Has expertise in conducting EIA's;
- Comply with the NEMA, the environmental regulations and all other applicable legislation;
- Takes into account all relevant factors relating to the application; and
- Provides full disclosure to the applicant and the relevant environmental authority.

EIMS is a private and independent environmental management-consulting firm that was founded in 1993. EIMS has in excess of 29 years' experience in conducting EIA's, including many EIA's for mines and mining related projects. Please refer to the EIMS website (www.eims.co.za) for examples of EIA documentation currently available.

Mr Khupe is an environmental scientist, project manager and environmental auditor. He is a registered Professional Natural Scientist (SACNASP) and Environmental Assessment Practitioner (EAPASA) who holds a Bachelor of Science Honours degree in Applied Environmental Science from the University of Zimbabwe and is a trained Environmental Auditor (Crystal Clear, 2012). His training included all aspects of Environmental Auditing as well as EMS auditing in terms of ISO14001. In addition, he is a trained on the ISO14001:2015 environmental standard and has completed the EMS lead auditor training in terms of ISO14001:2015. Mr Khupe is registered with the Institute of Environmental Management and Assessment (IEMA) as an Environmental Auditor and with the South African Auditor and Training Certification Authority (SAATCA) as a Provisional Auditor. He has more than 14 years' experience in the environmental field. His key focus is on environmental compliance advice and monitoring, environmental impact assessments, environmental permitting, public participation, environmental management plans and programmes, strategic environmental advice, rehabilitation advice and monitoring as well as providing technical input for projects in the environmental management field. He is conversant with the South African environmental legislation as well as sustainability auditing, including Equator Principles, IFC Performance Standards and World Bank EHS guidelines. The Curriculum Vitae of the EAP that is responsible for the compilation of this Report is included in Appendix A.

1.3 SPECIALIST CONSULTANTS

Table 3 provides a list of the specialist studies that have been undertaken to address the key impacts that required investigation for this EIA. The specialist reports are included in Appendix D.

Table 3: List of specialists

Study	Specialist
Geohydrological Impact Assessment	MvB Consulting.
Hydrological Impact Assessment	Hydrologic Consulting (Pty) Ltd.
Freshwater Ecology Impact Assessment (Wetlands)	The Biodiversity Company (Pty) Ltd.
Terrestrial Ecology Impact Assessment	The Biodiversity Company (Pty) Ltd.
Hydropedology Impact Assessment	The Biodiversity Company (Pty) Ltd.
Agriculture Potential	The Biodiversity Company (Pty) Ltd.
Heritage and Cultural Resources Impact Assessment	PGS Heritage (Pty) Ltd.
Air Quality Impact Assessment	Airshed Planning Professionals (Pty) Ltd.
Social Impact Assessment	NLN Consulting.
Closure Costing	Environmental Impact Management Services (Pty) Ltd.
Traffic Impact Assessment	SMEC South Africa

2 DESCRIPTION OF THE PROPERTY

Table 4 indicates the farm portions that fall within the proposed Kalgold Expansion Project including details on the project location as well as the distance from the proposed project area to the nearest towns.

Table 4: Locality details

Farm Name	Remainder of portion 1 and portion 5 of the Farm Spanover 549, the remaining portion of Farm Spanover 552, the Farm Ferndale 554, Portion 13 of the Farm Ferndale 551 and the Remaining extent of the Farm Goldridge 632.		
Application Area (Ha)	The properties that form part of the application area for the proposed Kalgold Expansion Project cover an extent of approximately 2699 hectares (ha).		
Magisterial District	Ngaka Modiri Molema District		
Distance and direction from nearest towns	Kalgold mine is a gold mine located approximately 55km southwest of the town Mafikeng and 60km northeast of the town Stella. The geographic coordinates at the centre of the site is approximately: 26° 8'58.01"S; 25°14'35.97"E.		
21-digit Surveyor General Code for each Portion	**Farm Name:**	**Portion:**	**21 Digit Surveyor General Code**
	Spanover 549	RE of portion 1	T0IO00000000054900001
	Spanover 549	Portion 5	T0IO00000000054900005
	Spanover 552	RE	T0IO00000000055200000
	Ferndale 554	0	T0IO00000000055400000
	Ferndale 551	Portion 13	T0IO00000000055100013
	Goldridge 632	RE	T0IO00000000063200000

Figure 1 and Figure 2 indicate the locality of the existing Kalgold Mine, and the existing Kalgold operations.

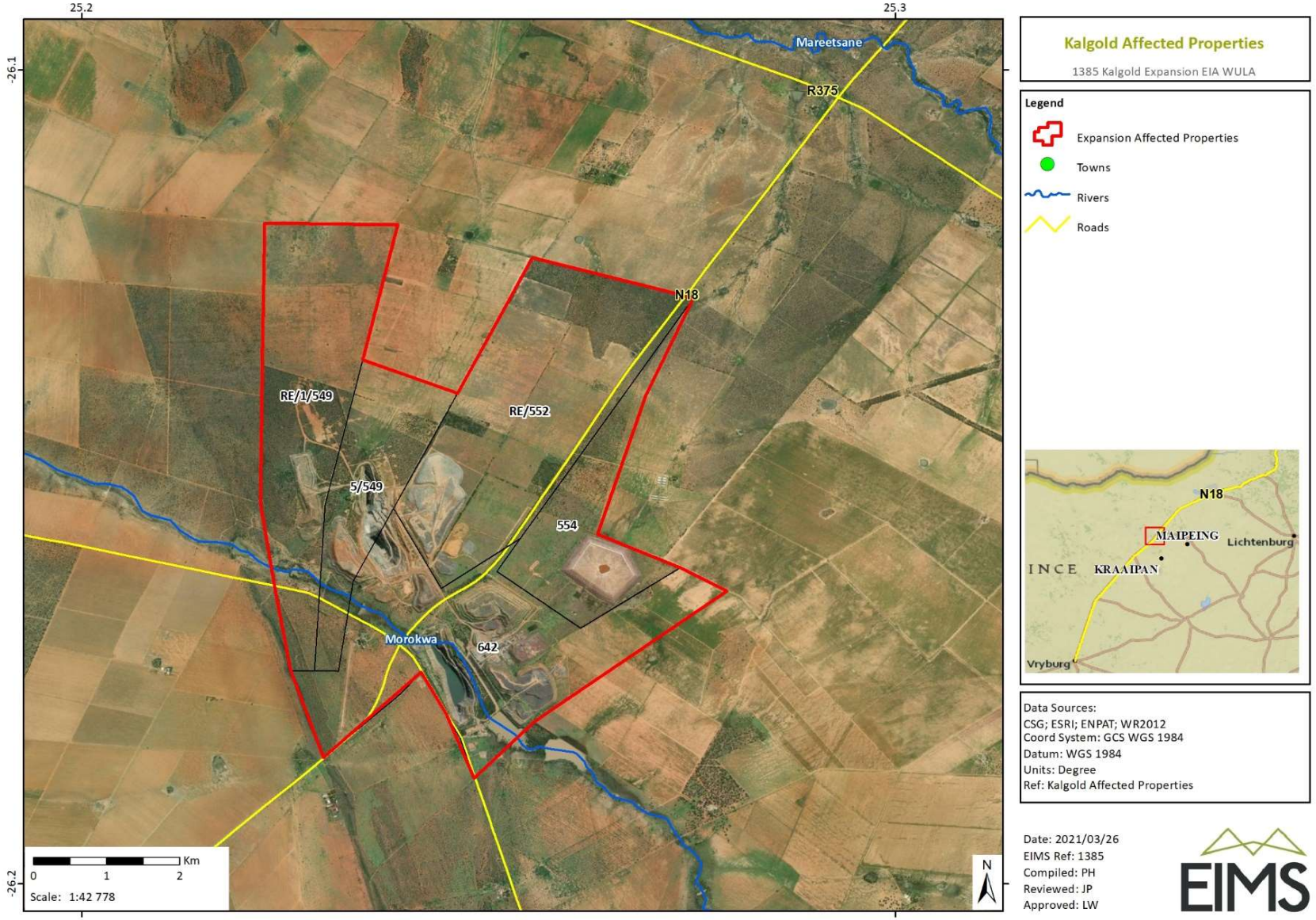


Figure 1: Topographical locality map indicating the location of the Kalgold mine and properties affected by the expansion project.

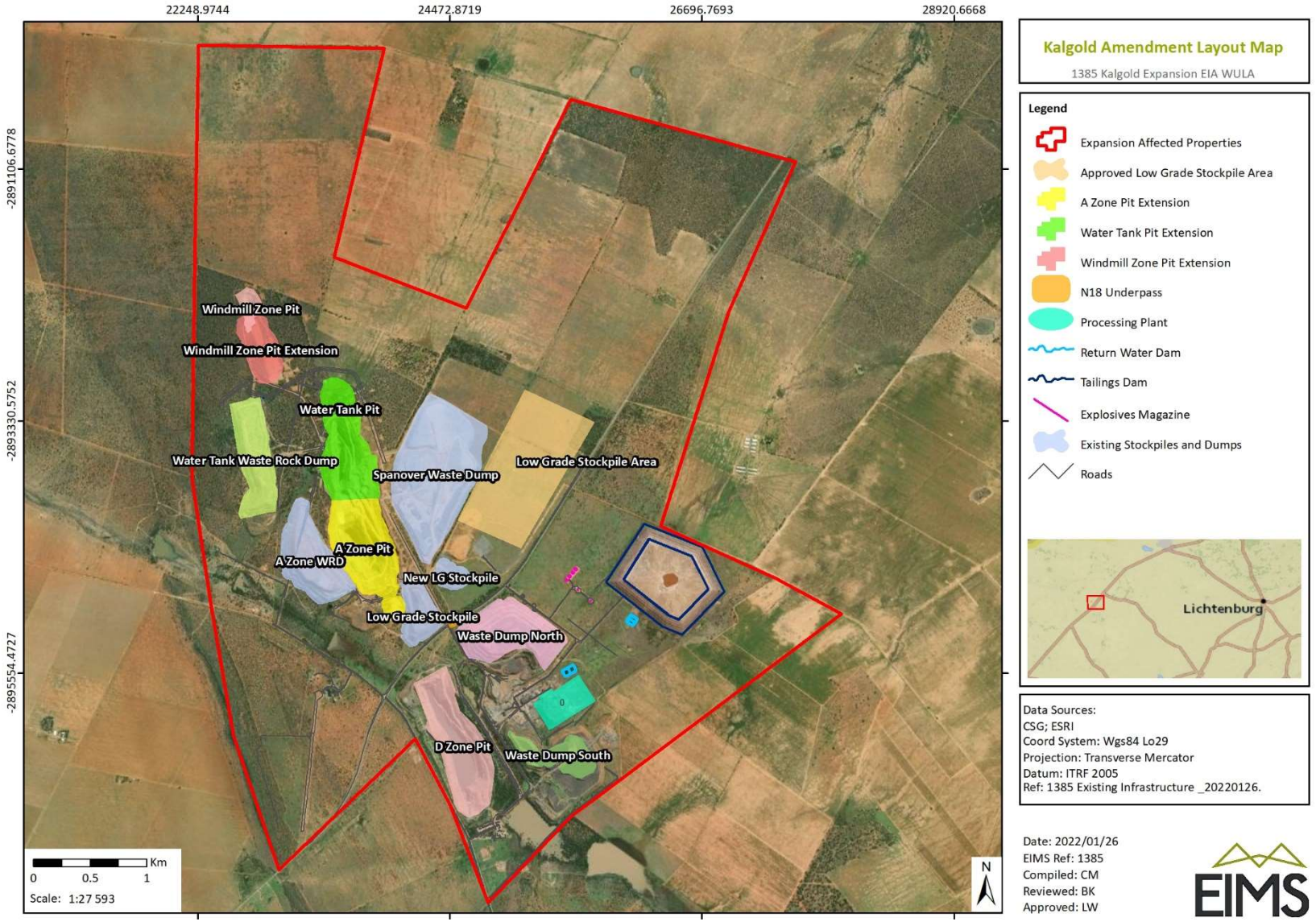


Figure 2: Aerial imagery locality map indicating the existing Kalgold operation and areas

3 DESCRIPTION AND SCOPE OF THE PROPOSED PROJECT

The section below provides a detailed project description for the proposed Kalgold Expansion Project. The aim of the project description is to indicate the activities that are taking place at the current Kalgold operation and the proposed activities to take place for the Kalgold Expansion Project. Furthermore, the detailed project description below is designed to facilitate the understanding of the proposed project related activities which are anticipated to lead to the impacts identified and assessed in this report, and for which management measures have been recommended.

3.1 RESOURCE DETAILS

The Kalgold operation is located within the Kraaipan Greenstone Belt, which forms part of the larger Amalia-Kraaipan Greenstone terrain. The Kraaipan Greenstone Belt consists of north trending linear belts of Archaean metavolcanic and metasedimentary rocks, separated by granitoid units. Mineralisation occurs in shallow dipping quartz veins, which occur in clusters or swarms, within the steeply dipping magnetite-chert banded iron formation. Disseminated sulphide mineralisation, dominated mostly by pyrite, occurs around and between the shallow dipping quartz vein swarms. The following rocks are associated with the ore body:

- The footwall consists of mafic schist and the hanging wall of greywacke, shale, sandstone, conglomerate and siltstone.
- The host rock is Banded Iron Formation (BIF) intercalated with shale. The greenstone formations are exposed in discontinuous outcrops of steeply dipping rocks which define three narrow, sub-parallel belts that strike approximately north-south (GCS, 2008).

The ore body mined at Kalgold occurs within the central belt which comprises banded iron formation (BIF), magnetite quartzite, chert, greywacke, shale and schist. The gold mineralization is hosted by steeply dipping BIF that are interbedded with schist, shale and greywacke. The greenstones are hosted within intrusive granite and gneiss. The Kraaipan greenstone is intruded by numerous east-west trending dykes. One such dyke cuts across the southern boundary of the mining lease area. The area is further characterised by abundant faults with displacement from a few metres to hundreds of metres.

3.2 MAIN MINING ACTIONS, ACTIVITIES AND PROCESSES OCCURRING ON SITE

Kalgold Mine first started operation during the mid-1990s where it focussed on mining of the D-Zone ore body. The economic ore body was mined out by a single open pit operation, along a strike length of 1300m and to a depth of approximately 290m below surface. The mining operation at D-Zone open Pit ceased in March 2009. Mining at Kalgold Mine has continued despite the operation cessation at D-Zone Open Pit. The A-Zone Open Pit, Windmill Open Pit and Watertank Open Pit are ongoing opencast operations.

The current opencast pits at Kalgold are therefore:

- The D-Zone pit – the largest ore body, which was mined as a single opencast operation along a strike length of 1300m to a depth of approximately 290m, from 1996 to 2009. Kalgold is currently depositing tailings into the D-Zone pit[1].
- The A-Zone open pit – commissioned in 2005 is located immediately south of the Watertank North pit and is approximately 27ha in size.
- The Watertank and Windmill Zone – commissioned in 2008.

The open pit workings are accessed by ramps.

[1] On 16 February 2009 as part of conditions of an EMPr approval, Kalgold was required to backfill all excavations with waste generated from the mine. In the EMPr appendment approval dated 4 May 2019, it was further indicated that no dump structures should be left on the surface (topsoil, overburden, waste rock, tailings and slime dams).

Extensive metallurgical test work conducted by The Council for Mineral Technology (Mintek) and detailed feasibility studies completed in 1995 have shown that the ores at Goldridge are non-refractory and that gold is economically extractable by conventional carbon-in-leach (CIL) technology, yielding high (+91%) recoveries. In addition, the ores in the oxidized portions of the deposits are amenable to gold extraction by the low-cost heap leach method, which recovers between 60 and 70% of the gold. The metallurgical extraction strategy designed for the Goldridge ores, involved the construction of a twin-process plant which incorporates a common batch crushing facility from which the product is fed either to the CIL process (for high grade and sulphidic ores) or the heap leach process (primarily for lower grade oxidised ores). The plant construction programme was designed so that the heap leach plant and pads were constructed first. The heap leach process started producing gold during the third quarter of 1996. Construction of the CIL portion of the plant commenced during May 1997 and the CIL plant came on stream during the first quarter of 1998. At full capacity, the current metallurgical complex can process up to 150 000 tons (90 000 tons CIL, 60 000 tons heap leach) of ore per month yielding approximately 2 500kg (80 000 ounces) of gold per year.

Heap leach and CIL are industrial mining processes to extract metals and other compounds form ore. Ore from the open pit is trucked to the run of mine (ROM) stockpile area. From here it is transferred via conveyor through pre-primary, primary, secondary, tertiary and quaternary crushing circuits that reduce the ore size from 1000mm to 6mm. This product is stockpiled before lime is added and the material is transported and stacked on the heap leach pads. The cyanide solutions are pumped onto the heaps via a network of drip pipes. These solutions percolate through the ore particles within the heaps. Exposed grains of gold are dissolved and carried in solution via a system of drainage channels at the base of the heap to the pregnant pond. The pregnant pond overflows to an emergency pond in the event of excess solution volumes flowing from the heaps e.g. after a high rainfall event. The pregnant liquor is then pumped through carbon solution columns in which the gold is loaded by absorption onto carbon granules. After gold extraction, the cyanide solutions are pumped to the barren pond, where the cyanide is replenished, and the solutions prepared for the next leaching cycle. The loaded carbon is diluted and gold recovered by electro-winning and smelting. The current heap leach facility is no longer operational. Occasionally the heap is loaded into the mills for processing. The historical heap leach and associated dams and ponds are lined with PVC.

The CIL circuit came on stream during March 1998 and shares a batch ore crushing facility with the heap leach operation. This process is used to treat higher-grade oxide and sulphide ores. Ore is taken to the tertiary crusher stage after which 12mm crush will be transferred to the mills where it is reduced to 80% minus 75µm. This pulp is then passed via a gravity concentrator in which the coarse gold is removed for smelting. The gravity tails are transferred to the CIL tanks where cyanide and carbon are added. A series of 6 tanks is in use, the first 2 for gold dissolution only and the following 4 for carbon-in-leach extraction. Loaded carbon from the CIL tanks is transferred to elution columns for gold extraction and electro-winning. Barren ore pulps from the CIL tanks are pumped to the slimes dam for disposal. Storage tanks for the heap leach are: Cyanide: 2 tanks at 29t each; Caustic soda: 1 tank at 29t; and Lime: 120t.

On 16 February 2009 as part of conditions of an EMPr approval, Kalgold was required to backfill all excavations with waste generated from the mine. In the EMPr appendment approval dated 4 May 2017, it was further indicated that no dump structures should be left on the surface (topsoil, overburden, waste rock, tailings and slime dams). The decision was made by Kalgold to utilise tailings for backfilling the pit in line with DMRE conditions, in this regard deposition to the existing TSF was suspended in July 2015. The process of backfilling of the D-Zone open pit with tailings utilises one pipeline with several smaller pipelines, with a total diameter of 269mm, located above ground to transport the tailings slurry from the tailings pump station to the D-Zone open pit. The tailings slurry comprises of 20% tailings and 80% water. The waste rock would be made available for aggregate production.

3.3 DESCRIPTION OF ACTIVITIES TO BE UNDERTAKEN

The existing Harmony Kalgold operation wishes to expand its current production from the current production rate of 130 000 tons per month to 300 000 tons per month. A pre-feasibility study has been undertaken. The findings of the pre-feasibility study have concluded that the following new activities and expansions are proposed and are consequently assessed in this report:

- The pit footprint will increase.
    - A-Zone and Water Tank Pits will be combined and total footprint increased. Total footprint will be 127 ha for both pits combined.
    - Windmill pit: Total footprint will be 13 ha.
- Larger dewatering pipelines (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s).
- Extension to Spanover waste rock dump (expand the waste rock dump with another 140 ha)
- New ROM pad.
- New processing plant.
- Recommission old TSF at low deposition rate (an average deposition rate of 74 000 tonnes/month)
- Increase deposition rate at D-Zone pit (from 136 000 tonnes/month to 240 000 tonnes/month)
- Install pipeline from Central dam to the new plant (Internal diameter of approximately 450mm and peak throughput of approximately 230L/s).
- Install a tailings pipeline from the new plant to old TSF and D-zone pit (pipelines for both deposition and also another for return water). The Internal diameter of the pipelines will be of approximately 350mm and peak throughput of approximately 150L/s.
- Install pipeline from old plant raw water pond to the new plant (D-Zone return water, Internal diameter of approximately 450mm and peak throughput of approximately 230L/s).
- Install two 22kv power lines from Ferndale substation to the new plant.
- Install a water treatment plant at the new plant (treat up to 12000m^3/day)
- Relocate and expand the explosives magazine.
- Additional new road from the plant to the N18 and from the old plant to the N18 (approximately 13m wide).
- New road from pit to ROM pad (approximately 28m wide).
- New road to Spanover waste rock dump extension.
- Instal a 350mm diameter pipeline for the discharge of treated water to the Morokwa River.
- Increase the size of the water pipe from A-Zone to Central dam (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s).
- Increase the size of the water pipe from Watertank pit to Central dam. (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s).

The layout of the infrastructure proposed for the expansion project is presented in Figure 3 and further details presented below.

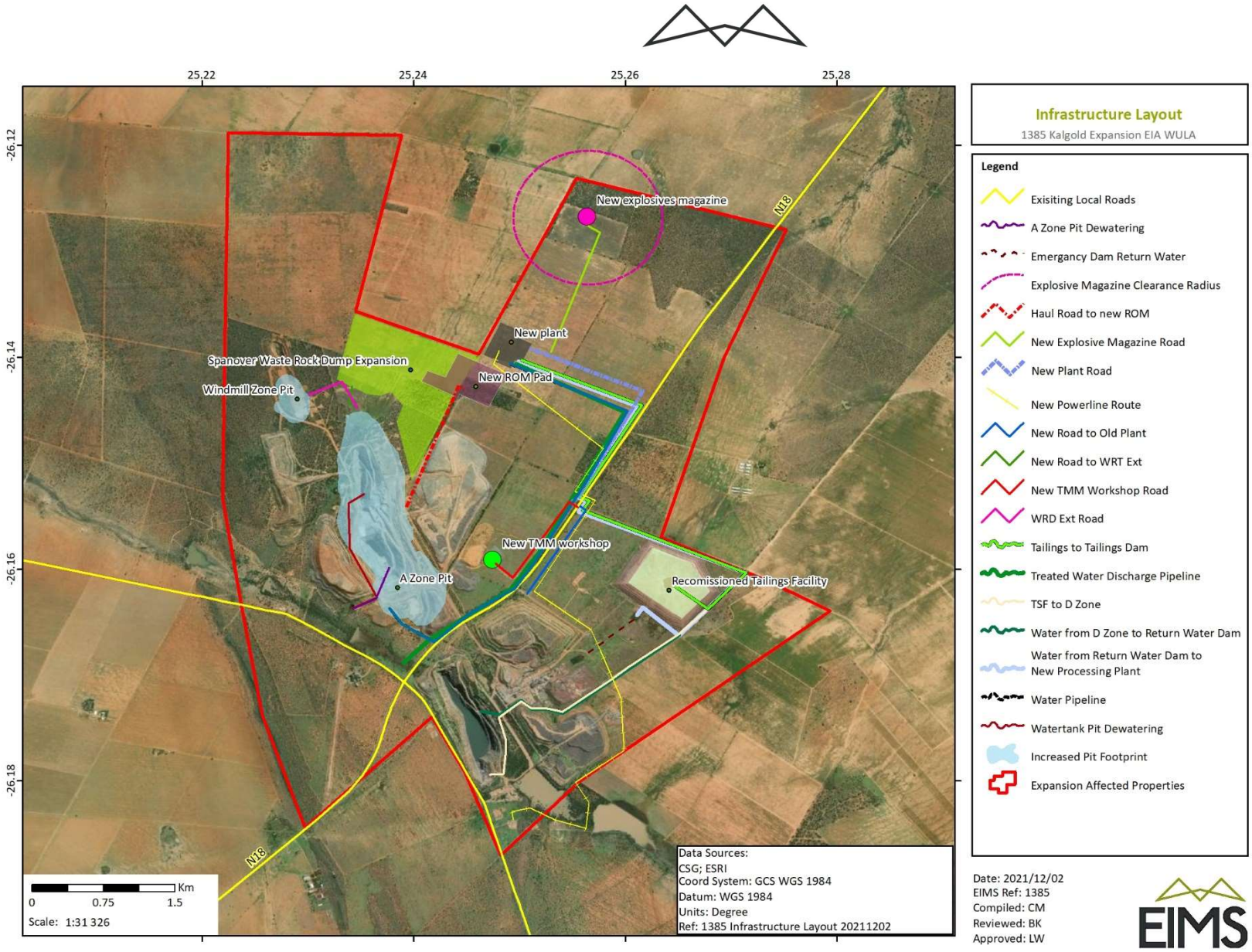
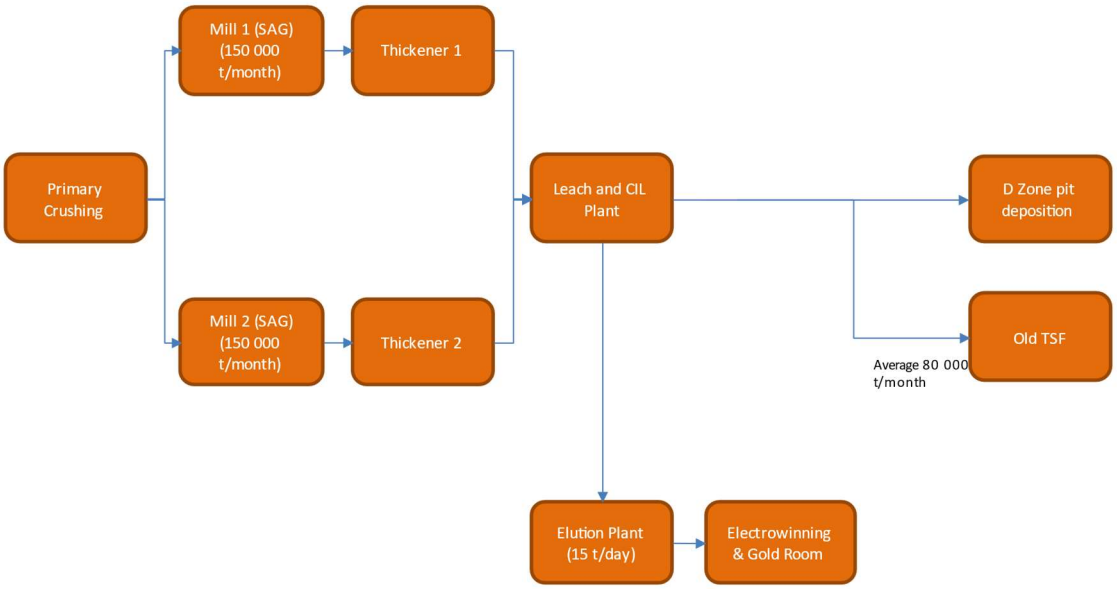


Figure 3: Preliminary layout of the proposed infrastructure for the expansion project

3.3.1 PROPOSED PROCESSING PLANT

The proposed processing plant will utilise the CIL method to extract gold and other metals/compounds from the ore. Ore from the open pit will be trucked to the proposed new run of mine (ROM) stockpile area. From here it is transferred via conveyor through pre-primary, primary, secondary, tertiary and quaternary crushing circuits to reduce the ore sizes. This pulp is then passed via a gravity concentrator in which the coarse gold is removed for smelting. The gravity tails are transferred to the CIL tanks where cyanide and carbon are added. A series of tanks will be used, some for gold dissolution only and some for carbon-in-leach extraction. Loaded carbon from the CIL tanks is transferred to elution columns for gold extraction and electro-winning. Reagents required for the processing are detailed in section 3.3.2 below. Barren ore pulps from the CIL tanks are pumped to the tailing disposal facilities. The proposed tailings management method is detailed in section 3.3.7.



A water treatment plant is also proposed next to the new processing plant. Excess treated water that cannot used within the plant and mining operations will be discharged into the Morokwa river through a new proposed pipeline (proposed pipelines are detailed in Section 3.3.3). Two new 22kv powerlines are also proposed to supply the new procesing plant with electricity from the Ferndale substation.

3.3.2 PROPOSED STORAGE OF HARZADOUS SUBSTANCES

Table 5 below provides details of some of the hazardous substances that will be stored at the proposed gold processing plant.

Table 5: Hazardous Substance Storage

Reagent	Storage Tank Capacity
Dilute Acids Make-up Tank	56m^3
Sulphamic Acid	59 m^3
Hydrochloric Acid Dosing tanks	2x 30 m^3
Cyanide	3 x 73 m^3
Caustic Soda	32 m^3

Reagent	Storage Tank Capacity
Eluted carbon storage tank	39 m^3
Regenerated Carbon Tank	39 m^3
Eluant Distribution Tank	2.46 m^3
Cathode Wash Tank	12.58 m^3
Cathode Sludge Tank	12.58 m^3
Gold Room Filtrate Tank	3.03 m^3
Barren Solution Tank	242 m^3
Diesel (for back-up generator)	46 m^3
Total	**771,07 m^3**

3.3.3 PROPOSED PIPELINES

The details of the proposed pipelines in Figure 3 are summarised below:

- Pipeline from Central dam to new plant (Internal diameter of approximately 450mm and peak throughput of approximately 230L/s).
- Pipeline from D-zone to the new plant (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s).
- Pipeline from new plant to stream for discharge of treated water.
- Dewatering pipelines (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s). This includes the following pipelines among others:
    - Water pipe from A-Zone to Central dam.
    - Water pipe from Watertank pit to Central dam.
- Tailings pipeline from new plant to old TSF and D-zone pit (Internal diameter of approximately 350mm and peak throughput of approximately 160L/s).

3.3.4 PROPOSED ROADS

New access from the N18 is proposed. Preliminary layout of the access road is indicated in Figure 4. Two roads are proposed from the N18 to the new plan and another from the N18 to the old plant. The roads will be approximately 13m wide. The proposed new haul roads on site will be approximately 28m wide. All other proposed internal access roads will be approximately 13m wide. The internal and haul roads include the following:

- Road from pit to ROM pad.
- Road to Spanover waste rock dump extension.
- Road to the proposed explosives magazine.

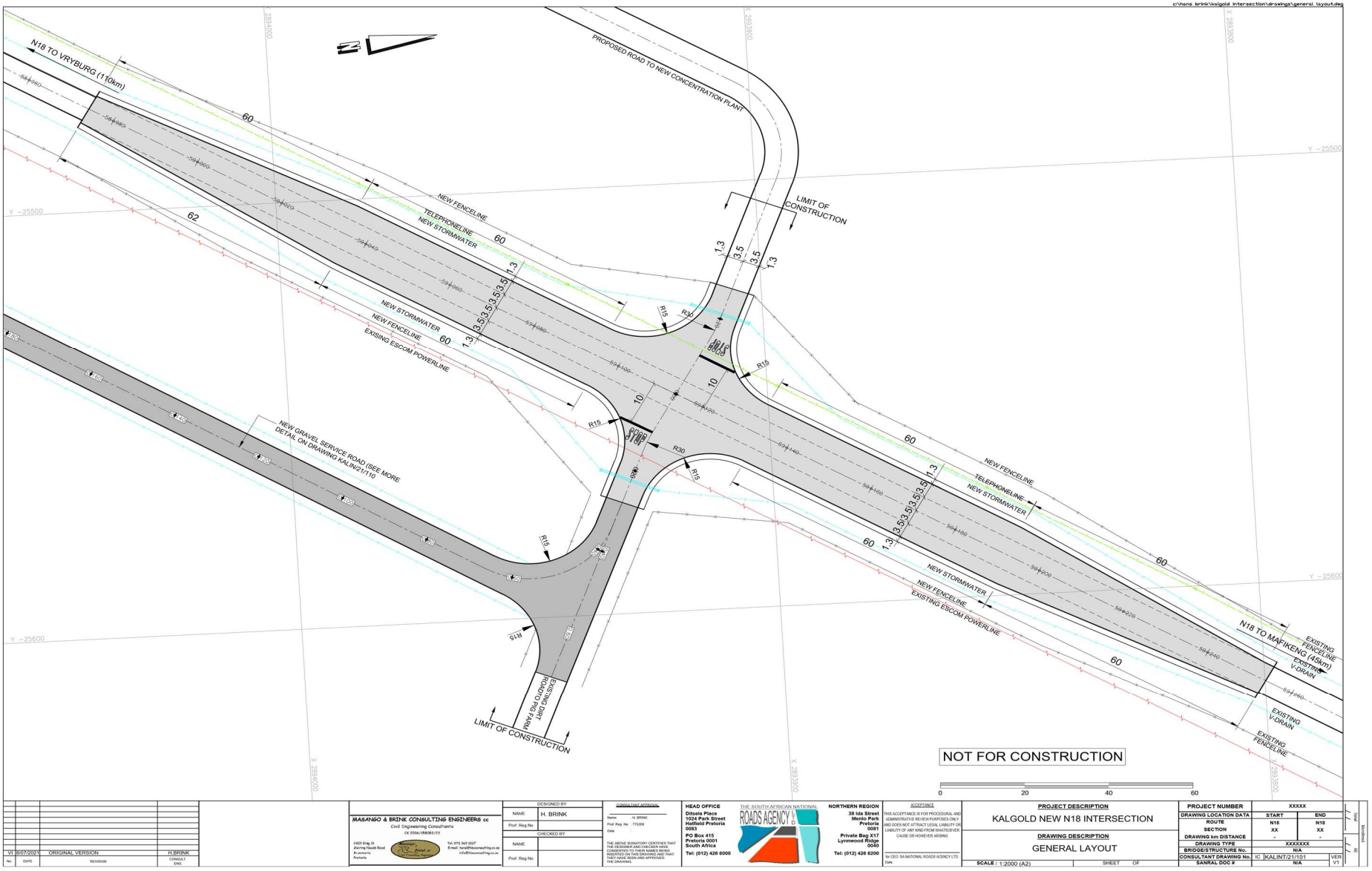


Figure 4: Preliminary N18 access road design

3.3.5 PIT EXTENSIONS

The following pits are proposed to be extended as part of the expansion project.

- **The A-Zone and Watertank Pits will be combined and increased**. This will increase the total footprint of both pits combined to 127 ha. A grader will be used to clear the vegetation at the extension areas. Topsoil will be removed by an excavator and stockpiled adjacent to the open pit for use during rehabilitation. Mining in the extension areas is proposed continue in the same manner using open pit truck and shovel methods.

- **Windmill Pit**: The existing Windmill Zone pit is located to the northwest of the Kalgold Mining Right areas and is approximately 2ha in size with a current approval to extend it by 20 ha (EIMS EMPr 2021). The proposed expansion is to increase the footprint by 13ha. A grader will be used to clear the vegetation at the extension areas. Topsoil will be removed by an excavator and stockpiled adjacent to the open pit for use during rehabilitation. Mining in the extension areas is proposed to continue in the same manner using open pit truck and shovel methods.

3.3.6 SPANOVER WASTE ROCK DUMP EXTENSIONS

The Spanover waste rock dump has an existing approved footprint of 98ha. The proposal is to expand the waste rock dump with another 140ha to the north of the existing waste rock dump and adjacent to the new processing plant (see Figure 3). The total footprint of the waste rock dump will then be 238 ha.

3.3.7 TAILINGS MANAGEMENT

On 16 February 2009 as part of conditions of an EMPr approval, Kalgold was required to backfill all excavations with waste generated from the mine. In the EMPr appendment approval dated 4 May 2017, it was indicated that no dump structures should be left on the surface (topsoil, overburden, waste rock, tailings and slime dams). The decision was made by Kalgold to utilise tailings for backfilling the D-Zone pit in line with DMRE conditions, in this regard deposition to the existing TSF was suspended in July 2015. Tailings are currently being deposited at the D-zone pit and will continue to be deposited in the pit.

Due to the proposed production increase, Kalgold proposes to recommission this existing TSF at a low deposition rate (an average 74 000 tonnes/month) and also to increase the tailings deposition rate to the D-Zone pit (from 136 000 tonnes/month to 240 000 tonnes/month). The deposition will be conducted concurrently in both tailings facilities. An above ground tailings pipeline from the new plant to the old TSF and D-zone pit is proposed (Internal diameter of approximately 350mm and peak throughput of approximately 160L/s). The tailings slurry comprises of 20% tailings and 80% water.

3.3.8 EXPLOSIVES MAGAZINE

Due to safety requirements a new explosives magazine is proposed north of the proposed processing plant. A new road will also be constructed to the new explosives magazine.

3.3.9 PROPOSED PCD

Based on the conceptual stormwater management plan a number of Pollution Control Dams (PCDs) are proposed to be constructed on site. Table 6 below summarises the preliminary PCD design recommendations from the conceptual stormwater management in the Hydrology Study (Hydrologic Consulting, 2021). The proposed positions of the PCDs are indicated in Figure 5. Berms and channels would be constructed to divert water into these PCDs.

Table 6: Proposed PCDs

Containment	Area (M^2)	1:50 RI Volume (m3)	Recommended Volume (m3)	Depth Based on Recommended (m)
PDC1	8 000	15 100	22 100	2.76
PDC2	60 000	174 000	198 800	3.31
PDC3	25 000	85 200	98 800	3.95
PDC4	5 000	13 200	15 100	3.00
PDC5	2 500	5 830	6 500	2.57
PDC6	14 000	69 200	79 400	5.66

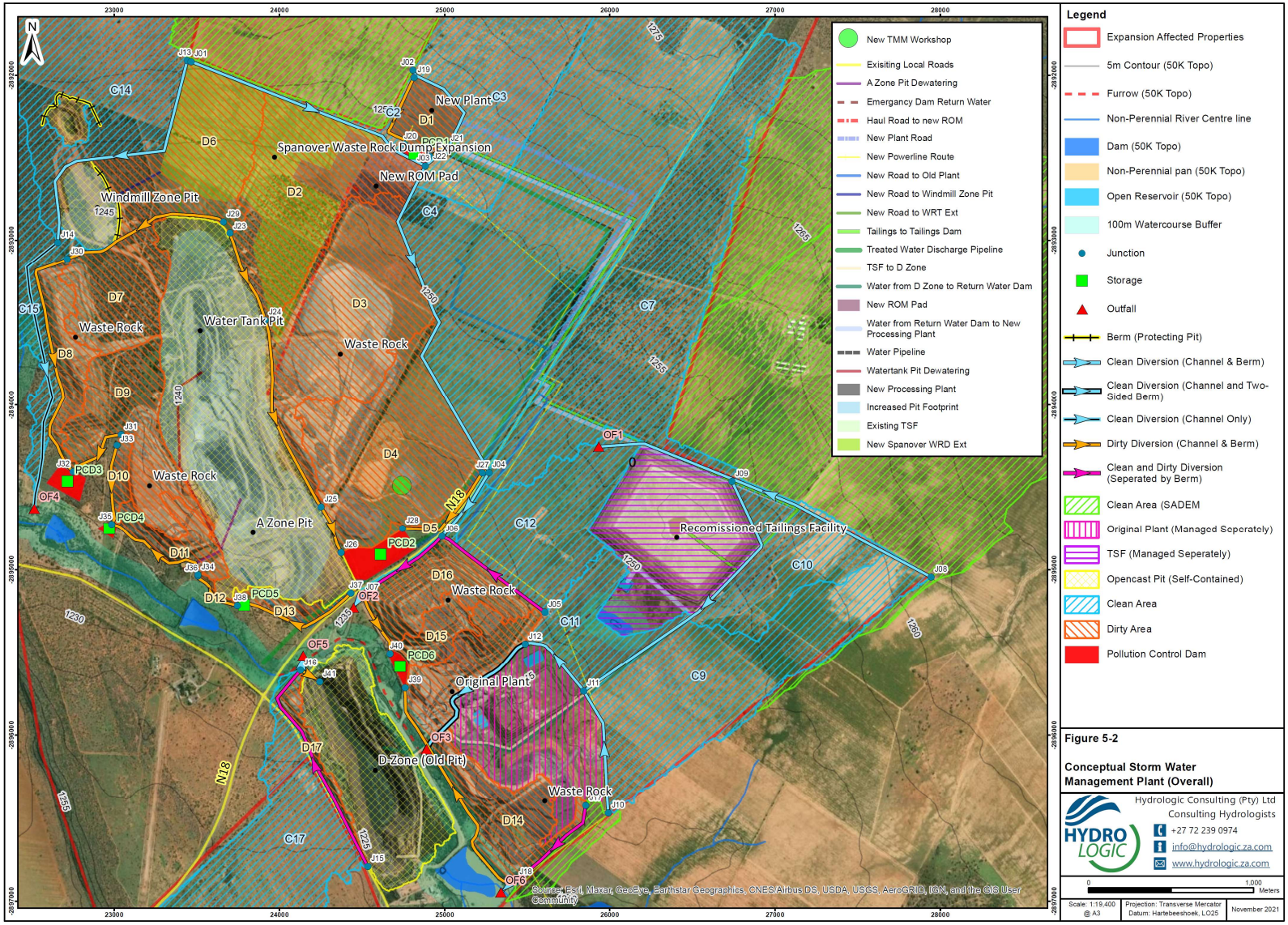


Figure 5: Conceptual Stormwater Management Plan and Proposed PCDs

3.4 LISTED AND SPECIFIED ACTIVITIES TRIGGERED

The overall Kalgold Expansion Project requires Environmental Authorization, Waste Management Licence, a Water Use License and an Air Emissions License to operate. The project will also require an amendment of the approved EMPr and MWP through a Section 102 (S102) application. Identified listed and specified activities are detailed below.

3.4.1 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA)

Table 7 below indicates the Listed activities in terms of the NEMA 2014 EIA Regulations (as amended) that are applicable to the proposed Kalgold Expansion Project.

Table 7: Listed activities in terms of the NEMA EIA Regulations (2014) as amended

GNR #	Activity Number	Description of the applicable listed activity	Applicability
GNR 983	9	The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water— (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where— (a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve or railway line reserve; or (b) where such development will occur within an urban area.	Construction of the following pipelines: • Pipeline from central dam to new plant (Internal diameter of approximately 450mm and peak throughput of approximately 230L/s). • Pipeline from TSF and D-zone to the new plant) (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s). • Pipeline from new plant to stream for discharge of treated water (Internal diameter of approximately 350mm) • Pipeline from old plant raw water pond to the new plant (D-Zone return water). • Water pipe from A-Zone to Central dam. (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s). • Water pipe from Watertank pit to Central dam (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s).
GNR 983	10	The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, wastewater, return water, industrial discharge or slimes – (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where—	Construction of the following pipelines: • Dewatering pipelines (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s). • Tailings pipeline from new plant to old TSF and D-zone pit (Internal diameter of approximately 350mm and peak throughput of approximately 160L/s).

GNR #	Activity Number	Description of the applicable listed activity	Applicability
		(a) such infrastructure is for the bulk transportation of sewage, effluent, process water, wastewater, return water, industrial discharge or slimes inside a road reserve or railway line reserve; or (b) where such development will occur within an urban area.	• Pipeline from old plant raw water pond to the new plant (D-Zone return water, Internal diameter of approximately 450mm and peak throughput of approximately 230L/s). • Water pipe from A-Zone to Central dam (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s). • Water pipe from Watertank pit to Central dam (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s).
GNR 983	12	"The development of— (i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or (ii) infrastructure or structures with a physical footprint of 100 square metres or more; where such development occurs— (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; — excluding— (aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;	• New pollution control dams. 6 PCDs are proposed. • Pipeline from old plant raw water pond to the new plant (D-Zone return water). • Tailings pipeline from the new plant to D-Zone pit. • Treated water discharge pipeline (from new plant to stream). • Emergency Dam return water pipeline. • Water pipe from Watertank pit to Central dam. • Construction of a powerline.

GNR #	Activity Number	Description of the applicable listed activity	Applicability
		(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies; (dd) where such development occurs within an urban area; (ee) where such development occurs within existing roads, road reserves or railway line reserves; or (ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared. "	
GNR 983	19	"The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse; but excluding where such infilling, depositing, dredging, excavation, removal or moving— (a) will occur behind a development setback; (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies; (d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or (e) where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies."	Expansion of the pits and other associated infrastructure will result in excavation of more than 10 cubic metres of soils and rock from watercourse.
GNR 983	24	"The development of a road—	Construction of internal haul roads. The following roads are required:

GNR #	Activity Number	Description of the applicable listed activity	Applicability
		(i) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Government Notice 545 of 2010; or (ii) with a reserve wider than 13,5 meters, or where no reserve exists where the road is wider than 8 metres; but excluding a road— (a) which is identified and included in activity 27 in Listing Notice 2 of 2014; (b) where the entire road falls within an urban area; or (c) which is 1 kilometre or shorter."	• Road from Pit to new ROM pad (approximately 28m wide). • Road to Spanover waste rock dump extension. • Road from the new and old plants to the N18 ((approximately 13m wide). • Road to new explosives magazine (approximately 13m wide). • Internal access roads
GNR 983	25	The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of more than 2 000 cubic metres but less than 15 000 cubic metres.	Proposed water treatment plant with a capacity of up to 12000m^3/day.

GNR 983	27	All infrastructure (ventilation shaft)
		"The clearance of an area of 1 hectares or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for-
		(i) the undertaking of a linear activity; or
		(ii) maintenance purposes undertaken in accordance with a maintenance management plan."
			Vegetation clearance will be required for the following among others:
			• Pit expansion
			  ○ A-Zone Pit (127 ha)
			  ○ Windmill South (13 ha)
			• Extension of Spanover waste rock dump (140 ha).
			• New ROM Pad (~ 11 ha).
			• Explosives magazine.
			• Linear infrastructure.

GNR 983	45	The expansion of infrastructure for the bulk transportation of water or storm water where the existing infrastructure—	Expansion of the following pipelines: • Pipeline from A-zone to Central dam.

GNR #	Activity Number	Description of the applicable listed activity	Applicability
		(i) has an internal diameter of 0,36 metres or more; or (ii) has a peak throughput of 120 litres per second or more; and (a) where the facility or infrastructure is expanded by more than 1 000 metres in length; or (b) where the throughput capacity of the facility or infrastructure will be increased by 10% or more; excluding where such expansion— (aa) relates to transportation of water or storm water within a road reserve or railway line reserve; or (bb) will occur within an urban area.	• Pipeline from Watertank pit to Central dam.
GNR 983	56	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (i) where the existing reserve is wider than 13,5 meters; or (ii) where no reserve exists, where the existing road is wider than 8 metres; excluding where widening or lengthening occur inside urban areas.	Upgrade to existing internal roads.
GNR 984	4	The development and related operation of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres	Development of storage facilities for chemicals required in the new processing plant. Facilities for the following will be required: • Dilute Acids Make-up Tank (56m^3) • Sulphamic Acid (59 m^3) • Hydrochloric Acid Dosing tanks (2x 30 m^3) • Cyanide (3 x 73 m^3) • Caustic Soda (32 m^3) • Eluted Carbon Storage Tank (39 m^3)

GNR #	Activity Number	Description of the applicable listed activity	Applicability
			• Regenerated Carbon Tank (39 m^3) • Eluant Distribution Tank (2.46 m^3) • Cathode Wash Tank (12.58 m^3) • Cathode Sludge Tan (12.58 m^3) • Gold Room Filtrate Tank (3.03 m^3) • Barren Solution Tank (242 m^3) • Diesel (46 m^3)
GNR 984	6	The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding– (i) activities which are identified and included in Listing Notice 1 of 2014; (ii) activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the National Environmental Management: Waste Act, 2008 applies; (iii) the development of facilities or infrastructure for the treatment of effluent, polluted water, wastewater or sewage where such facilities have a daily throughput capacity of 2 000 cubic metres or less; or (iv) where the development is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will not exceed 50 cubic metres per day.	Construction and operation of the processing plant will require an Atmospheric Emissions Licence (AEL).
GNR 984	7	The development and related operation of facilities or infrastructure for the bulk transportation of dangerous goods-	Pipeline from TSF and D-zone to the new plant) (Internal diameter of approximately 350mm and peak throughput of approximately 150L/s).

GNR #	Activity Number	Description of the applicable listed activity	Applicability
		(i) in gas form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity of more than 700 tons per day; (ii) in liquid form, outside an industrial complex, using pipelines, exceeding 1 000 metres in length, with a throughput capacity of more than 50 cubic metres per day; or (iii) in solid form, outside an industrial complex, using funiculars or conveyors with a throughput capacity of more than 50 tons per day.	

GNR 984	15	The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for-
		(i) the undertaking of a linear activity; or
		(ii) maintenance purposes undertaken in accordance with a maintenance management plan.
			Vegetation clearance will be required for the following among others:
			• Pit expansion
			  ○ A-Zone Pit (127 ha)
			  ○ Windmill South (13 ha)
			• Extension of Spanover waste rock dump (140ha)
			• New ROM Pad (Appr 11 ha)
			• Explosives magazine.
			• Linear infrastructure.

GN 984	17	Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including— (a) associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource; or (b) the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing;	Mining activities including the proposed additional infrastructure required.

GNR #	Activity Number	Description of the applicable listed activity	Applicability
		but excluding the secondary processing of a mineral resource, including the smelting, beneficiation, reduction, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies.	
GNR 985	4	The development of a road wider than 4 meters with a reserve less than 13.5 meters.	Construction of internal access roads.
GNR 985	10	The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres.	Development of storage facilities for chemicals required in the new processing plant. Facilities for the following will be required: • Dilute Acids Make-up Tank (56m^3) • Sulphamic Acid (59 m^3) • Hydrochloric Acid Dosing tanks (2x 30 m^3) • Cyanide (3 x 73 m^3) • Caustic Soda (32 m^3) • Eluted Carbon Storage Tank (39 m^3) • Regenerated Carbon Tank (39 m^3) • Eluant Distribution Tank (2.46 m^3) • Cathode Wash Tank (12.58 m^3) • Cathode Sludge Tan (12.58 m^3) • Gold Room Filtrate Tank (3.03 m^3) • Barren Solution Tank (242 m^3) • Diesel (46m^3)
GNR 985	12	The clearance of an area of 300 square meters or more of indigenous vegetation except where such clearance of indigenous vegetation is required	The construction of the powerline, tailings pipeline, roads and return water pipelines.

GNR #	Activity Number	Description of the applicable listed activity	Applicability
		for maintenance purposes undertaken in accordance with a maintenance management plan. i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004	The Power line, water pipeline, roads and return water corridor falls across the ESA1 areas.
GNR 985	14	The development of— (i) dams or weirs, where the dam or weir, including infrastructure and water surface area exceeds 10 square metres; or (ii) infrastructure or structures with a physical footprint of 10 square metres or more; where such development occurs— (a) within a watercourse; (b) in front of a development setback; or (c) if no development setback has been adopted, within 32 metres of a watercourse, measured from the edge of a watercourse; excluding the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour.	Construction of pollution control dams. 6 pollution control dams are proposed as part of the storm water management plan.
GNR 985	18	The widening of a road by more than 4 meters; or the lengthening of a road by more than 1 kilometre.	Construction or widening of internal haul roads.

3.4.2 THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT (NEMWA)

The listed activities that are triggered by the project in terms of GN921 promulgated under the National Environmental Management Waste Act (Act 59 of 2008 - NEMWA) are detailed in Table 8 below.

Table 8: Waste management activities applicable to the expansion project

NEMWA_GNR921 Activity	Description of Applicable Listed Activity	Applicability
Category B10	The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity).	Extension of Spanover waste rock dump and recommissioning of the existing Tailings Storage Facility.
Category B11	The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	Extension of Spanover waste rock dump and recommissioning of the existing Tailings Storage Facility.

3.4.3 THE NATIONAL WATER ACT (NWA)

An application for a Water Use Licence (WUL) will be lodged with the Department of Water and Sanitation (DWS) for the water uses triggered by the expansion project. The following water use are applicable for the expansion project and will be confirm in consultation with the DWS:

- Section 21(c): Impeding or diverting the flow of water in a watercourse;
- Section 21(g): Disposing of waste in a manner which may detrimentally impact on a water resource;
- Section 21(i): Altering the bed, banks, course or characteristics of a watercourse; and
- Section 21(j): Removing, discharging or disposing of water found underground.

3.4.4 THE NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT (NEM:AQA)

In terms of the NEM:AQA, no person may conduct an activity listed on the national list anywhere in the Republic or listed on a list applicable in a province anywhere in that province without a Provisional Atmospheric Emission Licence (PAEL) or an AEL. The Kalgold operations has an existing full AEL (no. NWPG/ KALGOLD/AEL 4.17 /OCT 2019) in respect of the listed activity category 4, subcategory 4.17; of the Section 21 to NEM:AQA. The AEL was issued based on the information provided in the application dated 04 September 2019 and is valid for a period of five (5) years from 14 October 2019.

A separate AEL will be required for the new processing plant. Based on information available the new processing plant will trigger the following listed activities under Section 21 of the NEM:AQA:

- Subcategory 4.1: Drying and calcining of mineral solids including ore.
- Subcategory 4.17: The production or processing of precious and associated base metals through chemical treatment.

4 POLICY AND LEGISLATIVE CONTEXT

This section provides an overview of the governing legislation identified which relates to the proposed project. A summary of the applicable legislation is provided in Table 9 below.

Table 9: Applicable legislation and guidelines overview

Applicable Legislation and Guidelines	Applicability to Project
(A description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process).	
APPLICABLE LEGISLATION	
Constitution of the Republic of South Africa (Act 108 of 1996): The constitution of any country is the supreme law of that country. The Bill of Rights in Chapter 2 Section 24 of the Constitution of South Africa Act (Act 108 of 1996) makes provisions for environmental issues and declares that: "Everyone has the right - a) to an environment that is not harmful to their health or well-being; and b) to have the environment protected, for the benefit of present and future c) generations, through reasonable legislative and other measures that: i. prevent pollution and ecological degradation; ii. promote conservation; and iii. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development" Therefore, the EIA is conducted to fulfil the requirement of the Bill of Rights.	The EIA and associated impact mitigation actions are conducted to fulfil the requirement of the Bill of Rights.
National Environmental Management Act (Act 107 of 1998 – NEMA); and the EIA Regulations (2014, as amended): The NEMA (1998) requires that a project of this nature (inclusive of a Mining Right) must undergo a Scoping and Environmental Impact Assessment (EIA); an Environmental Management Programme (EMPr) must also be compiled. Regulations applicable to this project include the following: • EIA Regulations GN R. 982 (2014, as amended) in terms of the NEMA; • EIA Regulations GN R. 983 (2014, as amended) in terms of the NEMA; • EIA Regulations GN R. 984 (2014, as amended) in terms of the NEMA; and • EIA Regulations GN R. 985 (2014, as amended) in terms of the NEMA.	The proposed project triggers various NEMA Listed Activities. An integrated Environmental authorisation is being applied for.
Minerals and Petroleum Resources Development Act (Act 28 of 2002 – MPRDA) as amended; and the Mineral and Petroleum Resources Development Regulations (2004, as amended):	Kalgold has an approved Mining Right and Environmental Management Programme (EMPR) in terms of the Minerals and Petroleum Resources

Applicable Legislation and Guidelines	Applicability to Project
The MPRDA (2002) requires an applicant who wishes to proceed with a mining project to obtain a Mining Right, part of which requires the applicant to obtain Environmental Authorisation in terms of the NEMA.	Development Act (Act 28 of 2002, as amended) (MPRDA), for the Kalgold Mine.
National Water Act (Act 36 of 1998 – NWA): The NWA recognises that water is a scarce and unevenly distributed national resource which must be managed encompassing all aspects of water resources. In terms of Chapter 4 of the NWA, activities and processes associated with the proposed Kalgold Expansion Project and associated infrastructure, are required to be licensed by the Human Settlements, Water and Sanitation (DHSWS). An Integrated Water Use Licence Application (IWULA) has been lodged with the DHSWS in terms of Section 21 of the NWA and is currently in process. It is anticipated that the following water uses require authorisation • Section 21 (a); • Section 21(c); • Section 21(i); • Section 21 (g); and • Section 21 (j). Furthermore, the Integrated Water and Waste Management Plan (IWWMP) will be amended. This is being compiled and will be submitted in support of the IWULA after being made available to the public for comment.	An amendment of the current WUL will be required for the new water volumes required as well as the tailings to be deposited. In addition, some infrastructure might be close to or require crossing of watercourses.
National Heritage Resources Act (Act 25 of 1999 – NHRA): The NHRA established the South African Heritage Resources Agency (SAHRA) in 1999. SAHRA is tasked with protecting heritage resources of national significance. Section 34 and 38 of the NHRA details specific activities that require a Heritage Impact Assessment (HIA) that will need to be approved by SAHRA, principally: • Section 34(1): Structures older than 60 years may not be altered or demolished prior to permission from SAHRA • Section 38(1a): The construction of a road, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length • Section 38(1c): Any development or other activity which will change the character of a site (i) exceeding 5000m2 in extent, or (ii) involving three or more erven or subdivisions Furthermore, Section 48(2) requires a permit from a heritage resources authority to perform these activities. Conditions and restrictions may be specified in the permit and the proposed project triggers activities that require approval from SAHRA.	Heritage and Palaeontology specialist studies have been conducted as part of the Impact Assessment.
Specific Environmental Management Acts (SEMAs):	An application for a Waste Management Licence (WML) is

Applicable Legislation and Guidelines	Applicability to Project
The SEMAs refer to specific portions of the environment where additional legislation over and above the NEMA (1998) as amended, is applicable. SEMAs likely to be relevant to this application include the following: • National Environmental Management: Biodiversity Act (Act 10 of 2004); • National Environmental Management: Air Quality Act (Act 39 of 2004); and • National Environmental Management: Waste Act (Act 59 of 2008). SEMAs likely to be applicable in this regard (if any) include the Threatened Or Protected Species (TOPS) permit for the removal of any protected tree species from site, and Waste Management related licencing or registration.	being applied for in terms of Categories B10 and B11 (construction of a facility for the disposal of hazardous waste – discard / residue deposit).
APPLICABLE GUIDELINES	
<u>Integrated Environmental Management Information Guidelines Series</u>: This series of guidelines was published by the Department of Environment, Forestry and Fisheries (DEFF), and refers to various environmental aspects. Applicable guidelines in the series for the Kalgold Expansion Project include: • Guideline 5: Companion to NEMA EIA Regulations, 2010; • Guideline 7: Public participation; and • Guideline 9: Need and desirability. Additional guidelines published in terms of the NEMA EIA Regulations, 2014 (as amended), in particular: • Guideline 3: General Guide to Environmental Impact Assessment Regulations, 2006; • Guideline 4: Public Participation in support of the EIA Regulations, 2006; and • Guideline 5: Assessment of alternatives and impacts in support of the EIA Regulations, 2006.	The guidelines will be used throughout the environmental Scoping and Impact Assessment process.
<u>Best Practise Guideline (BPG) Series</u>: The BPG series refers to publications by the then Department of Water Affairs and Forestry (now Human Settlements, Water and Sanitation – DHSWS) providing best practice principles and guidelines relevant to certain aspects of water management. Best practice guidelines relevant to the proposed Kalgold Expansion Project include the following: • BPG A4: Pollution Control Dams; • BPG H1: Integrated Mine Water Management; • BPG H2: Pollution Prevention and Minimisation of Impacts; • BPG H3: Water Reuse and Reclamation; • BPG H4: Water treatment; • BPG G1: Storm Water Management; • BPG G2: Water and Salt balances; • BPG G3: Water Monitoring Systems; and • BPG G4: Impact Prediction.	Surface water and groundwater specialist studies, as well as the environmental Scoping and Impact Assessment process.

Applicable Legislation and Guidelines	Applicability to Project
Global Industry Standard on Tailings Management The Global Industry Standard on Tailings Management, which is the outcome of the Global Tailings Review process, is an important milestone towards the ambition of zero harm to people and the environment from tailings facilities. Underpinned by an integrated approach to tailings management, the Standard aims to prevent catastrophic failure and enhance the safety of mine tailings facilities across the globe. It goes beyond existing guidance on the management of tailing facilities addressing crucial issues including: • meaningful engagement of project affected people throughout the lifecycle of the mine tailing facility; • raising the bar on human rights related requirements; • strengthening of environmental protection requirements, including stronger attention to the evolving climate change impacts on mine tailing facilities and to restoration; • application of a structured and robust approach to the risk classification of existing and planned facilities; • establishing a governance mechanism for the management of tailing facilities, as well as identifying high level responsibility for the implementation of the standard, in direct communication with the Board; • public disclosure and transparency of information on mine tailing facilities to stakeholders.	The guidelines will be considered where applicable during the Impact Assessment process.

The legal framework within which the proposed Kalgold Expansion Project operates is governed by many Acts, Regulations, Standards and Guidelines on an international, national, provincial and local level. Legislation applicable to the project includes (but is not limited to) those discussed below.

4.1 THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT (MPRDA)

The MPRDA aims to "make provision for equitable access to, and sustainable development of, the nation's mineral and petroleum resources". The MPRDA outlines the procedural requirements that need to be met to acquire mineral and petroleum rights in South Africa. The MPRDA further governs the sustainable utilisation of South Africa's mineral resources. In the event that the proposed activities require material (e.g. sand, gravel, aggregate) for the purposes of construction then the provisions of the MPRDA may apply.

Several amendments have been made to the MPRDA. These include, but are not limited to, the amendment to Section 102 which concerns the amendment of rights, permits, programmes and plans, to requiring the written permission from the Minister for any amendment or alteration; and the Section 5A(c) requirement that landowners or land occupiers receive twenty-one (21) days' written notice prior to any activities taking place on their properties. One of the most recent amendments requires all mining related activities to follow the full NEMA process as per the 2014 EIA Regulations, which came into effect on 4 December 2014 as was amended in April 2017. This report pertains to an EA application for the proposed Kalgold Expansion Project. A Section 102 application, for the amendment of the MWP and approved EMPr to include the activities pertaining to the proposed Kalgold Expansion Project, will be completed in due course.

In support of the EA application submitted for the Kalgold Expansion Project, the applicant is required to conduct an EIA process comprising of the preparation of environmental Scoping and EIA Reports, an EMPr, as well as Interested and Affected Party (I&AP) consultations, all of which must be submitted to the DMRE for adjudication. This report has been compiled in accordance with Regulation 49 of the MPRDA and with Regulation 23 and Appendix 3 of the EIA Regulations (2014, as amended).

4.2 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (NEMA)

The main aim of the National Environmental Management Act, 1998 (Act 107 of 1998 – NEMA) is to provide for co-operative governance by establishing decision-making principles on matters affecting the environment. In terms of the NEMA EIA Regulations, the applicant is required to appoint an EAP to undertake the EIA process, as well as conduct the public participation process towards an application for EA. In South Africa, EIA's became a legal requirement in 1997 with the promulgation of regulations under the Environment Conservation Act (ECA). Subsequently, NEMA was passed in 1998. Section 24(2) of NEMA empowers the Minister and any MEC, with the concurrence of the Minister, to identify activities which must be considered, investigated, assessed and reported on to the competent authority responsible for granting the relevant EA. On 21 April 2006, the Minister of Environmental Affairs and Tourism (now DFFE) promulgated regulations in terms of Chapter 5 of the NEMA. These regulations, in terms of the NEMA, were amended in June 2010 and again in December 2014 as well as April 2017. The 2014 NEMA EIA Regulations (as amended) are applicable to this project. Mining activities, including activities such as those proposed for the proposed Kalgold Expansion Project, officially became governable under the NEMA EIA Regulations (as amended) in December 2014 with the competent authority identified as the DMRE.

The objective of the EIA Regulations is to establish the procedures that must be followed in the consideration, investigation, assessment and reporting of the listed activities that have been identified to be triggered by the proposed development/ mining activity. The purpose of these procedures is to provide the competent authority with adequate information to make decisions which ensure that activities which may impact negatively on the environment to an unacceptable degree are not authorised, and that activities which are authorised are undertaken in such a manner that the environmental impacts are managed to acceptable levels.

In accordance with the provisions of Sections 24(5) and Section 44 of the NEMA the Minister has published Regulations (GN R. 982) pertaining to the required process for conducting EIA's in order to apply for, and be considered for, the issuing of an EA. These EIA Regulations provide a detailed description of the EIA process to be followed when applying for EA for any listed activity.

The Regulations differentiate between a simpler Basic Assessment Process (required for activities listed in GN R. 983 and GN R. 985) and a more complete EIA process (activities listed in GN R. 984). In the case of the Kalgold Expansion Project, there are activities triggered under GN R. 984 and as such a full EIA process is necessary. Figure 6 below provides a graphic representation of all the components of a full EIA process.

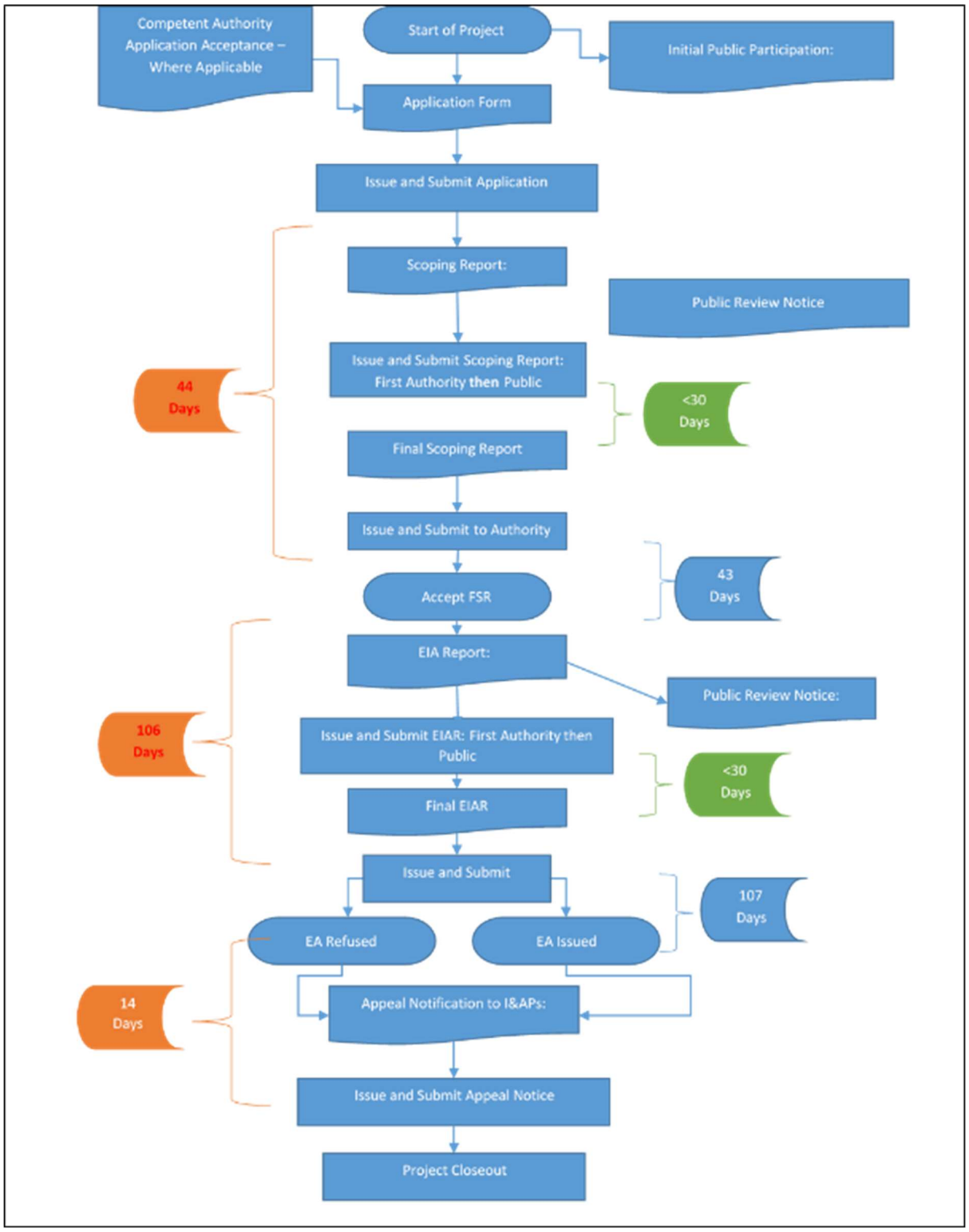


Figure 6: EIA process diagram

Section 24P of the NEMA requires that an applicant for an environmental authorisation relating to prospecting, mining or production must, before the Minister responsible for mineral resources issues the EA, comply with the prescribed financial provision for the rehabilitation, closure and ongoing post decommissioning management of negative environmental impacts. The extension of the transitional period promulgated under the current financial provisions under the NEMA state the following:

17B. Extension of the transitional period

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 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).

4.3 THE NATIONAL WATER ACT (NWA)

The National Water Act, 1998 (Act 36 of 1998 – NWA) makes provision for two types of applications for water use licences, namely individual applications and compulsory applications. The NWA also provides that the responsible authority may require an assessment by the applicant of the likely effect of the proposed licence on the resource quality, and that such assessment be subject to the NEMA EIA Regulations. A person may use water, if the use is –

- Permissible as a continuation of an existing lawful water use (ELWU);
- Permissible in terms of a general authorisation (GA);
- Permissible under Schedule 1; or
- Authorised by a licence.

These water use processes are described in Figure 7.

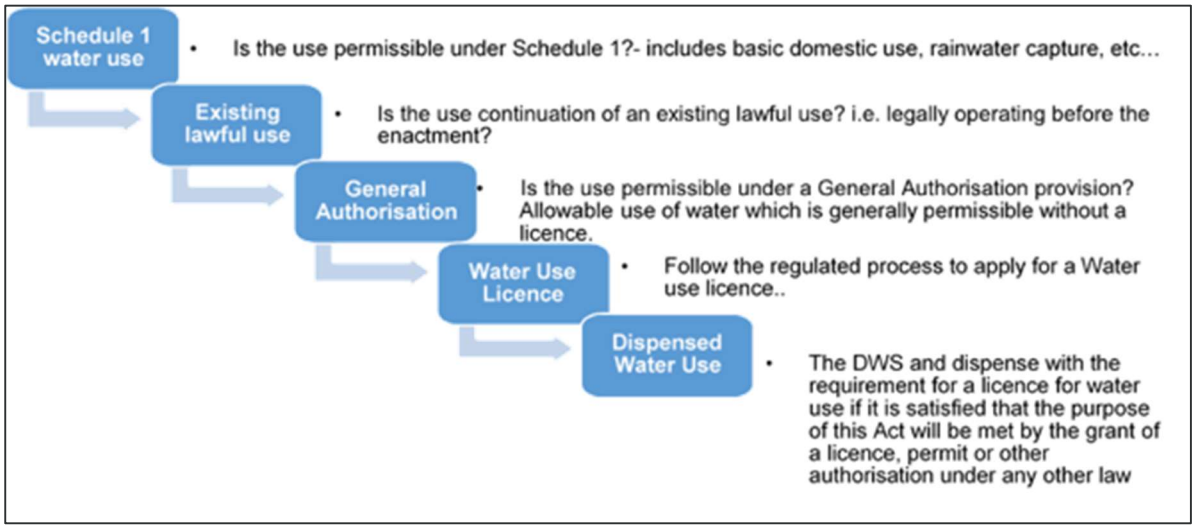


Figure 7: Authorisation processes for new water uses

The NWA defines 11 water uses. A water use may only be undertaken if authorised by the Human Settlements, Water and Sanitation (DHSWS). Water users are required to register certain water uses that actually took place on the date of registration, irrespective of whether the use was lawful or not. The water uses for which an authorisation or licence can be issued include:

- Taking water from a water resource;
- Storing water;
- Impeding or diverting the flow of water in a watercourse;
- Engaging in a stream flow reduction activity contemplated in section 36;

- Engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);
- Discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduits;
- Disposing of waste in a manner which may detrimentally impact on a water resource;
- Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
- Altering the bed, banks, course or characteristics of a watercourse;
- Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
- Using water for recreational purposes.

Harmony was granted an Integrated Water Use Licence (IWUL) in September 2016 and amended in February 2021 (Water Use Licence 07/D41B/ABCGIJ/4754) for the following water uses:

- Section 21(a): Taking of water from a water resource (groundwater abstraction borehole and opencast workings);
- Section 21 (b): Storage of water (Storage tank for domestic use and in dams)
- Section 21 (c): Impeding or diverting the flow of water in a watercourse (infrastructure with 500 m for the wetland);
- Section 21 (g): Disposing of waste in a manner which may detrimentally impact on a water resource (Septic tanks, pollution control dam, dirty water from stockpile areas and discard facility, recycled water, heap leach pad, Tailings facility);
- Section 21 (i): Altering the bed, banks, course or characteristics of a watercourse (infrastructure with 500 m for the wetland); and
- Section 21 (j): Removing, discharging or disposing of water found underground (dewatering from the opencast workings and boreholes).

On 16 February 2009 as part of conditions of an EMPr approval, Kalgold was issued a directive from the DMRE to backfill all excavations with waste generated from the mine. In the EMPr appendment approval dated 4 May 2019 Kalgold was further directed that no dump structures should be left on the surface (topsoil, overburden, waste rock, tailings and slime dams). In response to this directive and also motivated by the fact that the existing tailings dam had limited capacity, Kalgold subsequently decided to backfill the D-zone pit utilising tailings from the mining process. An Integrated Water and Waste Management Plan has been compiled for this project, dated October 2014. The water use licence will need to be amended to include the new water uses associated with the expansion project.

4.3.1 NWA GOVERNMENT NOTICE 704 (GN 704)

GN 704 (Government Gazette 20118 of June 1999) was established to provide regulations on the use of water for mining and related activities aimed at the protection of water resources. The five main principal conditions of GN 704 applicable to this project are:

- Condition 4 – which defines the area in which, mine workings or associated structures may be located, with reference to a watercourse and associated flooding. Any residue deposit, dam, reservoir together with any associated structure or any other facility should be situated outside the 1:100 year flood-line. Any underground or opencast mining, prospecting or any other operation or activity should be situated or undertaken outside of the 1:50 year flood-line. Where the flood-line is less than 100 metres away from the watercourse, then a minimum watercourse buffer distance of 100 metres is required for infrastructure and activities;

- Condition 5 – which indicates that no residue or substance which causes or is likely to cause pollution of a water resource may be used in the construction of any dams, impoundments or embankments or any other infrastructure which may cause pollution of a water resource;
- Condition 6 – which describes the capacity requirements of clean and dirty water systems. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated to ensure conveyance the 1:50 year peak flow. Clean and dirty water systems should not spill into each other more frequently than once in 50 years. Any dirty water dams should have a minimum freeboard of 0.8m above full supply level;
- Condition 7 – which describes the measures which must be taken to protect water resources. All dirty water or substances which may cause pollution should be prevented from entering a water resource (by spillage, seepage, erosion, etc.) and ensure that water used in any process is recycled as far as practicable; and
- Condition 10 – which describes the requirements for operations involving extraction of material from the channel of a watercourse. Measures should be taken to prevent impacts on the stability of the watercourse, prevent scour and erosion resulting from operations, prevent damage to in-stream habitat through erosion, sedimentation, alteration of vegetation and flow characteristics, construct treatment facilities to treat water before returning it to the watercourse, and implement control measures to prevent pollution by oil, grease, fuel and chemicals.

These conditions above restrict the proposed Kalgold Expansion Project opencast mining pit extension from being located within the 1:50 floodline or within a horizontal distance of 100 metres from any watercourse or estuary, whichever is the greatest. Furthermore, the clean and dirty water areas within the project are to be kept separate and the relevant infrastructure such as the proposed dirty water channels and sump at the stockpile dump areas and the pit must be designed, constructed, maintained and operated to ensure conveyance of the 1:50 year peak flow. Pollution of water resources in the vicinity of the project area is to be prevented and mitigated against. Moreover, should any material be removed from the surrounding watercourses during the construction and operation of the proposed Kalgold Expansion Project, mitigation measures to prevent instability, erosion, sedimentation, alteration and pollution of the watercourse. An application for the exemption for some of the conditions of GN704 will need to be considered as some of the proposed infrastructure are within the 1:50 floodline.

4.3.2 CATCHMENT MANAGEMENT STRATEGIES

The country has been divided into nineteen Water Management Areas (WMAs). The delegation of water resource management from central government to catchment level will be achieved by establishing Catchment Management Agencies (CMAs) at WMA level. Each CMA will progressively develop a Catchment Management Strategy (CMS) for the protection, use, development, conservation, management and control of water resources within its WMA. This is to ensure that on a regional scale, water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all persons. The main instrument that guides and governs the activities of a WMA is the CMS which, while conforming to relevant legislation and national strategies, provides detailed arrangements for the protection, use, development, conservation, management and control of the region's water resources.

The Kalgold Mine is situated in the Lower Vaal Water Management Area (WMA 5) within the Orange River primary catchment and the quaternary catchment D41B. The Morokwa River runs through the middle of the Kalgold Mine flowing in a north-westerly direction towards the Koedoespruit River. Other rivers that drain quaternary catchment D41B are the Mareetsane, Setlagole, Madibeng and Thuthwane Rivers, all flowing in a north-westerly direction.

Groundwater resources are of major importance in the Lower Vaal WMA, supporting the dispersed rural communities and urban centres. Therefore, the management of the groundwater resources is of utmost importance in this sub-catchment. The natural occurring water quality in the WMA is generally good in the dolomitic/karstic and fractured/crystalline aquifers. In the western portion of the WMA in the Kalahari group primary (sand/gravel) aquifers and clay formations the quality is often naturally poor with TDS values ranging

from 1500 mg/l and higher. Water to the western parts of the WMA are therefore supplied from the Vaal River system.

The Vaal River and its tributaries are generally accepted as "workhorse" rivers to support the water requirements of the hub of South Africa's economy. As indicated in the Vaal Overarching ISP report, the Vaal River Catchment has sub-catchments whose natural flow and water quality regimes are significantly changed from natural conditions, whilst others are close to natural. The impacted river systems in the Vaal River catchment are highly regulated by major and small dams. The natural flow patterns in many of these river reaches have been substantially modified by return flows from wastewater treatment plants, mine dewatering, agricultural return flows and releases of water from transfer schemes into the river systems.

In terms of the ecological reserve, the economic activities supported by the water resources in the Vaal River System are recognised as the economic engine of South Africa and the Vaal River is considered to be a "work horse" river. However, the ecology of the river should be managed to prevent further degradation and improve areas where unacceptable ecological conditions exists without causing a significant reduction in the water availability.

Agriculture plays a major role in terms of economic development in the WMA. Almost every farm unit in the WMA is dependent on groundwater for domestic use and stock watering. There are however limited abstraction volumes available but in terms of quantities of water, stock farming has a relatively small influence on the regional groundwater resource. There are several mining operations in this WMA. These activities vary from base-metal mining; diamond mining and even limited gold mining in the Kalahari greenstone belt. Groundwater use at most of these sites is limited and should any seepage occur into opencast pits or underground workings, the water is usually pumped and utilized in processes to minimize use of other water sources. This pumping often causes localized dewatering.

The proposed Kalgold Expansion Project is submitting an IWULA to ensure that any water resources (surface and groundwater as well as wetlands) affected by the proposed project activities are licensed and managed in accordance with the relevant water and environmental legislation.

4.4 THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT (NEMWA)

On 2 June 2014, the National Environmental Management: Waste Amendment Act came into force. Waste is accordingly no longer governed by the MPRDA but is subject to all the provisions of the National Environmental Management: Waste Act, 2008 (NEMWA).

Section 16 of the NEMWA must also be considered which states as follows:

1. A holder of waste must, within the holder's power, take all reasonable measures to-
    a) "Avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;
    b) Reduce, re-use, recycle and recover waste;
    c) Where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;
    d) Manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour, or visual impacts;
    e) Prevent any employee or any person under his or her supervision from contravening the Act; and
    f) Prevent the waste from being used for unauthorised purposes."

These general principles of responsible waste management will be incorporated into the requirements in the EMPr to be implemented for this project.

Waste can be defined as either hazardous or general in accordance with Schedule 3 of the NEMWA (2014) as amended. "Schedule 3: Defined Wastes" has been broken down into two categories – Category A being hazardous waste; and Category B being general waste.

In order to attempt to understand the implications of these waste groups, it is important to ensure that the definitions of all the relevant terminologies are defined:

- **Hazardous waste**: means "any waste that contains organic or inorganic elements or compounds that may, owning to the inherent physical, chemical or toxicological characteristic of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles."
- **Residue deposits**: means "any residue stockpile remaining at the termination, cancellation or expiry of a prospecting right, mining right, mining permit, exploration right or production right."
- **Residue stockpile**: means "any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, mineral processing plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated within the mining area for potential re-use, or which is disposed of, by the holder of a mining right, mining permit or, production right or an old order right, including historic mines and dumps created before the implementation of this Act."
- **General waste: means** "waste that does not pose an immediate hazard or threat to health or to the environment and includes – domestic waste; building and demolition waste; business waste; inert waste; or any waste classified as non-hazardous waste in terms of the regulations made under Section 69."

Furthermore, the NEMWA provides for specific waste management measures to be implemented, as well as providing for the licensing and control of waste management activities. The proposed expansion project triggers waste management activities in terms of Category B of GN R. 921 which states that "*a person who wishes to commence, undertake or conduct an activity listed under this Category, must conduct an environmental impact assessment process, as stipulated in the environmental impact assessment regulations made under section 24(5) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) as part of a waste management licence application*."

4.4.1 NEMWA WASTE CLASSIFICATION AND MANAGEMENT REGULATIONS, 2013 (GN R. 634)

These regulations pertaining to waste classification and management, including the management and control of residue stockpiles and residue deposits from a prospecting, mining, exploration or production operation which is relevant to the proposed Kalgold Expansion Project. The purpose of these Regulations is to –

- Regulate the classification and management of waste in a manner which supports and implements the provisions of the Act;
- Establish a mechanism and procedure for the listing of waste management activities that do not require a Waste Management Licence;
- Prescribe requirements for the disposal of waste to landfill;
- Prescribe requirements and timeframes for the management of certain wastes; and
- Prescribe general duties of waste generators, transporters and managers.

Waste classification, as presented in Chapter 4 of these regulations, entails the following:

- Wastes listed in Annexure 1 of these Regulations do not require classification in terms of SANS 10234;
- Subject to sub-regulation (1), all waste generators must ensure that the waste they generate is classified in accordance with SANS 10234 within one hundred and eighty (180) days of generation;

- Waste must be kept separate for the purposes of classification in terms of sub-regulation (2), and must not be mixed prior to classification;
- Waste-must be re-classified in terms of sub-regulation (2) every five (5) years, or within 30 days of modification to the process or activity that generated the waste, changes in raw materials or other inputs, or any other variation of relevant factors;
- Waste that has been subjected to any form of treatment must be re-classified in terms of sub-regulation (2), including any waste from the treatment process.; and
- If the Minister reasonably believes that a waste has not been classified correctly in terms of sub-regulation (2), he or she may require the waste generator to have the classification peer reviewed to confirm the classification.

Furthermore, Chapter 8 of the Regulations stipulates that unless otherwise directed by the Minister to ensure a better environmental outcome, or in response to an emergency so as to protect human health, property or the environment –

- Waste generators must ensure that their waste is assessed in accordance with the Norms and Standards for Assessment of Waste for Landfill Disposal set in terms of section 7(1) of the Act prior to the disposal of the waste to landfill;
- Waste generators must ensure that the disposal of their waste to landfill is done in accordance with the Norms and Standards for Disposal of Waste to Landfill set in terms of section 7(1) of the Act; and
- Waste managers disposing of waste to landfill must only do so in accordance with the Norms and Standards for Disposal of Waste to Landfill set in terms of section 7 (1) of the Act.

Waste classification was conducted by GeoDyn Systems in 2020 (Appendix D) for the various waste streams at Kalgold and the following conclusions made specifically for the waste material at the Spanover Waste Rock Dump (to be expanded) and also tailing (deposition will be increased at D-zone and old existing TSF recommissioned):

- Spanover waste rock:
    - The Kalgold Spanover waste rock material classifies as Type 3 according to the criteria set out in R635. However, the Type 3 class is reached by the exceedance of only boron and only in the total analysis (TCT). Long-term, numeric geochemical modelling confirms the leach test that the boron is located within the silicate mineral structures and are thus unlikely to leach from the waste rock in concentrations excluding any regulatory guideline values. The waste should therefore classify as Type 4 based on the geochemical assessment.
    - The Kalgold waste rock material is unlikely to produce acid mine drainage conditions.
    - The risk rating of the cumulative impacts from the Kalgold waste rock material is “Low.
- Kalgold tailings material:
    - The geochemical assessment indicates that only sulphate is likely to exceed regulatory guidelines in the Operational Phase of the project. In the post-operational phase, a cap can be placed on the tailings facility to reduce oxygen infiltration into the facility and reduce sulphate leaching to acceptable levels in the post operational phase. Therefore, this material should be classified as Type 4 as defined in R635.
    - Although the leachate from the tailings is expected to be slightly acidic (pH ~4.5), it is unlikely to develop acid mine drainage conditions, which generally has pH values of less than 3.
    - The risk rating of the cumulative impacts from the Kalgold tailings material is “Low”

4.4.2 NEMWA NATIONAL NORMS AND STANDARDS FOR THE ASSESSMENT OF WASTE FOR LANDFILL DISPOSAL, 2013 (GN R. 635)

These Norms and Standards prescribe the requirements for the assessment of waste prior to storage or disposal to landfill. The aim of the waste assessment tests is to characterise the material to be deposited or stored in terms of the above-mentioned waste assessment guidelines set by the DEFF. The waste generated at the proposed Kalgold Expansion Project and not listed under Annexure 1 of the Waste Classification and Management Regulations, must be assessed in accordance to these Norms and Standards to determine the waste type. In terms of Regulation 12(1) of GN R 634 with regards to the classification of waste, the potential level of risk associated with disposal or downstream use of waste must be determined by following the prescribed and appropriate analysis protocol as detailed in these Norms and Standards. The assessment of the waste from the Kalgold Expansion Project will:

- Identify the chemical substances present in the waste;
- Sampling and analysis to determine the total concentration (TC) and leachable concentration (LC) of the elements and chemical substances that have been identified within the waste according to section 6 of this regulation;
- Based on the TC and LC limits of the identified elements and chemical substances in the analysed waste exceeding the corresponding TC and LC thresholds respectively, the waste type will be determined (Type 0 Waste to Type 4 Waste); and
- The waste type will then be used determine to which landfill class site the waste must be disposed and / or the suitable containment barrier design for storage (See Section 4.4.1

4.4.3 NEMWA NATIONAL NORMS AND STANDARDS FOR THE DISPOSAL OF WASTE TO LANDFILL, 2013 (GN R. 636)

Once the waste has been assessed and waste type determined, these Norms and Standards can be used to determine the minimum requirements for the landfill and containment barrier design. This will distinguish between Class A, Class B, Class C, or Class D landfills and the associated containment barrier requirements. Although these Norms and Standards prescribe the containment barrier or liner design for each determined waste type, the recent amendments in chapter 3 of the regulations to the planning and management of residue stockpiles and residue deposits, a competent person must recommend the pollution control measures suitable for a specific residue stockpile or residue deposit on the basis of a risk analysis as contemplated in regulations 4 and 5 of the regulations. The recommendation should be founded on a risk analysis based on the characteristics and classification in regulation 4 and 5 of these Regulations, towards determining the appropriate mitigation and management measures.

4.4.4 THE REGULATIONS REGARDING THE PLANNING AND MANAGEMENT OF RESIDUE STOCKPILES AND RESIDUE DEPOSITS AND ASSOCIATED AMENDMENT

These Regulations, which pertain to the planning and management of residue stockpiles and residue deposits from a prospecting, mining, exploration or production operation, were published in 2015 and were amended in 2018. The Regulations and associated amendment relate to the assessment of impacts and the analyses of risks relating to the management of residue stockpiles and residue deposits, and involve the following:

- The identification and assessment of environmental impacts arising from the establishment of residue stockpiles and residue deposits must be done as part of the environmental impact assessment conducted in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998);
- A risk analysis based on the characteristics and the classification set out in regulation 4 (characterisation of residue stockpiles and residue deposits) and regulation 5 (classification of residue stockpiles and residue deposits) must be used to determine the appropriate mitigation and management measures; and

- A competent person must recommend the pollution control measures suitable for a specific residue stockpile or residue deposit on the basis of a risk analysis as contemplated in regulations 4 and 5 of these Regulations.

The expansion of the Spanover waste rock dump is subject to these regulations. A Waste classification was conducted for the waste rock and report included in Appendix D.

4.5 THE NATIONAL ENVIRONMENTAL MANAGEMENT AIR QUALITY ACT (NEMAQA)

The National Environmental Management: Air Quality Act (Act No. 39 of 2004 as amended – NEMAQA) is the main legislative tool for the management of air pollution and related activities. The Object of the Act is:

- To protect the environment by providing reasonable measures for –
    i. the protection and enhancement of the quality of air in the republic;
    ii. the prevention of air pollution and ecological degradation; and
    iii. securing ecologically sustainable development while promoting justifiable economic and social development; and
- Generally, to give effect to Section 24(b) of the constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of people.

The NEMAQA mandates the Minister of Environment to publish a list of activities which result in atmospheric emissions and consequently cause significant detrimental effects on the environment, human health and social welfare. All scheduled processes as previously stipulated under the Air Pollution Prevention Act (APPA) are included as listed activities with additional activities being added to the list. The updated Listed Activities and Minimum National Emission Standards were published on the 22nd November 2013 (Government Gazette No. 37054). The proposed expansion project will trigger some of these listed activities (see section 3.4.4).

According to the NEMAQA, air quality management control and enforcement is in the hands of local government with District and Metropolitan Municipalities as the licensing authorities. Provincial government is primarily responsible for ambient monitoring and ensuring municipalities fulfil their legal obligations, with national government primarily as policy maker and co-ordinator. Each sphere of government must appoint an Air Quality Officer responsible for co-ordinating matters pertaining to air quality management. Given that air quality management under the old Act was the sole responsibility of national government, local authorities have in the past only been responsible for smoke and vehicle tailpipe emission control.

The National Pollution Prevention Plans Regulations were published in March 2014 (Government Gazette 37421) and tie in with the National Greenhouse Gas (GHG) Emission Reporting Regulations which took effect on 3 April 2017. In summary, the Regulations aim to prescribe the requirements that pollution prevention plans of greenhouse gases declared as priority air pollutants, need to comply with in terms of the NEMAQA. The Regulations specify who needs to comply, and by when, as well as prescribing the content requirements. Mines do have an obligation to report on the GHG emissions under these Regulations. All mines are required to account for the amount of pollutants discharged into the atmosphere (total emissions for one or more specific GHG pollutants) by 31 March each year.

The Carbon Tax Policy Paper (CTPP) (Department of National Treasury, 2013) stated consideration will be given to sectors where the potential for emissions reduction is limited. Certain production processes indicated in Annexure A of the notice (Government Gazette No. 40996 dated 21 July 2017) with GHG in excess of 0.1 Mt, measured as CO2-eq, are required to submit a pollution prevention plan to the Minister for approval.

4.5.1 NATIONAL DUST CONTROL REGULATIONS

Dust fall is assessed for nuisance impact and not for inhalation health impact. The National Dust Control Regulations (Department of Environmental Affairs, 2013) prescribes measures for the control of dust in residential and non-residential areas. Acceptable dust fall rates are measured (using American Standard Testing

Methodology (ASTM) D1739:1970 or equivalent) at and beyond the boundary of the premises where dust originates. In addition to the dust fall limits, the National Dust Control Regulations prescribe monitoring procedures and reporting requirements. Dust created from the proposed Kalgold Expansion Project will be managed in accordance with these Regulations.

4.6 THE NATIONAL HERITAGE RESOURCES ACT (NHRA)

The National Heritage Resources Act (Act 25 of 1999 – NHRA) stipulates that cultural heritage resources may not be disturbed without authorisation from the relevant heritage authority. Section 34(1) of the NHRA states that, "*no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority…*" The NHRA is utilised as the basis for the identification, evaluation and management of heritage resources and in the case of Cultural Resource Management (CRM) those resources specifically impacted on by development as stipulated in Section 38 of NHRA, and those developments administered through the NEMA, MPRDA and the Development Facilitation Act (FDA) legislation. In the latter cases the feedback from the relevant heritage resources authority is required by the State and Provincial Departments managing these Acts before any authorisations are granted for a development. The last few years have seen a significant change towards the inclusion of heritage assessments as a major component of Environmental Impact Processes required by the NEMA and MPRDA. This change requires us to evaluate the Section of these Acts relevant to heritage (Fourie, 2008b).

The NEMA 23(2)(b) states that an integrated environmental management plan should, "…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage". A study of subsections (23)(2)(d), (29)(1)(d), (32)(2)(d) and (34)(b) and their requirements reveals the compulsory inclusion of the identification of cultural resources, the evaluation of the impacts of the proposed activity on these resources, the identification of alternatives and the management procedures for such cultural resources for each of the documents noted in the Environmental Regulations. A further important aspect to be taken into account of in the EIA Regulations under the NEMA relates to the Specialist Report requirements (Appendix 6 of EIA Regulations 2014, as amended).

The MPRDA defines 'environment' as it is in the NEMA and, therefore, acknowledges cultural resources as part of the environment. Section 39(3)(b) of this Act specifically refers to the evaluation, assessment and identification of impacts on all heritage resources as identified in Section 3(2) of the NHRA that are to be impacted on by activities governed by the MPRDA. Section 40 of the same Act requires the consultation with any State Department administering any law that has relevance on such an application through Section 39 of the MPRDA. This implies the evaluation of Heritage Assessment Reports in Environmental Management Plans or Programmes by the relevant heritage authorities (Fourie, 2008b).

In accordance with the legislative requirements and EIA rating criteria, the regulations of the South African Heritage Resources Agency (SAHRA) and Association of Southern African Professional Archaeologists (ASAPA) have also been incorporated to ensure that a comprehensive and legally compatible Heritage Impact Assessment Report (HSR) is compiled (see appendix D).

4.7 THE NATIONAL FORESTS ACT (NFA)

According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that "*no person may cut, damage, disturb, destroy or remove any protected tree, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister*."

A permit will be required to remove any protected trees found within any project areas that need to be cleared.

4.8 NATIONAL ENVIRONMENTAL MANAGEMENT BIODIVERSITY ACT (NEMBA) – ALIEN AND INVASIVE SPECIES LIST

This Act is applicable since is protects the quality and quantity of arable land in South Africa. Loss of arable land should be avoided and declared Weeds and Invaders in South Africa are categorised according to one of the following categories, and require control or removal:

- *Category 1a Listed Invasive Species*: Category 1a Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of the Act as species which must be combated or eradicated;
- *Category 1b Listed Invasive Species*: Category 1b Listed Invasive Species are those species listed as such by notice in terms of section 70(1)(a) of the Act as species which must be controlled;
- *Category 2 Listed Invasive Species*: Category 2 Listed Invasive Species are those species listed by notice in terms of section 70(1)(a) of the Act as species which require a permit to carry out a restricted activity within an area specified in the Notice or an area specified in the permit, as the case may be; and
- *Category 3 Listed Invasive Species*: Category 3 Listed Invasive Species are species that are listed by notice in terms of section 70(1)(a) of the Act, as species which are subject to exemptions in terms of section 71(3) and prohibitions in terms of section 71A of Act, as specified in the Notice.

The provisions of this Act have been considered and where relevant will be incorporated into the proposed mitigation measures and requirements of the EMPr.

4.9 THE SUB-DIVISION OF AGRICULTURAL LAND ACT

In terms of the Subdivision of Agricultural Land Act (Act 70 of 1970), any application for change of land use must be approved by the Minister of Agriculture, and while under the Conservation of Agricultural Resources Act (Act 43 of 1983) no degradation of natural land is permitted.

4.10 THE CONSERVATION OF AGRICULTURAL RESOURCES ACT

The law on Conservation of Agricultural Resources (Act 43 of 1983) aims to provide for the conservation of the natural agricultural resources of the Republic by the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants. In order to achieve the objectives of this Act, control measures related to the following may be prescribed to land users to whom they apply:

- The cultivation of virgin soil;
- The utilisation and protection of land which is cultivated;
- The irrigation of land;
- The prevention or control of waterlogging or salination of land;
- The utilisation and protection of vleis, marshes, water sponges, water courses and water sources;
- The regulating of the flow pattern of run-off water;
- The utilisation and protection of the vegetation;
- The grazing capacity of veld, expressed as an area of veld per large stock unit;
- The maximum number and the kind of animals which may be kept on veld; The prevention and control of veld fires;
- The utilisation and protection of veld which has burned;
- The control of weeds and invader plants;
- The restoration or reclamation of eroded land or land which is otherwise disturbed or denuded;

- The protection of water sources against pollution on account of farming practices;
- The construction, maintenance, alteration or removal of soil conservation works or other structures on land; and
- Any other matter which the Minister may deem necessary or expedient in order that the objects of this Act may be achieved.

Further, different control measures may be prescribed in respect of different classes of land users or different areas or in such other respects as the Minister may determine. Preliminary impacts on the soil, biodiversity and water resources have been identified with regards to the proposed expansion, and mitigation and management measures recommended.

4.11 THE SPATIAL PLANNING AND LAND USE MANAGEMENT ACT (SPLUMA)

The Spatial Planning and Land Use Management (Act 16 of 2013 – SPLUMA) is set to aid effective and efficient planning and land use management, as well as to promotes optimal exploitation of minerals and mineral resources. The SPLUMA was developed to legislate for a single, integrated planning system for the entire country. Therefore, the Act provides a framework for a planning system for the country and introduces provisions to cater for development principles; norms and standards; inter-governmental support; Spatial Development Frameworks (SDFs) across national, provincial, regional and municipal areas; Land Use Schemes (LUS); and municipal planning tribunals. Furthermore, the SPLUMA strengthens the position of mining right holders when land needs to be re-zoned for mining purposes. The proposed expansion project activities are located within an approved MR boundary in which mining currently takes place.

4.12 ENVIRONMENT CONSERVATION ACT (ECA)

The Environment Conservation Act (Act 73 of 1989 – ECA) was, prior to the promulgation of the NEMA, the backbone of environmental legislation in South Africa. To date the majority of the ECA has been repealed by various other Acts, however Section 25 of the Act and the Noise Regulations (GN R. 154 of 1992) promulgated under this section are still in effect. These Regulations serve to control noise and general prohibitions relating to noise impact and nuisance.

4.12.1 NOISE CONTROL REGULATIONS, 1992 (GN R.154)

In terms of section 25 of the ECA, the National Noise Control Regulations (GN R. 154 – NCRs) published in Government Gazette No. 13717 dated 10 January 1992, were promulgated. The NCRs were revised under GN R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations. Provincial noise control regulations have been promulgated in Gauteng, Free State and Western Cape Provinces.

The NCRs will need to be considered in relation to the potential noise that may be generated mainly during the construction phase of the proposed project. The two key aspects of the NCRs relate to disturbing noise and noise nuisance.

Section 4 of the Regulations prohibits a person from making, producing or causing a disturbing noise, or allowing it to be made produced or caused by any person, machine, device or apparatus or any combination thereof. A disturbing noise is defined in the Regulations as "*a noise level which exceeds the zone sound level or if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more*."

Section 5 of the NCRs in essence prohibits the creation of a noise nuisance. A noise nuisance is defined as "*any sound which disturbs or impairs or may disturb or impair the convenience or peace of any person"*. The South African National Standard 10103 also applies to the measurement and consideration of environmental noise and should be considered in conjunction with these Regulations

4.12.2 NOISE STANDARDS

There are a few South African scientific standards (SABS) relevant to noise from mines, industry and roads. They are:

- South African National Standard (SANS) 10103:2008 – 'The measurement and rating of environmental noise with respect to annoyance and to speech communication';
- SANS 10210:2004 – 'Calculating and predicting road traffic noise';
- SANS 10328:2008 – 'Methods for environmental noise impact assessments';
- SANS 10357:2004 – 'The calculation of sound propagation by the Concave method';
- SANS 10181:2003 – 'The Measurement of Noise Emitted by Road Vehicles when Stationary'; and
- SANS 10205:2003 – 'The Measurement of Noise Emitted by Motor Vehicles in Motion'.

The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account, but single event noise by itself does not determine whether noise levels are acceptable for land use purposes. With regards to SANS 10103:2008, the recommendations are likely to inform decisions by authorities, but non-compliance with the standard will not necessarily render an activity unlawful per se. The proposed expansion activities will not result in additional noise over and above the current ambient noise levels on Kalgold and its surroundings.

5 NEED AND DESIRABILITY OF THE PROPOSED PROJECT

The Kalgold Expansion Project will allow the Kalgold mine to increase its gold production capacity. There are also several socio-economic benefits associated with the expansion project. If the project were not to proceed, the additional economic activity, skills development and available jobs would not be created or sustained.

The Kalgold mine is an existing mine and the expansion project will only increase the production and associated tonnage output at the mine. The proposed Kalgold Expansion Project will allow the applicant to increase production at the current mine.

The needs and desirability analysis component of the "*Guideline on need and desirability in terms of the Environmental Impact EIA Regulations (Notice 819 of 2014*)" includes, but is not limited to, describing the linkages and dependencies between human well-being, livelihoods and ecosystem services applicable to the area in question, and how the proposed development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage sites, opportunity costs, etc.). Table 10 below presents the needs and desirability analysis undertaken for the Kalgold Expansion Project.

Table 10: Needs and desirability analysis for the Kalgold Expansion Project

Ref No.	Question	Answer
1	**Securing ecological sustainable development and use of natural resources**	
1.1	How were the ecological integrity considerations taken into account in terms of: Threatened Ecosystems, Sensitive and vulnerable ecosystems, Critical Biodiversity Areas, Ecological Support Systems, Conservation Targets, Ecological drivers of the ecosystem, Environmental Management Framework, Spatial Development Framework (SDF) and global and international responsibilities.	The following specialist studies were conducted for the proposed Kalgold Expansion Project: • Air quality; • Terrestrial Ecology; • Heritage; • Social; • Freshwater Ecology (Wetlands); • Agriculture Potential, Soils and Land capability; • Hydrology; • Hydropedology; and • Geohydrology. The conclusions of these studies, and the identified potential impacts and associated mitigation measures are included in the EIA Report and accompanying EMPr. The potential benefits and motivation for the Kalgold Expansion project is presented in this section of the report.
1.2	How will this project disturb or enhance ecosystems and / or result in the loss or protection of biological diversity? What measures were explored to avoid these negative impacts, and where these negative impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	Refer to baseline ecological information in Section 8, and the impact assessment and mitigation measures in Section 9 of this report. Efforts have been made to avoid disturbance to sensitive biodiversity.
1.3	How will this development pollute and / or degrade the biophysical environment? What measures were explored to either avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	Refer to the alternatives considered for this project in Section 6, the baseline ecological information in Section 8, and the impact assessment and mitigation measures in Section 9 of this EIA Report.
1.4	What waste will be generated by this development? What measures were explored to avoid waste, and where waste could not be avoided altogether, what measures were explored to minimise, reuse and / or recycle the waste? What measures have been explored to safely treat and/or dispose of unavoidable waste?	Refer to Section 3.

Ref No.	Question	Answer
1.5	How will this project disturb or enhance landscapes and / or sites that constitute the nation's cultural heritage? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	In addition to the baseline heritage and palaeontological findings presented in Section 8 of this Report as well as the associated specialist Heritage Scoping Report in Appendix D, a Phase 1 Heritage impact assessment and a palaeontological study were undertaken in the EIA phase and the findings thereof presented in this EIA Report and EMPr.
1.6	How will this project use and / or impact on non-renewable natural resources? What measures were explored to ensure responsible and equitable use of the resources? How have the consequences of the depletion of the non-renewable natural resources been considered? What measures were explored to firstly avoid these impacts, and where impacts could not be avoided altogether, what measures were explored to minimise and remedy the impacts? What measures were explored to enhance positive impacts?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this Report. It is noted that due to the nature of this project (mining of gold), a non-renewable resource will be depleted. Gold mining does however contribute significantly to the country's economy and therefore at the current stage mining of gold is still needed within South Africa. Preliminary impacts from the proposed project have been identified and mitigation measures aimed at avoiding, reducing and / or managing the negative impacts as well as enhancing the positive impacts have been recommended (Section 9).
1.7	How will this project use and / or impact on renewable natural resources and the ecosystem of which they are part? Will the use of the resources and / or impacts on the ecosystem jeopardise the integrity of the resource and / or system taking into account carrying capacity restrictions, limits of acceptable change, and thresholds? What measures were explored to firstly avoid the use of resources, or if avoidance is not possible, to minimise the use of resources? What measures were taken to ensure responsible and equitable use of the resources? What measures were explored to enhance positive impacts?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this Report.
1.7.1	Does the proposed project exacerbate the increased dependency on increased use of resources to maintain economic growth or does it reduce resource dependency (i.e. de-materialised growth)?	The proposed Kalgold Expansion Project will rely on / depend on the extraction of a mineral resource.
1.7.2	Does the proposed use of natural resources constitute the best use thereof? Is the use justifiable when considering intra- and intergenerational equity, and are there more important priorities for which the resources should be used?	The Kalgold mine is already existing. Refer to Section 6 for the alternatives considered in this report.
1.7.3	Do the proposed location, type and scale of development promote a reduced dependency on resources?	The Kalgold mine is already an existing mine and the proposed project will be an expansion of the existing mine utilising infrastructure.
1.8	**How were a risk-averse and cautious approach applied in terms of ecological impacts**	

Ref No.	Question	Answer
1.8.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	The limitations and/or gaps in knowledge are presented in Section 13
1.8.2	What is the level of risk associated with the limits of current knowledge?	The level of risk is considered low at this EIA phase.
1.8.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	Sufficient information was gathered prior to the onset of this process to indicate that the potential mining of additional gold is feasible. In addition, it is noted that this project extends a current mining operation.
1.9	**How will the ecological impacts resulting from this development impact on people's environmental right in terms following?**	
1.9.1	Negative impacts: e.g. access to resources, opportunity costs, loss of amenity (e.g. open space), air and water quality impacts, nuisance (noise, odour, etc.), health impacts, visual impacts, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.
1.9.2	Positive impacts: e.g. improved access to resources, improved amenity, improved air or water quality, etc. What measures were taken to enhance positive impacts?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.
1.10	Describe the linkages and dependencies between human wellbeing, livelihoods and ecosystem services applicable to the area in question and how the development's ecological impacts will result in socio-economic impacts (e.g. on livelihoods, loss of heritage site, opportunity costs, etc.)?	Refer to baseline ecological information in Section 8, and the impact assessment and mitigation measures in Section 9 of this report.
1.11	Based on all of the above, how will this development positively or negatively impact on ecological integrity objectives / targets / considerations of the area?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.
1.12	Considering the need to secure ecological integrity and a healthy biophysical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the "best practicable environmental option" in terms of ecological considerations?	Refer to Section 6 for details of the alternatives considered, as well as this section of the report for the advantages and disadvantages of the proposed activity.
1.13	Describe the positive and negative cumulative ecological / biophysical impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and existing and other planned developments in the area?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.

Ref No.	Question	Answer
2	**Promoting justifiable economic and social development**	
2.1	**What is the socio-economic context of the area, based on, amongst other considerations, the following:**	
2.1.1	The IDP (and its sector plans' vision, objectives, strategies, indicators and targets) and any other strategic plans, frameworks or policies applicable to the area,	It is indicated in the Social Impact Report (refer to Appendix D) that according to the NMMDM IDP (2018/19), mining and quarrying was the biggest contributor the district's economy with a contribution of close on R47 million to the district's economy in the 2015/16 financial year.
2.1.2	Spatial priorities and desired spatial patterns (e.g. need for integrated of segregated communities, need to upgrade informal settlements, need for densification, etc.),	The mine will make use of labourers from the local community as far as possible. According to the RLM's Spatial Development Plan (SDF) (in the RLM IDP, 2016), most people in the municipal area live in rural villages characterised by low economic activity forcing people into subsistence livelihoods. Places of employment are generally far from villages and therefore tend to be inaccessible. Agriculture is the predominant sector in the Ratlou local economy. The project area is within the area currently characterised by both agriculture and mining activities. According to the NMMDM IDP (2018/19), mining and quarrying was the biggest contributor the district's economy with a contribution of close on R47 million to the district's economy in the 2015/16 financial year.
2.1.3	Spatial characteristics (e.g. existing land uses, planned land uses, cultural landscapes, etc.), and	Refer to the baseline environment in Section 8 of this report.
2.1.4	Municipal Economic Development Strategy ("LED Strategy").	The proposed project will promote and support the sustainability of existing business, as well as assist in increasing local beneficiation and shared economic growth, through extending the LOM.
2.2	Considering the socio-economic context, what will the socio-economic impacts be of the development (and its separate elements/aspects), and specifically also on the socio-economic objectives of the area?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.
2.2.1	Will the development complement the local socio-economic initiatives (such as local economic development (LED) initiatives), or skills development programs?	The proposed project will ensure that additional community projects are initiated by the mine. This will complement the local socio-economic initiatives identified for the area.
2.3	How will this development address the specific physical, psychological, developmental, cultural and social needs and interests of the relevant communities?	Refer to the public participation process undertaken to date in Section 7 of this report. Furthermore, refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this Report.

Ref No.	Question	Answer
2.4	Will the development result in equitable (intra- and inter-generational) impact distribution, in the short- and long-term? Will the impact be socially and economically sustainable in the short- and long-term?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.
2.5	**In terms of location, describe how the placement of the proposed development will:**	
2.5.1	Result in the creation of residential and employment opportunities in close proximity to or integrated with each other.	As the proposed expansion project relates to construction of additional infrastructure within an existing mining right and mining operation, there are limited employment opportunities directly relating to the construction of the additional infrastructure. The employment opportunities, transport needs, etc are more specifically related to the main mining operations which are already assessed and approved.
2.5.2	Reduce the need for transport of people and goods.	
2.5.3	Result in access to public transport or enable non-motorised and pedestrian transport (e.g. will the development result in densification and the achievement of thresholds in terms public transport),	
2.5.4	Compliment other uses in the area,	The proposed Kalgold Expansion Project entails the increase of production at an existing mine. The existing land use, which is the mining of gold, will therefore be complimented by the expansion of the mine.
2.5.5	Be in line with the planning for the area.	Refer to item 2.2.1 of this table (above).
2.5.6	For urban related development, make use of underutilised land available with the urban edge.	Not applicable. The proposed Kalgold Expansion Project area is outside an urban area.
2.5.7	Optimise the use of existing resources and infrastructure.	The proposed Kalgold Expansion Project entails the increase of production at an existing mine. The proposed infrastructure is proposed to support the existing infrastructure.
2.5.8	Opportunity costs in terms of bulk infrastructure expansions in non-priority areas (e.g. not aligned with the bulk infrastructure planning for the settlement that reflects the spatial reconstruction priorities of the settlement).	
2.5.9	Discourage "urban sprawl" and contribute to compaction / densification.	Employment from the surrounding communities is recommended where possible, such that there will be no significant influx of additional workers to the area as a direct result of the proposed project.
2.5.10	Contribute to the correction of the historically distorted spatial patterns of settlements and to the optimum use of existing infrastructure in excess of current needs.	Not applicable as this application does not relate to urban development and is not anticipated to impact on historically distorted spatial patterns of settlements or the optimum use of existing infrastructure in excess of current needs.

Ref No.	Question	Answer
2.5.11	Encourage environmentally sustainable land development practices and processes.	The proposed land use for the Kalgold Expansion Project will be developed with effort made towards being environmentally sustainable in the long term. One of the key aspects to ensuring long terms land sustainability will be to ensure successful rehabilitation of disturbed areas.
2.5.12	Take into account special locational factors that might favour the specific location (e.g. the location of a strategic mineral resource, access to the port, access to rail, etc.).	Refer to item 1.7.3 of this table (above). The proposed Kalgold Expansion Project is associated with a portion of a strategic mineral resource (gold).
2.5.13	The investment in the settlement or area in question will generate the highest socio-economic returns (i.e. an area with high economic potential).	The proposed project will allow the mine to continue contributing to the local, regional and national Gross Domestic Product (GDPs), and also to the local communities through continued employment of workers and local contractors, as well as other influences and community upliftment programmes that are undertaken by the mine through their SLP.
2.5.14	Impact on the sense of history, sense of place and heritage of the area and the socio-cultural and cultural-historic characteristics and sensitivities of the area.	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report. No heritage features were found in the areas proposed for the various expansion infrastructure.
2.5.15	In terms of the nature, scale and location of the development promote or act as a catalyst to create a more integrated settlement?	The proposed project will ensure continued employment in the area, as well as programmes implemented from the mine's SLP.
2.6	**How was a risk-averse and cautious approach applied in terms of socio-economic impacts**	
2.6.1	What are the limits of current knowledge (note: the gaps, uncertainties and assumptions must be clearly stated)?	The assumptions and limitations in terms of this study are included in Section 9 of this report
2.6.2	What is the level of risk (note: related to inequality, social fabric, livelihoods, vulnerable communities, critical resources, economic vulnerability and sustainability) associated with the limits of current knowledge?	The level of risk is low as the project is not expected to have far reaching impacts on socio-economic conditions should the recommended mitigation and management measures be implemented and adhered to.
2.6.3	Based on the limits of knowledge and the level of risk, how and to what extent was a risk-averse and cautious approach applied to the development?	As this project extends a current mining operation, and does not constitute a new mine, a cautious approach has been applied.
2.7	**How will the socio-economic impacts resulting from this development, impact on people's environmental right in terms following:**	
2.7.1	Negative impacts: e.g. health (e.g. HIV-Aids), safety, social ills, etc. What measures were taken to firstly avoid negative impacts, but if avoidance is not possible, to minimise, manage and remedy negative impacts?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.

Ref No.	Question	Answer
2.7.2	Positive impacts. What measures were taken to enhance positive impacts?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.
2.8	Considering the linkages and dependencies between human wellbeing, livelihoods and ecosystem services, describe the linkages and dependencies applicable to the area in question and how the development's socioeconomic impacts will result in ecological impacts (e.g. over utilisation of natural resources, etc.)?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.
2.9	What measures were taken to pursue the selection of the "best practicable environmental option" in terms of socio-economic considerations?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.
2.10	What measures were taken to pursue environmental justice so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons (who are the beneficiaries and is the development located appropriately)? Considering the need for social equity and justice, do the alternatives identified, allow the "best practicable environmental option" to be selected, or is there a need for other alternatives to be considered?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report. Moreover, Kalgold mine represented by Harmony will, in line with the regulatory requirements, provide financial provision to ensure that the mitigation measures proposed can be carried out.
2.11	What measures were taken to pursue equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing, and what special measures were taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination?	By conducting a Scoping and EIA process, the applicant ensures that equitable access to the environment has been considered. Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.
2.12	What measures were taken to ensure that the responsibility for the environmental health and safety consequences of the development has been addressed throughout the development's life cycle?	As the proposed activities will form part of the existing mining operations, the Mine Health and Safety Act will provide overarching governance to health and safety risks.
2.13	**What measures were taken to:**	
2.13.1	Ensure the participation of all interested and affected parties.	Refer to the public participation process undertaken to date in Section 7 of this report. Public participation and consultation will continue during the EIA phase.
2.13.2	Provide all people with an opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation,	Refer to the public participation process undertaken to date in Section 7 of this report. Public participation and consultation will continue during the EIA phase.

Ref No.	Question	Answer
2.13.3	Ensure participation by vulnerable and disadvantaged persons,	Advertisements as well as site notices were distributed in and around the project area in English and Setswana to assist in understanding the project. A Public open day was conducted during scoping phase and is also planned to be undertaken in the and EIA phases of the project. Also, public meetings will be undertaken such that women and youth are encouraged to participate and provide input which will then be recorded and submitted with the relevant reports to the competent authority.
2.13.4	Promote community wellbeing and empowerment through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means,	
2.13.5	Ensure openness and transparency, and access to information in terms of the process,	
2.13.6	Ensure that the interests, needs and values of all interested and affected parties were taken into account, and that adequate recognition were given to all forms of knowledge, including traditional and ordinary knowledge,	
2.13.7	Ensure that the vital role of women and youth in environmental management and development were recognised and their full participation therein will be promoted?	
2.14	Considering the interests, needs and values of all the interested and affected parties, describe how the development will allow for opportunities for all the segments of the community (e.g. a mixture of low-, middle-, and high-income housing opportunities) that is consistent with the priority needs of the local area (or that is proportional to the needs of an area)?	Refer to the public participation process undertaken to date in Section 7 of this report. Furthermore, refer to the identified impacts, their assessment and recommended mitigation measures in Section 9. Moreover, the current SLP is due for an update, as part of a separate undertaking.
2.15	What measures have been taken to ensure that current and / or future workers will be informed of work that potentially might be harmful to human health or the environment or of dangers associated with the work, and what measures have been taken to ensure that the right of workers to refuse such work will be respected and protected?	Mine workers are educated on a regular basis as to the environmental and safety risks that may occur within their work environment. Furthermore, measures are taken to ensure that the appropriate personal protective equipment is issued to workers based on the areas that they work and the requirements of their jobs. Furthermore the mine is regulated by the Mine Health and Safety Act as well as the Occupational Health and Safety Act.
2.16	**Describe how the development will impact on job creation in terms of, amongst other aspects:**	
2.16.1	The number of temporary versus permanent jobs that will be created.	The following employment opportunities are anticipated: • The construction phase will last for approximately 24 months and could lead to the employment of 300 people over the two years. • No additional people will be employed for the operational phase.
2.16.2	Whether the labour available in the area will be able to take up the job opportunities (i.e. do the required skills match the skills available in the area).	
2.16.3	The distance from where labourers will have to travel.	

Ref No.	Question	Answer
2.16.4	The location of jobs opportunities versus the location of impacts.	
2.16.5	The opportunity costs in terms of job creation.	
2.17	**What measures were taken to ensure:**	
2.17.1	That there were intergovernmental coordination and harmonisation of policies, legislation and actions relating to the environment.	The Scoping and EIA Process requires governmental departments to communicate regarding any application. In addition, all relevant departments are notified of the opportunity to participate at the various phases of the application process.
2.17.2	That actual or potential conflicts of interest between organs of state were resolved through conflict resolution procedures.	
2.18	What measures were taken to ensure that the environment will be held in public trust for the people, that the beneficial use of environmental resources will serve the public interest, and that the environment will be protected as the people's common heritage?	Refer to the public participation process undertaken to date in Section 7 of this report. Furthermore, refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.
2.19	Are the mitigation measures proposed realistic and what long-term environmental legacy and managed burden will be left?	The proposed mitigation measures are considered realistic as they are based on tried and tested industry standards. Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.
2.20	What measures were taken to ensure that the costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects will be paid for by those responsible for harming the environment?	The Kalgold mine represented by Harmony provides regular updates on the financial provisioning to DMRE and the new infrastructure will be included in the financial provisioning moving forward.
2.21	Considering the need to secure ecological integrity and a healthy bio-physical environment, describe how the alternatives identified (in terms of all the different elements of the development and all the different impacts being proposed), resulted in the selection of the best practicable environmental option in terms of socio-economic considerations?	Refer to Section 6 for details of alternatives considered in this report.
2.22	Describe the positive and negative cumulative socio-economic impacts bearing in mind the size, scale, scope and nature of the project in relation to its location and other planned developments in the area?	Refer to the identified impacts, their assessment and recommended mitigation measures in Section 9 of this report.

6 PROJECT ALTERNATIVES

As mentioned in Section 5 of this report, the need for the proposed expansion project arises from the proposed increase in production capacity at the current Kalgold mine. The increase in production will require expansion of existing operations. As the application relates to expansion of existing operations, there are very limited feasible and/or reasonable alternatives that can be considered. These are described and motivated below.

6.1 ACTIVITY ALTERNATIVES

The current land use within and around the Kalgold Expansion Project area comprise largely of mining activities. Mining operations as a land use, are often viewed as directly competing and eventually replacing existing land uses. However, a mixed land use approach consisting of both mining and continued agriculture is possible. Current agricultural activities in the vicinity and within the proposed Kalgold Expansion Project area will be able to continue where no mining infrastructure is located, particularly because the proposed project mostly involves limited expansion of already existing infrastructure since the mine is already in operation. In this regard, no activity alternatives were considered for this project.

6.2 LOCATION ALTERNATIVES

The land use in and around the proposed Kalgold Expansion Project area predominantly consists of agricultural activities (crop farming) with mining related activities in its vicinity. The development location for the expansion was selected based on the fact that the proposed expansion project is required for production increase and expansion of the already existing Kalgold operation. In this regard, no other location alternative is being considered for the Kalgold Expansion Project. The environmental impacts associated with this location alternative are discussed in Section 9 of this report.

6.3 DESIGN OR LAYOUT ALTERNATIVES

The preliminary positions or layout of the various infrastructure has been identified through various technical considerations. A feasibility study was conducted to determine the proposed infrastructure required to meet the expansion objectives. As there is various existing infrastructure, the proposed infrastructure has to be located in such a way that is not an obstruction to existing operational infrastructure. The following layout alternatives were considered as part of the feasibility studies (see Figure 8 below):

- Alternative L1a: Production/processing Plant Alternative 1.
- Alternative L1b: Production/processing Plant Alternative 2.
- Alternative L2a: Explosives Magazine Alternative 1.
- Alternative L2b: Explosives Magazine Alternative 2.
- Alternative L3a: New Tailings Storage Facility Alternative 1.
- Alternative L3b: New Tailings Storage Facility Alternative 2.

Production Plant Alternative 2 (Alternative L1b) was found to be not technically and environmentally feasible due to its proximity to a drainage line and requirement to build haul roads across drainage lines among other technical considerations. This alternative was not considered further in the Scoping and EIA process.

Explosives Magazine Alternative 2 (Alternative L2b) was found to be not technically feasible as the location is proposed for the expansion of the low-grade stockpile (an existing authorised activity) and also requires a safety clearance radius around it. Explosives Magazine Alternative 1 (Alternative L2a) has been moved to another position to cater for the safety requirements. In this regard this alternative was not considered further in the Scoping and EIA process.

Both alternatives of the new Tailings Storage Facility were found to not be technically feasible at this stage and where therefore no longer considered in the Scoping and EIA process. It is now proposed to recommission the existing TSF at a low deposition rate.

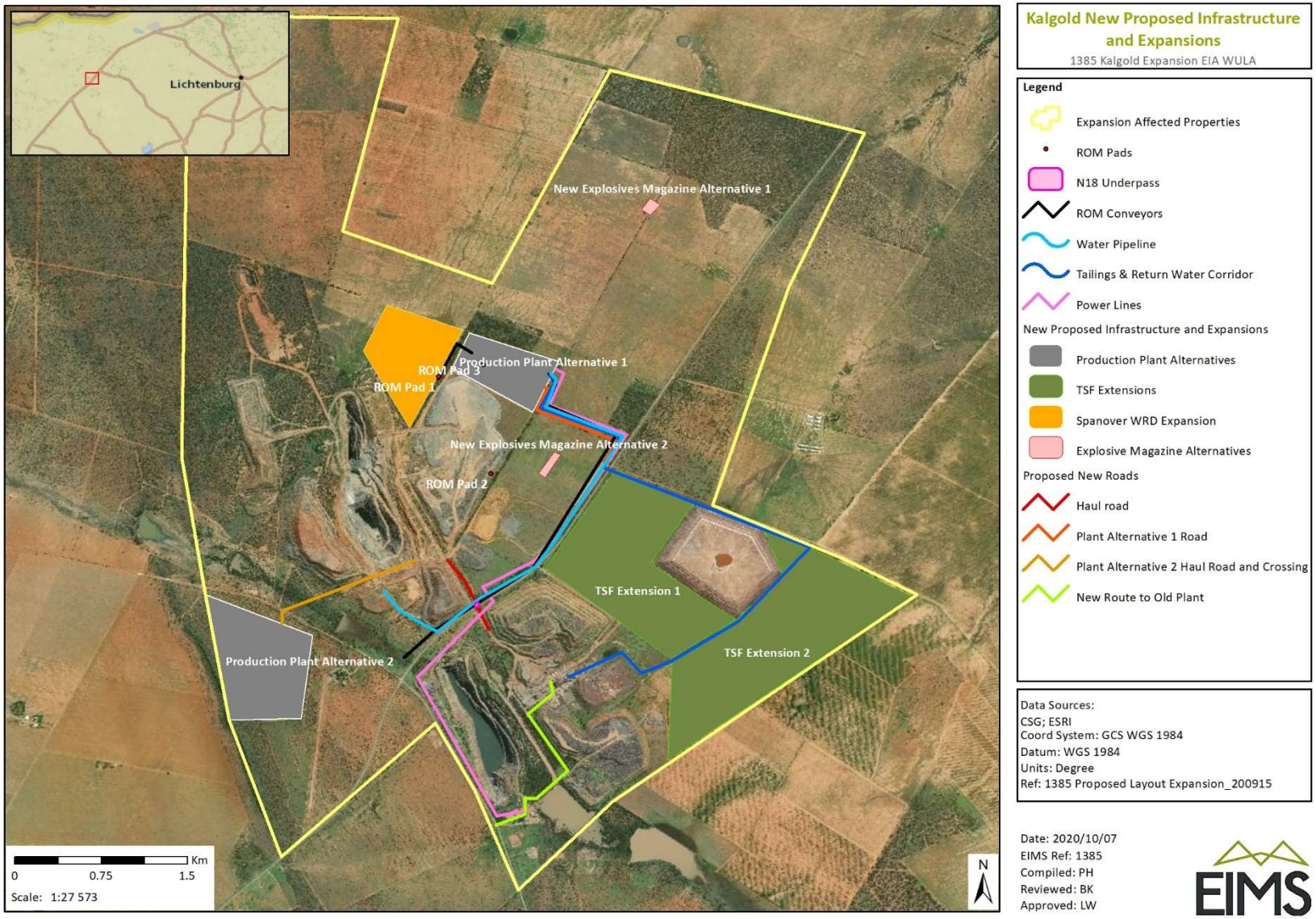


Figure 8: Location alternatives considered during feasibility

The preliminary positions or layout was assessed with regards to potential impacts on the receiving environment as part of the Scoping phase. Based on the findings of the scoping report, the layout has been updated and this layout has been assessed in this report.

6.4 NO-GO ALTERNATIVE

The no-go option means 'do nothing' or the option of not undertaking the proposed Kalgold Expansion Project or any of its alternatives. The 'do nothing' alternative or keeping the current *status quo* of production also provides the baseline against which the impacts of other alternatives should be compared.

During construction and operation, the local area is likely to experience an economic injection in the form of employment creation, taxes, CSI and SLP spend, and increased business and consumer spending. In addition, it is evident from the scoping studies that the proposed expansion project will have a potentially limited environmental impact on the receiving environment. This is mainly because the site is an existing mine, and the expansion project only entails additional new infrastructure on properties already affected by current mining activities.

Various other economic changes and impacts will not be realized if the project does not go ahead, these include:

- Employment creation, which impacts on people's livelihoods.
- Diversification of economic activities: The project could stimulate a process of change from one type of production to another type (e.g. agricultural to mining). This will diversify the local economy but could also draw labour from other sectors.
- Increased tax income: Continued and increased tax income for the local authority who can apply the money to LED.

The no-go alternative would mean that the benefits of local and regional employment associated with the expansion project would not be realised in the long term. The potential employment and economic benefits will therefore be forgone. The no-go alternative would maintain the current environmental *status quo* at the site.

7 STAKEHOLDER ENGAGEMENT

The Public Participation Process (PPP) is a requirement of several pieces of South African legislation and aims to ensure that all relevant Interested and Affected Parties (I&APs) are consulted, involved and their opinions are taken into account, and a record included in the reports submitted to relevant authorities. The process aims to ensure that all stakeholders are provided an opportunity as part of a transparent process which allows for a robust and comprehensive environmental study. The PPP for the proposed project needs to be managed sensitively and according to best practises in order to ensure and promote:

- Compliance with international best practise options;
- Compliance with national legislation;
- Establish and manage relationships with key stakeholder groups; and
- Encourage involvement and participation in the environmental study and authorisation / approval process.

As such, the purpose of the PPP and stakeholder engagement process is to:

- Provide an opportunity for I&APs to obtain clear, accurate and comprehensible information about the proposed activity, its alternatives or the decision and the environmental impacts thereof;
- Provide I&APs with an opportunity to indicate their view-points, issues and concerns regarding the activity, alternatives and / or the decision;
- Provide I&APs with the opportunity to suggest ways of avoiding, reducing or mitigating negative impacts of an activity and enhancing positive impacts;
- Enable the applicant to incorporate the needs, preferences and values of I&APs into the activity;
- Provide opportunities to avoid and resolve disputes and reconcile conflicting interests;
- Enhance transparency and accountability in decision-making;
- Identify all significant issues for the project; and
- Identify possible mitigation measures or environmental management plans to minimise and/or prevent negative environmental impacts and maximize and/or promote positive environmental impacts associated with the project.

7.1 LEGAL COMPLIANCE

The PPP must comply with several important sets of legislation that require public participation as part of an application for authorisation or approval, namely:

- The Mineral and Petroleum Resources Development Act (Act No. 28 of 2002 – MPRDA);
- The National Environmental Management Act (Act No. 107 of 1998 – NEMA);
- The National Environmental Management Waste Act (Act No. 59 of 2008 – NEMWA); and
- The National Water Act (Act No. 36 o1998 – NWA).

Adherence to the requirements of the above-mentioned Acts will allow for an Integrated PPP to be conducted, and in so doing, satisfy the requirement for public participation referenced in the Acts. The details of the Integrated PPP followed are provided below.

7.2 IDENTIFICATION OF INTERESTED AND AFFECTED PARTIES

The I&AP databases compiled for various past environmental authorisation processes in the vicinity of the proposed Kalgold Expansion Project have been utilised towards compiling a pre-notification register of key I&APs to be notified of the Environmental Authorisation Application. The I&AP database includes amongst others:

landowners, communities, regulatory authorities and other specialist interest groups. Additional I&APs have been registered during the initial notification and call to register period. The I&APs database will continue to be updated throughout the duration of the EIA process. A full list of I&APs is attached in Appendix C.

7.2.1 LIST OF AUTHORITIES IDENTIFIED AND NOTIFIED

The following Government Authorities were notified of the proposed project:

- National Department of Environment, Forestry and Fisheries
- National Department of Mineral Resources and Energy
- National Department of Agriculture
- National Department of Rural Development and Land Reform
- National Human Settlements, Water and Sanitation
- Cooperative Governance and Traditional Affairs (COGTA)
- South African National Roads Agency Limited (SANRAL)
- South African National Parks (SanParks)
- South African Heritage Resources Agency (SAHRA)
- North-West Provincial Government

7.2.2 OTHER KEY STAKEHOLDERS IDENTIFIED AND NOTIFIED

The following key stakeholders have been identified and notified of the proposed project:

- South African National Biodiversity Institute (SANBI)
- Birdlife South Africa
- Ward Councillors
- Ratlou Local Municipality
- Tribal Authorities
- Endangered Wildlife Trust
- Ngaka Modiri Molema District Municipality
- Landowners and Adjacent landowners
- Eskom Holdings SOC Limited

7.3 INITIAL NOTIFICATION OF I&APS

The initial PPP commenced on the 26th of March 2021 with the placement of site notices and call to register ending on the 9th of April 2021. The initial notification was given in the following manner:

7.3.1 REGISTERED LETTERS, FAXES AND EMAILS

Registered letters, emails and facsimiles (faxes) were prepared and distributed to the identified relevant authorities, affected and adjacent landowners and legal occupiers, ward councillors and other pre-identified key stakeholders. The notification documents included the following information (in English and Setswana):

- The purpose of the proposed project;
- Details of the MPRDA, NEMA and NWA Regulations that are anticipated to be applicable and must be adhered to;
- List of anticipated activities to be authorised;
- Location and extent of activities to be authorised;
- Details of the affected properties (including a locality map or an indication of where the locality map may be viewed or obtained);
- Brief but sufficient detail of the intended operation to enable I&APs to assess / surmise what impact the project will have on them or on the use of their land (if any); and
- Contact details of the EAP.

In addition, a registration form was included in the registered letters, emails and facsimiles distributed to I&APs and it included a request for the following information from I&APs:

- Provide information on current land uses and their location within the area under consideration;
- Provide information on the location of environmental features on site;
- State how and to what standard or extent they perceive these identified features are likely to be impacted upon by the proposed project;
- Provide information on how they consider that the proposed Kalgold Expansion Project will impact on them or their socio-economic conditions;
- Make proposals as to how the potential impacts on identified environmental features, their infrastructure, and socio-economic concerns may be managed, avoided or mitigated;
- Details of the landowner and information on lawful occupiers;
- Details of any communities existing within the area;
- Details of any Tribal Authorities within the area;
- Details of any other I&APs that need to be notified;
- Details on any land developments proposed; and
- Any specific comments or concerns regarding the proposed Kalgold Expansion Project application for environmental authorisation.

Proof of the registered letters, emails and facsimiles that were distributed during the initial notification and call to register period are attached in Appendix C.

7.3.2 SITE NOTICES AND POSTERS

Four (4) Site notices were placed along the perimeter of the proposed project area and its surroundings on 29 March 2021. The on-site notices included the following information (in English and Setswana):

- Project name;
- Applicant name;
- Project location;
- Description of the environmental authorisation application process;
- Legislative requirements; and
- Relevant EAP contact person details for the project.

Please refer Appendix C for proof of site notice and poster placement.

7.3.3 BACKGROUND INFORMATION DOCUMENT

Included in the I&AP notification letters, emails and facsimiles, was a Background Information Document (BID). The BID includes the following information:

- Project name;
- Applicant name;
- Project location;
- Map of affected project area;
- Description of the environmental authorisation application process;
- Information on document review; and

- Relevant EAP contact person details for the project.

Please refer to Appendix C for a copy of the BID issued to I&APs.

7.3.4 NEWSPAPER ADVERTISEMENTS

English and Setswana advertisements were placed on the 26th of March 2021 in the Mahikeng Mail newspaper which was indicated to have the widest reach within the project area and its vicinity towards notifying the public regarding the proposed Kalgold Expansion Project.

The newspaper advertisements included the following information (in English and Setswana):

- Project name;
- Applicant name;
- Project location;
- Description of the environmental authorisation application process;
- Legislative requirements; and
- Relevant EAP contact person details for the project.

7.4 AVAILABILITY OF THE SCOPING REPORT

Notification regarding the availability of the Scoping Report for public review was given in the following manner to all registered I&APs (in English and Setswana):

- Registered letters with details on where the scoping report could be obtained and/or reviewed, availability of a presentation overview of the project, EIMS contact details as well as the public review comment period;
- Facsimile notifications with information similar to that in the registered letter described above; and/or
- Email notifications with a letter attachment containing the information described above.

The Scoping Report was made available for public review at the Kalgold Mine and at the Kraaipan Tribal Council from the 4th of May 2021 until the 3rd of June 2021, for a period of 30 days.

A public open day was conducted on the 26th of May 2021 at the Ratlou Local Municipality Chambers, on R507 Setlagole Village (next to Setlagole Library). The open day was run from 10AM to 3PM. In light of the Covid-19 pandemic an open day meeting was conducted to ensure venue number restrictions as per the directions issued in line with the Disaster Management Act (Act 57 of 2002).

The main objectives of the public open day was to share available information with the I&APs pertaining to the findings of the Scoping phase studies, as well as to provide the I&APs with the opportunity to ask questions, raise potential issues and concerns, and to make comments on the proposed project.

All comments received up to the close of the Scoping Phase PPP was included in the final Scoping Report submission to the DMRE for review and approval and the DMRE approved the Scoping Report on 02 November 2021.

7.5 AVAILABILITY OF THE EIA/EMPR REPORT

Notification regarding the availability of the EIA/EMPr Report for public review was given in the same manner as for the Scoping Report above and the report will be available for public review and comment for a period of 30 days from 04 February 2022 to 7 March 2022.

A public open day will be conducted at the Ratlou Local Municipality Chambers, on R507 Setlagole Village (next to Setlagole Library).

7.6 COMMENTS AND REPONSES

Comments raised have been addressed in a transparent manner and included in the Public Participation Report (Appendix C). To date comments have been received as per below:

- Correspondence from SAHRA requesting that a case be created on the SAHRIS website;
- Letter of Objection received from Chief GH Phoi on a separate application that has been lodged by the applicant for Kalgold Mine;
- Request for registration from the local business;
- I&AP requesting to be removed from the project's database;
- Statutory comment from Transnet stating that their pipelines were not affected by the proposed project;
- Request for a copy of the report to be delivered to the SANRAL offices for comment;
- Local organisation requesting support;
- Land claims enquiry;
- Request for the applicant to develop the surrounding communities socially and economically; and
- Statutory comment from SAHRA.

8 ENVIRONMENTAL ATTRIBUTES AND BASELINE

This section provides a description of the environment that may be affected by the proposed Kalgold Expansion Project. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the proposed extension have been described. Baseline information sourced from the various specialist studies has been utilised to prepare the environmental attributes baseline below.

8.1 TOPOGRAPHY AND REGIONAL DRAINAGE

The topography in the vicinity of the mining area is flat but undulating and ranges from 1245 metres above mean sea level (mamsl) in the south-east to 1220 mamsl in the north-west. The regional catchment in which the mine is located is characterised by generally northwesterly flowing drainages leading to the Molopo River (GCS, 2008).

The catchment is drained by a number of small tributaries including the Mareetsane River, Morokwa River and Koedoe Spruit drainages. These convert and flow into the Setlagole River which drains north-west into the Molopo River (Figure 9). The Morokwa River flows along the southern boundary of the mine and has been diverted around D-Zone pit. This river is generally dry and only flows for short periods after rainfall events. There is generally no flow in the Morokwa drainage and there are therefore no riparian water users in the area (GCS, 2008). However, certain landowners have constructed dams along the drainage which impound stormwater runoff after high rainfall. This surplus water is not normal and is available only for short periods. Baseflow contribution to river and stream features represents one of the primary natural groundwater discharge processes.

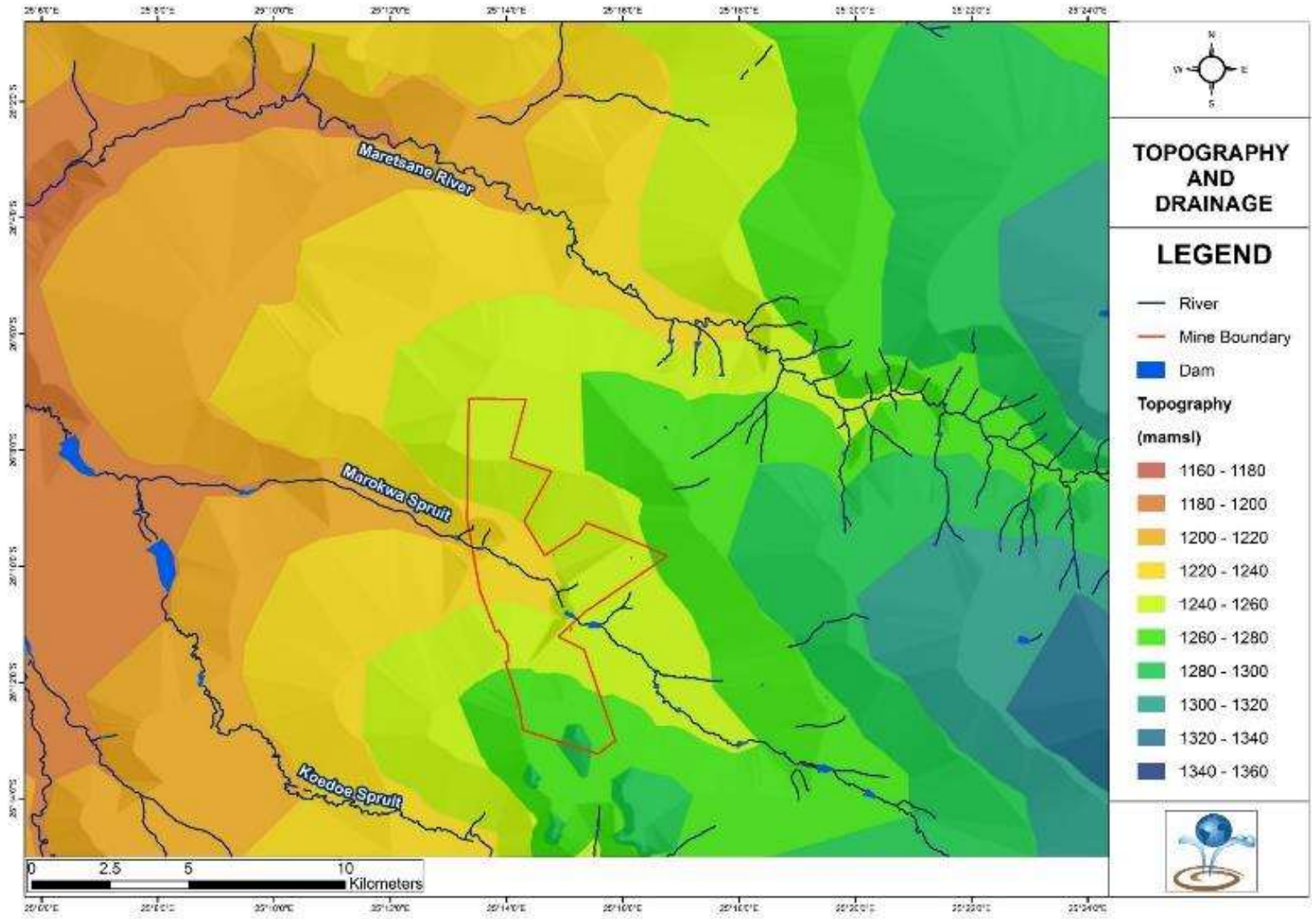


Figure 9: Regional topography and drainage for the Kalgold Expansion Project area (MvB Consulting, 2021)

8.2 GEOLOGY AND SOILS

The Kalgold operation is located within the Kraaipan Greenstone Belt, which forms part of the larger Amalia-Kraaipan Greenstone terrain (Wilson and Anhaeusser, 1998). The Kraaipan Greenstone Belt consists of north trending linear belts of Archaean metavolcanic and metasedimentary rocks, separated by granitoid units. Mineralisation occurs in shallow dipping quartz veins, which occur in clusters or swarms, within the steeply dipping magnetite-chert banded iron formation. Disseminated sulphide mineralisation, dominated mostly by pyrite, occurs around and between the shallow dipping quartz vein swarms.

The following rocks are associated with the ore body:

- The footwall consists of mafic schist and the hanging wall of greywacke, shale, sandstone, conglomerate and siltstone.
- The host rock is Banded Iron Formation (BIF) intercalated with shale. The greenstone formations are exposed in discontinuous outcrops of steeply dipping rocks which define three narrow, sub-parallel belts that strike approximately north-south (GCS, 2008).

The ore body mined at Kalgold occur within the central belt which comprises banded iron formation (BIF), magnetite quartzite, chert, greywacke, shale and schist. The gold mineralization is hosted by steeply dipping BIF that are interbedded with schist, shale and greywacke. The greenstones are hosted within intrusive granite and gneiss. The Kraaipan greenstone is intruded by numerous east-west trending dykes. One such dyke cuts across the southern boundary of the mining lease area. The area is further characterised by abundant faults with displacement from a few metres to hundreds of metres. Groundwater movement in the area takes place in a northerly direction mainly along strike on the contacts of the cherty banded iron units and is affected by crosscutting dykes and faults (GCS, 2008).

Figure 10 shows the regional geology of the project area.

According to the land type database (Land Type Survey Staff, 1972 - 2006), the project area is characterised by the Ae29, Ah17 and Ai3 land types (TBC, 2021). A description of these land types is as follows (see

Figure 11):

- Land type Ai3 is dominated by the foot-slopes terrain unit and has a slope of 0 to 1 %. The dominant soil forms expected in this land type is the Clovelly (Cv) and the Fernwood (Fw). Both these soils are expected to be sandy with a clay percentage of around 5 % or less and have depths exceeding 1.2 m.
- Land type Ah17 has a good mix of terrain units but predominantly the slope is between 0 and 5 %. The dominant soil forms expected in this land type is the Clovelly (Cv) and the Hutton (Hu). Both these soils are expected to be sandy with a clay percentage of around 5 % or less and have depths exceeding 1.2 m and should have a good land capability associated with them.
- Land type Ae29 is dominated by the mid-slopes terrain unit and has a slope of 0 to 10 %. The dominant soil form expected in this land type is the Hutton (Hu). The expected clay content for these soils are between 5 % and 15 % and the depths range from 750 mm to deeper than 1200 mm.

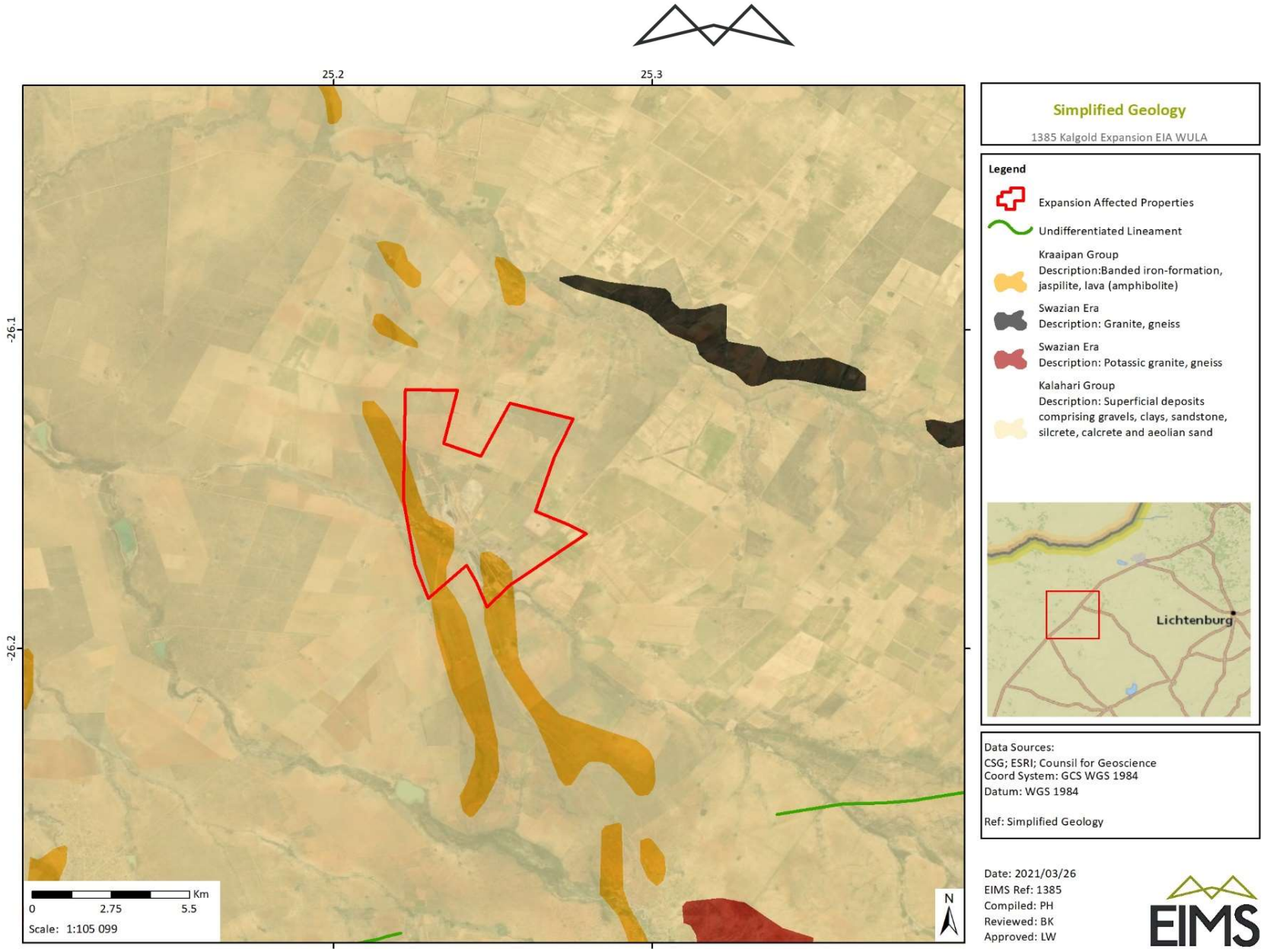


Figure 10: Regional geological map

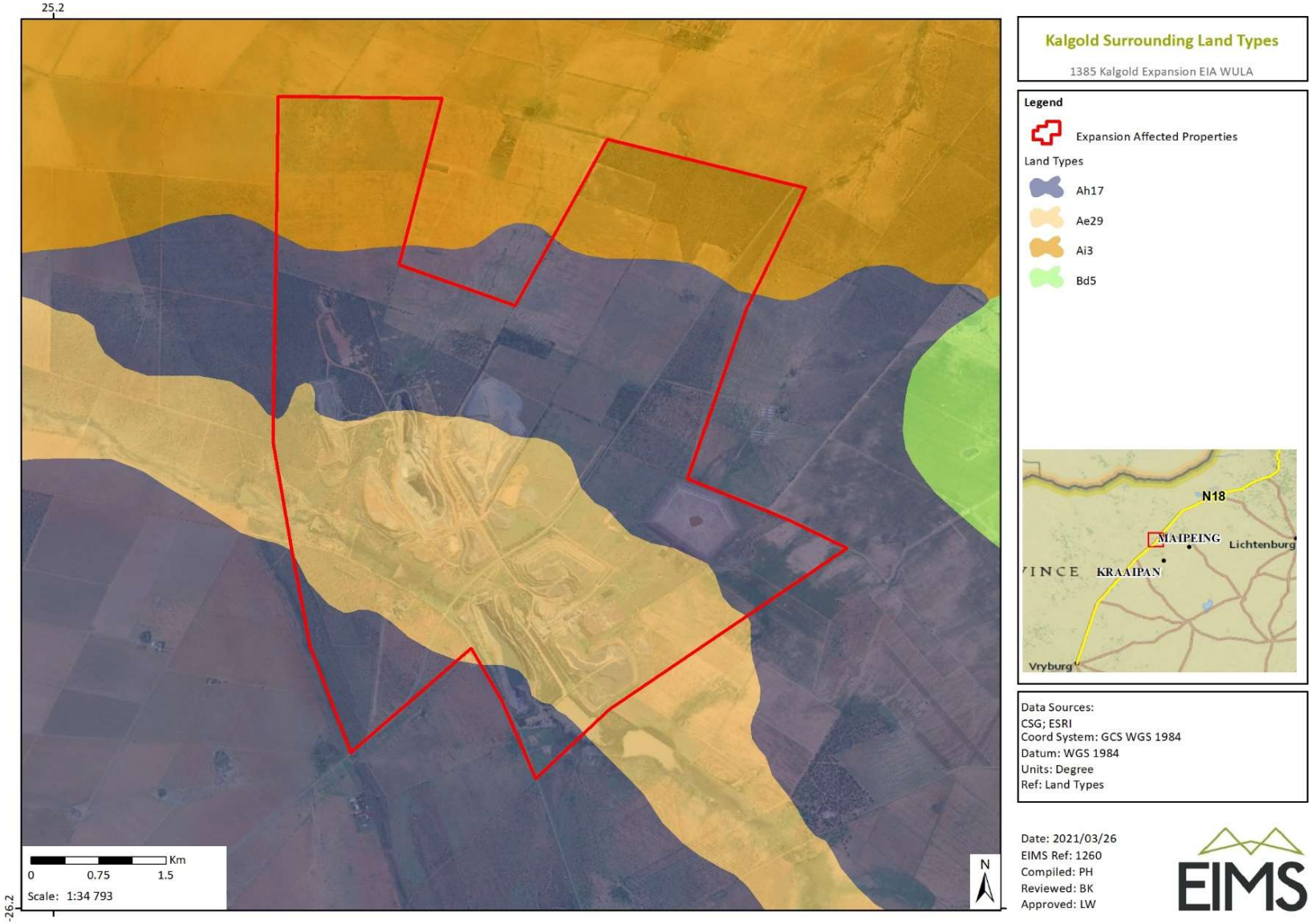


Figure 11: Land types in the study area

8.3 CLIMATE

The project area is characterised by summer rainfall with very dry winters. The mean annual precipitation (MAP) is about 400–480 mm. There is frost frequent in winter, Mucina & Rutherford (2006). Figure 12 illustrates the climate summary for the region

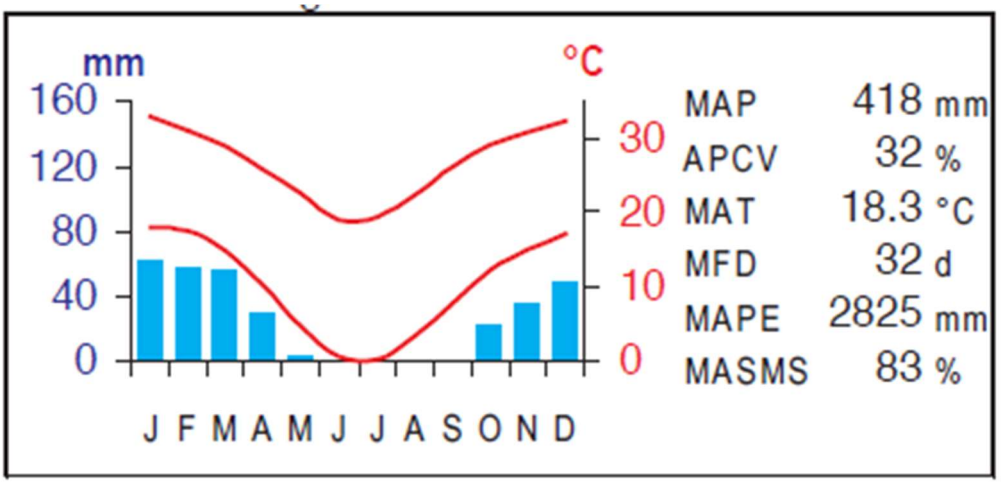


Figure 12: The climate summary for the region (Mucina & Rutherford, 2006)

8.4 LAND CAPABILITY

The project area is flat in relief. The land type data suggest that soils of the Hutton, Clovelly, and Fernwood forms are present in the landscape. The average land capability based on the land type data is that of a Class III (moderate cultivation) Class III land would pose moderate limitations to agriculture with some erosion hazard and would require special conservation practice and tillage methods (TBC, 2021). The farming method for this capability would require the rotation of crops and ley (50%). The current land use seems to be croplands in the north with the remaining undisturbed area being veld/grazing. The disturbed areas are classified as mining land use.

8.5 SOCIAL, DEMOGRAPHICS AND EMPLOYMENT STATISTICS

A Socio-Economic Study was conducted NLN Consulting in December 2021, the full report is available in Appendix D . This included a comprehensive desktop study, in conjunction with a site visit. Based on the report, the project falls within the Ngaka Modiri Molema District Municipality (NMMDM). The district covers a geographical area of 28 440 km^2 and is bordered by Botswana to the north and west, the Dr Ruth Segomotsi Mompati District to the southwest, the Dr Kenneth Kuanda District to the southeast and the Bojanala District to the east. The district is one of four districts of the Northwest Province and consists of five local municipalities (Ratlou, Mahikeng, Ramotshere Moila, Ditsobotla and Tswaing).

The Kalgold mining area (including all existing and newly proposed infrastructure) is located in Ward 11 of the Ratlou Local Municipality (RLM11). RLM11 covers a geographical area of 1 589km^2 and in 2011, was home to 7 155 people (with a population density of 4.5 people per km^2 – indicative of an area that is largely rural in nature). In 2001 the ward had a total population of 6 489 people, which means that the area experienced a positive population growth rate of around 1.03% per annum. Based on this growth rate, the 2018 population size is an estimated 7 670 people.

The majority of the current population in RLM11 are Black African (92.8%), followed by the White (6.1%) population group. Although more new Black African people settled in the ward (381), the largest proportional in-migration was under the White population group who more than doubled in population size – from 171 people in 2001 to 438 in 2011.

The most widely spoken languages in the ward are Setswana (85.9%) and Afrikaans (6.2%). All the other official languages together account for the remaining 7.9%.

The majority of RLM11's population (96.4%) are South African and native to the North West Province (91.4%). There has been a definite increase in the male population in RLM11 between 1996 (46.8%) and 2001 (49.2%) and 2011 (54.0%). This, coupled with the fact that the majority of the population are in the economically active age group of 15-64 (58.9%) and the positive population growth rate in a predominantly rural ward, is indicative of existing population in-migration, i.e. it is likely that the mining activities in the ward attract people to the area – either in the form of legitimate mine workers or in the form of job seekers.

The education levels in the ward are fairly low, with only 13.9% of the adult population (those aged 20 years and older) having completed their secondary education (Grade 12). Only 3.1% of the population have completed some form of tertiary education (diploma, degree, etc.). An overview of the educational profile of the ward is provided in Figure 13 .

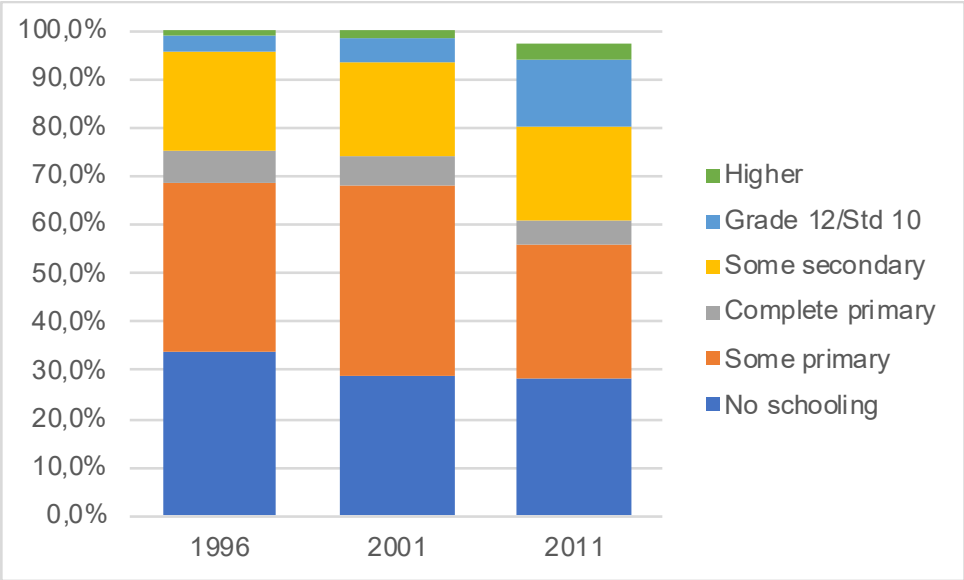


Figure 13: Overview of the Education Profile of RLM11 between 1996 and 2011

The employment rate in RLM11 amongst the labour force increased year on year – from 42.1% in 1996 to 57.7% in 2001, to 73.7% in 2011. In other words, in 2011, 73.7% of the site-specific study area's economically active population (58.9% of the total population) were employed. An overview of the site-specific study area's employment profile is provided in Figure 14.

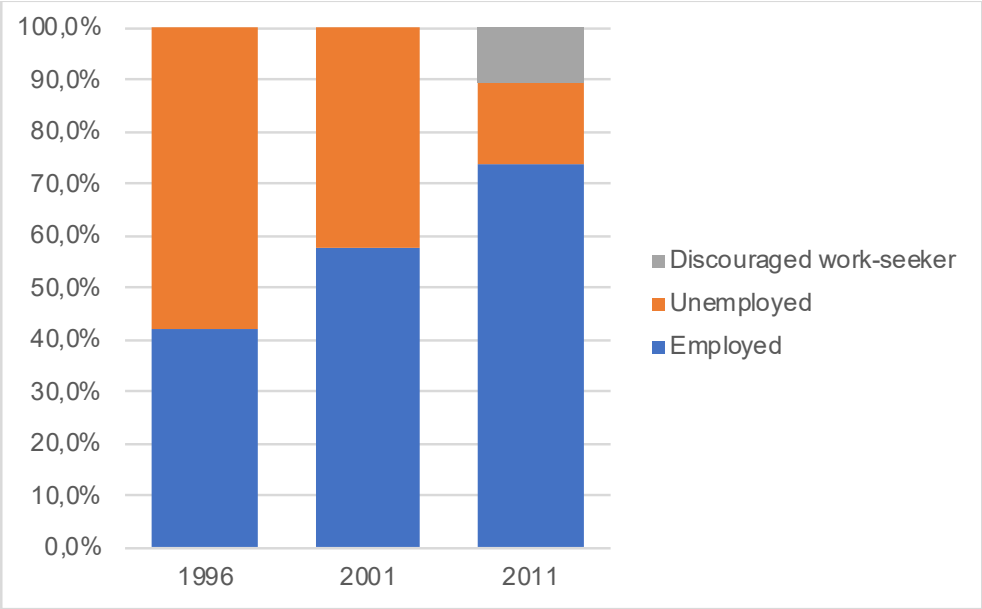


Figure 14: Overview of the Site-Specific Study Area's Employment Profile

However, of those employed, more than half (57.1%) are employed in private households with a further 14.4% employed in the informal sector. Despite there being a consistent improvement in the monthly income profile of the local households (in 2001 almost all of the households in RLM11 - 88.8% - lived in absolute poverty , which has been reduced to 58.4% of households in 2011), it would appear that the majority of those employed are still employed in minimum wage jobs (unskilled work such as house-keeping and gardening).

The RLM has developed a Local Economic Development (LED) strategy as part of its Integrated Development Plan (IDP, 2016). The strategy provides the municipality with guidelines on how to create and sustain economic development. The LED strategy was adopted in August 2012 and identified ten short- and longer-term goals to focus the municipalities LED efforts. These include:

- Strengthening the municipality's local stake in mining;
- Establishing a Further Education and Training (FET) college;
- The development and support of co-operatives;
- Rural development and agrarian reform;
- Branding and marketing;
- The implementation of learnerships, skills programmes and internships;
- Local business support (through procurement of services);
- Local and foreign investment attraction;
- Soft infrastructure development to increase the municipality's competitive advantage; and
- Development and implementation of a tourism strategy.

8.6 CULTURAL AND HERITAGE RESOURCES

A heritage assessment for the Kalgold Expansion Project was undertaken by PGS Heritage in November 2021. The high-level archival research focused on available information sources was used to compile a general background history of the project area and surrounds. The map analysis and previous studies shows that number of known possible heritage features were identified in the study area (Figure 15).

A controlled surface survey was conducted on foot and by vehicle from 11 to 13 October 2021. During the survey, no heritage sites were identified within the project areas for the proposed expansion. This includes historical structures and burial ground and graves.

A Palaeontological Impact assessment was conducted by PG Heritage and Banzai Environmental in November 2021. It is noted that a Low Palaeontological Significance was determined for the development. It was therefore indicated that the proposed development will not lead to detrimental impacts on the palaeontological resources of the area.

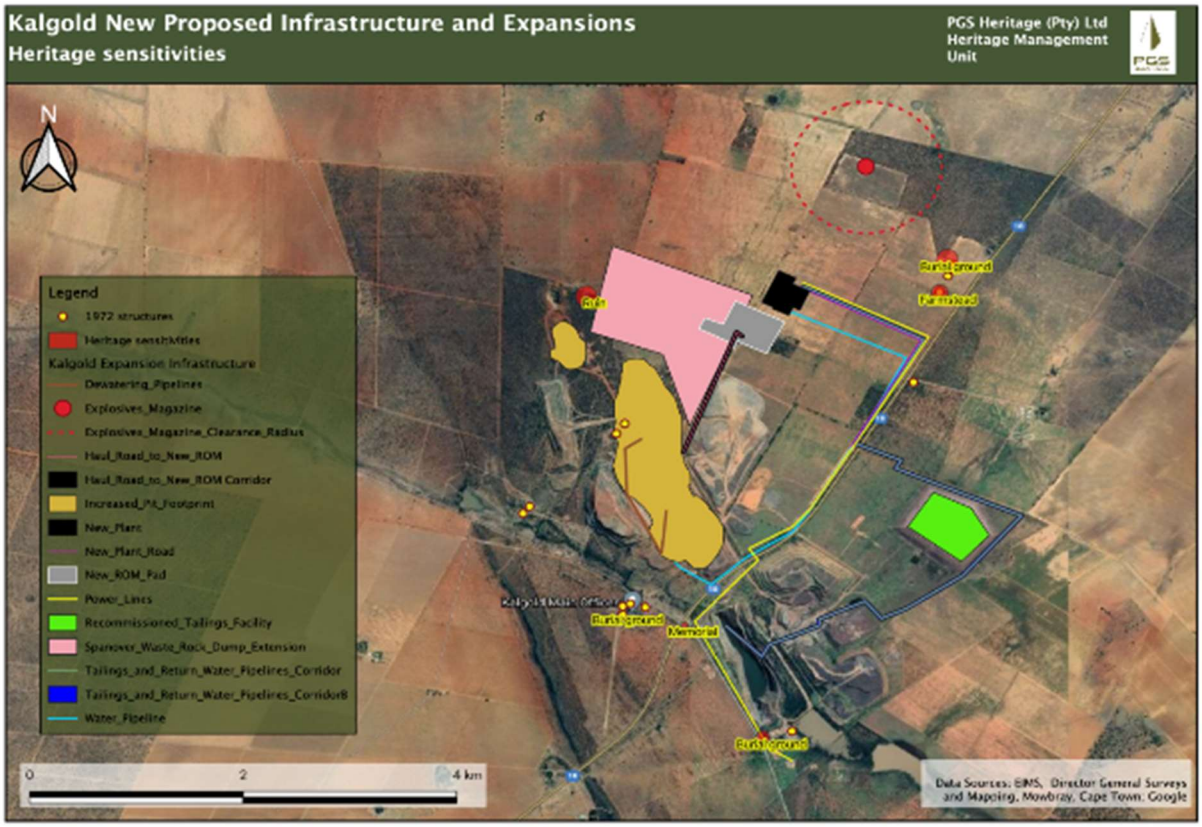


Figure 15: Heritage sensitivity map

8.7 FLORA

Terrestrial Ecology Study was prepared by The Biodiversity Company (TBC) in November 2021, the full report is available in Appendix D. This included a comprehensive desktop study, in conjunction with surveys.

The Kalgold Expansion Project area is situated within the Savannah biome. The savanna vegetation of South Africa represents the southern-most extension of the most widespread biome in Africa (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the Savanna biome include:

- Seasonal precipitation; and
- (Sub) tropical thermal regime with no or usually low incidence of frost (Mucina & Rutherford, 2006).

Most savanna vegetation communities are characterised by a herbaceous layer dominated by grasses and a discontinuous to sometimes very open tree layer (Mucina & Rutherford, 2006). The savanna biome comprises many different vegetation types. The project area is situated within one vegetation type; namely the Mafikeng Bushveld vegetation type according to Mucina & Rutherford (2006)

During the site inspection it was noted that the project area comprises three broad habitat units, namely the Transformed habitat unit, the Mafikeng Bushveld habitat unit, Wetland habitat unit (includes riparian zones) (Figure 16). The Transformed habitat unit which is the largest of the three units represents areas where vegetation cover has been significantly impacted by current and historical mining and agricultural activities as well as through infrastructure associated with the mining activities. This habitat unit has no conservation value and from ecological perspective is regarded as having low conservation value.

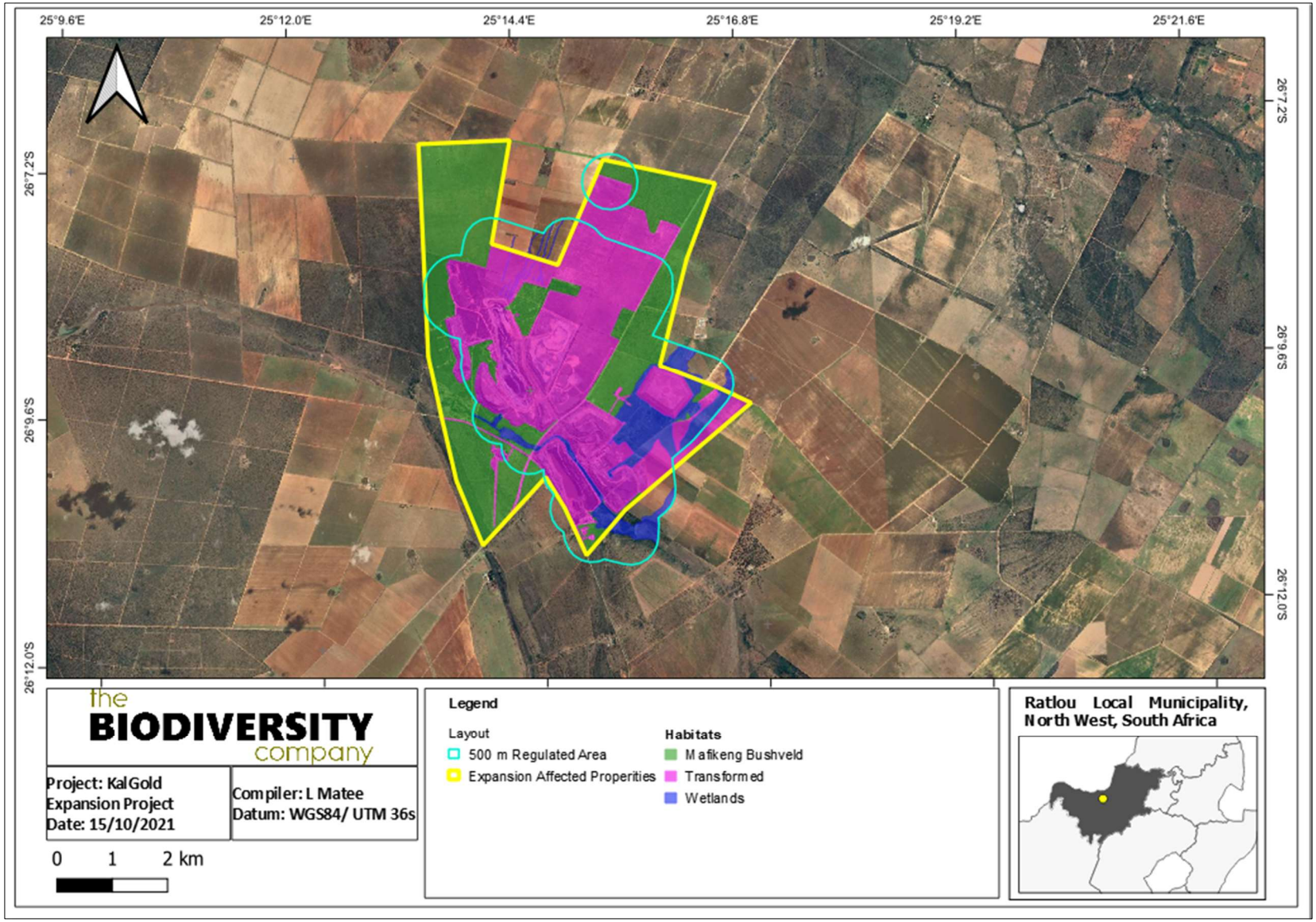


Figure 16: The Kalgold Expansion Project area showing Habitats identified within the project area.

The Mafikeng Bushveld vegetation type is listed as Vulnerable (Mucina & Rutherford, 2006). The conservation target for the vegetation type is at 16%. No section of this vegetation type is conserved in statutory conservation areas, but a very small area is conserved in the Mmabatho Recreation Area. About 25% of this vegetation type is considered to be already transformed, mainly due to cultivation and urban development.

The vegetation assessment was conducted throughout the extent of the project area. A total of 59 tree, shrub, graminoid and herbaceous plant species were recorded. One nationally protected plant was recorded, *Vachellia erioloba* (Camel Thorn), which is a protected tree in terms of the National Forests Act (Act No. 84 of 1998), was recorded in abundance throughout the project area.

Eleven (11) Category 1b and one (1) Category 2 invasive species were recorded within the project area and must therefore be removed by implementing an alien invasive plant management programme in compliance of section 75 of the Act as stated above.

8.7.1 TERRESTRIAL SENSITIVITY

Three (3) different terrestrial habitat types were delineated within the project area. The Transformed habitat unit which is the largest of the three units represents areas where vegetation cover has been significantly impacted by current and historical mining and agricultural activities as well as through infrastructure placement. This habitat unit has no conservation value and from ecological perspective is regarded as having low conservation value.

The vegetation structure within the Mafikeng Bushveld habitat unit is relatively intact, with few areas of bush encroachment, typical of overgrazing, noted as well as edge effects from mining. However, due to hosting protected tree species and it's habitat value for faunal species including the NT Brown Hyena (*Parahyaena brunnea*), the habitat is considered to be of high ecological importance and sensitivity.

The Wetland (and riparian zone) habitat unit is of high ecological sensitivity due to the contribution of the various wetland (and riparian zone) features to faunal migratory connectivity, ecoservices provision and the unique habitat provided for faunal and floral species. The summary of the sensitivities for each habitat unit is presented Figure 17.

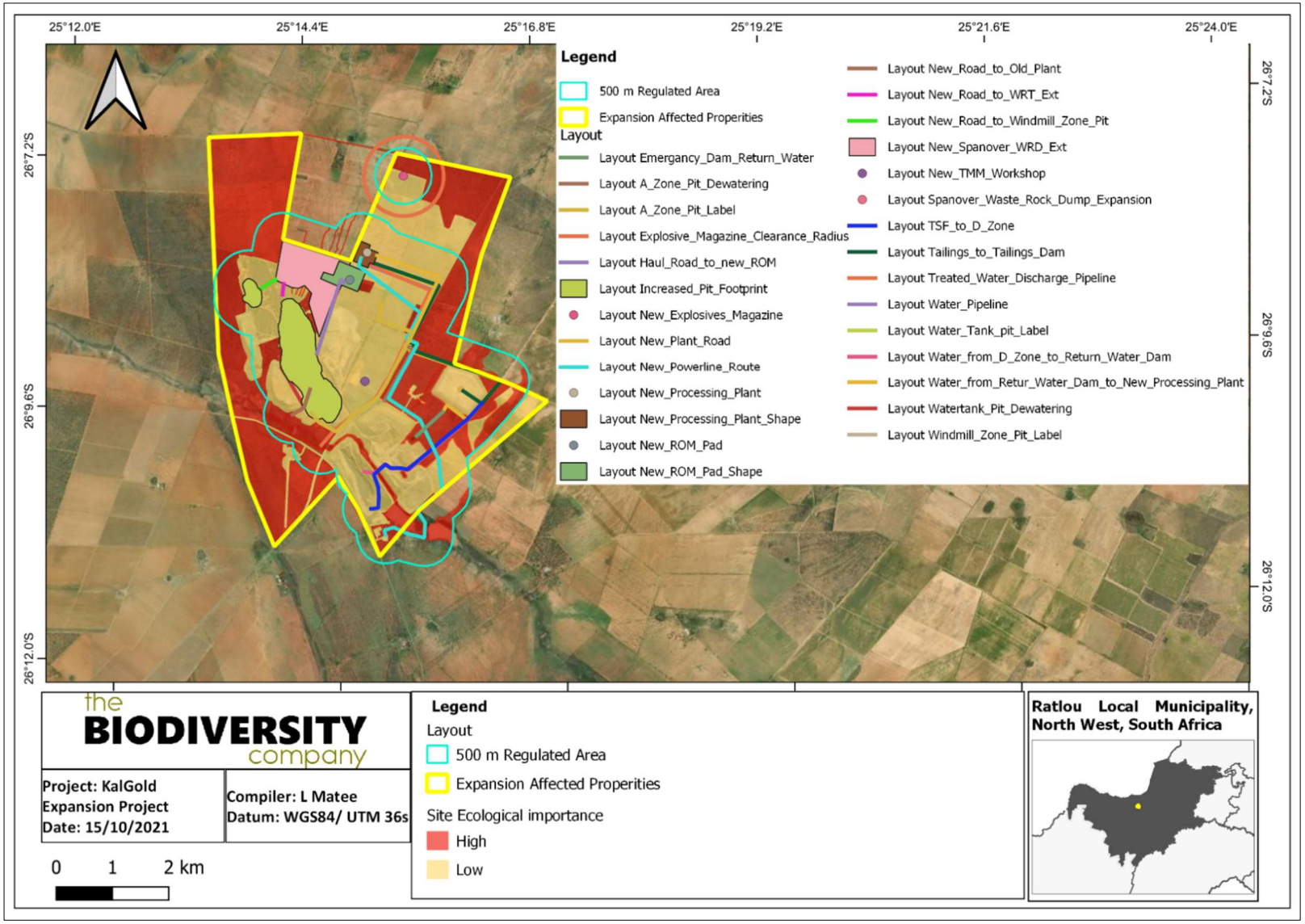


Figure 17: The layout of the infrastructure superimposed over the sensitivities in the area

8.8 FAUNA

Faunal assessment at the proposed project area included the following faunal categories: avifauna, mammals as well as reptiles and amphibians. The regional species expected to occur on site for each faunal category are presented below.

8.8.1 AVIFAUNA

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 309 bird species have the potential to occur in the vicinity of the project area (pentads 2605_2505; 2605_2510; 2605_2515; 2610_2505; 2610_2510; 2610_2515; 2615_2505; 2615_2510; 2615_2515). Of the potential bird species, nineteen (19) species (6.14%) are listed as SCC either on a regional (17) or global scale (11) (Table 11).

The SCC include the following:

- One (1) species that is listed as Critically Endangered (CR) on a regional scale;
- Four (4) species that are listed as Endangered (EN) on a regional basis;
- Four (4) species that are listed as Vulnerable (VU) on a regional basis; and
- Eight (8) species that are listed as Near Threatened (NT) on a regional basis.

On a global scale, one (1) species is listed as CR, two (2) species are listed as EN, two (2) species are listed as VU and six (6) species as NT (Table 11).

Table 11: List of bird species of regional or global conservation importance that are expected to occur at the site.

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Ardeotis kori	Bustard, Kori	NT	NT	High
Calidris ferruginea	Sandpiper, Curlew	LC[2]	NT	Moderate
Ciconia abdimii	Stork, Abdim's	NT	LC	Low
Ciconia nigra	Stork, Black	VU	LC	Moderate
Circus macrourus	Harrier, Pallid	NT	NT	Moderate
Coracias garrulus	Roller, European	NT	LC	Moderate
Falco biarmicus	Falcon, Lanner	VU	LC	High
Falco chicquera	Falcon, Red-necked	Unlisted	NT	High
Gyps africanus	Vulture, White-backed	CR	CR	Moderate
Gyps coprotheres	Vulture, Cape	EN	EN	Low
Mycteria ibis	Stork, Yellow-billed	EN	LC	High
Oxyura maccoa	Duck, Maccoa	NT	NT	High
Pelecanus rufescens	Pelican, Pink-backed	VU	LC	Moderate
Phoeniconaias minor	Flamingo, Lesser	NT	NT	Low
Phoenicopterus ruber	Flamingo, Greater	NT	LC	Low
Polemaetus bellicosus	Eagle, Martial	EN	VU	High
Rostratula benghalensis	Painted-snipe, Greater	NT	LC	Moderate

[2] Least Concern

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Sagittarius serpentarius	Secretarybird	VU	VU	High
Torgos tracheliotus	Vulture, Lappet-faced	EN	EN	Moderate

During the survey, 35 bird species were recorded (see Terrestrial Ecology Study). The following two of the species of conservation concern were noted:

- *Ardeotis kori* (Kori Bustard), and
- *Gyps africanus* (White-backed Vulture).

8.8.2 MAMMALS

The IUCN Red List Spatial Data (IUCN, 2017) lists 67 mammal species that could be expected to occur within the project area. Of these species, 8 are medium to large conservation dependant species, such *Ceratotherium simum* (Southern White Rhinoceros) and *Tragelaphus oryx* (Common Eland) that, in South Africa, are generally restricted to protected areas such as game reserves. These species are not expected to occur in the project area and are removed from the expected SCC list. They are however still included in the expected species list.

Of the remaining 59 small to medium sized mammal species, ten (10) (17%) are listed as being of conservation concern on a regional or global basis (Table 12).

The list of potential species includes:

- Four (4) that are listed as VU on a regional basis; and
- Six (6) that are listed as NT on a regional scale.

On a global scale, 1 species is listed as EN, 3 are listed as VU and 2 as NT (Table 12).

Table 12: List of mammal species of conservation concern that may occur in the project area as well as their global and regional conservation statuses (IUCN, 2017; SANBI, 2016).

Species	Common name	Conservation Status	
		Regional (SANBI, 2016)	IUCN (2017)
Aonyx capensis	Cape Clawless Otter	NT	NT
Atelerix frontalis	South Africa Hedgehog	NT	LC
Crocuta crocuta	Spotted Hyaena	NT	LC
Felis nigripes	Black-footed Cat	VU	VU
Mystromys albicaudatus	White-tailed Rat	VU	EN
Panthera pardus	Leopard	VU	VU
Parahyaena brunnea	Brown Hyena	NT	NT
Poecilogale albinucha	African Striped Weasel	NT	LC
Rhinolophus denti	Dent's Horseshoe Bat	NT	LC
Smutsia temminckii	Temminck's Ground Pangolin	VU	VU

Seventeen (17) mammal species were observed in the project area. Two of these species were of conservation concern. According to personnel at the Kalgold Mine, the Cheetah (*Acinonyx jubatus*) is often recorded within the project area and surrounds, this was however not confirmed during the survey. The following species of conservation concern were noted on site:

- *Acinonyx jubatus* (Cheetah)
- *Parahyaena brunnea* (Brown Hyaena)

8.8.3 HERPETOFAUNA (REPTILES AND AMPHIBIANS)

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the Reptile Map database provided by the Animal Demography Unit (ADU, 2019) 20 reptile species have the potential to occur in the project area. None of the expected species are SCCs (IUCN, 2017).

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the Amphibian Map database provided by the Animal Demography Unit (ADU, 2017) 16 amphibian species have the potential to occur in the project area. One (1) amphibian species of conservation concern should be present in the project area according to the above-mentioned sources but in situ confirmation is required (Table 13).

Table 13: List of reptile species of conservation concern that may occur in the project area as well as their global and regional conservation statuses (IUCN, 2017; *Bates et al*., 2014).

Species	Common name	Conservation Status		Likelihood of Occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Crocodylus niloticus	Nile Crocodile	VU	LC	Low

Five reptiles and no amphibian species were recorded in the project area during the survey. None of the herpetofauna species recorded are regarded as threatened, albeit all are protected under provincial legislation. This can be attributed to the timing of the survey as well as the fact that no pitfall trapping was done. Species richness and capture rates are dependent on the time of the year, time of the day and length of survey period as well as weather conditions

8.9 HYDROLOGY

Hydrologic Consulting conducted a Hydrological Impact Assessment Study for the proposed expansion and the report is presented in Appendix D. The aim of the hydrological study was to determine the potential hydrological impacts related to the proposed expansion and associated works, to provide a Storm Water Management Plan and to update the Water Balance.

8.9.1 SURFACE HYDROLOGY

The site is positioned within quaternary catchment D41B which is drained by the primary Setlagole River.

Figure 18 presents the WMA and quaternary catchment in relation to the study site. The site is intersected by the Morokwa River which is the most significant watercourse in the region (about the site). The Morokwa River is classified as a non-perennial river according to the NGI's 1:50,000 topographical map data.

Two minor non-perennial tributaries to the Morokwa River intersect the site, while a third minor non-perennial river (which is not a tributary to the Morokwa River), intersects the north-eastern corner of the site (

Figure 18). A few dams are also noted within the site (according to the NGI's 1:50,000 topographical map data) and are generally located along the Morokwa River. One exception to this is the small dam to the south-west of the TSF. Open reservoirs are also noted, although these are understood to be part of the mining operation and thereby not fed by natural upstream/upslope catchments.

8.9.2 HYDROLOGICAL SENSITIVITY

Sensitivity mapping was undertaken to identify sensitive features relating to the hydrological (surface water) environment within the site and is indicated in Figure 19. This illustrates that the proposed expansion infrastructure falling within the identified areas of sensitivity.

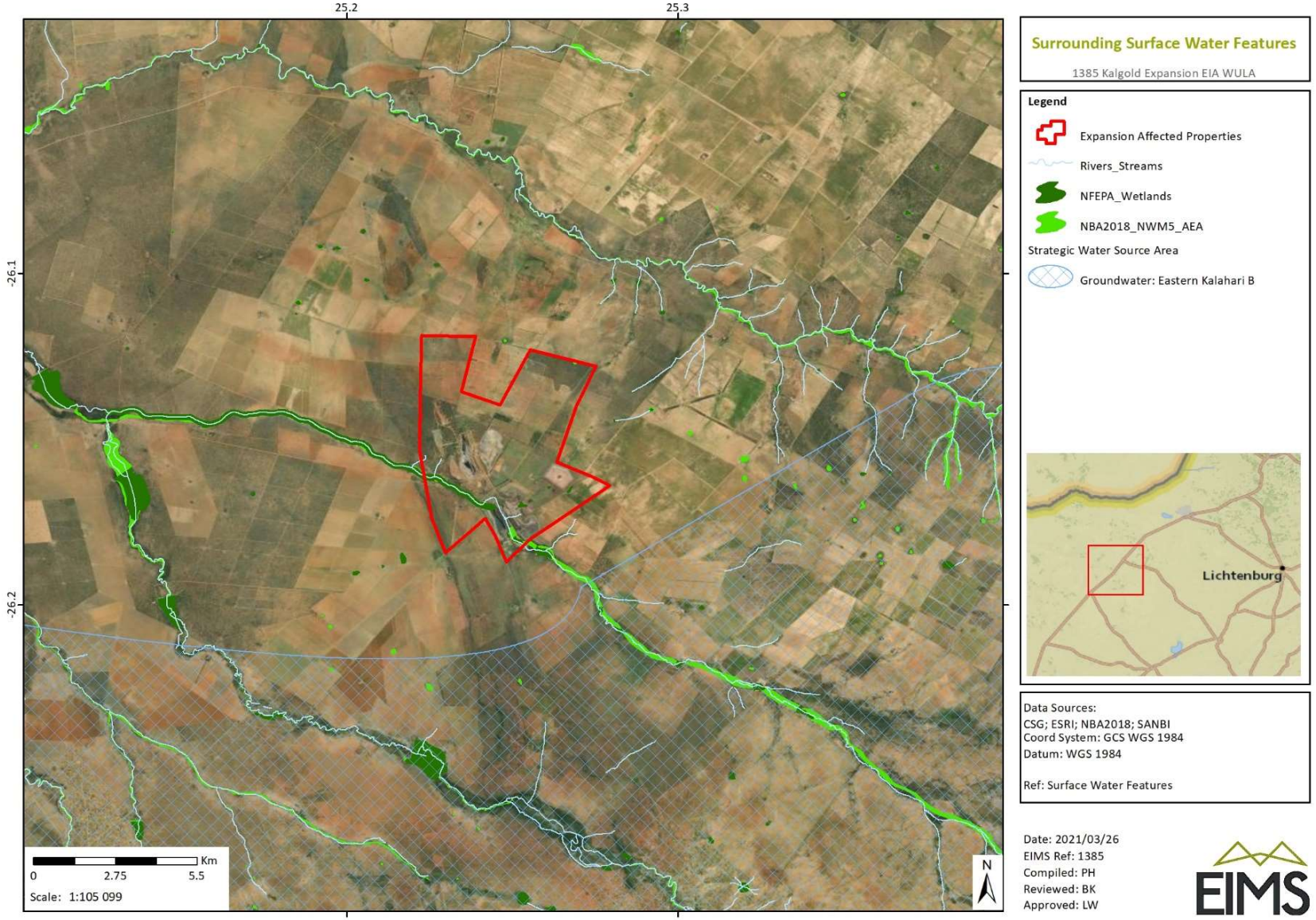


Figure 18: Summary of hydrological setting

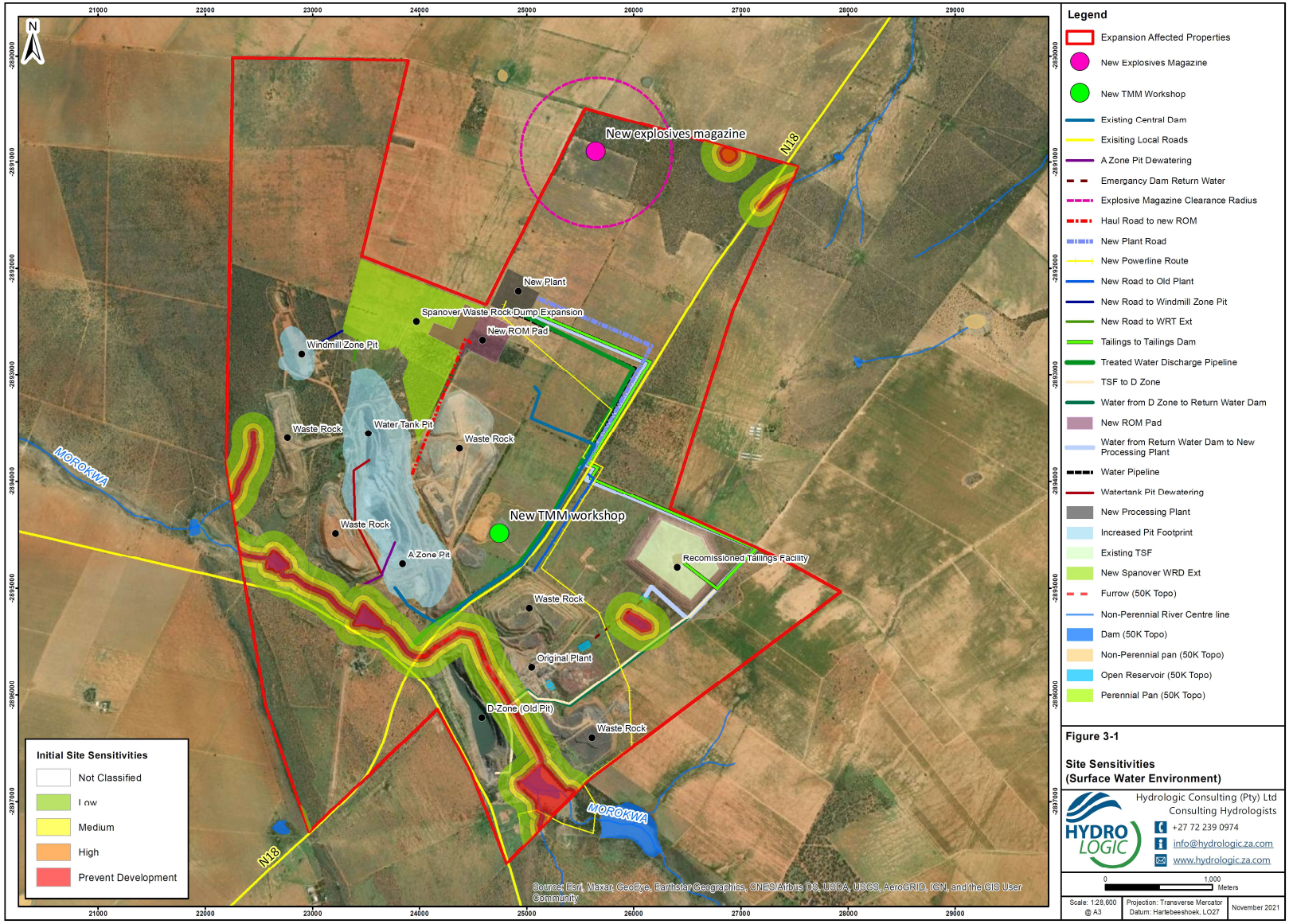


Figure 19. Site identified hydrological sensitives.

8.10 WETLANDS

A Wetland Impact Assessment was conducted in November 2021 by The Biodiversity Company to assess all aspects of the proposed expansion and the report is presented in (Appendix D). The survey included assessing all the wetland indicators as well as assessing the integrity or health of the wetland, the wetland's ability to provide goods and services (eco-services) and the EIS of the wetlands.

8.10.1 WETLAND DELINEATION

The wetland areas were delineated in accordance with the DWAF (2005) guidelines. Two natural wetland units were identified within the development envelope, namely HGM 1 and 2 (unchanneled valley bottom wetlands) (Figure 20). In addition, some artificial wetlands, drainage features and a riparian system were identified . The latter has comprehensively been assessed during the aquatics baseline assessment. The artificial system has been formed due to continuous leaks occurring upstream of the system where dust suppression vehicles refill. This system has therefore been disregarded from the assessment.

Even though HGM 1 seems to form at the edge of the existing TSF, historic imagery suggests that a wetland system was present before the construction of this facility, hence the classification of natural. The overall wetland health for both HGM systems was determined to be Seriously Modified (E). The higher hydrological modification can be explained by the presence of a large TSF which significantly modifies the surface and sub-surface flows of the system. For similar reasons, the geomorphological modifications are slightly higher for HGM 1 than for HGM 2 due to the obstructive nature of the mentioned TSF as well as the mining areas (including open cast pit) to the southern portion of HGM 1. The vegetation component of HGM 2 has been modified significantly more than HGM 1 due to the entire extent of the wetland being covered in crop fields. This phenomenon ultimately has resulted in natural vegetation being removed with the land cover being bare for long periods throughout the year after harvesting.

The Ecological Importance and Sensitivity (EIS) for both HGMs was calculated to be of Moderate importance. The wetlands in were determined to have a "Low" importance and sensitivity.

8.10.2 WETLAND SENSITIVITY

Based on the sensitivity rating methodology HGM 1 and the riparian zone has been scored "Medium Sensitivity" due to the fact that linear components are proposed to cross and impede into these systems (Figure 21). As for HGM 2, the drainage features and the artificial wetland, least concern sensitivity scores are applicable. Besides the fact that the latter two are deemed non-sensitive, no impacts are foreseen to these systems by means of any of the proposed components.

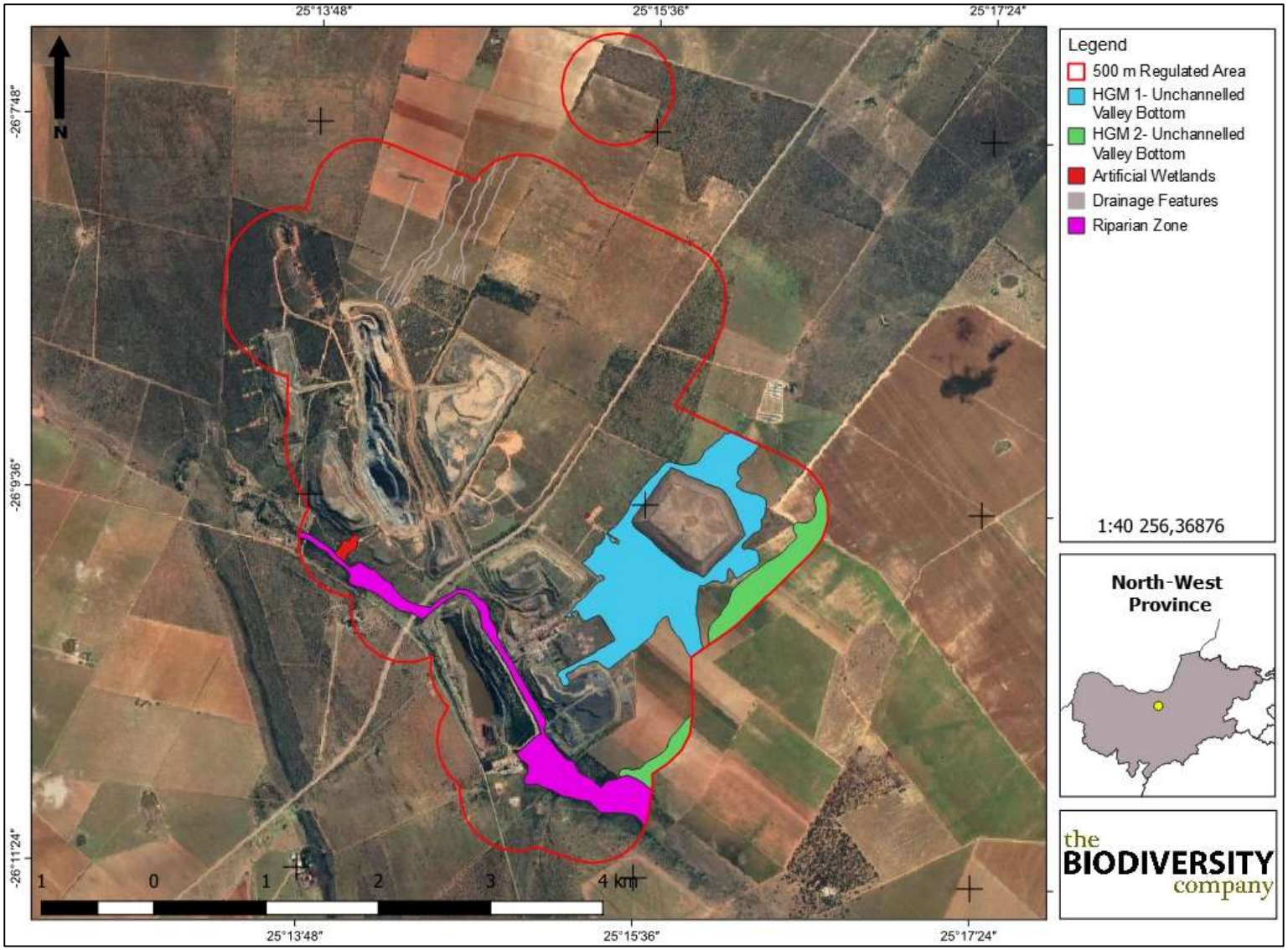


Figure 20: Delineation of wetlands within project area

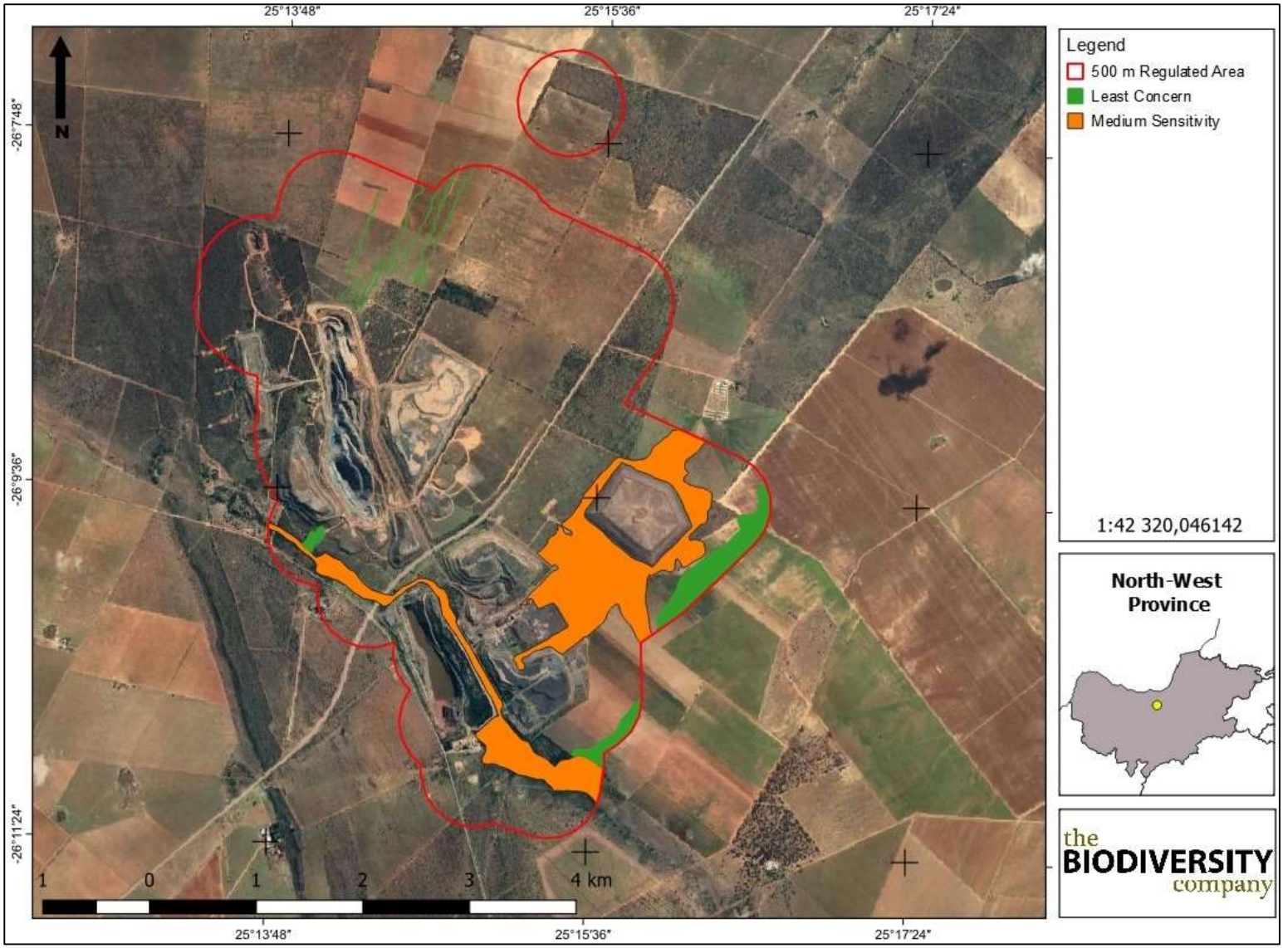


Figure 21: Overall sensitivity of identified features

8.11 GEOHYDROLOGY (GROUNDWATER)

A geohydrology study was undertaken by M van Biljoen in October 2020 and updated in March 2021, the full report is presented in Appendix D. The geohydrology of the study area was assessed based on available mine monitoring data and previous studies and limited additional field work. The geohydrological setting and conceptual model of the study area is described according to the following criteria:

- Hydro census and borehole information;
- Aquifer type;
- Aquifer parameters;
- Groundwater gradients and flow; and
- Aquifer classification.

8.11.1 HYDROCENSUS

Auctus (2011) conducted a hydro census on all the neighbouring farms. The hydro census was conducted within an approximate radius of 5km around the mine. Twenty-nine boreholes were identified within this radius and included private as well as selected mine boreholes. The hydro census information is summarised in the groundwater report in Appendix D. It is important that the hydro census boreholes are shown in this assessment as some of them may be impacted on if contamination from the tailings deposition occur. Over the years Kalgold also drilled additional boreholes including several water supply and dewatering boreholes. Information from all available boreholes were utilised in understanding the geohydrological regime. Detailed hydro census results are presented in the groundwater report in Appendix D.

8.11.2 AQUIFER TYPE

The available information suggests the presence of the following aquifers in the modelled area, as illustrated in the schematic cross section in Figure 22 .

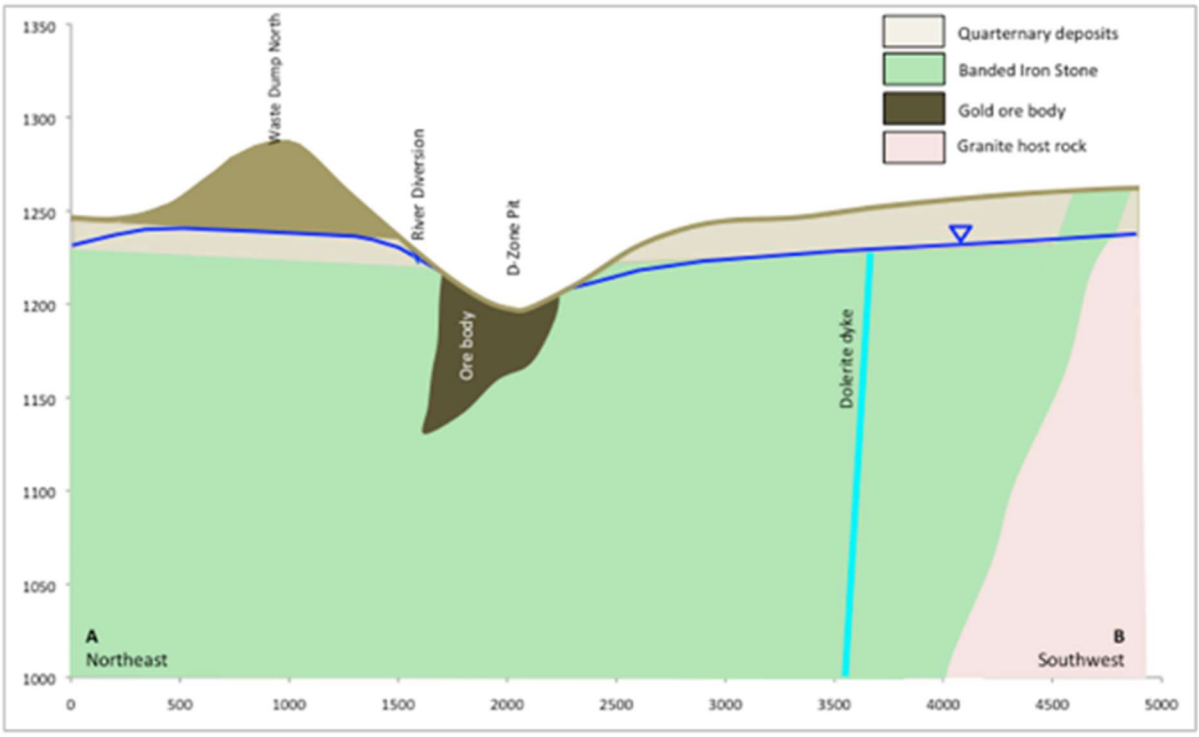


Figure 22: Schematic cross-section showing different aquifers

The following aquifers are present in the vicinity of Kalgold mine (Auctus, 2011):

- The quaternary Kalahari sand, which covers the project area, forms an intergranular, unconfined aquifer in the upper 30m of the geological succession. The deposit consists typically of sand and silt. The rate of recharge to the aquifer is normally below 1% of the Mean Annual Precipitation (MAP). It is however assumed, based on groundwater level information that the three boreholes with shallow groundwater levels of ±10m (WB168, WB114 and KFBH15) are possibly drilled into this aquifer. A groundwater mound has potentially formed underneath the waste rock dump at the D-Zone Pit, which may result in a slightly elevated groundwater level in that area. In intergranular porous deposits, like the Kalahari sands, aquifer parameters are reasonably homogeneous. There is currently no aquifer parameter information available for this aquifer in the study area and literature-based values have therefore been used to quantify this aquifer. It is unclear whether this aquifer is laterally extensive over the project area, but the aquifer is probably recharged seasonally with rainwater and therefore could contribute to water make in the pits. If boreholes are used regionally to abstract groundwater from this aquifer, the yield per borehole is expected to be 0.10 – 0.50 litres per second (ℓ/s), which is low.
- A deeper fractured rock aquifer is formed by bedding planes, fractures and faults in the weathered and competent meta-sediments of the Kraaipan Greenstone Belt. In fractured rocks, the interconnected discontinuities are considered to be the main passage for groundwater flow and the solid rock blocks considered to be of very low permeability or impermeable. Despite the absence of geological logs, the aquifer characteristics obtained from the recently pumped boreholes are thought to represent this aquifer. Inherently, these types of aquifers are heterogeneous, as is evident from the pump test information, which indicates that the transmissivity in this aquifer varies between 0.90 and 346 m^3/day. The fractured rock aquifer will be recharged through rainwater infiltrating from the overlying intergranular aquifer or through direct recharge where the Banded Iron Formation (BIF) outcrops. The depth to groundwater in this aquifer is on average 25m, based on measurements in the monitoring boreholes thought not to be affected by mining or groundwater abstraction. Aquifer test information suggests that the aquifer could yield 0.50 – 3.0 ℓ/s, which is higher than that recorded for the intergranular Kalahari sand aquifer.

8.11.3 GROUNDWATER FLOW

Groundwater levels were measured as a first step to determine the regional groundwater gradients and flow directions. Typically, a linear relationship exists between the depth to groundwater and the topography, since groundwater normally drains under gravity towards streams and rivers. At Kalgold, however, a poor correlation (36%) exists, and it cannot be assumed that groundwater flow mimics the topography. The disturbance in this relationship is caused by the dewatering around Watertank and A-Zone pits, as well as the cone of depression around D-zone pit.

Contouring of the measured groundwater levels indicate that the regional groundwater flow is primarily towards the dewatering cone in the vicinity of the various mining pits (Figure 23).

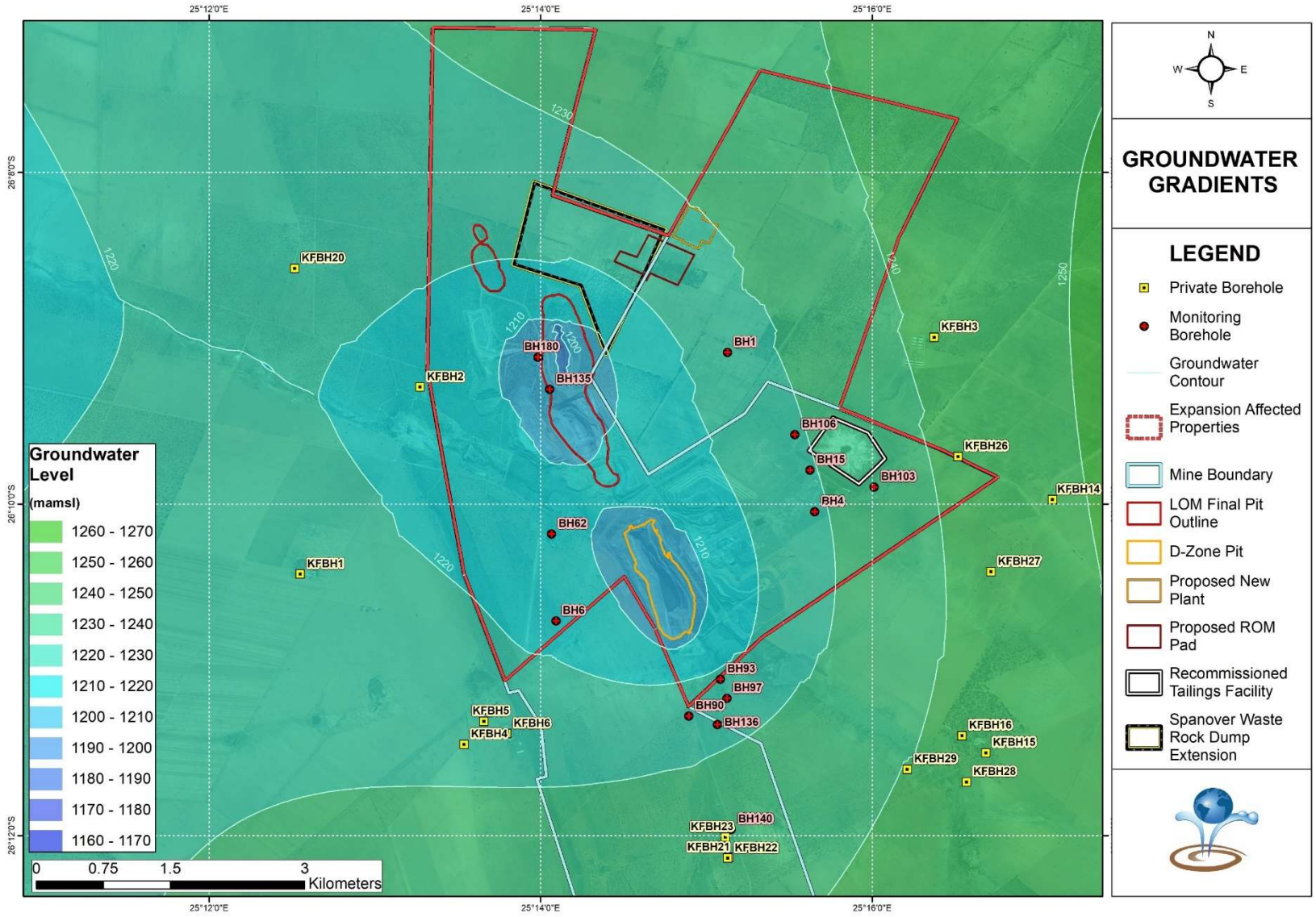


Figure 23: Regional groundwater gradient

8.11.4 AQUIFER CLASSIFICATION

The aquifer classification system used to classify the aquifers is the proposed National Aquifer Classification System of Parsons (1995). This system has a certain amount of flexibility and can be linked to second classifications such as a vulnerability or usage classification. Parsons suggests that aquifer classification forms a very useful planning tool that can be used to guide the management of groundwater issues. He also suggests that some level of flexibility should be incorporated when using such a classification system. The South African Aquifer System Management Classification is presented by five major classes.

The following definitions apply to the aquifer classification system:

- Sole source aquifer system: "An aquifer that is used to supply 50 % or more of domestic water for a given area, and for which there are no reasonable alternative sources should the aquifer become depleted or impacted upon. Aquifer yields and natural water quality are immaterial".
- Major aquifer system: "Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good".
- Minor aquifer system: "These can be fractured or potentially fractured rocks that do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although this aquifer seldom produces large quantities of water, they are both important for local supplies and in supplying base flow for rivers".
- Non-aquifer system: "These are formations with negligible permeability that are generally regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, groundwater flow through such rocks does occur, although imperceptible, and needs to be considered when assessing risk associated with persistent pollutants".
- Special aquifer system: "An aquifer designated as such by the Minister of Water Affairs, after due process".

After rating the aquifer system management and the aquifer vulnerability, the points are added together to obtain a Groundwater Quality Management (GQM) index. Based on the above, the aquifers in the study area are classified as follows:

Table 14: Aquifer Classification

Description	Aquifer	Vulnerability	Rating	Protection
Weathered Aquifer	Minor (2)	2	4	Medium
Fractured Aquifer	Sole Source (6)	2	8	High

Since the fractured aquifer is the sole water supply to the farms in the region it is regarded as a sensitive and important aquifer that needs high level protection.

8.11.5 SIMULATED TOTAL GROUNDWATER INFLOW VOLUMES

The mining schedule estimated a Life of Mine (LOM) of approximately 10 years after July 2024. The ore tonnages peak at approximately 300 000 tons per month. Monthly tailings deposition from July 2024 will be 260 000 tons into D-Zone and 40 000 tons on the existing TSF that will be recommissioned as part of the expansion. This information formed the basis of assumption made in the geohydrological simulations.

The unavoidable inflow of groundwater into the opencast pits and the pumping of this water will have an impact on the groundwater levels near the mining operations. The based on the geohydrological simulations, dewatering impact is illustrated in Figure 24, which shows the expected groundwater drawdown cone at the end of mining (FY34).

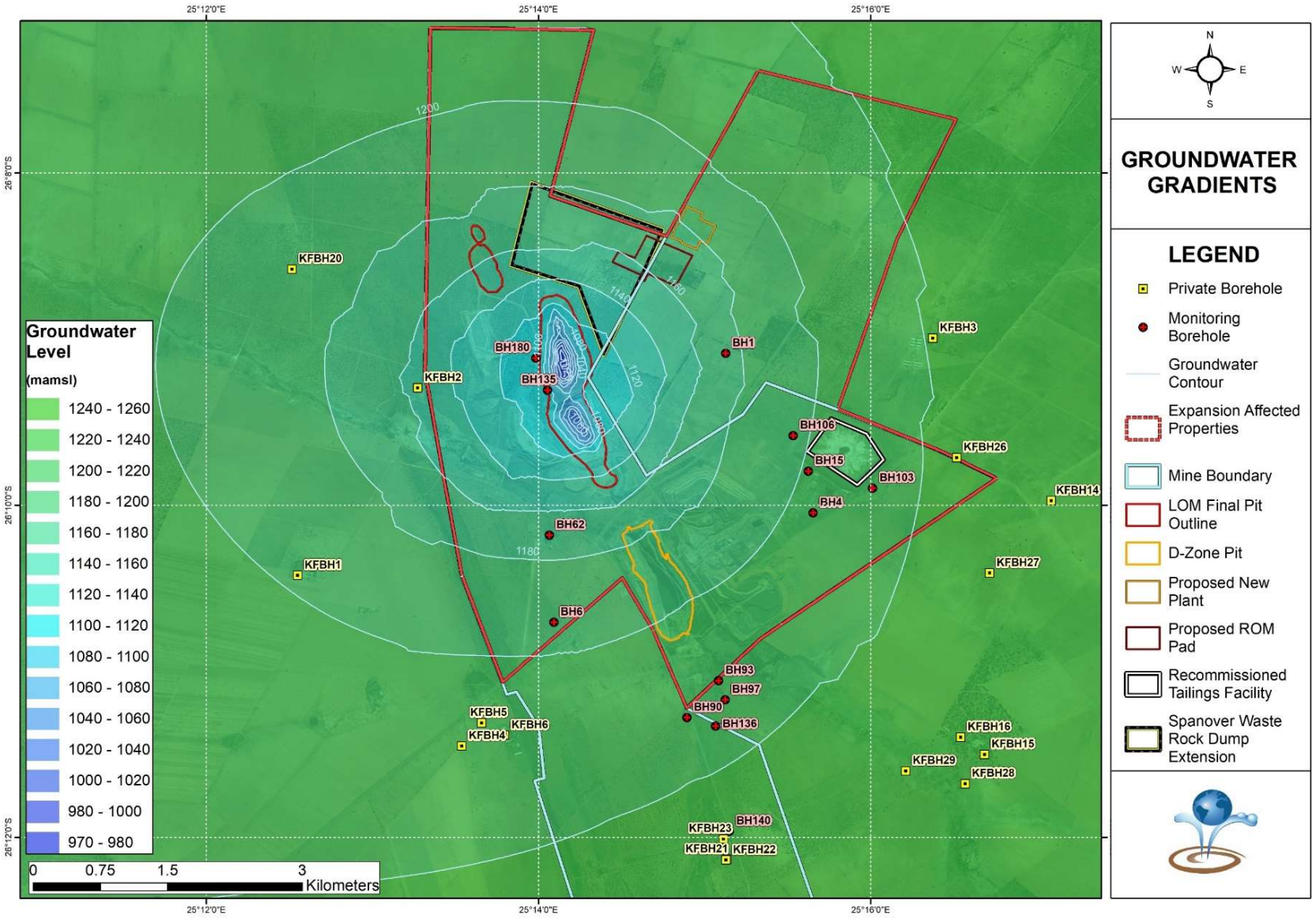


Figure 24: Simulated groundwater drawdown at the end of mining (2034)

There are four (4) private boreholes that may potentially be impacted by this dewatering (see Figure 24 for the locations referred to below). These include:

- KFBH1: Potential 21m drop in the groundwater level expected.
- KFBH2: Potential 57m drop in the groundwater level expected, which may cause this borehole to dry up.
- KFBH3: Potential 17m drop in the groundwater level expected.
- KFBH20: Potential 28m drop in the groundwater level expected.

It is recommended that these boreholes be included in the mine monitoring programme to verify the findings of this simulation. Borehole KFBH2 may need to be replaced if the simulations prove to be correct. It is further recommended that the groundwater levels in the "High and Medium Risk" categories are measured quarterly to verify model predictions and to act if necessary. The depths of these boreholes should also be confirmed.

During the operational phase of the mine the water will be pumped from the opencast operations. Post-closure this pumping will cease, and the groundwater level will recover. It is estimated that it will take approximately 25 years to recover to the average pre-mining groundwater level. Due to the high evaporation rates in the region the pits will always, if left open, act as a sink and groundwater flow will be towards the pits.

8.11.6 GROUNDWATER QUALITY IMPACTS

Waste assessment and waste classification studies were recently undertaken (See Appendix D). Distilled water shake flask tests were performed on the waste rock and the tailings samples to determine which soluble constituents are present in the material. There are no elements exceeding the Leachable Concentration Threshold (LCT0) for any of the samples, indicating a low contaminant seepage risk.

The contaminant plume migration from the Kalgold waste bodies were simulated with the numerical model. Total Dissolved Solids (TDS) was selected as a conservative tracer that represents the migration of contaminants through the aquifer. The simulated contaminant plume at the end of mining is shown in Figure 25.

The following post-closure alternatives were simulated as part of the geohydrological studies:

- Alternative 1: In the first scenario the Watertank and A-Zone pits will be left open or backfilled with tailings material if required. If backfilled the groundwater levels will revert to pre-mining water levels. The WRD will be removed (sold as aggregate), and the TSF will remain in its current position i.e. it does not get reclaimed and will be capped and vegetated. This option is currently the preferred option according to which the mining feasibility is planned.
- Alternative 2: In the second scenario the Watertank and A-Zone pits remain open. In this instance the pit will fill with water, which will remain below the regional groundwater level due to evaporation. The pit will act as a sink and will continue to draw groundwater towards it. The WRD's will remain in their current position, and it is assumed that the TSF will be capped and vegetated.

In each instance the two alternatives are compared to the do-nothing scenario in which the pits remain open, the WRD's will remain and the TSF will be uncapped. In other words, no rehabilitation measures will be implemented. The results of these simulations are presented in Figure 26 (Alternative 1) and Figure 27 (Alternative 2).

It is evident from the figures below that while the pits remain open after closure they continue to act as sinks, drawing water towards them and therefore containing any contamination within the pits. With the backfilling of the pits and the removal of the WRD, the impacted footprint areas clean-up after some time. In this scenario the contaminant plume from the TSF migrates towards D-zone as opposed to towards A-Zone if the pits remain open. If the TSF is capped the recharge rate reduces significantly, but the contamination currently in the groundwater continues to migrate down-gradient. It will, however, clean-up quicker than when it is not capped.

The numerical modelling and risk assessment concluded the following:

- The potential lowering of the groundwater level is regarded as a low risk and if the recommended mitigation is implemented the risk reduces even further..
- The recommissioning of the TSF will contribute marginally to the contaminant load. The capping and vegetating of the TSF will largely terminate additional load to the groundwater system after mine closure. The contaminants that entered the system during the operational phase will continue to migrate after closure.
- D-Zone pit will be filled with tailings to just below the original groundwater level of 1 210 mamsl. A pool of water will remain within the pit and the pit will act as a sink. Groundwater flow would therefore be towards D-Zone pit and any contamination will be contained within the immediate vicinity of the pit. If, however, the Watertank and A-Zone pits are also left open the groundwater level in these pits is expected to be lower than that in D-Zone, due to a larger surface area and higher evaporation. In this instance water from D-Zone will be pulled towards Watertank and A-Zone pits
- Removal of the WRD's and its associated impacts is considered slightly more advantageous, if it is an economical viable option.
- Both alternatives are acceptable in terms of groundwater contamination as the potential pollution will largely be restricted to the mining footprint.
- Mitigation to minimize the groundwater impacts post-closure includes the rehabilitation of the TSF. The rehabilitation is assumed to include the capping and vegetation of the tailings facility. If the TSF is capped the recharge rate reduces significantly, but the contamination currently in the groundwater continues to migrate down-gradient. It will, however, clean up quicker than when it is not capped and is expected to clean up 25 – 30 years after rehabilitation.

The simulations have indicated that in all instances the contaminant plumes are contained and irrespective of the rehabilitation option chosen, the private groundwater users will not be impacted during mining or after closure.

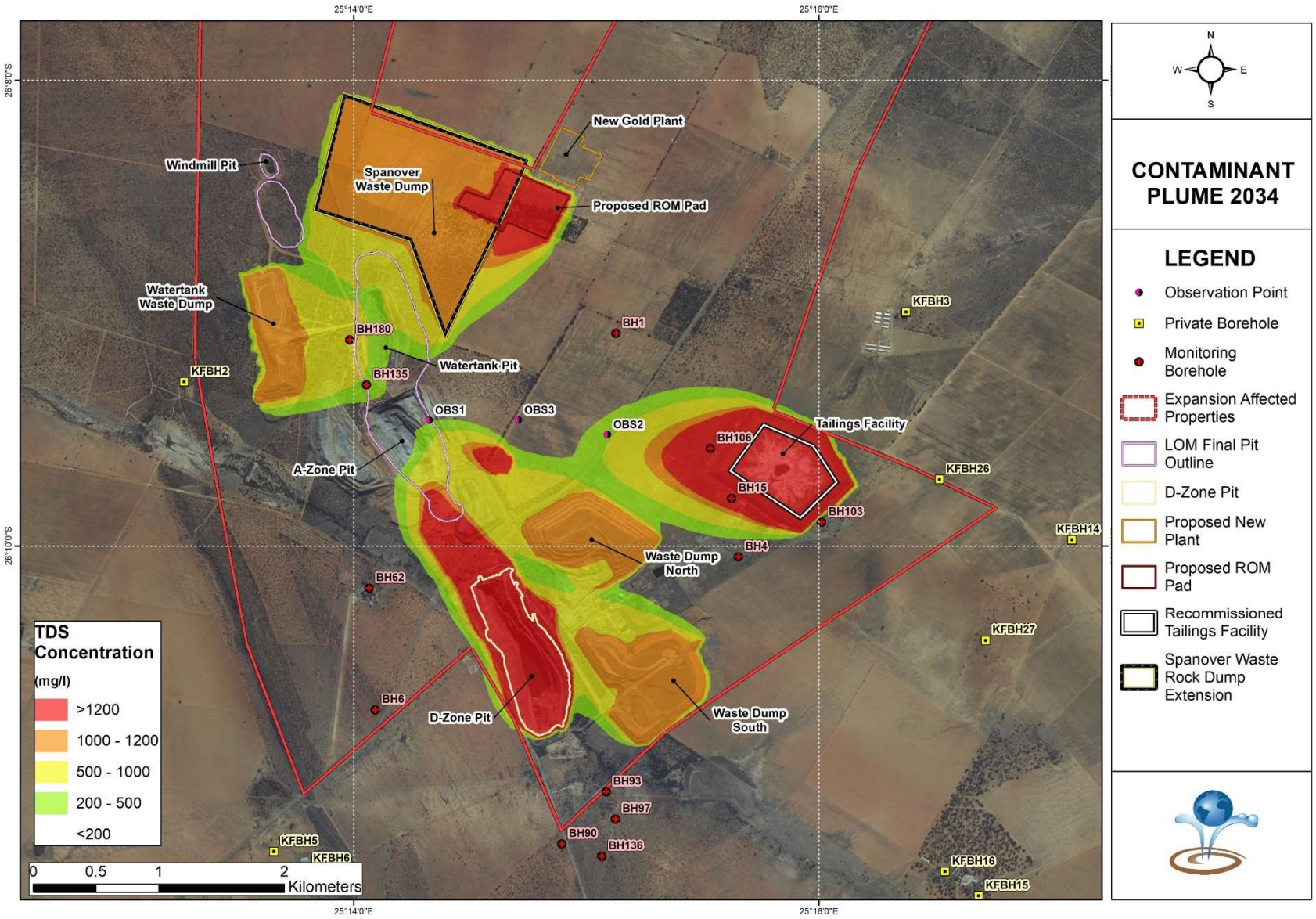


Figure 25: Simulated TDS plume at the end of mining (2034)

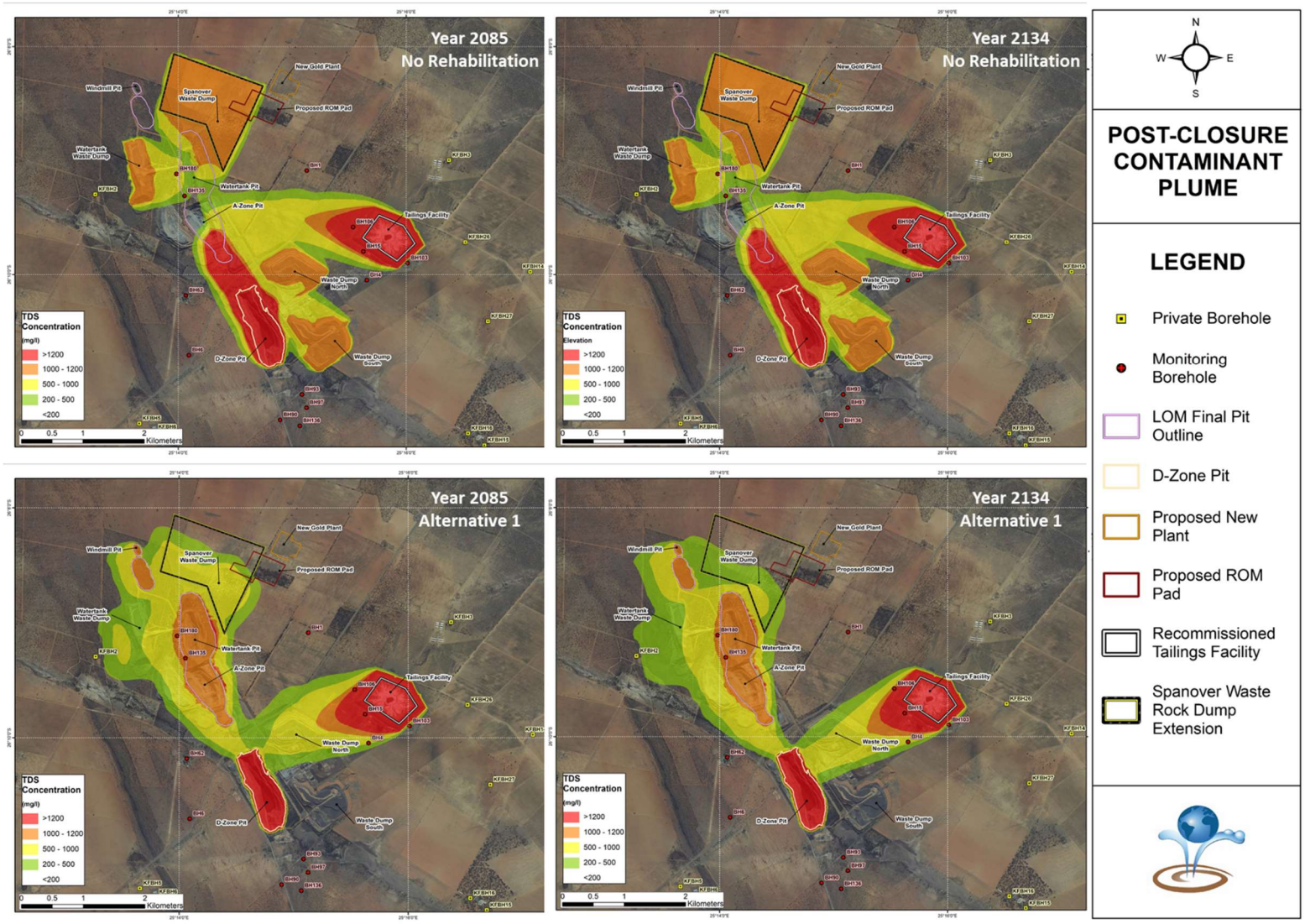


Figure 26: Comparison between contaminant plumes after 50 and 100 years – post-closure alternative 1 (pits backfilled with waste rock and TSF capped)

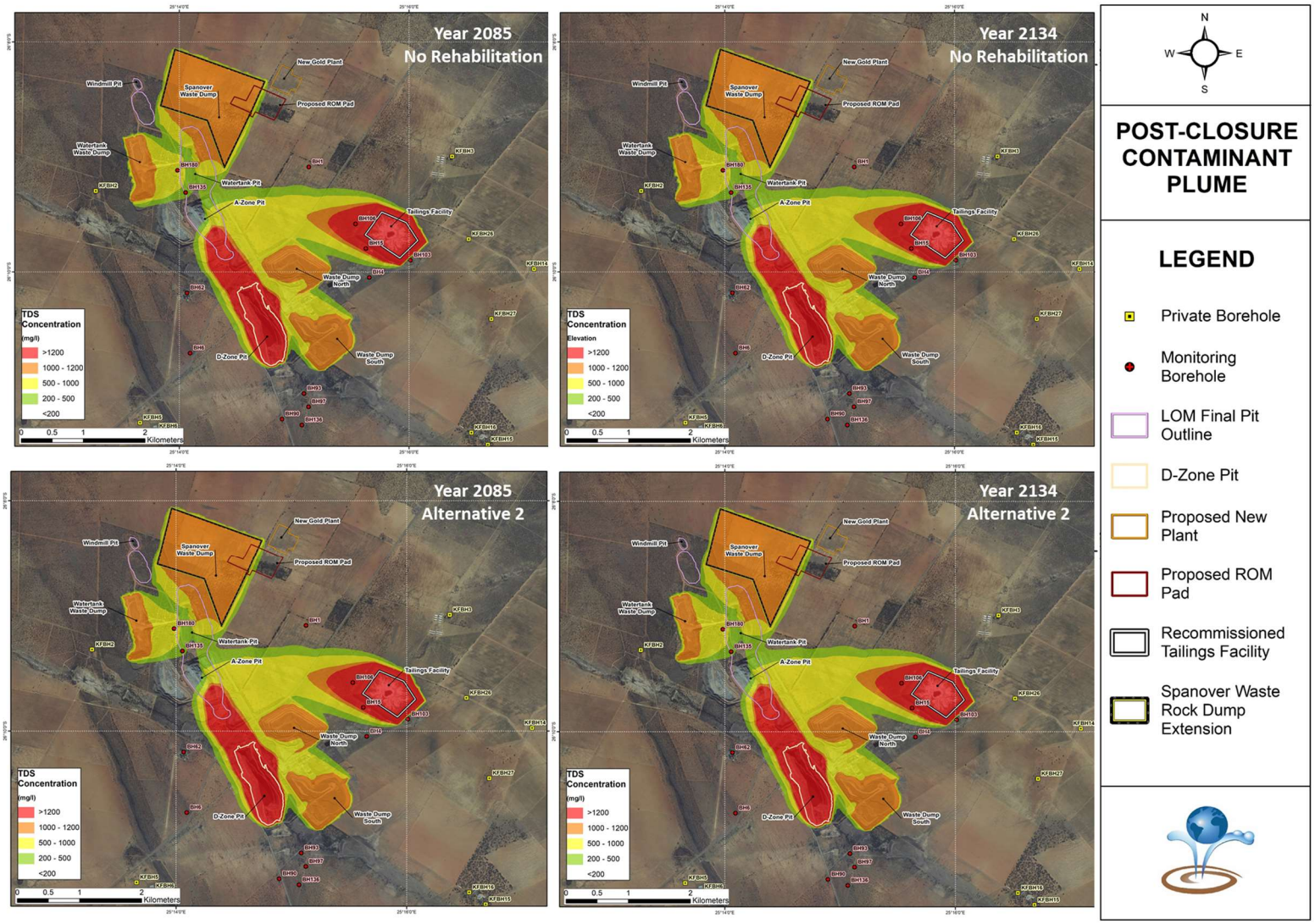


Figure 27: Comparison between contaminant plumes after 50 and 100 years – post-closure alternative 2 (pits open, WRD's remain and TSF capped).

8.12 AIR QUALITY

The air quality impact study was undertaken by Airshed Planning Professionals (Pty) Ltd in December 2021. The findings of the study are presented in this section, full details are presented in Appendix D.

8.12.1 AIR QUALITY SENSITIVE RECEPTORS

Air Quality Sensitive receptors (AQSR) in the surrounding area are identified as areas that may be impacted negatively due to emissions from the site. Examples of receptors include, but are not limited to, schools, shopping centres, hospitals, office blocks and residential areas. The sensitive receptors (within a 5km radius) identified in the area are presented in Table 15 .

Table 15: Sensitive receptors within a 5km radius

Receptor	Sensitive receptor description	Distance from site boundary (km)	Co-ordinates	
			Longitude	Latitude
R01	Neighbouring Farm	0.57	25.23152	-26.18991
R02	Neighbouring Farm	1.42	25.21098	-26.17402
R03	Neighbouring Farm	1.26	25.26321	-26.11359
R04	Neighbouring Farm	5.00	25.24546	-26.07454
R05	Neighbouring Farm	4.00	25.31348	-26.12076
R06	Neighbouring Farm	4.72	25.32589	-26.17147
R07	Neighbouring Farm	3.86	25.31043	-26.18452
R08	Neighbouring Farm	0.51	25.27014	-26.15222
R09	Neighbouring Farm	2.08	25.27640	-26.18993

8.12.2 LOCAL WIND FIELD

The vertical dispersion of pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of wind speed, in combination with surface roughness (Tiwary & Colls, 2010).

Wind roses comprise 16 spokes, which represent the directions from which winds blew during a specific period. The colours used in the wind roses below, reflect the different categories of wind speeds; the orange area, for example, representing winds in between 4 and 5 m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. Calm conditions are periods when the wind speed was below 1 m/s. Values of 0 m/s could be when there is no wind; or, when there may be wind, but it is below the anemometer starting threshold (AST).

The period wind field and diurnal variability in the wind field are shown in Figure 28 , while the seasonal variations in the wind field are provided in Figure 29. The wind field is dominated by winds from the east-north-east, north-east and east. These directions were associated with the strongest winds. The period average wind speed is 1.08 m/s with calm winds occurring 29.7% of the time. The day-time wind rose shows a predominant east-north-easterly and north-easterly winds. The average wind speed during the day is 1.47 m/s with calm winds occurring 21.58% of the time. The night-time is characterised by a higher frequency of calm conditions (39.12%) and dominant winds originating from the east with and average wind speed of 0.68 m/s. Summer, winter, autumn and spring show similar wind direction profiles to the period average with an increase in

southerly winds during Winter. The winds speeds are mostly lowest during Autumn and Winter; however, there are high frequency of winds above 4 m/s during Winter.

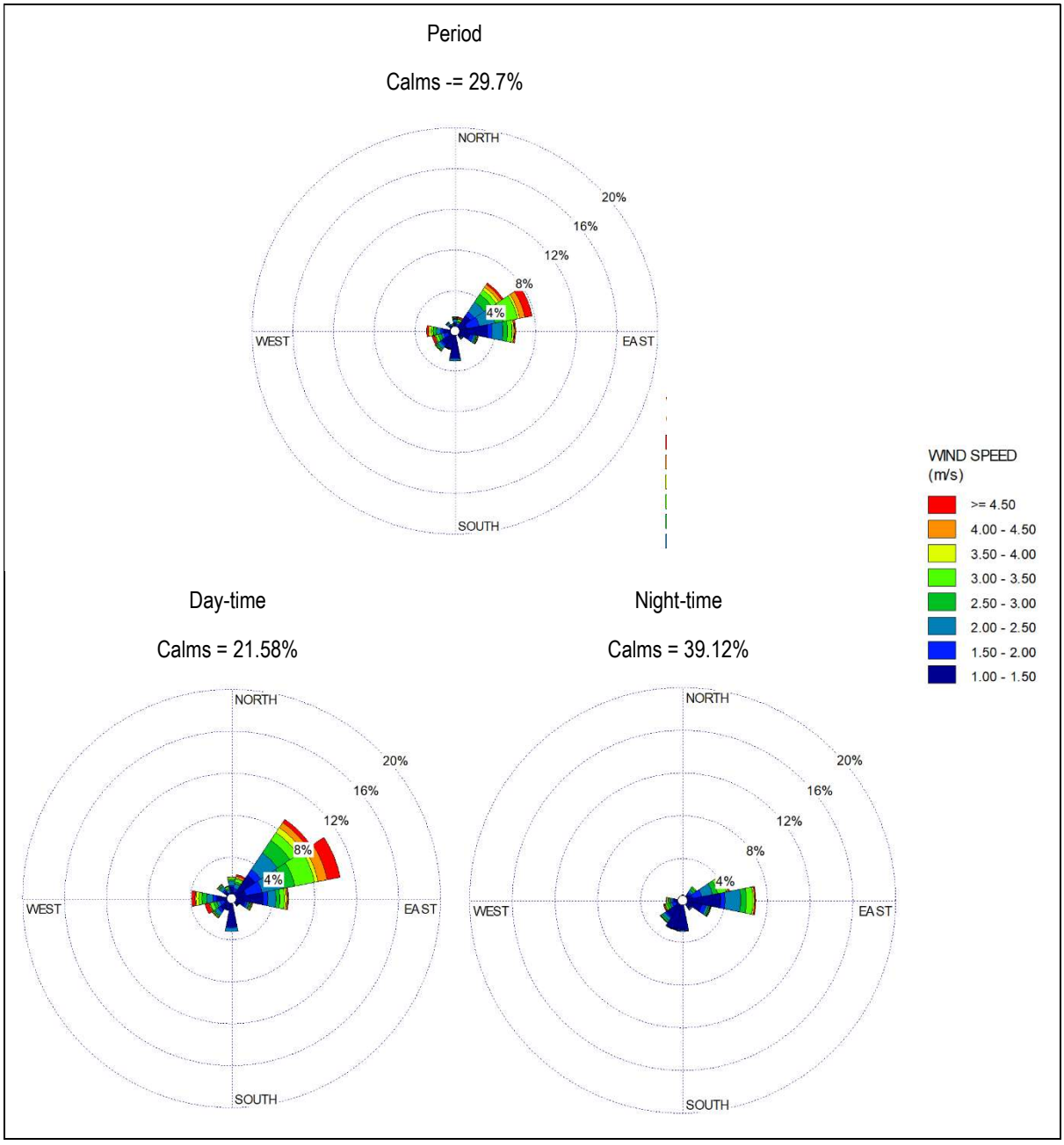


Figure 28: Period, day- and night-time wind roses (Harmony Kalgold Station August 2019 – September 2020)

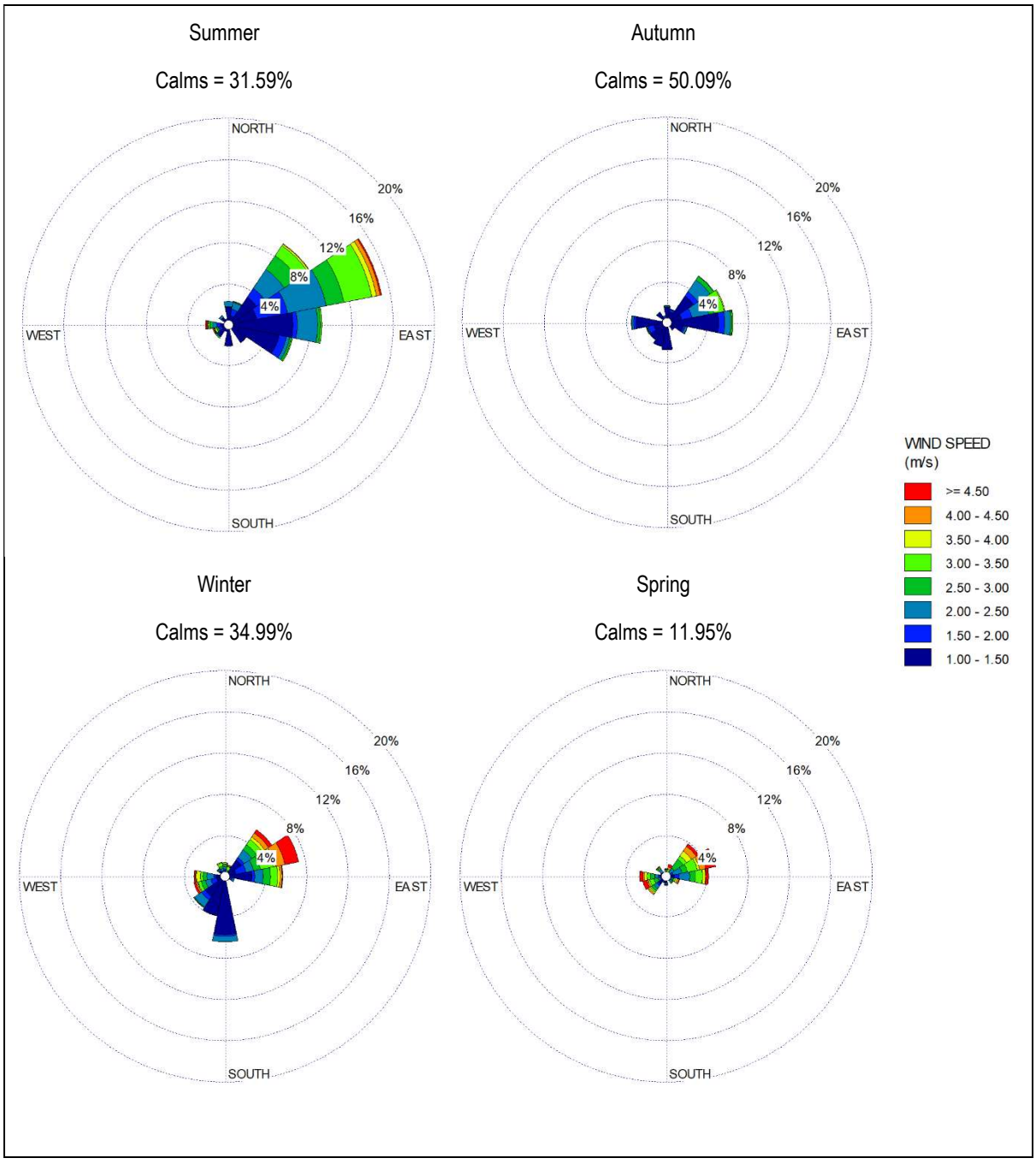


Figure 29: Seasonal wind roses (Harmony Kalgold Station August 2019 – September 2020)

8.12.3 EXISTING AIR QUALITY

The following is known for the existing air quality sources:

- **Regional Sources**: The area surrounding the Kalgold mine is a predominant agricultural zone consisting of beef, maize, sunflower and groundnut production. Currently the area surrounding Kalgold is being used for crop and livestock farming. Local sources include wind erosion from exposed areas, fugitive dust from agricultural and mining operations, vehicle entrainment from roadways and veld burning.
- **Agricultural Operations**: Activities associated with agriculture such as land tillage, land clearing by prescribed burning, animal feeding operations, mineral fertilizer application, fuel burning, movement of livestock and manure management often lead to gaseous and particulate pollutants being emitted

to the air. Pollutants usually associated with agricultural activities include NH_3, $PM_{2.5}$, PM_{10}, NOx, VOCs, CH_4, N_2O, and CO_2. However, some of the activities are intermittent and only happen seasonally hence the impacts are usually less.

- **Domestic Fuel Burning**: Many households burn fuel to meet all or a portion of their energy requirements. The main fuels with air pollution potentials used by households within the study region are gas, coal, wood and paraffin. Pollutants released from domestic fuels include CO, NO_2, SO_2, inhalable particulates and polycyclic aromatic hydrocarbons.
- **Biomass Burning**: The biomass burning includes the burning of evergreen and deciduous forests, woodlands, grasslands, and agricultural lands. Within the project vicinity, crop-residue burning and wildfires (locally known as veld fires) may represent significant sources of combustion-related emissions.
- **Vehicles Travelling on Public and Private Roads**: Possible contributors to mobile combustion emissions include two main roads, namely, R375 and N18, as well as other access and haul roads surrounding the site. Neighbouring communities are likely to use these routes daily to access the mine and nearby amenities and commercial areas.
- **Other Fugitive Dust Sources**: Fugitive dust emissions may occur because of vehicle entrained dust from local paved and unpaved roads, wind erosion from open areas and dust generated by agricultural activities (e.g., tilling) and mining. The extent of particulate emissions from the main roads will depend on the number of vehicles using the roads, and on the silt loading on the roadways.

The following pollutant concentrations and dust fall Rates are know based on existing monitoring on site:

- **Measured Particulate Matter Concentrations**: PM_{10} represents the size fraction that would be deposited in and can cause damage to the lower airways and gas-exchange chamber of the lungs. However, only data for the ambient PM_{10} concentrations were available. Based on the available data at the time of completing this report, the daily PM_{10} concentrations measured on-site are below the 24-hour NAAQS of 75 µg/m³; however, the data availability was low (17% in 2019, 29% in 2020, and 52% in 2021).
- **Measured Dust Fall Rates**: Based on existing dust monitoring programme there was only one exceedance of the National Dust Control Regulations (NDCR) limit for non-residential areas in 2020 (KG7/HAR07 during April 2020) thus the sampled dustfall rates are in compliance with the NDCR that year; however, four months of data was not provided for 2020. There was only one exceedance of the NDCR limit for non-residential areas at two sites in 2021 (KG7/HAR07 during July 2021 and KG4/HAR04 during August 2021) thus the sampled dustfall rates are in compliance with the NDCR that year; however, only 8 of the 12 months data was available.

8.12.4 SIMULATION RESULTS OF THE FUTURE OPERATIONS

The sources of atmospheric emissions during the operational phase associated with the proposed project include:

- **Particulate emissions from**
  - blasting
  - excavation.
  - material handling
  - crushing and screening.
  - bulldozing as part of waste dump management.
  - erosion of stockpiles, portions of the waste dumps and the TSF due to the wind lifting and dispersing loose material during high wind incidents (>5.4 m/s).
  - road surface material entrainment along the unpaved in-pit, haul roads and access road
  - grading of unpaved haul roads and access road.
- **Particulate and gaseous emissions from**
  - vehicles and equipment exhaust.
  - smelter, kiln and assay laboratory stacks.

The main findings from the simulation of potential pollutants conducted are as follows:

- **Construction, decommissioning/closure and post-closure phases:** The environmental risk rating related inhalation health, nuisance impacts and vegetation impacts are likely to be "low" without and with additional mitigation. The overall environmental risk rating is also expected to be "low negative".
- **Operational phase:** PM_{10}, $PM_{2.5}$ (particulate matter with diameter of less than 2.5 µm), total suspended particulates (TSP), sulphur dioxide (SO_2), oxides of nitrogen (NO_x), carbon monoxide (CO) diesel particulate matter (DPM), lead (Pb), hydrogen fluoride (HF), hydrogen chloride (HCL), chlorine (CH_2) and ammonia (NH_3) emissions and impacts were quantified. The following was noted from the simulations:
    - PM_{10} concentrations as a result of mitigated operations **are not within compliance at one AQSRs over the short-term** (24-hour average). Simulated annual average PM10 concentrations exceed the NAAQS of 40 µg/m^3 beyond the permit area (off-site) but not at any of AQSRs. The 24-hour NAAQS (4 days of exceedance of 75 µg/m3) is exceeded beyond the permit area (off-site) and **at one AQSR (isolated homestead R02**) (Figure 30).
    - Simulated annual average $PM_{2.5}$ concentrations exceed the current and future NAAQS of 20 µg/m^3 and 15 µg/m^3, beyond the permit area (off-site) **but not at any of AQSRs**. The current 24-hour NAAQS (4 days of exceedance of 40 µg/m^3) is exceeded beyond the permit area (off-site) **but not at any AQSRs**. The 24-hour future4 NAAQS (4 days of exceedance of 25 µg/m^3) is exceeded beyond the permit area (off-site) **but not at any AQSRs**.
    - PM_{10} and $PM_{2.5}$ concentrations as a result of mitigated operations are not within compliance off-site but are in compliance at all AQSRs over the short-term and long-term (annual average).
    - Dustfall rates are above the NDCR limits for non-residential areas and above 400 mg/m²-day at some agricultural areas; however, the dustfall rates are below the NDCR limits for residential areas at all AQSRs.
    - DPM does not exceed the United States Environmental Protection Agency (US EPA) Integrated Risk Information System (IRIS) Inhalation reference concentrations (RfC) at any AQSRs**.**
    - NOx concentrations **are in compliance** with the nitrogen dioxide (NO_2) NAAQS at all AQSRs over the long-term and short-term**.**
    - SO_2 and CO concentrations are below the NAAQ limit values.

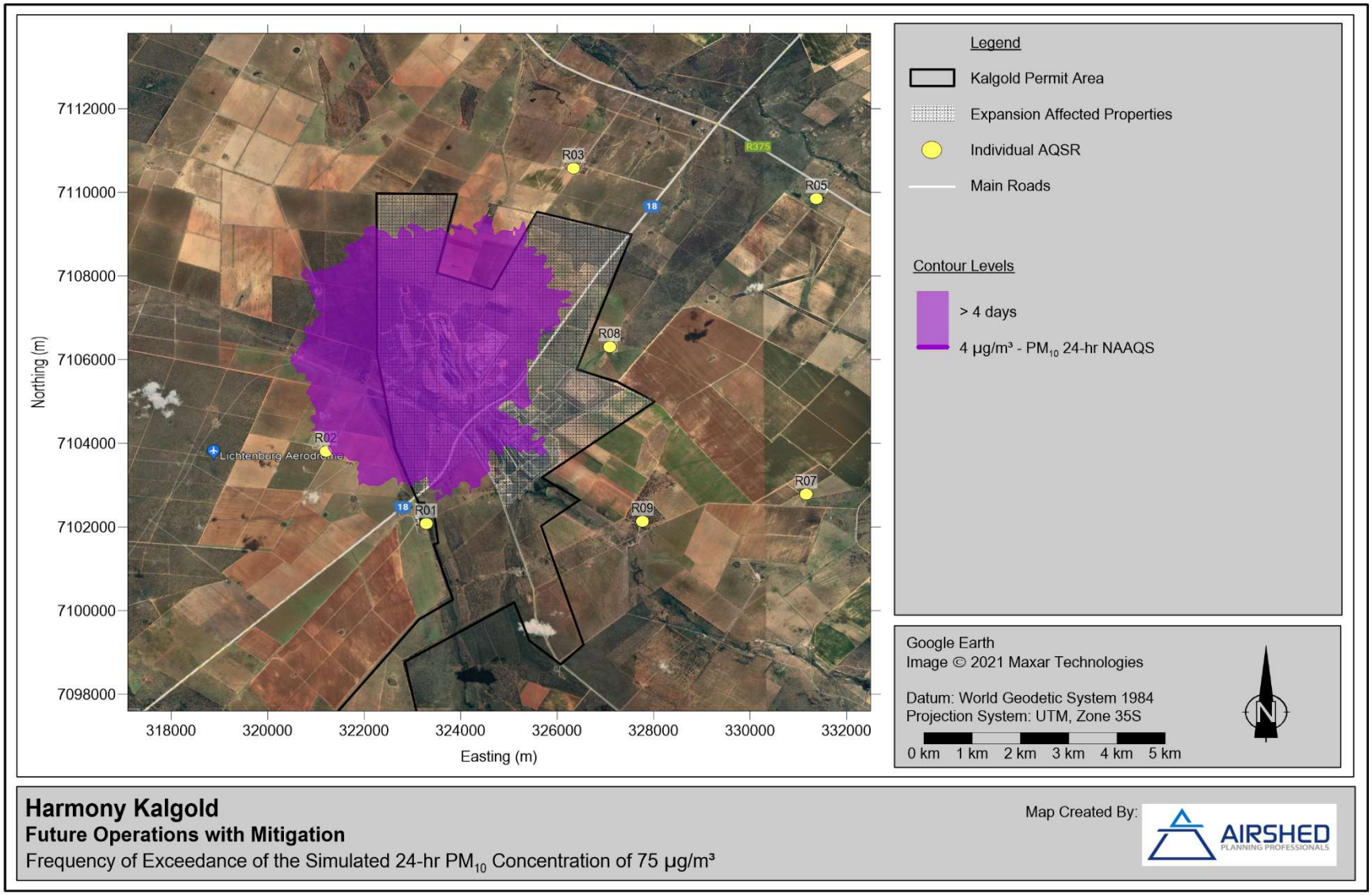


Figure 30: Kalgold expansion operations – simulated area of exceedance of the 24-hour PM_{10} NAAQS

8.13 TRAFFIC STUDY

A Traffic Impact Assessment (TIA) was conducted by SMEC South Africa and the report is included in Appendix D. The purpose of this TIA is to investigate and assess the impact of traffic generated by the proposed expansion on the surrounding road network in the immediate vicinity of the development site.

Based on the TIA, the existing site access layout is acceptable from a capacity perspective for the full lifespan of the mine. A 500m acceleration lane on the exit side of the northeast approach needs to be provided at the access along the N18. This is based on the requirement of TMH16[3] which states that where heavy vehicles exiting the site via this access exceed 10 heavy vehicles in a 12-hour daytime period or 5 heavy vehicles in a 12-hour night-time period, an acceleration lane should be provided. The traffic count conducted at the site access showed over 10 heavy vehicles exiting the site during a 12-hour daytime period.

A new site access has been proposed on the N18. It is recommended that it should have the same layout as the existing access and needs to be checked to ensure sufficient sight distances. If a new access is implemented, the existing access will need to be closed to meet the minimum access spacing requirements on rural Class 1 roads (8km) otherwise special permission from SANRAL will be required.

[3] The Technical Methods for Highways (TMH) 16: Volume 1 and Volume 2 - South African Traffic Impact and Site Traffic Assessment Standards and Requirements Manual and Volume 2

9 SENSITIVITY MAPPING

Environmental sensitivity mapping provides a strategic overview of the environmental, cultural and social assets in a region. The sensitivity mapping technique integrates numerous datasets (base maps and shapefiles) into a single consolidated layer making use of Geographic Information System (GIS) software. Environmental sensitivity mapping is a rapid and objective method applied to identify areas which may be particularly sensitive to development based on environmental, cultural and social sensitivity weightings – which is determined by specialists' input within each respective field based on aerial or ground-surveys. Therefore, the sensitivity mapping exercise assists in the identification of least concern, low, medium and highly sensitive areas within the development footprint.

Table 16 below provides a breakdown of the sensitivity rating and weightings applied to determine the sensitivity score of each aspect, and Figure 31 below presents how the sensitivity mapping technique integrates numerous datasets into a single consolidated sensitivity layer.

A final sensitivity map of the proposed development footprint as contemplated in the accepted scoping report is included in Figure 32. The combined sensitivity map includes individual sensitivities according to heritage, social, wetlands, air quality and soil land type features in and around the project area. The sensitivities related to geohydrology (groundwater) and land use economics were excluded as their effects cannot be directly or accurately measured to ascertain sensitivity. Climate change effects occur over time and at a very broad scale influencing several features and thus, it is not possible to assign sensitivity at project area level. Groundwater features are continuous in nature and their sensitivity or vulnerability dependant on various entities (e.g. water travel time, contamination migration, plume stability, soil, etc.) making it difficult to directly and accurately measure or assign sensitivity at project area level. Furthermore, land use economics pertain to the economic value of different land uses in an area which cannot be allocated sensitivity criteria due to their variability. Lastly, the exclusion of visual sensitivity as part of the combined sensitivity map does not mean that there will be no visual sensitivities, but indicates that the entire site and its surroundings is already visually impacted upon by similar activities as the proposed development and thus the project area and its immediate surroundings cannot be assigned different levels of sensitivity.

Table 16: Sensitivity rating and weighting

Sensitivity Rating	Description	Weighting
Least concern	The inherent feature status and sensitivity is already degraded or contain no inherent sensitivities. The proposed development will not affect the current status and/or may result in a positive impact. These features would be the preferred alternative for mining or infrastructure placement.	-1
Low/Poor	The proposed development will not have a significant effect on the inherent feature status and sensitivity.	0
High	The proposed development will moderately negatively influence the current status of the feature.	1
Very high	The proposed development will have a significantly negative influence on the current status of the feature.	2

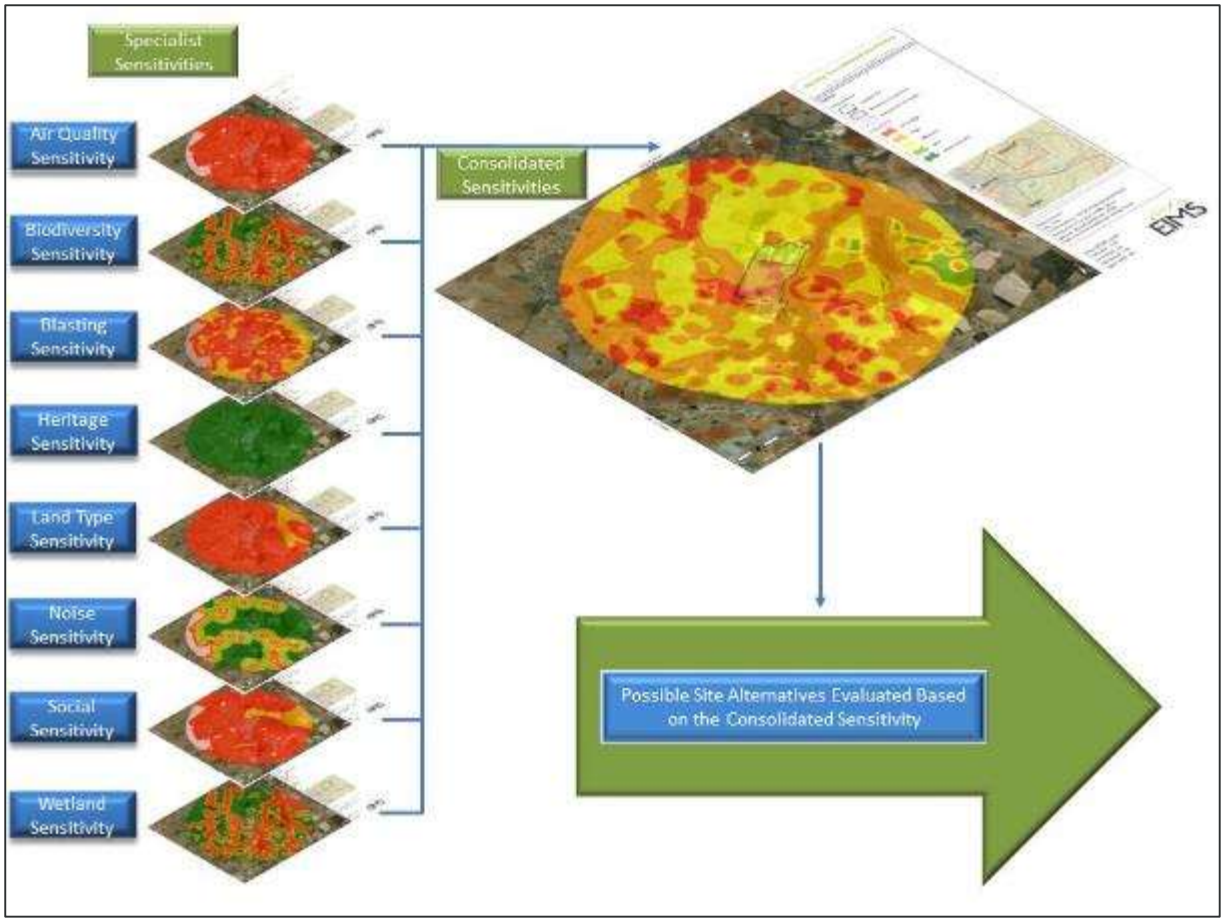


Figure 31: Sensitivity mapping approach

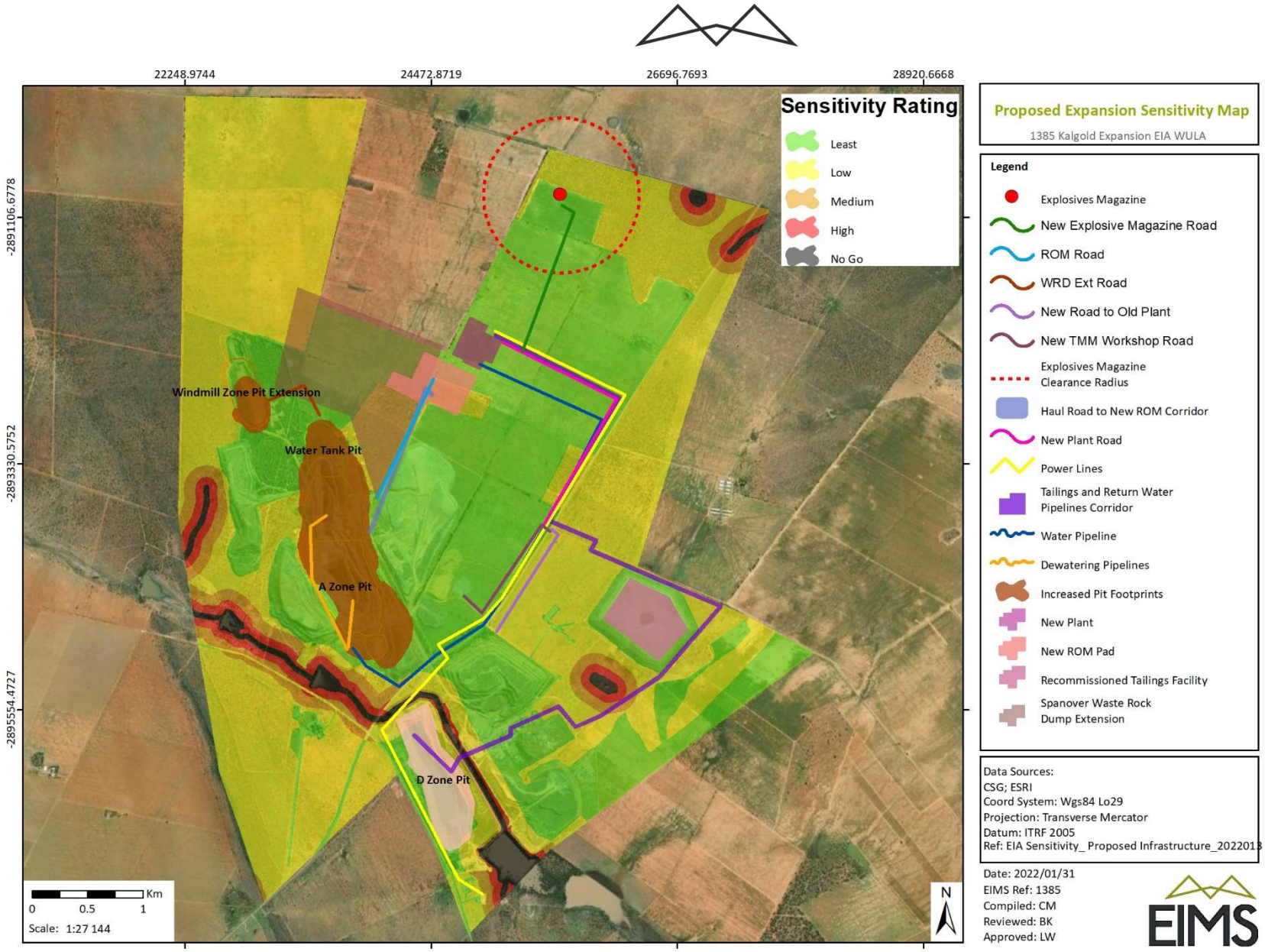


Figure 32: Combined sensitivity map

10 ENVIRONMENTAL IMPACT ASSESSMENT

10.1 IMPACT ASSESSMENT METHODOLOGY

The impact significance rating methodology, as prepared by EIMS, 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. This determines the environmental risk. In addition, other factors, including cumulative impacts and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S). The impact assessment will be applied to all identified alternatives. Where possible, mitigation measures will be recommended for impacts identified.

10.1.1 DETERMINATION OF ENVIRONMENTAL RISK

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:

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

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table 17 below.

Table 17: 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 18.

Table 18: 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 x P

Table 19: 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 scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table 20.

Table 20: Significance Classes.

Environmental Risk Score	
Value	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.

10.1.2 IMPACT PRIORITISATION

Further to the assessment criteria presented in the section above, it is necessary to assess each potentially significant impact in terms of:

1. Cumulative impacts; and
2. The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post-mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table 21: Criteria for Determining Prioritisation.

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/ definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable Loss of Resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table 21. The impact priority is therefore determined as follows:

Priority = CI + LR

The result is a priority score which ranges from 2 to 6 and a consequent PF ranging from 1 to 1.5 (Refer to Table 22).

Table 22: Determination of Prioritisation Factor.

Priority	Prioritisation Factor
2	**1**
3	**1.125**
4	**1.25**
5	**1.375**
6	**1.5**

In order to determine the final impact significance, the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is an attempt to increase the post mitigation environmental risk rating by a factor of 0.5, if all the priority attributes are high (i.e. if an impact comes out with a high medium environmental risk after the conventional impact rating, but there is significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Table 23: Final Environmental Significance Rating.

Significance Rating	Description
≤ -17	High negative (i.e. where the impact must have an influence on the decision process to develop in the area).
> -17 ≤ -9	Medium negative (i.e. where the impact could influence the decision to develop in the area).
> -9 < 0	Low negative (i.e. where this impact would not have a direct influence on the decision to develop in the area).
0	No impact
>0 <9	Low positive (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥ 9 < 17	Medium positive (i.e. where the impact could influence the decision to develop in the area).
≥ 17	High positive (i.e. where the impact must have an influence on the decision process to develop in the area).

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

10.2 IMPACTS IDENTIFIED

This Section presents the impacts that have undergone a preliminary assessment during the Scoping Phase and were identified in the Plan of Study as impacts that should be further assessed in the EIA phase (this report). These impacts were identified as requiring further assessment by the EAP, the appointed specialists, as well as the public. The management and mitigation measures for impacts identified during Scoping Phase and EIA phase are contained in the EMPr (Appendix F). Table 24 provides the list of impacts which have been further assessed in this report.

Without proper mitigation measures and continual environmental management, most of the identified impacts may potentially become cumulative, affecting areas outside of their originally identified zone of impact. The potential cumulative impacts have been identified, evaluated, and mitigation measures suggested which will be updated during the detailed EIA level investigation.

When considering cumulative impacts, it is important to bear in mind the scale at which different impacts occur. There is potential for a cumulative effect at a broad scale, such as regional deterioration of air quality, as well as finer scale effects occurring in the area surrounding the activity. The main impacts which have a cumulative effect on a regional scale are related to the transportation vectors that they act upon. For example, air movement patterns result in localised air quality impacts having a cumulative effect on air quality in the region. Similarly, water acts as a vector for distribution of impacts such as contamination across a much wider area than the localised extent of the impacts source. At a finer scale, there are also impacts that have the potential to result in a cumulative effect, although due to the smaller scale at which these operate, the significance of the cumulative impact is lower in the broader context.

Table 24: Identified environmental impacts

Main Activity/ Action/ Process	Ancillary Activity	Geo-physical (geology, topography, air, water, etc.)	Biological	Socio-economic	Heritage and Cultural
Site Preparation (Planning)	• Vegetation clearance • Removal of any existing on-site infrastructure • Planned placement of infrastructure • Establishment of construction contractor area	• Loss of land capability and agricultural potential			
Human Resources Management (Planning)	• Employment / recruitment • I&AP consultations (where necessary) • Corporate Social Investment initiatives • Skills development programmes • Environmental awareness training • Integration with municipalities' strategic long-term planning				
Earthworks (Construction)	• Cleaning, grubbing and bulldozing • Removal of building waste and cleared vegetation • Digging trenches and foundations • Establishing stormwater management measures	• Sedimentation of downstream drainage / watercourses • Hydrocarbon fuel spillage • Reduction of catchment yield • Flooding • Loss of land capability and agricultural potential • Loss of seepage (infiltration) areas • Alteration to surface runoff flow volumes	• Alien vegetation infestation • Loss of, or impaired ecosystem services • Further loss and fragmentation of the vegetation community as well the destruction of a portion of a	• Project-induced in-migration • Labour draw down from other sectors • Employment and income creation • Increased demand for housing and services • Social disintegration and conflict • Impact on farmsteads	• Impact on chance finds heritage resources

Main Activity/ Action/ Process	Ancillary Activity	Geo-physical (geology, topography, air, water, etc.)	Biological	Socio-economic	Heritage and Cultural
		• Alteration of patterns of flows • Impaired water quality • Increase in sediment inputs and turbidity • Inputs of toxic organic contaminants • Inputs of toxic heavy metal contaminants • Erosion	Vulnerable vegetation type • Displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise) • Loss of movement corridor that animals use to migrate between fragmented habitats • Loss of fauna and flora (direct and indirect) • Direct loss of wetlands	• Net GGP impact • Net employment impacts • Fiscal income • Economic development per capita • Country and industry competitiveness • Loss of agricultural land and production (change in land use) • Need and desirability	
Civil Works (Construction)	• Establishment of infrastructure and services • Mixing of concrete and concrete works • Establishment of general waste area • Access control and security • General site management	• Sedimentation of downstream drainage/watercourses • Hydrocarbon fuel spillage • Reduction of catchment yield • Flooding of proposed infrastructures • Loss of land capability • Loss of surface roughness • Loss of seepage (infiltration) areas • Alteration to surface runoff flow volumes	• Alien vegetation infestation • Loss of, or impaired ecosystem services • Further loss and fragmentation of the vegetation community as well the destruction of a portion of a Vulnerable vegetation type	• Project-induced in-migration • Labour draw down from other sectors • Employment and income creation • Increased demand for housing and services • Social disintegration and conflict • Dewatering of aquifer leading to reduction in water supply	• Impact on chance finds heritage resources

Main Activity/ Action/ Process	Ancillary Activity	Geo-physical (geology, topography, air, water, etc.)	Biological	Socio-economic	Heritage and Cultural
		• Alteration of patterns of flows (increased flood peaks) • Impaired water quality • Increase in sediment inputs & turbidity • Inputs of contaminants • Erosion • Decline in air quality	• Displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise) • Loss of movement corridor that animals use to migrate between fragmented habitats	• Change of character • Impact on urban edge • Impact on farmsteads • Impact on local roads • Net GGP impact • Net employment impacts • Fiscal income • Economic development per capita • Black economic transformation • Country and industry competitiveness • Alternative land-use • Need and desirability	
Operation	• Tailings transport • Processing • Milling • Deposition of tailings • Ore transport • Soil management • Water management • Concurrent rehabilitation	• Sedimentation/pollution of downstream drainage/watercourse • Flooding of proposed infrastructures • Loss of land capability • Direct loss of wetlands • Loss of, or impaired ecosystem services • Loss of seepage (infiltration) areas • Loss of aquifers (and recharge) • Alteration to surface runoff flow volumes	• Alien vegetation infestation	• Tax income • Employment and income creation • Conversion of land use • Social investment in the local community • Net GGP impact • Net employment impacts • Fiscal income • Economic development per capita • Black economic transformation	• Impact on chance finds heritage resources

Main Activity/ Action/ Process	Ancillary Activity	Geo-physical (geology, topography, air, water, etc.)	Biological	Socio-economic	Heritage and Cultural
		• Alteration of patterns of flows (increased flood peaks) • Impaired water quality • Increase in sediment inputs & turbidity • Increased nutrient inputs • Inputs of contaminants • Alien vegetation infestation • Erosion • Decline in air quality		• Country and industry competitiveness • Alternative land-use • Need and desirability	
Infrastructure Removal (Decommissioning)	• Safety control	• Siltation of water resources • Loss of land capability • Decline in air quality		• Net GGP impact • Net employment impacts • Fiscal income • Economic development per capita • Black economic transformation • Country and industry competitiveness • Alternative land-use • Need and desirability	
Rehabilitation (Closure)	• Slope stabilisation • Erosion control • Landscaping • Replacing topsoil • Removal of alien/invasive vegetation • Re-vegetation • Restoration of natural drainage patterns	• Migration of residual contamination after rehabilitation • Siltation of water resources • Decline in air quality	• Alien vegetation infestation	• Net GGP impact • Net employment impacts • Forex savings • Fiscal income • Economic development per capita • Black economic transformation	

Main Activity/ Action/ Process	Ancillary Activity	Geo-physical (geology, topography, air, water, etc.)	Biological	Socio-economic	Heritage and Cultural
	• Remediation of ground and surface water • Rehabilitation of external roads • Initiate maintenance and aftercare program			• Country and industry competitiveness • Alternative land-use • Need and desirability	
Maintenance (Post-closure)	• Environmental aspect monitoring • Monitoring of rehabilitation	• Contamination of water resources			

10.3 DESCRIPTION AND ASSESSMENT OF IMPACTS

The following potential impacts were further assessed during this EIA phase assessment. The detailed impact assessment matrix (including pre- and post-mitigation assessment) for impact assessed during the EIA phase is included in Appendix E. These impact calculations will be subject to amendment based on the results of public consultation being undertaken. Table 25 provides a description of each impact with mitigation measures.

Table 25: Impact assessment.

#	Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Mitigation Measures
1	Potential impact on human health from increased pollutant concentrations	Construction	-6	-3	Non-compliance of TSP, $PM_{2.5}$, PM_{10}, SO_2, NO_x concentrations with the relevant NAAQS could result in human health impacts and impacts on vegetation. The sources of atmospheric emissions during the operational phase associated with the proposed project include: • Particulate emissions from: ○ drilling ○ blasting ○ excavation ○ material handling ○ crushing and screening ○ bulldozing as part of waste dump management ○ erosion of stockpiles, portions of the waste dumps and the TSF due to the wind lifting and dispersing loose material during high wind incidents (>5.4 m/s) ○ road surface material entrainment along the unpaved in-pit, haul roads and access road ○ grading of unpaved haul roads and access road. • Particulate and gaseous emissions from: ○ vehicles and equipment exhaust ○ smelter, kiln and assay laboratory stacks. Based on the simulation conducted the following is anticipated during the operational phase: • PM10 concentrations as a result of mitigated operations are not within compliance at one AQSRs over the short-term (24-hour average). • PM10 and PM2.5 concentrations as a result of design mitigated operations are not within compliance off-site but are in compliance at all AQSRs over the short-term and long-term (annual average). • Dustfall rates are above the NDCR limits for non-residential areas and above 400 mg/m²-day at some agricultural areas; however, the dustfall rates are below the NDCR limits for residential areas at all AQSRs. • DPM does not exceed the US EPA IRIS RfC at any AQSRs. • NOx concentrations are in compliance with the NO_2 NAAQS at all AQSRs over the long-term and short-term. • SO_2 and CO concentrations are below the NAAQ limit values.	The following mitigation measures are recommended • Reduction of fugitive PM emissions through the watering of roads, stockpiles and inactive open areas and the use of screens. • Reductions of vehicle exhaust emissions through the use of better-quality diesel; and inspection and maintenance programs. • Combine chemical suppressants with the use of water sprays on unpaved roads. • Implement the air quality management plan and detailed in the Air Quality Impact Assessment Report. This includes the following: ○ The management of the operations; resulting in the mitigation of associated air quality impacts ○ The dustfall sampling, ambient fine particulate monitoring and operating of the on-site weather station. Should the dustfall sampling show higher rates than those estimated in this study it is suggested that Kalgold investigate and consider adopting additional mitigation and management measures. Fallout dust tends to settle relatively close to sources of emissions and thus if the dustfall sampling show significantly higher rates there is likely to be significantly higher finer particulate matter concentrations as well ○ Record keeping and community liaison procedures.
		Operation	-9.75	-8.25		
		Closure	-1.25	-1.25		
2	Increased nuisance dust fall rates	Construction	-3.5	-1.25		
		Operation	-8.25	-7.5		
		Closure	-1.25	-1.25		
3	Potential impact on vegetation health from increased dust fall rates and pollutant concentrations	Construction	-3.5	-1.25		
		Operation	-9	-8.25		
		Closure	-1.25	-1.25		
3	Impacts on the watercourses associated Continuation of TSF	Construction	-6,75	-3,5	The construction phase of the TSFs will include the construction of ancillary infrastructure, including pump stations, pipe connection components, ablution facilities etc. These components will typically be located in close proximity to the TSF, which potentially includes the construction thereof within HGM 1 wetland. The operational phase of the TSFs will including the transportation of tailings material to the TSF from the processing plant. The potential impacts surrounding these activities typically include leaks from the TSF and/or pipelines and potential erosion/collapses of the TSF	The following mitigation measures a recommended by the Wetland Specialist: • Effective stormwater management which includes and controls seepage and runoff control from the expanded operational TSF area. • Implementation of clean and dirty water separation as effective pollution control using a diversion trench and berm systems which diverts clean stormwater around pollution sources and convey and contain dirty water to central pollution control impoundments effectively controlling runoff. Following a risk based approach, the use of a barrier systems that may include synthetic, clay and geological liners to minimize contaminated seepage and runoff is encouraged.
		Operation	-8,25	-5		
		Closure	-6,75	-3,5		
3	Impacts on the watercourses associated Construction of Pipelines and Powerlines	Construction	-4	-3	The construction of the pipelines and powerlines will include the clearance of servitudes as well as the placement of powerline pylons. This will disrupt the functionality of wetland areas for a brief period,	
		Operation	-5	-4,5		
		Closure	-4	-3		

#	Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Mitigation Measures
					after which the functionality of the wetland is expected to recover to some extent. The operational phase of the pipelines and powerlines will include infrastructure being maintained and monitored frequently, with no other expected impacts potentially threatening water resources	• Erosion and sedimentation controls such as energy dissipation and silt screens where feasible. The focus must be placed on locations where stormwater enters the watercourse from disturbed areas. • The crossing points should be stabilized to reduce the resulting erosion and downstream sedimentation. Access crossing points must be prioritized and upgraded. • Structures must not be damaged by floods smaller than those which may occur on average once in every 50 years. • The indiscriminate use of heavy vehicles and machinery within the water resource areas will result in the compaction of soils and vegetation and must be controlled. • Erosion prevention mechanisms such as gabions must be employed to ensure the sustainability of all structures to prevent instream sedimentation where feasible. • The planting of indigenous vegetation around pollution control impoundments and structures should be completed as this has been shown to be effective in erosion and nutrient control. • The continued removal of alien invasive flora species. • The continued implementation of the derived buffer zones and avoidances. Prioritize the use of existing routes and servitudes. • The feasibility of passive or active water treatment and containment for seepage and runoff emanating from the TSF and decant areas must be investigated
5	Changes in Hillslope Hydrology	Construction	-4.5	-4.5	The proposed expansion will result in the stripping of topsoil and alterations to the existing land uses. These changes are likely to result in changes in the land use from undisturbed areas to mining (or transformed). The quantifications associated with the proposed activities have been considered for this impact assessment specifically in regard to the changes in hillslope hydrology".	The following mitigation measures are recommended by the hydropedologist: • Proper planning of mining sequences • Acquire stripping and stockpiling guideline. • Stockpile the stripped soils in designated stockpile areas. • Vegetate stockpiles according to the rehabilitation plan. • Continuously monitor erosion on site. • Monitor compaction on site. • Implement proper storm water management plans. • All rehabilitated areas should be assessed for signs of compaction, fertility and erosion. • 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.
		Operation	-5.5	-5.5		
		Decommissioning	-4.5	-4.5		
		Closure Phase	-1,75	-1,75		
6	Temporary disturbance of wildlife due to increased human presence and possible use of machinery and/or vehicles.	Planning	-9	-4	As more vehicles will be driving in the area to survey various components of the project, the wildlife will be disturbed. The possible use of light machinery can also lead to the trampling of both vegetation and faunal species.	The following mitigation measures are recommended by the biodiversity specialist: • Speed limits on the road to the mine must be enforced. • The areas to be developed must be specifically demarcated to prevent movement of staff or any individual into highly sensitive areas and the surrounding environments. Signs must be put up to enforce this. • Noise must be kept to an absolute minimum during the evenings and at night to minimize all possible disturbances to amphibian species and nocturnal mammals. • No trapping, killing, or poisoning of any wildlife is to be allowed. Signs must be put up to enforce this.
7	Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, light, dust, rock chips, vibration and poaching).	Construction	-18	-10.5	Faunal community will be influenced in a number of ways, including the loss of habitat, disturbances that will either make them move out of the area if possible or have to adapt and possible deaths due to physical harm or indirect harm.	
		Operation	16	-4		

#	Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Mitigation Measures
						• Outside lighting should be designed and limited to minimize impacts on fauna. All outside lighting should be directed away from highly sensitive areas. Fluorescent and mercury vapor lighting should be avoided, and sodium vapor (yellow) lights should be used wherever possible. • All construction and maintenance motor vehicle operators should undergo an environmental induction that includes instruction on the need to comply with speed limits, to respect all forms of wildlife. Speed limits must still be enforced to ensure that road killings and erosion is limited. Signs must be put up to enforce this. • Schedule activities and operations during least sensitive periods, to avoid migration, nesting and breeding seasons. Driving on access roads close to highly sensitive areas at night should be prevented in order to reduce or prevent wildlife road mortalities which occur more frequently during this period; • Based on the observed avifaunal species, bird strikes, and electrocutions will be a highly likely, bird flappers must be placed on any transmission lines and the towers must be insulated to prevent electrocutions, especially on any transmission lines close to the river and wetland areas. • Infrastructure should be consolidated where possible in order to minimise the amount of ground and air space used.
8	Powerline collisions and electrocutions	Operation	-17	-10.5	A number of avifauna species including two Species of Conservation Concern were identified on site that is at risk for collisions and electrocutions.	• Based on the observed avifaunal species, bird strikes, and electrocutions will be a highly likely, bird flappers must be placed where the transmission line crosses a river or a wetland. Powerline towers must be insulated to prevent electrocutions, especially on any transmission lines close to the river and wetland areas. • Where feasible all the parts of the infrastructure must be nest proofed and anti-perch devices placed on areas that can lead to electrocution. • The design of the proposed powerline must be of a type or similar structure as endorsed by the Eskom-EWT Strategic Partnership on Birds and Energy, considering the mitigation guidelines recommended by Birdlife South Africa (Jenkins et al., 2015). • All areas to be extended must be walked through prior to any activity to ensure no nests or birds area found in the area. Should any species of conservation concern not move out of the area or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.
9	Continued displacement and fragmentation of the faunal community due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation/loss (litter, road mortalities and/or poaching).	Decommissioning	-9.75	-9	During the decommissioning phase infrastructure will now be broken down, removed and disturbed. As the infrastructure is being removed this will disrupt the ecosystem.	• Speed limits on the road to the mine must be enforced. • The duration of the decommissioning should be minimized to as short term as possible, to reduce the period of disturbance on fauna. • Schedule activities and operations during least sensitive periods, to avoid migration, nesting and breeding seasons. Driving on access roads close to highly sensitive areas at night should be prevented in order to reduce or prevent wildlife road mortalities which occur more frequently during this period;

#	Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Mitigation Measures
						• Develop post-mining environments in conjunction with regional development plans as well as the recreation of habitats where possible or structure altered landscapes to be compatible with regional habitats.
10	Destruction, further loss and fragmentation of the vegetation community	Construction	-23.75	-13	The vegetation communities are classed as Vulnerable (VU), through site clearing, more of the vegetation communities will be lost. Unmitigated, this will also lead to habitat fragmentation and the establishment of alien invasive species as well as soil erosion.	The following Mitigation measures are recommended by the biodiversity specialist: • Development within the high sensitivity areas need to be limited. Clearing of the low sensitivity areas is permitted. The areas to be developed/mined must be specifically demarcated to prevent movement into highly sensitive surrounding environments. • Areas of indigenous vegetation, even secondary communities outside of the direct project footprint, should under no circumstances be fragmented or disturbed further. Clearing of vegetation should be minimized and avoided where possible. • Where possible, existing access routes and walking paths must be made use of, and the development of new routes limited • All laydown, chemical toilets etc. should be restricted to low sensitivity areas. Any materials may not be stored for extended periods of time and must be removed from the project area once the construction/closure phase has been concluded. Buildings should preferably be prefabricated or constructed of re-usable/recyclable materials. No storage of vehicles or equipment will be allowed outside of the designated project areas. • Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood events. This will also reduce the likelihood of encroachment by alien invasive plant species. • All structure footprints to be rehabilitated and landscaped after construction is complete. Rehabilitation of the disturbed areas existing in the project area must be made a priority. Topsoil must also be utilised, and any disturbed area must be re-vegetated with plant and grass species which are endemic to this vegetation type. • Progressive rehabilitation and mining will enable topsoil to be returned more rapidly, thus ensuring more recruitment from the existing seedbank Any indigenous woody material removed during construction can be shredded and used in conjunction with the topsoil to augment soil moisture and prevent further erosion. • A spill management plan must be put in place to ensure that should there be any chemical spill out or over that it does not run into the surrounding areas. The Contractor shall be in possession of an emergency spill kit that must always be complete and available on site. Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use. No servicing of equipment on site unless necessary. All contaminated soil / yard stone shall be treated in situ or removed and be placed in containers. Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) in such a way as to prevent them leaking and entering the environment.
		Operation	-16	-9.75		

#	Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Mitigation Measures
						• Keep the surface & sub-surface water as well as storm water away that may run off from the dumps from the low laying areas, such as wetlands as well as the surrounding areas, from leaving the project area in an uncontrolled manner. • Leaking equipment and vehicles must be repaired immediately or be removed from project area to facilitate repair • Storm Water run-off & Discharge Water Quality monitoring • Staff should be made aware that they are not allowed to take/bring any plant species into/out of any portion of the project area. No plant species whether indigenous or exotic should be brought into/taken from the project area, to prevent the spread of exotic or invasive species or the illegal collection of plants. Signs must be put up to enforce this. • Any topsoil that is removed during construction must be appropriately removed and stored according to the national and provincial guidelines. This includes on-going maintenance of such topsoil piles so that they can be utilised during decommissioning phases and re-vegetation. All removed soil and material must not be stockpiled within the medium/high sensitivity areas. Stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds. • Appropriate speed reduction measures (i.e humps), enforcing of speed limits via signs and mitre drains must be constructed along the access roads (every three metres of elevation) in order to slow the flow of water run-off from the road surface, if this does not already exist. Reducing the dust generated by the listed activities above, especially the earth moving machinery, through wetting the soil surface (with "dirty water") and putting up signs to enforce speed limit as well as speed bumps built to force slow speeds. • A fire management plan needs to be complied and implemented to restrict the impact fire might have on the rehabilitated areas. • Aquatic monitoring must be done, this includes ground water and surface water to ensure that that acid mine drainage is detected and managed. A management plan must be compiled for acid mine drainage should this be identified. • Any individual of the protected plants that are present needs a relocation or destruction permit in order for any individual that may be removed or destroyed due to the development. Hi visibility flags must be placed near any threatened/protected plants in order to avoid any damage or destruction of the species. If left undisturbed the sensitivity and importance of these species needs to be part of the environmental awareness program.
11	Introduction of alien species, especially plants	Construction	-17	-9	The spread of alien invasive species will result in the loss of habitat and water for indigenous fauna and flora. It can also contribute to the spreading of potentially dangerous diseases due to invasive - and pest species. Overall, the fauna assemblage will be changed.	The following Mitigation measures are recommended by the biodiversity specialist: • Compilation of and implementation of an alien vegetation management plan. • The footprint area of the construction should be kept to a minimum. The footprint area must be clearly demarcated to avoid unnecessary disturbances to adjacent areas.
		Operation	-17	-6.5		
12	Continued encroachment of an indigenous and VU vegetation community by alien invasive plant species as well as erosion due to disturbed soils	Decommissioning	-16	-9.75	The spread of alien invasive species will result in the loss of habitat and water for indigenous fauna and flora. Overall, the fauna assemblage will be changed. Erosion will also disrupt the vegetation in the surrounding areas and result in habitat loss.	

#	Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Mitigation Measures
						• 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.

13	Erosion due to storm water runoff and wind	Construction	-16	-9.75	Erosion will lead to the loss of vegetation, the removal/ relocation of the topsoil and the destruction of habitat.	The following Mitigation measures are recommended by the biodiversity specialist:
						• Appropriate speed reduction measures (i.e humps), enforcing of speed limits and mitre drains must be constructed along the access roads (every three metres of elevation) in order to slow the flow of water run-off from the road surface, if this does not already exist;
						  ○ Reducing the dust generated by the listed activities above, especially the earth moving machinery, through wetting the soil surface (with "dirty water") and putting up signs to enforce speed limit as well as speed bumps built to force slow speeds;
						  ○ Signs must be put up to enforce this.
						• Where possible, existing access routes and walking paths must be made use of, and the development of new routes limited.
						• Areas that are denuded during construction need to be re-vegetated with indigenous vegetation to prevent erosion during flood events.
						• A storm water management plan must be compiled and implemented.
						• A row of indigenous trees may be planted to act as a wind breaker and to reduce the overall levels of dust and erosion. The location of the trees must be determined after dust monitoring has been done.

		Operation	-10.5	-5		
14	Environmental pollution due to water/ mine drainage runoff potential leaks, discharges, pollutant and storage leaching into the surrounding environment	Operation	-16	-9.75	Hydrocarbons leaching into the surrounding area will result in the loss of usable water resources. This will also result in the contamination of the topsoil and reduce the likelihood of successful rehabilitation of an area	The following Mitigation measures are recommended by the biodiversity specialist: • Waste management must be a priority and all waste must be collected and stored effectively. • In cases or portable toilets, a minimum of one toilet must be provided per 15 persons. Portable toilets must be pumped dry to ensure the system does not degrade over time and spill into the surrounding area. • The Contractor should supply sealable and properly marked domestic waste collection bins and all solid waste collected shall be disposed of at a licensed disposal facility • Where a registered disposal facility is not available close to the project area, the Contractor shall provide a method statement with regard to waste management. Under no circumstances may domestic waste be burned on site • Refuse bins will be emptied and secured Temporary storage of domestic waste shall be in covered waste skips. Maximum domestic waste storage period will be 10 days. • Sewage system must be pumped dry to ensure the system does not degrade over time and spill into the surrounding area.
15	Loss of land capability - TSP, Pit, WRD	Construction	-20	-12	The proposed expansion will result in the stripping of topsoil and alterations to the existing land uses. These changes are likely to result in changes in the land use from agricultural to mining (or transformed). The proposed activities will impact on areas expected to be high agricultural potential, with some aspects affecting medium to low sensitivity areas. It is possible that suitable agricultural land could	The following Mitigation measures are recommended by the soils and agricultural potential specialist: • Proper planning of mining sequences. • Acquire stripping and stockpiling guideline.
16	Loss of land capability - Linear servitudes and Magazine	Construction	-18.75	-12		
17	Loss of land capability – Processing Plants	Construction	-20	-12		

#	Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Mitigation Measures
					become fragmented, resulting in these smaller portions no longer being deemed feasible to farm.	• Detailed investigation into ideal locations for the construction of all the infrastructure on site. • Manage, maintain and care for soil stockpiles. • Stockpile the stripped soils in designated stockpile. Vegetate these stockpiles according to the rehabilitation plan. • Continuously monitor erosion on site. • Monitor compaction on site. • Implement proper storm water management plans. • All rehabilitated areas should be assessed for signs of compaction, fertility and erosion. • Post closure, 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. • If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place
18	Loss of land capability	Operation	-16	-9	The spread of alien invasive species will result in the loss of habitat and water for indigenous fauna and flora. Overall, the fauna assemblage will be changed. Erosion will also disrupt the vegetation in the surrounding areas and result in habitat loss.	
		Decommissioning	-13	-8.25		
		Closure	-12	-8.25		
19	Erosion of Soils	Construction	-13	-8.25	The removal of vegetation and changes to the local topography could result in an alteration to surface run-off dynamics. The soils in the project area are generally characterised by excessive drainage and also high erodibility. This could result in further loss of topsoil, and soil forms suitable for agriculture.	
		Operation	-13	-8.25		
		Decommissioning	-13	-8.25		
		Closure	-12	-8.25		
20	Pollutants entering surface water	Construction	-17.5	-6.5	Operation of earthmoving machinery or maintenance of vehicles on-site during construction, operation, decommissioning and rehab/closure (including the possible storage or handling of hydrocarbons) poses a potential source of hydrocarbon contamination with regards to the surface water environment. An emergency response plan for unforeseen hydrocarbon spills should be developed while the existing surface water monitoring should be reviewed to ensure adequate coverage of the proposed expansion. A storm water management plan is a necessary part of the development of the expansion (as per GN 704) and will form an integral mitigation measure with regard to the management of dirty areas. Uncontrolled release of tailings or contaminated water (e.g. due to a pipeline failure) is possible and would be considered a residual risk (post mitigation).	The following Mitigation measures are proposed by the hydrologist: Implement a storm water management plan inclusive of containment of dirty water areas. • Ensure the tailings facility and return water dam have adequate capacity to contain both operational water and the relevant stormwater event. • storm (e.g. probable maximum precipitation) and that all are adequately engineered to prevent failure (e.g. of embankments or side slopes). • Keep tailings pipelines (and any other pipelines with possible contaminants) within the managed dirty water footprint where possible. • Keep tailings pipelines (and any other pipelines with possible contaminants) well maintained to prevent leakage. • Store hydrocarbons off site where possible, or otherwise implement hydrocarbon storage procedure. • Handle hydrocarbons carefully to limit spillage. • Ensure vehicles are regularly serviced so that hydrocarbon leaks are limited. • Designate a single location for refuelling and maintenance where possible. • Keep a spill kit on site to deal with any hydrocarbon leaks. • Remove soil from the site which has been contaminated by hydrocarbon spillage. • Undertake surface water monitoring to enable change detection related to contaminants originating from the site.
		Operation	-20	-8		
		Decommissioning	-17.5	-6.5		
		Closure	-13	-6.5		
21	Decrease surface runoff	Construction	-17.5	-16.5	An increase in runoff could be expected due to the proposed construction of infrastructure which will increase impermeable hardstanding and compaction from movement of machinery and use of laydown areas. The necessary introduction of a storm water management plan will, however, result in containment of much of the aforementioned area, thereby effectively decreasing runoff from the site. A decrease in runoff is a typical impact associated with the containment of dirty areas on mines and the mitigation of this impact is often not	The following Mitigation measures are proposed by the hydrologist: • Keeping the contained dirty area to a minimum thereby limiting this impact. • Discharge excess water of an acceptable quality back into the surface water environment (river).
		Operation	-17.5	-16.5		
		Decommissioning	-17.5	-16.5		
		Closure	-15	-15		

#	Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Mitigation Measures
					practical or possible with a reduction in mean annual runoff an expected outcome	
22	Flood Risk (River)	Construction	-5.5	-2.75	Flood risk is an impact to the proposed Kalgold Expansion Project and not the environment as with the other impacts identified in this report. This risk is expected to be present during the construction, operational and decommissioning phases due to the existence of infrastructure/works that could be flooded and the presence of personnel who might be caught in flood waters. Some proposed infrastructure (tailings & return water pipeline and power lines) crosses the Morokwa River and have a certain flood risk (based on intersection with a watercourse). This infrastructure, however, likely has a low flood vulnerability thereby limiting the potential impact of flooding. Other infrastructure (e.g., waste rock dumps) located near a watercourse (specifically the Morokwa River) may have a flood risk. The greatest impact from flooding is likely to opencast pits near a watercourse, such as D-Zone. The 1:100-year flood event may consequently not be sufficient to assess flood risk to this pit, since less likely events (e.g. 1:200 year) could breach flood defences (if not adequately engineered) while breaching of existing defences (due to possible failure) could see lesser events (e.g., 1:20 year) entering the pit. Flooding has not been assessed in detail in the Hydrological study and as such its impact cannot be fully defined.	The following Mitigation measures are proposed by the hydrologist: • Works should ideally not take place, nor infrastructure placed within 100m of the river or within the 1:100-year flood-line so as to • limit the applicability of Section 21 water uses and GN 704 Condition 4. • The defined 1:100-year flood-line should be defined for infrastructure or works near a watercourse, while the expansion of excavated areas (i.e. pits) should be assessed with regards to the potential that flood waters could enter them. • Flood protection in the form of berms or increased flood conveyance (through river engineering) may be necessary where a flood risk exists. • If determined to be relevant to the proposed expansion, flood modelling should be undertaken to define the flood risk and consequently the expected impact (previous flood modelling has been undertaken although the accuracy of this flood modelling is not known). • D-Zone Pit is adjacent a river diversion and flood protection and adequate conveyance of flood waters should be confirmed given the potential for a breach of flood waters into D-Zone Pit.
		Operation	-5.5	-2.75		
		Decommissioning/ Closure	-5.5	-2.75		
23	Potential impact on heritage resources	All phases	-3.5	-1.5	Despite an intensive walkthrough of the footprint area, no evidence for any archaeological or heritage sites could be identified. As a result, no impact is expected from the proposed development on heritage. However, impacts were still assessed due to possibility of chance finds.	The following Mitigation measures are proposed by the heritage specialist: • Implement the chance find procedure as detailed in the Heritage Impact Assessment report. • Implement a grave management plan as detailed in the Heritage Impact Assessment report should any of the identified graves be affected by construction activities.
24	Potential impact on palaeontology	Planning	-11.25	-3		
25	Project induced in-migration	Construction	-4,50	-3,50	The in-migration of people associated with development is a common phenomenon. It usually occurs on two levels: formal in-migration as a result of the arrival of the construction and operational workforce and informal in-migration due to job seekers.	The following Mitigation measures are proposed by the social impact specialist: • Prioritise recruitment of local labour as far as possible • No employment at the gate. Follow the establish formal process for employing casual day labour (if required) as Harmony/Kalgold policies. • Communicate this process in the local newspaper, including contact details and employment requirements. • Enter into formal employment contracts with casual labour and the construction staff to ensure that they are aware that employment is for a limited period only and that it is unlikely that the mine will employ construction staff on the mine when in operation. • Communicate redeployment with current operational staff and in the media to prevent word spreading of new job opportunities at the mine.
26	Increase in Crime	Construction	-4.0	-3.50	An influx of job seekers could result in an increase in criminal activities. It is also possible that, during the construction phase of the project, an opportunistic criminal element may take advantage of increased activities in certain areas around construction sites. Based on interviews with farmers in the local area, limited security at the mine	The following Mitigation measures are proposed by the social impact specialist: • Increase security in terms of entry into mining area • Liaise with and support local community policing groups / forums to aid proactive policing.

#	Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Mitigation Measures
					sometimes provides leeway for illegal hunters passing though the mining area. Due to the widely publicised countrywide spike in violent crimes on farms, isolated households on farmlands around the mine could feel especially vulnerable to crime.	
27	Nuisance factors	Construction	-6.00	-5.25	An increase in nuisance factors such as noise and dust pollution impact on nearby households and communities' health and wellbeing. Possible health effects of mining operations include air / dust pollution, noise pollution, and light pollution during the construction phase.	The following Mitigation measures are proposed by the social impact specialist: • Adhere to the mitigation measures of the Air quality report. • Water down dust roads used during construction activities. • Alert the area when activities that will increase noise levels will take place. • Communicate the mine's grievance mechanism through the local media. Ensure that stakeholders know how to access the grievance mechanism. Address grievances timeously. • Develop a database of goods and services that could potentially be outsourced to the local community. • Establish a supplier development programme as part of the Local Economic Development component of the SLP. The programme should focus on small businesses in MLM and RLM that could supply to the mine (e.g. catering and cleaning) as well as larger businesses within the region. The focus of the fund should be on the development of HDI owned and controlled businesses with less than a R 50 million turnover.
		Operations	-7,50	-9,00		
28	Employment and income	Construction	12.00	13.00	The duration of the construction works could be effectively completed over two years and could for the short period could lead to the employment of approximately 300 workers, representing close to 3% of the 9,000 people employed in the municipal area in 2011 (Stats SA, 2011). Based on the skills distribution in the construction sector the majority of these workers could be semi-skilled (45%) and unskilled (35%).	The following Mitigation measures are proposed by the social impact specialist: • Prioritise local labour in the recruitment process as part of the company's own recruitment policy or as part of contractor management plan. • The objective should be to 100% recruitment of additional/ new unskilled labour from local communities.
		Operations	11.00	12.00		
29	Poverty reduction	Construction	10.00	11.00	The construction works could directly employ 35% unskilled workers, i.e. about 105 unskilled workers over 2 years. Assuming an average household size of 3.3 people per poor household, these workers could support 346 people living in low household incomes over the 2year period about 1% of the population that live in poverty	
30	Tax income	Operations	15.00	15.00	The Kalgold extension is expected to generate an additional GVA of R343m per annum as indicated in Table 6-8 above as well. In addition, its profits (direct GVA) could increase by an additional R200m per annum. Assuming he average tax: GVA ratio for the national economy of 26%, the extension could annually generate additional tax in the region of R144m.	No measures proposed.
31	Local economic development funds	Operations	4.50	8.25	Mining legislation specifies that mining operations should contribute to the economic development of the affected local community as per a Social and Labour Plan (SLP). The Local Economic Development plan should be aligned to the local, provincial and national development priorities. The local communities should furthermore be consulted. Both income generating activities and social infrastructure should be implemented as part of the plan.	The following measures are proposed by the social impact specialist to enhance the positive impact: • Ensure that the updated SLP (2023- 2028) takes the increased profits into account due to the extension and adjusts the social funds in line with the targets of the Mining Charter of 2018. • Prioritise immediate adjacent communities of RLM for additional funds allocated to the SLP • Monitor and manage the social contribution of multinational suppliers (in-house as well as suppliers to contractor and direct service providers).
32	Structural damage from blasting	Operations	-8.25	-11.00	Based on interviews with adjacent farmers, there are concerns around blasting activities related to current Kalgold mining activities causing structural damage to properties close to the mining area. The	The following Mitigation measures are proposed by the social impact specialist:

#	Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Mitigation Measures
					expansion would increase blasting activities and the area as well as the real or perceived risks related to structural damage to properties.	• Communicate blasting timelines to local farmers. • Monitor grievances voiced by adjacent farmers. • Compensate affected parties in case of proof of damage from blasting.
33	Increased economic concentration	Operations	-13.00	-10.00	The local economy of RLM is dominated by mining and agricultural activities. Both sectors are vulnerable to exogenous shocks either in the form of the weather or international commodity prices. For the stability of local output in an economy, it makes sense to have a more diversified economic base, thereby mitigating the effect of exposure to external variables usually influencing a specific sector, e.g. international commodity prices in the case of the mining sector. Due to the large exposure of the local economy towards mining output however, one could expect the mining sector cumulatively to have some destabilising influence on local output levels. The extension will increase the concentration of economic activities in the mining sector and could restrict the local adjustment process towards a post-mining economy.	The following Mitigation measures are proposed by the social impact specialist: • Focus on the support of non-mining related activities in community development programmes and business support programmes. • Focus additional local procurement programme related to the extension on non-core mining inputs (e.g. catering, accommodation). Currently close to 57% of local spending is on non-core items. This percentage could be higher to shield to local economy against concentration of economic activities around the mining sector.
34	Loss of agricultural land	Operations	-11.00	-11.67	The project area is around 200 hectares of which the larger percentage (57%) have been classified as arable land; 7% as grazing areas and 36% as disturbed areas. According to the agricultural impact study that form part of the EIA, the proposed expansion will result in the stripping of topsoil and alterations to the existing land uses. It is possible that suitable agricultural land could become fragmented, resulting in these smaller portions no longer being deemed feasible to farm. The removal of vegetation and changes to the local topography could result in an alteration to surface run-off dynamics. The soils in the project area are generally characterised by excessive drainage and also high erodibility. This could result in further loss of topsoil, and soil forms suitable for agriculture (The Biodiversity Company, 2021).	The following Mitigation measures are proposed by the social impact specialist: • Implement mitigation measures as per agricultural impact study. • On-going rehabilitation as per mine rehabilitation plan.
35	External Environmental Costs	Operations	-5.50	-6.67	Increase in environmental costs to local area (could include costs related to externalities of soil pollution, traffic flow; water pollution, air pollution, rising crime levels). The external costs on the local community due to soil pollution, increased traffic, air pollution and rising crime levels are considered to be low. The only major external costs anticipated during extended mining operations include potential impacts on availability of groundwater that could affect one or two boreholes close to the project area. During opencast mining groundwater will flow into the workings, which will then be pumped out. This will result in the lowering of the groundwater levels in the vicinity of the open pits during the operational phase of the mining operation. The extent of this dewatering cone is important as it can potentially impact on private groundwater users and in extreme situations may cause boreholes to dry up. After mining ceases the groundwater levels are expected to recover and this risk will no longer be applicable (MvB Consulting, 2021).	The following Mitigation measures are proposed by the social impact specialist: • Implement recommendations from the geohydrological report. • Compensate affected farmers if evidence is found that mining activities negatively impact in groundwater levels.
36	Termination of employment	Closure	-21.25	-25.00	Although the mine extension will not result in additional employment directly at the mine, the increased spending on suppliers will result in indirect and induced employment impacts during the operational phase. After mine closure jobs associated with supply spending will cease. The decommissioning of the mine will also have some high cumulative impacts as the whole mine (including original activities) will also cease. This will lead to the termination of an additional 690 positions of workers directly employed by the mine.	The following Mitigation measures are proposed by the social impact specialist: • As per the SLP (section 6) develop mechanisms to assist employees, prior to retrenchment date in the transition phase after closure of the operations, including portable skilled development programmes during the operational phase of the mine, providing assistance in accessing available and suitable jobs with other local mines or companies etc.

#	Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Mitigation Measures
						• Focus on non-core related local supply links during the operational phases of the mine to facilitate easier transitioning of local suppliers to other industries.
37	Termination of LED funds	Closure	-17.50	-15.00	The proponent's regulatory commitment with regards to social and economic development is expected to decrease during the decommissioning and closure of the mine. The risk exist that projects are dependent on the funding that they receive from the proponent and that projects will fail due to the decrease in funding	The following Mitigation measures are proposed by the social impact specialist: • Develop a community investment strategy in conjunction with the local communities. • Develop and implement community investment projects in participation with beneficiaries. • Plan projects with an exit strategy of which beneficiaries are aware of.
38	Permanent loss of agricultural land	Closure	-17.50	-16.25	The mining method to be used is opencast which entails progressive backfilling and rehabilitation of disturbed land. It is unlikely that the land capability will be rehabilitated back to its full potential after mining. It is likely that 57% of the land area that can be classified as arable land will be used for grazing area after rehabilitation.	The following Mitigation measures are proposed by the social impact specialist: • Adhere to the rehabilitation plan.
39	Safety risks	Closure	-10.50	-8,67	After mine closure there is a risk that remaining infrastructure and pits could pose a safety risk for the adjacent communities and their livestock. While there are currently no illegal mining activities in the local area, the closure of the mine could attract illegal miners to the local area.	The following Mitigation measures are proposed by the social impact specialist: • Demolish all infrastructure that pose safety hazards to the local community
40	Deterioration of road network condition	Construction	-6.75	-6.75	Heavy vehicle trips are expected to cause additional wear and tear on the surrounding road network. As most construction will take place on site with existing equipment, the expected effects of this short-term construction on the surrounding road network is minor as the surrounding national road network has been designed to carry heavy vehicles over long periods. The gravel access road to the site is expected to sustain damage during the construction and should be repaired and maintained as required	The following mitigation measures are proposed: • Repair and maintenance of site gravel access road during operational period.
		Operation	-6.75	-6.75		
		Decommissioning	-6.75	-6.75		
41	Increase in dust along access road	Construction	-4.5	-3.5	Dust is generated along gravel roads due to heavy vehicles operating at high speeds. There are no nearby residential communities and heavy vehicle volumes are fairly low therefore effects are not expected to be significant.	The following mitigation measures are proposed by the traffic impact specialists: • Limit heavy vehicle speed to 40km/h along site access road • Water down access road on a regular basis (as required) to reduce dust.
		Operation	-4.5	-3.5		
		Decommissioning	-4.5	-3.5		
42	Increase in peak hour traffic volumes	Construction	-6	-6	Impact relates to increase in peak hour traffic volumes. No further capacity upgrades are required to support construction trips. With the existing access and the proposed access performing at overall.	The following mitigation measures are proposed by the traffic impact specialists: • Limit construction heavy vehicle trips to off-peak hours when possible. • Ensure SARTSM Vol 2 Guidelines are followed in case number of heavy vehicles exceeds 10 per 12-hour daytime period or 5 per 12-hour night-time period, or ensure special approval from the road authority.
		Operation	-6	-6		
		Decommissioning	-6	-6		
43	Reduction in ground water levels (Option 2: Watertank and A-Zone pits remain open)	Operation	-7.5	-5.25	During opencast mining groundwater will flow into the workings, which will then be pumped out. This will result in the lowering of the groundwater levels in the vicinity of the open pits during the operational phase of the mining operation. The extent of this dewatering cone is important as it can potentially impact on private groundwater users and in extreme situations may cause boreholes to dry up. After mining ceases the groundwater levels are expected to recover and this risk will no longer be applicable.	This risk is essentially a short-term risk. Continuous monitoring of the groundwater levels in the monitoring boreholes as well as in selected private boreholes is recommended. This will provide early warning if private users are to be impacted on, in which case the mine should supply these farmers with an alternative source until the groundwater levels recover. Alternative sources can include a new borehole or a water supply pipeline from the mine. The surface streams in the area are classified as losing streams. In other words, the groundwater does not contribute to the baseflow in the streams. Lowering of the groundwater level will therefore not impact on any of the streams.
		Decommissioning	-7.5	-5.25		
		Closure	-7.5	-2.5		
44	Reduction in ground water levels (Option 1: Watertank and A-Zone pits backfilled with WRD)	Decommissioning	-7.5	-3.5		
		Closure	-7.5	-1.25		
45		Operation	-12	-8.25		

#	Impact	Phase	Pre-mitigation Environmental Risk	Post-mitigation Environmental Risk	Description	Mitigation Measures
	Contaminant Seepage from TSF (Option 2: Watertank and A-Zone pits remain open)	Decommissioning	-12	-1.5	The waste bodies at Kalgold includes the tailings facility (TSF) and the waste rock dumps (WRD). Rainwater seepage through the waste material may become contaminated and when entering the groundwater system, the contaminants will migrate from these facilities. Due to this contaminant migration down-gradient receptors may be impacted on. Receptors include surface streams and private groundwater users	This risk is regarded as a longer-term risk. The primary receptors that may be impacted are the private groundwater users. Due to the streams being losings streams any groundwater contamination is also not expected to impact on the streams.
		Closure	-12	-4.5		
46	Contaminant Seepage from TSF (Option 1: Watertank and A-Zone pits backfilled with WRD)	Decommissioning	-12	-8.25		
		Closure	-12	-4.5		
47	Contaminant Seepage from WRD (Option 2: Watertank and A-Zone pits remain open)	Operation	-9	-4.5		
		Decommissioning	-9	-4.5		
		Closure	-9	-4.5		
48	Contaminant Seepage from WRD (Option 1: Watertank and A-Zone pits backfilled with WRD)	Decommissioning	-9	-4.5		
		Closure	-9	-4.5		

11 CLOSURE COSTING

Kalgold undertakes annual updates to determine the cost associated with final rehabilitation, decommissioning and closure for the mining operation. The proposed expansion activities will require a top-up to the existing provision committed to the DMRE. An assessment of the quantum of financial provisions required for closure using the DMR Master Rates and the Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision' provided by a Mine (DMR Guidelines) was conducted by Minelock Environmental Engineers (2021) and the report included in Appendix D. A summarised breakdown of the assessment is provided in Table 26.

Table 26: Summary of closure cost for the expansion project

	CALCULATION OF THE QUANTUM						
	MINE: Kalgold Mine			LOCATION: NORTH WEST			
	EVAULUATORS: MINELOCK ENVIRONMENTAL ENGINEERS (PTY) LTD			DATE: 2022/02/01			
NO	DESCRIPTION	UNIT	A QUANTITY	B MASTER RATE 2020	C MULTIPLICATION FACTOR	D WEIGHTIN G FACTOR	AMOUNT RAND 2021
1	Dismantling of processing plant and related structures (Including overland conveyors and power lines)	m^3	15 608.06	R 16.32	1.00	1.00	R 254 761.94
2(A)	Demolition of steel buildings and structures	m^2	2 824.27	R 227.37	1.00	1.00	R 642 142.18
2(b)	Demolition of reinforced concrete buildings and structures	m^2	4 156.21	R 335.07	1.00	1.00	R 1 392 602.48
3	Rehabilitation of access roads Including all haul roads	m^2	64 754.16	R 40.69	1.00	1.00	R 2 634 619.96
4(A)	Demolition and rehabilitation of electrified railway lines	m	-	R 394.90	-	-	R 0.00
4(B)	Demolition and rehabilitation of non-electrified railway lines	m^2	-	R 215.40	-	-	R 0.00
5	Demolition of housing and/or administration facilities	m^2	1 367.00	R 454.73	1.00	1.00	R 621 617.88
6	Opencast rehabilitation including final voids and ramps	ha	-	R 231 434.37	-	-	R 0.00
7	Sealing of shafts, adits and inclines	m^3	-	R 122.06	-	-	R 0.00
8(A)	Rehabilitation of overburden and spoils	ha	-	R 158 916.67	-	-	R 0.00
8(B)	Rehabilitation of processing waste deposits and evaporation ponds (basic, salt-producing waste)	ha	0.80	R 197 927.84	1.00	1.00	R 158 342.27
8(C)	Rehabilitation of processing waste deposits and evaporation ponds (acidic, metal-rich waste)	ha	-	R 574 876.28	-	-	R 0.00
9	Rehabilitation of subsided areas	ha	-	R 133 068.78	-	-	R 0.00
10	General surface rehabilitation	ha	33.30	R 125 888.81	1.00	1.00	R 4 191 589.94
11	River diversions	ha	-	R 125 888.81	-	-	R 0.00

	CALCULATION OF THE QUANTUM						
	MINE: Kalgold Mine				**LOCATION: NORTH WEST**		
	EVAULUATORS: MINELOCK ENVIRONMENTAL ENGINEERS (PTY) LTD				**DATE: 2022/02/01**		
NO	**DESCRIPTION**	**UNIT**	**A QUANTITY**	**B MASTER RATE 2020**	**C MULTIPLICATION FACTOR**	**D WEIGHTING FACTOR**	**AMOUNT RAND 2021**
12	Fencing	m	2 880.00	R 143.60	1.00	1.00	R 413 566.28
13	Water management	ha	-	R 47 866.47	-	-	R 0.00
14	2 to 3 years of maintenance and aftercare	ha	40.57	R 16 753.26	1.00	1.00	R 679 703.11
						Sub Total 1	**R 10 988 946.05**
						Weighting factor 2 (1.00)	**R 10 988 946.05**
1	**Preliminary and general**			**12 % of Sub Total 1**			R1 318 673.53
						Sub Total 2	**R 12 307 619.57**
7	**Contingencies**			**10 % of Sub Total 1**			R 1 098 894.60
						Grand Total (Excl. VAT)	**R 13 406 514.18**

12 CONCLUSION AND RECOMMENDATIONS

The existing Harmony Kalgold operation wishes to expand its current production from the current production rate of 130 000 tons per month to 300 000 tons per month. Various infrastructure and operational changes are required to meet this increase in production. Several listed activities contained in the National Environmental Management Act (Act 107 of 1998) (NEMA), National Water Act (Act 36 of 1998) (NWA), the National Environmental Management Air Quality Act (Act 39 of 2004) and the National Environmental Management Waste Act (Act 59 of 2008) (NEMWA) are triggered by the proposed Kalgold Expansion Project. In this regard the Kalgold Expansion Project requires an Integrated Environmental Authorization, amendment of the Water Use License, an Atmospheric Emissions License for the new processing plant as well as an amendment of the approved Environmental Management Programme (EMPr) and Mine Works Programme (MWP) for Kalgold mine. As such a full Scoping and Environmental Impact Assessment has been undertaken in accordance with the NEMA EIA Regulations.

Through the scoping and EIA phase, various positive and negative impacts were identified and assessed with mitigation measures put forward for those impacts carried through to the EIA phase. An alternative assessment was undertaken, and alternatives assessed in this report motivated in this report. Based on the EIA level assessment, the impact statement and recommendations for inclusion in the Integrated Environmental Authorisation are detailed in this section.

12.1 ENVIRONMENTAL IMPACT STATEMENT

The findings of the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the mine, the findings of the EIA studies, and the understanding of the significance level of potential environmental impacts, it is the opinion of the EIA project team that the significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures.

Despite the impacts caused by the mine, it must be considered that there are positive impacts as well, mostly based on the economic contributions, skills development and SLP initiatives. The mine employs a number of people in the community, and the mine closure would result in them losing their jobs. This will probably mean that they will struggle to find new employment.

It is the opinion of the EIA project team that the environmental impacts associated with the application for the proposed Kalgold expansion project can be mitigated to an acceptable level and the project should be authorized.

12.2 RECOMMENDATIONS FOR INCLUSION IN ENVIRONMENTAL AUTHORISATION

The following key recommendations are made and should be included in the Environmental Authorisation:

- Adopt the air quality management plan as set out in the Air Quality Specialist Report (Airshed, 2021).
- An alien invasive plant management plan must be implemented to control and prevent the spread of invasive aliens.
- All areas to be extended must be walked through prior to any activity to ensure no nests or birds area found in the area. Should any species of conservation concern not move out of the area or their nest be found in the area a suitably qualified specialist must be consulted to advise on the correct actions to be taken.
- The procurement policy for the mine should focus on utilising service providers from the local area to encourage the growth of businesses.
- Groundwater and surface water monitoring should be ongoing, and the recommendations made in the EMPr and specialist studies must be implemented.

- Storm water management plan should be implemented for the mine.
- The Environmental Management Programme (EMPr) and all mitigation measures therein are an extension of the Environmental Authorisation and must be complied with at all times.
- Should artefacts or archaeological/palaeontological items be observed in the area of disturbance, then all activity in this area should cease immediately, the area marked off and a specialist consulted prior to any further activity.
- Where the proposed powerline crosses wetland areas, appropriate bird mitigation measures should be put in place to avoid bird collisions and direct impacts to the infrastructure. This includes the use of 'bird-flappers' and bird-friendly powerline structures.
- If the mining operation is indeed affecting the quantity of groundwater available to identified farm users, the affected parties should be compensated. A monitoring program must be implemented where groundwater levels are measured on a routine basis. If it is established that the mine de-watering activities have impacted the farm boreholes the mine must install additional boreholes for water supply purposes or supply an alternative water source.

13 ASSUMPTIONS, LIMITATIONS AND UNCERTAINTIES

The following assumptions and limitations should be noted.

13.1 GENERAL ASSUMPTIONS

Certain assumptions, limitations, and uncertainties are associated with this report. This report is based on information that is currently available and, as a result, the following limitations and assumptions are applicable:

- This report is based on project information provided by the client;
- The description of the baseline environment has been obtained from specialist studies; and
- In determining the significance of impacts, with mitigation, it is assumed that mitigation measures proposed in the report are correctly and effectively implemented and managed throughout the life of the project.

13.2 TERRESTRIAL ECOLOGY

With respect to this EIA study, the following assumptions and limitations have been made:

- The assessment area was based on the area provided by the client and any alterations to the area and/or missing GIS information pertaining to the assessment area would have affected the area surveyed;
- Only a single season survey was conducted for the respective studies, this would constitute a dry season survey with its limitations;
- Flora identification is limited due to the lack of aboveground plant parts used to determine species, especially in regard to bulbous plants, the vegetation was dry and most plants had already lost the green flush;
- It must be noted that during the survey, only a fraction of the expected geophytes were visible due to their variable emergence patterns;
- The ridge being actively mined could not be surveyed due to safety risks;
- Whilst every effort is made to cover as much of the site as possible, representative sampling is completed and by its nature, it is possible that some plant and animal species that are present on site were not recorded during the field investigations; and
- The GPS used in the assessment has an accuracy of 5 m and consequently any spatial features may be offset by 5 m.

13.3 FRESHWATER ECOLOGY

With respect to this EIA study, the following assumptions and limitations have been made:

- A single aquatic ecology survey was completed for this assessment. Thus, temporal trends were not investigated;
- Significant modifications to delineated wetlands were identified, which have altered some of these systems to such an extent that identification and delineations are limited in accuracy by artificial influences;
- No baseline biomonitoring data/report(s) are available for the project area. Therefore, information presents the findings of the single aquatic survey;
- Due to the rapid nature of the assessment and the survey methods applied, fish diversity and abundance was likely to be underestimated;

- Dry conditions of the Morokwa River at the time of sampling, the Aquatic Macroinvertebrate Assessment, Fish Community Assessment and Present Ecological Status could not be conducted for the project area;
- Probe malfunction with regards to the Electrical Conductivity for water quality measurements. This was therefore substituted with data received from the client; and
- Ex - situ chemical analysis received from the client were missing some dates and/or sites which resulted from dry sites or lack of access.

13.4 AGRICULTURAL POTENTIAL

With respect to this EIA study, the following assumptions and limitations have been made

- Samples were only taken from areas that will be affected by the expansion of open cast pits and virgin areas that will be covered in overburden/waste rock material.

13.5 HYDROLOGY (SURFACE WATER)

The risk/impact assessment undertaken within this study is a preliminary risk assessment based on a desktop assessment. Flooding is potentially the impact with the greatest significance (whether indicated by an impact table or not). This risk needs to be clearly understood, particularly with regards to D-Zone Pit, waste rock dumps and associated storm water management adjacent to the Morokwa River.

13.6 GEOHYDROLOGICAL (GROUNDWATER)

The conceptual model forms the basis for the numerical groundwater flow and contaminant transport models that were used to assess the potential impacts associated with the proposed new activities on both groundwater quality and water levels. The following conditions typically need to be described in a model:

- Geological and geohydrological features;
- Boundary conditions of the study area (based on the geology and geohydrology);
- Initial groundwater levels of the study area;
- The processes governing groundwater flow; and
- Assumptions for the selection of the most appropriate numerical code. Field data is essential in solving the conditions listed above and developing the numerical model into a site-specific groundwater model.

Specific assumptions related to the available field data include:

- The top of the aquifer is represented by the generated groundwater heads;
- The available geological / geohydrological information was used to describe the different aquifers. The available information on the geology and field tests is considered as correct; and
- Many aquifer parameters have not been determined in the field and therefore must be estimated.

In order to develop a model of an aquifer system, certain assumptions must be made. The following assumptions were made:

- The system is initially in equilibrium and therefore in steady state, even though natural conditions have been disturbed;
- The boundary conditions assigned to the model are considered correct; and
- The impacts of other activities (e.g. agriculture) have not been considered. It is important to note that a numerical groundwater model is a representation of the real system.

It is therefore at most an approximation, and the level of accuracy depends on the quality of the data that is available. This implies that there are always errors associated with groundwater models due to uncertainty in the data and the capability of numerical methods to describe natural physical processes.

13.7 AIR QUALITY

The following important assumptions, exclusions and limitations to the specialist study should be noted:

- All project information was provided by EIMS; it is assumed that all this information is the most recent data and correct.
- Meteorology:
  - Data was available from one on-site weather station. The data availability was insufficient for dispersion modelling and three years (2018 - 2020) of WRF (Weather Research and Forecasting) modelled data was be acquired and used in the dispersion modelling.
  - The National Code of Practice for Air Dispersion Modelling described in the Regulations regarding air dispersion modelling prescribes the use of a minimum of one year of on-site data or at least three years of appropriate off-site data for use in Level 2 and Level 3 assessments. It also states that the meteorological data must be for a period no older than five years to the year of assessment. The WRF dataset period is within the timeframe recommended by the National Code of Practice for Air Dispersion Modelling, that is three years of data less than five years old.
- Emissions:
  - The impact assessment was limited to the pollutants of concern (those included in Section 2 on the Air Quality Impact Assessment Report). Some of these pollutants are regulated under NAAQS and considered key pollutants released by the operations associated with the future operations.
  - The quantification of sources of emission will be restricted to the Kalgold operations (current and future). Other existing sources of emission within the area including farming activities, domestic fires, biomass burning, vehicle exhaust emissions and dust entrained by vehicles on public roads will not include as part of the emissions inventory and simulations. Without detailed proposed (for when this project will be operational) operational data for other companies' mining and processing operations as well as estimated future vehicle data for public roads it is difficult to quantify these sources for the period of the proposed project operations. It is difficult to predict the contribution of the domestic and natural fires and farming sources to air quality during the period of the proposed project operations due to variability of these operations with regards to locality, spatial extent and duration.
- Greenhouse gases (GHG):
  - Emissions estimation and modelling is not included in the scope of work.
- Dispersion Simulations:
  - For the current operations, all significant fugitive sources will be simulated with the current mitigation measures applied and the most recent average stack emissions will be included in the dispersion simulation task.
  - It will be assumed that all NOx emitted is converted to NO_2.
- Assessment of impacts:
  - The health risk assessment is limited to the screening of ambient air concentrations against NAAQS and applicable international legal guidelines and limits and does not include a detailed human health risk assessment. Human health risk can occur due to exposures through inhalation, ingestion and dermal contact. The scope of the study will be confined to the quantification of impacts due to exposures via the inhalation pathway only.
  - A human health risk and nuisance and environmental impact screening assessment for the operational phase was based on dispersion simulation results.

- The EA process will be completed by EIMS. For this reason, the expected impact significance of the operations was determined based on the EIMS impact significance methodology.

13.8 HERITAGE

Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current vegetation cover. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must immediately be contacted.

Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply.

13.9 PALAEONTOLOGY

The accuracy of the Desktop Impact Assessment (DIA) is reduced by several factors which may include the following: the databases of institutions are not always up to date and relevant locality and geological information were not accurately documented in the past. Various remote areas of South Africa have not been assessed by palaeontologists and data is based on aerial photographs alone. Geological maps concentre on the geology of an area and the sheet explanations were never intended to focus on palaeontological heritage.

Similar Assemblage Zones, but in different areas is used to provide information on the presence of fossil heritage in an unmapped area. Desktop studies of similar geological formations and Assemblage Zones generally assume that exposed fossil heritage is present within the development area. The accuracy of the Palaeontological Impact Assessment is thus improved considerably by conducting a field-assessment.

13.10 TRAFFIC IMPACT ASSESSMENT

As this study was conducted during the covid-19 pandemic, historic data was used as a basis for analysis. Future changes to trip patterns and the development rate of the surrounding area are likely to result in changes to typical traffic volumes in the area. Historic counts grown at 3% per annum provide a conservative estimate of the demand on the surrounding road network and required road authority upgrades are likely to be less extensive than estimated in this report. Conservative assumptions were made in terms of construction labour requirements, no. of labourers accessing the site at the same time and in the distribution of trips to the surrounding road network.

14 UNDERTAKINGS

14.1 UNDERTAKING REGARDING CORRECTNESS OF INFORMATION

I __**Bongani Khupe**__ herewith undertake that the information provided in the foregoing report is correct to the best of my knowledge, and that the comments and inputs from stakeholders and Interested and Affected Parties has been correctly recorded in the report where applicable.

_____

Signature of the EAP

Date: __2 February 2022____

14.2 UNDERTAKING REGARDING LEVEL OF AGREEMENT

I ___**Bongani Khupe**___ herewith undertake that the information provided in the foregoing report is correct, and that the level of agreement with Interested and Affected Parties and stakeholders has been correctly recorded and reported herein.

_____

Signature of the EAP

Date: __2 February 2022___

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16 APPENDICES

Appendix A: Environmental Assessment Practitioner (EAP) Curriculum Vitae

Appendix B: Maps

Appendix C: Public Participation

Appendix D: Specialist Reports

Appendix E: Impact Assessment Matrix

Appendix F: Environmental Management Programme