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FINAL BASIC ASSESSMENT REPORT (BAR) AND ENVIRONMENTAL MANAGEMENT PROGRAMME (EMPR) REPORT FOR THE PROPOSED RAISING OF THE WALLS OF TAILINGS STORAGE FACILITIES (TSF) 2 AND TSF 2 EXTENSION (ALSO REFERRED TO AS TSF 2 PHASE 1 AND TSF 2 PHASE 2, RESPECTIVELY), BY 3-TO-5-METERS IN HEIGHT, AT EAST MINE FOR THARISA MINERALS

DMRE REFERENCE NUMBER: NW30/5/1/2/3/2/1/ (358) EM
MANYABE CONSULTANCY (PTY) LTD PROJECT CODE: 202305

Prepared for:

tharisa

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Date: 04 July 2025

MANAGING DIRECTOR: MPHO MANYABE
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mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

BASIC ASSESSMENT REPORT

AND

ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

SUBMITTED FOR ENVIRONMENTAL AUTHORIZATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

NAME OF APPLICANT: Tharisa Minerals (Pty) Ltd

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FILE REFERENCE NUMBER SAMRAD: NW-00360-MR/102

1. IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an environmental authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of, this template. Furthermore please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

2. Objective of the BA process

The objective of the BA process is to, through a consultative process─

(a) determine the policy and legislative context within which the proposed activity is located and how the activity complies with and responds to the policy and legislative context;

(b) identify the alternatives considered, including the activity, location, and technology alternatives;

(c) describe the need and desirability of the proposed alternatives,

(d) through the undertaking of an impact and risk assessment process inclusive of cumulative impacts which focused on determining the geographical, physical, biological, social, economic, heritage , and cultural sensitivity of the sites and locations within sites and the risk of impact of the proposed activity and technology alternatives on the these aspects to determine:

(i) the nature, significance, consequence, extent, duration, and probability of the impacts occurring to; and

(ii) the degree to which these impacts—

(aa) can be reversed;

(bb) may cause irreplaceable loss of resources; and

(cc) can be managed, avoided or mitigated;

(e) through a ranking of the site sensitivities and possible impacts the activity and technology alternatives will impose on the sites and location identified through the life of the activity to—

(i) identify and motivate a preferred site, activity and technology alternative;

(ii) identify suitable measures to manage, avoid or mitigate identified impacts; and

(iii) identify residual risks that need to be managed and monitored.

DOCUMENT HISTORY - MANYABE CONSULTANCY (PTY) LTD

Revision	Date	Compiled By	Comments
01	28 June 2025	Mpho Manyabe	Final BAR and EMPr for client review
02	04 July 2025	Mpho Manyabe	Final BAR and EMPr for submission to the Competent Authority

APPROVAL FOR RELEASE

Name	Title	Signed
Ms. Mpho Manyabe	Manyabe Consultancy (Pty) Ltd: Managing Director and Lead EAP	

THARISA MINERALS REPRESENTATIVE CONTACT DETAILS

Contact Person	Mr. Patrick Sibuyi
Email Address:	psibuyi@tharisa.com
Telephone Number:	+2714 572 0700

DECLARATION BY THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

I **Mpho Manyabe**, declare that -

- I act as the independent Environmental Assessment Practitioner (EAP) in this application for the proposed **raising of the walls of Tailings Storage Facility (TSF) 2 and TSF 2 Extension project** at Tharisa Mine.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting Environmental Impact Assessments (EIAs), including knowledge of the relevant Acts, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations and all other applicable legislation, policies and guidelines.
- Undertake to disclose to the applicant and the Competent Authority (CA) all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the CA; and the objectivity of any report, plan or document to be prepared by myself for submission to the CA.
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to Interested and Affected Parties (I&APs) and the public at large and that participation by I&APs is facilitated in such a manner that all I&APs, state department and CA will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application.
- I will ensure that the comments of all I&APs are considered and recorded in reports that are submitted to the CA in respect of the application, provided that comments that are made by I&APs in respect of a final report that will be submitted to the CA may be attached to the report without further amendment to the report.
- I will keep a register of all I&APs that participated in a public participation process (PPP); and all the particulars furnished by me in this form are true and correct.
- I will perform all other obligations as expected from an EAP in terms of the Regulations.

Signature of the EAP

Date: 04 July 2025

EAP Company: Manyabe Consultancy (Pty) Ltd

EXECUTIVE SUMMARY

PROJECT INTRODUCTION AND BACKGROUND

Tharisa Minerals (Pty) Ltd (Tharisa) has an opencast mining operation that produces chrome and platinum group metals (PGM) concentrate. The mine is located on Farms K/Kraal 342 JQ, Rooikoppies 297 JQ and Elandsdrift 467 JQ, south of Marikana in the North West Province.

Tharisa holds existing environmental authorisations (EAs) and licenses under the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA), the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA), the National Environmental Management: Waste Act, 2008 (Act. 59 of 2008) (NEMWA) and the National Water Act, 1998 (Act. No 36 of 1998) (NWA) for the mining activities of East, West and Far West open pits, and operation of associated infrastructure.

Tharisa Mine has been in operation since November 2009, having an initial Mining Right 49/2009 (MR) effective 19 September 2008, issued on 13 August 2009 by the then the Department of Minerals and Energy (DME). Tharisa subsequently applied for an amendment of the MR with the Reference Number: NW/30/5/1/2/2/358 MR, stamped 28 July 2011. This MR was however only registered in 2016.

Tharisa is subdivided into East and West Mine by the Sterkstroom river and the D1325 – Marikana Road both running from south to north through the mine boundary. Tailings Storage Facility (TSF) 2 and TSF 2 Extension, along with the majority of the mine infrastructure, are located at the East Mine. Tharisa extracts and processes the Middle Group (MG) 1 to 4 ores of the PGM in the Bushveld Igneous Complex. The mine currently operates three (3) processing plants, namely Genesis, Voyager and Vulcan. Genesis and Voyager are able to process 100 kt and 300 kt per month, respectively. The waste product produced by both plants is sent to the Vulcan plant for further extraction of chrome, after which, the tailings material is hydraulically pumped to TSF 2 Extension for storage.

It is expected that the current active TSF 2 Extension will reach its Full Supply Level (FSL) by December 2025 based on the current tailings production.

Manyabe Consultancy (Pty) Ltd (MC) has been appointed by Tharisa as an independent Environmental Assessment Practitioner (EAP), to undertake a Section 102 amendment application in terms of the MPRDA in order to amend the Environmental Management Programme (EMPr); to undertake Environmental Impact Assessment (EIA) to amend an EA in terms of the NEMA; to amend the Waste Management License (WML) in terms of the NEMWA; and to amend a Water Use License (WUL) in terms of the NWA.

The Competent Authority (CA) for the proposed **raising of the walls of TSF 2 and TSF 2 Extension project** is the Department of Mineral Resources and Energy (DMRE) for the issuance of an amended EA and WML (Integrated EA and WML); and the Department of Water and Sanitation (DWS), for the issuance of the amended WUL.

Tharisa holds the following approvals:

Approval	Reference	Licence Type	Approval Date
EIA and EMPr for a Proposed PGM Mine, Metago Project Number: T014-01, June 2008.	DMRE Reference Number: NW30/5/1/2/3/2/1/358EM	MR	19 September 2008
	North West Department of Agriculture, Conservation and Environment (DACE[1]) Reference Number: NWP/EIA/159/2007	EA	23 October 2009

[1] North West Department of Agriculture, Conservation and Environment (now known as the DEDECT).

Approval	Reference	Licence Type	Approval Date
Amendment of the EA, 23 October 2009 to incorporate additional listed activities previously excluded: Transmission and distribution of above ground electricity (120KV or more).	DACE Reference Number: NWP/EIA/159/2007	EA and EMPr Amendment	30 August 2011
EIA and EMPr for changes to the pit, tailings dam and waste rock facilities; a chrome sand drying plant and other operational and surface infrastructure.	Department of Economic Development, Environment, Conservation and Tourism (DEDECT) Reference Number: NWP/EIA/50/2011	EA	29 April 2015
	DMRE Reference Number: NW30/5/1/2/3/2/1/358EM	EA and EMPr Amendment and WML	24 June 2015
WUL.	DWS Reference Number: 03/A21K/ABCGIJ/1468	First issue of WUL (Superseded by 2020 Integrated WUL - IWUL)	16 July 2012
EIA Report and EMPr Amendment 3: Inclusion of Portion 113 of the Farm K/Kraal 342 JQ and increase of waste rock quantities.	DMRE Reference Number: NW30/5/1/2/3/2/1/358	EA and EMPr Amendment and WML	01 September 2020
WUL Amendment.	DWS Reference Number: 03/A21K/ABCGIJ/1468	WUL Amendment (Superseded by 2024 IWUL)	12 November 2020
Amendment of an EA for Increase Storage Capacity of Tailings Facility and Waste Rock Dump (WRD) and increase the authorised Fuel Storage Capacity in respect of Farm Rooikoppies JQ 297, Elandsdrift JQ 467 And K/Kraal JQ 342, within the Magisterial District of Bojanala, North West Province.	DMRE Reference Number: NW30/5/1/2/3/2/1/358EM	EA and EMPr Amendment and WML	03 August 2021
EA for the establishment of a mixed-use township development on portion 149 of the farm Rooikoppies 297.	NWP-EIA-60-2022 EA	EA	25 April 2023
Tharisa Additional Waste Rock Storage EIA and EMPr. • The expansion of the existing and approved Far West WRD 1 by a footprint of 109 ha. The expanded area will be referred to as the West Above Ground (OG) WRD. Portions of the West OG WRD will be located on backfilled areas of the West Pit; and • The establishment of a WRD (referred to as the East OG WRD) on backfilled portions of the East Pit. The proposed East OG WRD will cover an area of approximately 72 ha.	DMRE: NW 30/5/1/2/3/2/1/358EM	EA and EMPr Amendment and WML	31 May 2023
EA for TSF 3 WRD Extension 1.	DMRE: NW 30/5/1/2/3/2/1/358EM	EA and EMPr Amendment and WML	05 December 2024
WUL Amendment.	DWS Reference Number: 03/A21K/ABCGIJ/1468	Supersedes the 12 November 2020 WUL	12 November 2024
WUL for TSF3 WRD Extension 1.	DWS Reference Number: 03/A21K/ABCGIJ/1468	WUL	17 September 2024

Approval	Reference	Licence Type	Approval Date
TSF 3 Construction and Operation.	DMRE: NW 30/5/1/2/3/2/1/358EM	EA and EMPr Amendment and WML	Signed 02 February 2025. Received on 04 March 2025
Supporting Infrastructure			
EA for the diversion of an existing 275kV powerline and associated infrastructure.	Department of Environmental Affairs (DEA) . Record of Decision (RoD) Reference Number: 14/12/16/3/3/3/408	EA	15 November 2012
Amendment of an EA in respect of the upgrade of the existing Waste Water Treatment Plant (WWTP) in respect of the Farm Rooikoppies JQ 297, Elandsdrift JQ 467 and K/kraal JQ 342 JQ.	DMRE RoD Reference Number: NW30/5/1/2/3/2/1/358EM	Amendment of an EA	14 August 2020
Rectification of an unlawful commencement of a listed activity for the storage of dangerous goods of more than 80m^3 but les then 500m^3.	DMRE: NW 30/5/1/2/3/2/1/358EM	EA and EMPr	10 August 2021

PROJECT LOCALITY

Tharisa Mine is located on the farms Rooikoppies JQ 297, Elandsdrift JQ 467 and K/K JQ 342, near the town of Marikana within the Rustenburg Local Municipality, Bojanala Platinum District Municipality (BDM), North West Province. Access to the site is via a secondary road which intersects N4 to the south of the mine.

TSF 2 and TSF 2 Extension are located on the following farm portions:

- Portion 185 of Farm K/K 342 of the Major Region JQ (Title Deed Number T50806/2011).
- Portion 186 of Farm K/K 342 of the Major Region JQ (Title Deed Number T102908/2008).
- Portion 187 of Farm K/K 342 of the Major Region JQ (Title Deed Number T57904/2011).
- Portion 193 of Farm K/K 342 of the Major Region JQ (Title Deed Number T70210/2011).
- Portion 224 of Farm K/K 342 of the Major Region JQ (Title Deed Number T17597/1940).
- Portion 225 of Farm K/K 342 of the Major Region JQ (Title Deed Number T17597/1940).
- Portion 226 of Farm K/K 342 of the Major Region JQ (Title Deed Number T17585/940).
- Portion 242 of Farm K/K 342 of the Major Region JQ (Title Deed Number T5977/2010).
- Portion 317 of Farm K/K 342 of the Major Region JQ (Title Deed Number T22984/1960).
- Portion 89 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T26184/2013).
- Portion 90 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T42193/2013).
- Portion 92 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T76043/2008).
- Portion 176 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T66004/2011).
- Portion 177 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T66004/2011).
- Portion 227 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T27501/2017).
- Portion 228 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T27503/2017).
- Portion 229 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T27504/2017).
- Portion 230 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T62022/2017).

OVERVIEW OF THE EXISTING OPERATIONS AND PROPOSED PROJECT INFRASTRUCTURE

A. EXISTING OPERATIONS

Mining at Tharisa Mine is undertaken using conventional open pit truck and shovel methods. The two (2) mining sections (East and West) are separated by a tributary of the Sterkstroom River and the D1325 (Marikana Road). The waste rock from the open pit areas is stockpiled at various WRDs and TSFs. Some in-pit dumping of waste rock has taken place at East Mine.

The existing mining infrastructure includes the following:

- West WRD (64.89 ha);
- Far-West WRD (32.90 ha);
- Far-West Pit (48.03 ha);
- West Pit (39.47 ha);
- Central WRD /Eastern WRD 1 (76.3 ha);
- Eastern WRD (63.23 ha);
- East Pit (211.43 ha);
- Run of Mine (RoM) pad (15.84 ha);
- Concentrator plant (Genesis and Voyager) (28.43 ha);
- Vulcan plant (3.29 ha);
- TSF1 Phase 1 and 2 (115.99 ha);
- TSF 2 Phase 1 (TSF 2) and 2 (TSF Extension) (101.91 ha);
- Haul roads;
- Various product stockpiles;
- Topsoil stockpiles;
- Stormwater dam;
- Pollution Control Dam (PCD);
- Hernic quarry (stormwater dam);
- Sewage Treatment Plant (STP); and
- Supporting Infrastructure such as:
  - Offices;
  - Workshops;
  - Change houses; and
  - Access control facilities.

A network of roads exists within the mine. A 275 kV powerline and associated Eskom servitude cross through the eastern part of the mining area in a north-south direction. Smaller rural power and telephone lines currently service the residential areas within the western and eastern sections of the project area. Infrastructure (pipes and canals) associated with the Buffelspoort Irrigation Board traverses various sections of the project area in a south-north direction.

The activities associated with the current mining method are tabulated below.

Mining Activities	
Method	Tharisa is an opencast mine, which comprises two sections namely the East Mine and West Mine. The mining method at Tharisa comprises a standard open pit truck and shovel method.
Access to Ore	Access to the mining face is by means of haul roads and boxcuts with ramps. Steady state open pit dimensions will differ between the east and west sections because of the varying dip of the target ore body. In the western section, the dimensions are expected to be 360m wide, 1km in length along the outcrop with a final high wall averaging at approximately 180m. On the eastern section, the dimensions are expected to be 580m wide, 1km in length along the outcrop with a final high wall averaging at approximately 180m. The general mining direction is north.
Removal of topsoil	All topsoil is dozed into stockpiles along the low wall (outcrop) sides of the open pits. Topsoil is stockpiled separately for use in rehabilitation
Drilling and blasting	Once the topsoil is removed, the area is drilled as per the drill design. Charges are designed to prevent excessive ground vibration, airblast and fly rock. The remaining waste rock and the ore is drilled and blasted together.
Removal of waste rock	The removal of waste rock above the ore body is undertaken as a bulk operation by load and haul with large equipment. The material is placed on WRDs.
Removal of ore	RoM ore is stockpiled according to RoM type, prior to being sent to the concentrator plant for processing.
Mineral Processing - Concentrator Plant	
Crushing and screening	Chrome RoM material is tipped into a receiving bin for crushing by a primary jaw crusher. The crushed material is then conveyed to the secondary jaw crusher circuit. Oversized material from the secondary circuit is returned to the primary crusher feed conveyor for reprocessing. Correctly sized material from the secondary crushing process is separated into different fractions using a double deck screen. The lumpy and chips from the screening process report to the Dense Media Separation (DMS) section, while the undersized report to a mill feed stockpile for milling prior to spiral plant treatment. The PGM plant crushing facility consists of a primary gyratory crusher and a secondary cone crusher. Material is discharged directly into the primary gyratory crusher to be crushed. Following primary crushing, the material is stored in a stockpile. Ore is extracted from the stockpile by feeders onto a conveyor for transport to a sizing screen. The crushed material is screened with the oversized material

	reporting to the secondary crusher for further crushing (closed circuit). The undersized material from the screen reports to a silo for storage prior to milling.
DMS - chrome plant only	The chrome lumpy material is treated in a DMS plant, while the chip fraction is treated in a cyclone plant. A drum gives good separation at the lumpy size fraction as the cyclone does for the smaller chip fraction. The recovered lump and chip material is conveyed to separate stockpiles, while the discard (float) material is transported to a discard bin for removal to the waste rock stockpile.
Milling	The Chrome undersized material from the secondary screening process is fed at a controlled rate to a ball mill for grinding. Product from the ball mill is screened with oversize returning to the grinding circuit and undersize reporting to the spirals plant. PGM ore from the silo is fed onto the mill feed conveyor by three variable speed feeders. The primary ball mill receives both feed material, as well as mill water for flushing the ore into the mill. Material from the mill discharges onto a screen where the oversize is collected in a bin and the undersize pumped through a cyclone. The cyclone overflow is filtered with the oversized material being recycled and the undersize material reporting to a screen together with the cyclone sinks. Undersized material from the screen reports to the agitated rougher flotation feed tank, while the oversized material reports to the secondary mill feed.
Floating – PGM plant only	The flotation plant consists of a rougher, cleaner, re-cleaner and scavenger section. Chemicals are added at the various stages to the feed material, allowing the Platinum Group Elements (PGEs) to attach to the foam. In some cases, a depressant may be required to prevent other minerals from attaching to the carrier-bubbles. Underflow material is rejected to the PGE spirals plant whilst the concentrate is pumped to the product thickener for dewatering. The PGE concentrate is pumped to a storage tank for loading by truck.
Spiral	The PGM underflow material from the floatation section is pumped to cyclones with the underflow gravitating into the spirals and the overflow reporting to the tailing's thickener. Two streams leave the spirals plant; a product stream and tailings. The product stream is dewatered and stockpiled (8000t). Water is recovered from these stockpiles and is returned to the PGM plant for water and product recovery. Tailings are dewatered in the PGE tailings thickener for water recovery, with the underflow reporting to the tailings dam. Approximately 40 000 tonnes of PGM concentrate is produced per year. The chrome material from the grinding section is pumped to cyclones with the underflow gravitating into the spirals and the overflow reporting to the tailing's thickener. Two streams leave the spirals plant; a product stream (Met and Chem grade chromite) and tailings. The product stream is pumped to four cyclones to produce two fine material stockpiles (8000t met grade and 2000t chem. grade). Drainage from these stockpiles is returned to the MG1 plant for water and product recovery. Tailings are dewatered in the tailing's thickener for water recovery, while the underflow is pumped to the tailings dam. Approximately 1.5 million tonnes of chrome concentrate is produced per year.
Dispatch	
Method	Railway transportation of product is the preferred option for the mine. The nearest railway is to the north of the mine at the Marikana Siding (the siding has been upgraded in consultation with Transnet to cater for Tharisa's requirements). Product is transported via 30-tonne trucks with an estimated rate of 320 trucks/day for chrome concentrate and 8 trucks/day for PGM. Chrome is dispatched to Richards Bay via the Marikana Railway siding and/ or the N4. PGM is dispatched to smelters in the region.
Waste disposal	
Tailings dam	Slurry from the secondary rougher flotation process is discarded as tailings. It is thickened and pumped to a tailings facility for deposition by means of conventional spigotting. Tailings production is approximately 4 million tonnes per year. Process water from the tailings dam is recycled to the plant for use in the process.
Rehabilitation	
Method	Rehabilitation is concurrent with mining. Waste rock/ overburden is used to backfill voids where required. Overburden material is used to cater for any settlement. Once the backfill material has settled, topsoil is placed on top of the overburden for vegetation to re-established.

The raised facilities allow for the majority of the existing infrastructure components to remain in place and function as intended, as follows:

- Rockfill Embankment;
- Waste Rock Buttress;
- Toe drains;
- Seepage cut-off drains;
- Decant System;
- Penstock Energy Dissipator;
- Pool wall and Wing Walls;
- Catwalk;
- Geofabric;
- Solution Trench;
- Collection Sump;
- Collection Manhole;
- Drainage design;

  - *Pipe Loading;*
  - *Penstock outfall pipeline bearing capacity;*
  - *Penstock rings;*
  - *Penstock outfall valves;*
  - *Drainage Sizing;*
  - *Outlet Piping; and*
  - *Filter Compatibility.*
- Geofabric Separation Layer; and
- Barrier system.

The relevant aspects of the raised TSFs' stage capacity curves are summarised below:

- Maximum tailings height:
  - TSF 2 = ± 41 m
  - TSF 2 Extension = ± 45 m
- Additional capacity at maximum height:
  - TSF 2 = 1 686 784 tonnes (4.85 months)
  - TSF 2 Extension = 1 893 966 tonnes (5.44 months)

BASIC ASSESSMENT PROCESS

EIA is a planning and decision-making tool that is used to identify the environmental consequences of a proposed project, before the development takes place. The purpose of the EIA is to describe the potential consequences of the proposed **raising of the walls of TSF 2 and TSF 2 Extension project** in environmental, economic and social terms. Public issues and concerns must therefore be identified timeously so that these can be recorded and responded to in the EIA. All comments received in writing will be included in the submission to the CA for consideration.

The NEMA EIA Regulations, 2014, as amended, define two (2) broad processes for an EIA, namely: Basic Assessment (BA) and Scoping and Environmental Impact Reporting (S&EIR).

- A BA is required for projects with less significant impacts or impacts that can easily be mitigated.
- S&EIR is applicable to all projects likely to have significant environmental impacts due to their nature or extent, activities associated with potentially high levels of environmental degradation, or activities for which the impacts cannot be easily predicted. The proposed project entails the undertaking of a BA in terms of the NEMA EIA Regulations, 2014, as amended and the NEMWA.

The BA consists of the identification of potential issues which are investigated by undertaking specialist studies. A complete list of specialist studies and the issues that have been addressed have been detailed in this Final Basic Assessment Report (BAR) and EMPr Report, which is being submitted to the DMRE for decision making.

This Final BAR and EMPr Report has been compiled in terms of Appendix 1 of the NEMA EIA Regulations of 2014, as amended, as well as the requirements of the BAR and EMPr Report template issued by the DMRE. All comments received during the review of the Draft BAR and EMPr Report have been incorporated into this Final BAR and EMPr Report. Before Tharisa can commence with the proposed raising of the walls of TSF 2 and TSF 2 Extension, amendments to the existing approvals need to be undertaken in terms of the following national legislation:

- The NEMA, for the listed activities stipulated in the NEMA EIA Regulations of 2014, as amended;
- The MPRDA, for the amendment of the EMPr in accordance with Section 102 of the Act;
- The NEMWA, for waste management activities stipulated in Government Notice Regulation (GNR.) 921, promulgated under the Act; and
- The NWA for water uses identified under Section 21.

The approvals in terms of the NEMA, NEMWA and MPRDA are being applied for to the North West DMRE. The approval in terms of the NWA is being applied for to the North West DWS.

The amendments are being undertaken as per the following legislation:

Integrated EA and WML Amendment Application

In terms of GNR. 327 (Listing Notice 1), activities 21D, 34, 48 and 66; a BA process must be undertaken to obtain an amended EA from the DMRE. With respect to the WML, TSF 2 and TSF 2 Extension were previously authorised by the DMRE.

It must be noted that the current application is for the amendment of the existing approvals. It is for this reason that an Integrated EA and WML application is being lodged, and a BA process is being followed. TSF 2 and TSF 2 Extension are existing TSFs. TSF 2 Extension is currently being operated under the existing approvals.

Section 102 amendment application

Section 102 of the Act states that "*a reconnaissance permission, prospecting right, MR, mining permit, retention permit, technical corporation permit, reconnaissance permit, exploration right and production right work programme; mining work programme, EMPr, and Environmental Management Plan (EMP) may not be amended or varied (including by extension of the area covered by it or by the addition of minerals or a share or shares or seams, mineralised bodies, or strata, which are not at the time the subject thereof) without the written consent of the Minister"*.

It must be noted that Activity 21D has been included into Listing Notice 1 on the NEMA EIA Regulations, of 2014, as amended, which now requires that a **BA** must be undertaken as part of the amendment process in terms of section 102 of the MPRDA.

Water Use License Application

A Water Use License Application (WULA) process is being undertaken, for Section 21 (g): *"disposing of waste in a manner which may detrimentally impact on a water resource"* i.e., raising of the walls of TSF 2 and TSF 2 Extension, as the activity is listed as a water use under Section 21 of the NWA.

PROJECT ALTERNATIVES

In terms of Appendix 2 of the NEMA EIA Regulations, 2014, as amended, all environmental reports must contain a description of any feasible and reasonable alternatives that have been identified, including a description and comparative assessment of the advantages and disadvantages that the proposed activity and alternatives will have on the environment and on the community, that may be affected by the activity.

Every BA process must therefore identify and investigate alternatives, with feasible and reasonable alternatives to be comparatively assessed. If no alternatives exist, proof that an investigation was undertaken and motivation indicating that no reasonable or feasible alternatives other than the proposal/ preferred option and the no-go option exist must be provided.

The following alternatives have been considered and investigated:

Design Alternatives:

Design alternatives have not been considered for the proposed raising of the walls of TSF 2 and TSF 2 Extension, for the following reasons:

The TSF 2 and TSF 2 Extension are already existing, and the EA and WML were approved previously. The raised TSFs are designed as single paddock, full containment facilities. The existing infrastructure associated with the TSFs comprises the following:

- Single, full containment, engineered paddocks, constructed with selected waste rock from the open-pit mining operations.
- 1.5m high starter embankments along the upstream toe of the existing embankments, constructed from selected in-situ soils in compacted layers.

- Structural key-cuts along the upstream and downstream toe of the TSF embankments, replacing the in-situ soils with engineered rockfill.
- Penstock gravitation water decanting systems for TSF 2 and a decant tower for TSF 2 Extension.

The raised facilities will include the addition of:

- Embankments constructed using selected waste rock from open-pit mining operations, with a height of 5m for TSF 2, and 3m for TSF 2 Extension. The embankments will have a crest width of 15m with 1V:3H and 1V:2H downstream and upstream slopes, respectively.
- Geofabric separation layer (750 g/m^2) below the raised embankment at the tailings interface.
- Penstock outfall isolating valves.

Site Alternatives:

It is expected that the active TSF at the mine (TSF 2 Extension) (also known as TSF 2 Phase 2) will reach its FSL by December 2025 based on the current tailings production rate. A decision was made to lift the embankments of TSF 2 and TSF 2 Extension through an upstream construction methodology, thus increasing the capacity of the facilities. The raised facilities allow for the TSF footprint areas to remain unchanged with the continued utilisation of the existing decanting infrastructure.

Additionally, Tharisa MR boundary has significant space constraints due to the existing infrastructure. The area surrounding the mine is largely characterised by mining activities including the Marikana Platinum Mine to the west, Western Platinum Mine to the north and Samancor Western Chrome Mine to the east. The N4 and farming community of Buffelspoort is located to the South of Tharisa Mine.

For these reasons, no location alternatives for the proposed project could be considered. Given that the project components relate mainly to storage of waste material in order for mining to effectively take place and optimising approved mining activities, no real site alternatives for this project exist.

Technology Alternatives

i. Briquetting

Technological alternatives available for the disposal of tailings include the briquetting of tailing (fines). The briquetting of material can be undertaken either by uniaxial pressing or via roll pressing. Various binders are required for the processes, such as lime, molasses, magnesium lignosulfonate, and bentonite. Concerns of storing for periods in excess of five (5) weeks present issues associated with mildew formation, but as the mine is located in an area with a negative water balance, this is unlikely to be of concern. For this method to be effective, Tharisa would require a press to bind the materials as well as the relevant binders.

Disposal of tailings in TSFs is the method that is currently in place at the mine. The additional benefit of this process is that there is existing institutional knowledge for this process of disposal. Based on the existing infrastructure and knowledge in place, the disposal to tailings is seen as the preferable method.

ii. The use of waste rock for the raising of the walls

The raised facilities will include the addition of, *inter alia*, embankments constructed using selected waste rock from open-pit mining operations, with a height of 5m for TSF 2, and 3m for TSF 2 Extension. The embankments will have a crest width of 15m with 1V:3H and 1V:2H downstream and upstream slopes, respectively. The tailings will be deposited behind the embankment, into the basin.

This is the method that is currently in place at the mine, and there have not been any reported dams' failures. This is therefore the most preferable method.

The option of not implementing the activity/ No – Go Alternative

The option of the project not proceeding would mean that the environmental and social status would remain the same as current. This implies that both negative and positive impacts would not take place. The positive impacts such as expected revenue, economic development, employment creation, skills development, poverty alleviation and the continued upliftment of the surrounding communities would not be realised.

BIOPHYSICAL AND SOCIO-ECONOMIC ENVIRONMENT

An overview of the biophysical and socio-economic environment of the proposed **raising of the walls of TSF 2 and TSF 2 Extension project** is given below. This information was obtained from the existing data presented in the approved environmental reports and specialist studies reports which have been compiled for the proposed project.

Environmental Aspect	Description
Geology	The Bushveld Igneous Complex (BIC), a massive intrusive body, has undergone erosion and tilting, and now emerges along the apparent boundary of a large basin measuring nearly 350km across. The BIC is comprised of eastern and western lobes, with a northern and far western extension. Additionally, a buried limb, known as the Bethal Limb, exists based on borehole intersections. All five limbs were formed approximately 2000 million years ago. The eastern and western limbs exhibit striking similarities. This extensive complex originated when vast amounts of molten rock (magma) from the Earth's mantle ascended to the surface through vertical cracks and conduits in the crust. Upon reaching the surface, it differentiated, cooled, and solidified, resulting in a vast layered igneous body with a predominance of Chromite, thus forming the rare rock type known as chromitite. Chromite deposits in the BIC are found as stratified layers of massive chromitite. These significant chromitite layers are located in the lower section of the BIC known as the Critical Zone. They are categorised into three groups based on their proximity to each other. The Lower Group (LG) consists of seven chromitite layers, the MG has four main chromitite layers, and the Upper Group (UG) contains two chromitite layers (some sources also mention a third layer - UG3). The naming convention assigns ascending numbers to the layers within each group, starting from the bottom layer (e.g., LG1, LG2, and so on, up to UG2 at the top). This naming convention reflects the concept that the lowermost layers are considered the oldest. The Merensky Reef, situated at some distance above the UG2 chromitite layer, is the uppermost layer of economic interest in the Critical Zone. However, the Merensky Reef is mainly composed of Pyroxenite with only a few thin chromite stringers near its base. The individual chromitite layers can vary in width from a few centimeters to over 2 meters in localised areas, but they generally range around 1 meter in thickness, seldom exceeding 2 meters. As a general trend, the average chrome content and Cr/Fe ratio of the layers decrease as the sequence progresses upward, while the PGMs content increases. The chromitite layers in the MG exhibit intermediate concentrations of both chrome and PGE mineralisation, but there is a general decrease in grain size from the lowermost to the uppermost layers. Traditionally, chrome production primarily focused on exploiting the layers of the LG, while PGE production typically targeted the uppermost Merensky Reef and the underlying UG2 chromitite layer from the UG. From an economic perspective, the chrome and PGE concentrations in the MG chromitite layers are considered marginal on an individual basis.
Topography, Vegetation and Land Use	Tharisa Mine is situated on slightly undulating plains and located to the east and west of the perennial Sterkstroom River. Small sections of original vegetation remain intact on the site, although most of the site represents old, cultivated land. The major land uses of the project area as classified by the Environmental Potential Atlas of South Africa (2000) are mining and vacant/unspecified land (AGES, 2023b). Tharisa Mine is situated within the Savanna biome which is the largest biome in Southern Africa. The Savanna Biome is characterised by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs). Land use in the area was a mixture of farming, residential, mining, small business, and general community activities. Similar land uses still take place adjacent to the mine infrastructure and activity areas (Metago, 2008; SLR, 2014). Mining activities occur to the North and immediate West and East of Tharisa Mine. Amongst the mining activities is open land mostly owned by mining companies and the community of Marikana (GLYA, 2023). Immediately West of the mining area, in the MR footprint, is the Lapologang community.

Environmental Aspect	Description
	The predominant land cover types in the area are listed below: • Mine: Extraction pits and quarries; • Mine: Surface infrastructure; • Mine: Tailings and resource dumps; and • Commercial Annual crops rainfed/ dryland. As a result of this, the area may be described as significantly transformed by mining. TSF 2 and TSF 2 Extension have already been developed. The proposed project is for the lifting of their walls.
Climate	Tharisa Mine falls within the Highveld Climatic Zone (semi-tropical region) which is characterised by moderately warm temperatures, with mild dry winters and hot summers. The Buffelspoort weather station (Station No. 0511 855 W) is the closest station to Tharisa. The rainy season typically occurs in summer during October to March, with afternoon thundershowers occurring often from August to March. The area experiences hot temperatures during summer, with a maximum of 36.4°C for October. Winter temperatures are relatively low especially in May to July. The average annual precipitation in the region ranges from 873 mm and 939 mm (Airshed Planning Professionals, 2023a). Rainfall is generally in the form of thunderstorms. These can be of high intensity with lightening and strong gusty south-westerly winds. The frequency of hail is also high with approximately 4-7 hailstorms per season. Rainfall conditions are highly variable, and droughts and floods do occur. The annual Wind roses comprise 16 spokes which represent the directions from which winds blew during the period. The average wind speed at the project site is 3.29 m/s and calm conditions (<0.5 m/s) occurred for some 1.2% of the time. Wind speed capable of causing wind erosion i.e., ≥5.4 m/s occurred for about 8.8% of the time. This equates to about 32 days in a year. The prevailing winds are from the northeast (10.2%) and east (9.4%), east northeast (9.3%) respectively. Secondary contributions are from the southeast (9.2%) and east-southeast (9.1%).
Surface Water	Tharisa Mine is located in the Crocodile (West) and Marico Water Management Area (WMA) and is located mainly in the Quaternary Catchment Area (QCA) A21K. The Crocodile River is a major tributary of the Limpopo River (Drainage Region A) which discharges into the Indian Ocean (Mozambique). The Pienaars, Apies, Moretele, Jukskie, Hennops, Magalies and Elands rivers are all major tributaries of the Crocodile River which make up the A20 tertiary hydrological catchment with its 39 quaternary catchments. The main river upstream of the project site is the Sterkstroom River, which is a source of water for the Buffelspoort Dam. The water quality of the Sterkstroom River (a tributary of the Crocodile River) must be continuously monitored to assess the impacts of the mine on water quality. This river originates in the headwaters of the A21K quaternary catchment, which then flows through the Buffelspoort Dam (approximately 5.8 km upstream) and then traverses the mine and continues towards the Crocodile River. The Sterkstroom River has an ecological category of Class C (DWS, 2014). Class C means the river system is moderately modified and a loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.
Groundwater	Groundwater enters the mine as direct recharge from rainfall or as seepage from the TSFs or WRDs. According to the Groundwater Resources Association (GRA) II datasets, the average recharge for the entire catchment is about 28 mm/a, or about 0.000077 m/d (SLR, 2014). Due to mine dewatering, the local groundwater flow directions in the deeper fractured aquifer are generally re-directed towards the mine. The general groundwater flow direction is from south to north, or southeast to northwest. Groundwater within the mining area is neutral (pH~7.8) and non-saline [average Total Dissolved Solids (TDS) of 340 mg/l]. The average sulphate concentration is ~38.9 mg/l and the average nitrate as N concentration is ~5.8 mg/l.
Terrestrial Ecology (Flora and Fauna)	The mine falls within the Marikana Thornveld which is an important vegetation type that requires careful consideration when developing mining projects. The project area includes a terrestrial Critical Biodiversity Area (CBA) and a critically endangered river (the Sterkstroom) defined by the North-West Province 2009 biodiversity assessment, and a High Biodiversity area in terms of the recently published Mining Biodiversity Guidelines. It is important to note that these national guidelines and assessments were published after the mine was approved in 2008. The area has been transformed by agricultural and mining activities (both on the project site and in the surrounding areas). Though the CBA and Ecological Support Area (ESA) map shows the project area overlapping ESA1 and ESA2 areas, the area has been disturbed.

Environmental Aspect	Description
Air Quality	Existing sources of emissions in the region and the characterisation of existing ambient pollution concentration is fundamental to the assessment of cumulative air impacts. A change in ambient air quality can result in a range of impacts which in turn may cause a disturbance and/or health impacts to nearby receptors. The main pollutant of concern in the region is particulate matter [Total suspended particulates (TSP); Particulate Matter $(PM)_{10}$ and $PM_{2.5}$] resulting from vehicle entrainment on the roads (paved and unpaved surfaces), mining and smelter activities, farming activities and windblown dust from exposed surfaces, mine waste dumps and TSFs. Gaseous pollutants such as SO_2, NO_x, CO and CO_2 would result from vehicles, mining equipment, smelter and processing emissions. A dustfall network is in place comprising of 15 single dust buckets located at and around Tharisa Mine, and passive sampling is conducted at three locations to determine background SO_2 and NO_2 concentrations.
Noise	The mine is located in an area where the character of ambient noise is already affected by industrialisation and economic activity, which over time, has resulted in an increase in road traffic noise and noise generated by intensive mining activities by surrounding mines. Road traffic emanates specifically from the N4 and various secondary roads, such as the Marikana Road that runs between the East and West mining areas at Tharisa Mine. The N4 has a wide noise footprint, affecting people living within a zone of approximately 1.2 km either side of the road, while noise generated by surrounding mining activities affects communities, farmers and other third parties in the immediate surrounds. The closest potential sensitive receptors to the proposed project consist of the Mmaditlhokwa Community, Lapologang Community, Piet Retief Primary School and farmers.
Visual Aesthetic	The visual character of an area is determined by considering landscape character, scenic quality, sensitivity of the visual resource, sense of place and visual receptors. Mine-related infrastructure and activities has the potential to alter the visual aspects in a project area and surrounding area. The project area is largely disturbed and is characterised by Tharisa's mining-related infrastructure and activities as well as private farming and community related activities. Natural elements within the Mining Right Area (MRA) exist, including various scattered patches of natural habitat and the Sterkstroom River, separating the East and West mining areas. However, the Marikana Road is in close proximity and contributes a low scenic quality in contrast to the aforementioned natural features. The proposed project site consists of existing TSFs and has therefore been disturbed. There is no natural vegetation. It follows that the overall scenic quality within the proposed project area is very low to low.
Heritage/ Archaeology and Palaeontology	The most important heritage resources discovered in the area were stone-walled settlements, graveyards, a historical village and homestead, mining heritage remains, isolated and randomly scattered stone tools, historical houses and outdated and discarded agricultural implements. Graveyards located within the mining area have since been relocated with all associated consultations and permits. Tharisa obtained a permit in terms of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA), for the exhumation and relocation of graves to be disturbed by the mining of the east pit. There are several churches within the MRA. These churches include the African Faith Mission (AFM), Uniting Reform Church (URC), New Earth Apostolic Church (NEAC) Ts'enolo Apostolic Church (TAC) and many other apostolic churches whose members assemble at various venues including private homes, schools and/or hired venues. Although no paleontological resources are expected within the MRA, these resources are protected by national legislation and must be reported to the South African Heritage Resources Agency (SAHRA) should they be identified on-site.
Socio-Economic Environment	The mining sector is a big contributor to the economy of South Africa as well as the region. The Rustenburg area has a large concentration of mining activities, with the mining sector creating the biggest job opportunities. The proposed project to be implemented has many positive benefits and spinoffs both during the construction and operational phases. The benefits and positive impacts have a countrywide reach.

SPECIALIST STUDIES

The following specialists' studies have been undertaken, for the various environmental aspects, for the proposed project:

- Soils, Land Capability and Land Use/ Agricultural Potential Assessment.
- Surface Water Study, including Wetland Delineation, Freshwater (Aquatic) and Terrestrial Ecology.
- Air Quality Impact Assessment Study.
- Noise Impact Assessment.

- Heritage Impact Assessment (HIA) screener and Exemption of Palaeontological Impact Assessment.
- Visual Impact Assessment.
- Geohydrological Investigations.
- Geochemistry Study and Waste Assessment.

PUBLIC PARTICIPATION

The Public Participation Process (PPP) has been undertaken in terms of Chapter 6, regulation 41 of the EIA 2014 Regulations, as amended, for the proposed project triggering listed activities under the NEMA, NEMWA, MPRDA and NWA. MC on behalf of Tharisa considered all relevant guidelines applicable to the PPP as contemplated in section 24J of the NEMA. Notices were given to all potential I&APs to participate in the project, as follows:

Announcement of the project and the Draft BAR and EMPr Report availability

The objectives of PPP are to provide sufficient and accessible information to I&APs in an objective manner to enable them to raise comments, issues of concern and suggestions for enhanced benefits. I&APs also have an opportunity to provide input into the specialist studies reports, and to contribute relevant local and traditional knowledge to the BA process.

The project was announced to the public from **Friday, 09 February 2024 to Monday, 11 March 2024**, by means of the placement of a newspaper advertisement and site notices. Background Information Documents (BIDs) were distributed to I&APs to create awareness of the proposed project. The Draft BAR and EMPr Report including specialist studies were subjected to a PPP of at least 30 days and this Final BAR and EMPr Report reflects the incorporation of comments received, including any comments from the competent and commenting authorities.

The following processes were undertaken to announce the project and the availability of the Draft BAR and EMPr Report:

- An I&AP database was compiled and is being maintained and includes all I&APs in respect of the application in accordance with Regulation 42.
- Letters were sent to all I&APs, written in any of the manners provided for in section 47D of the NEMA, announcing the project and the availability of the Draft BAR and EMPr Report, containing project information, a locality map to the municipal councillor, community members, the local and district municipality, state departments and all other stakeholders as required by the CA, including adjacent communities' members.
- Telephonic consultation was undertaken with I&APs to obtain comments and to share information about the Project.
- Affected parties who could not be reached via mail, fax or e-mail of the proposed project, were visited for delivery of the letters. The letters attached sheets which allowed I&APs to register and/ or/ comment on the Draft BAR and EMPr Report.
- Four (4) site notice boards were fixed at places conspicuous to and accessible by the public at the boundary of the site where the activity to which the application relates. Site notices were written in English and Setswana.
- One (1) advertisement (translated into both English and Setswana) was placed in the Rustenburg Herald Local newspaper.
- The Draft BAR and EMPr Report was also made available on the MC website (https://manyabeconsultancy.com/stakeholder-engagement/); and at the Marikana Public Library.
- SMS notifications of the availability of the Draft BAR and EMPr Report for public comment were distributed.

Invitation to public meetings for the review of the Draft BAR and EMPr Report

Two (2) focus group meetings were hosted with the surrounding community members, to discuss the Draft BAR and EMPr Report and the project.

Public meetings were convened at the following public venues:

Venue	Date	Times
Mmaditlhokwa Village: **Open Space**	10 February 2024	10:00 - 12:00
Lapologang Village: **Sports Ground**	10 February 2024	14:00 - 16:00

The minutes of the meetings are attached to this report as Appendix H of Appendix 3.

The proceedings of the public meetings, as well as all comments submitted have been captured in a Comments and Responses Report (CRR) which is attached to this Final BAR and EMPr Report (Appendix F of Appendix 3) which is being submitted to the DMRE for decision-making.

Comments from the DMRE on the Draft BAR and EMPr Report were received on 12 June 2025, as summarised below, and have been addressed in this Final BAR and EMPr Report:

- The DMRE confirmed having received the application for an EA on 18 November 2024 via email together with the Draft BAR and EMPr Report on 07 February 2025.
- The lifting of the walls of the TSF would be 3 to 5 meters high. How high would the TSF be, including the current approval? Furthermore, how would the extension affect the footprint of the approved TSF.
- Since there is an application for uplifting the walls in order to increases the capacity of the TSF, the EAP is required to clarify if the proposed project would trigger the WUL or not, since there would be a change in respect of the approved capacity of the material.
- The visual impacts around the area would be highly affected by the proposed project and the air quality within the area has been heavily impacted by the mining activities. What could be the measure to curb such impacts.
- The Draft BAR and EMPr Report has been evaluated. The EAP is required to include the report on PPP according to regulation 41 (1) of the EIA Regulation, 2014 as amended. The report should reflect the process undertaken as per the regulation 41 (2) of the said Regulations. The report must reflect all the comments and the response thereof, as required in terms of regulation 44(1) of the EIA Regulations. The CA expect that the report would be covering both projects as it has been reflected on the reference numbers.
- The EAP is required to recalculate the quantum for financial provision with the use of the 2024 master rate. The revised quantum must be attached to the Final BAR and EMPr.

Announcement of the Submission of the Final BAR and EMPr Report to the Competent Authority

The Draft BAR and EMPr Report was updated based on the comments and inputs received during the review and commenting period of the Draft BAR and EMPr Report. The Final BAR and EMPr Report is being made available for public comment from **Friday, 04 July 2025 to Monday, 04 August 2025**. The Final BAR and EMPr Report is concurrently being submitted to the DMRE for decision-making on **Friday, 04 July 2025**. All registered I&APs are being notified of the Final BAR and EMPr Report's submission and its availability on the MC website for review and comment. Additional comments received will be forwarded to the DMRE.

IMPACT ASSESSMENT

The impact assessment undertaken by the EAP, as part of the Integrated EA and WML application process followed due process to inform the findings of the EIA study in accordance with the EIA Regulations of 2014, as amended. The EIA process included an assessment of potential impacts identified, further investigations by specialists in their respective fields, and the undertaking of the legislated required participation with I&APs.

The impact assessment considered both the biophysical and socio-economic aspects of the environment within which the TSF 2 and TSF 2 Extension are located.

The social impacts can be mitigated where negative, however by enhancing the positive impacts, the mine will have an overall positive impact, through the implementation of the mine's policies and the proposed management measures as detailed in the EMPr.

A summary of the potential significant impacts identified is provided in the table below. The level of residual risk after management or mitigation, associated with the proposed project, is also estimated. A detailed impact assessment is provided in SECTION 13:.

Potential Impact	Aspects Affected	Significance	Significance if mitigated
CONSTRUCTION PHASE			
• Change in ambient concentrations.	Air quality	**Medium (Negative)**	**Medium (Negative)**
• Increase in ambient noise level.	Noise	**Medium to High (Negative)**	**Medium (Negative)**
• Change in landscape and related visual aspects.	Visual	**Low (Negative)**	**Low (Negative)**
• Contamination to ground- and surface water systems from oil, grease, and diesel spillages from construction vehicles.	Groundwater Systems and Surface Water	**Medium to High (Negative)**	**Negligible**
• Storage of chemicals and building materials during construction of waste facility.	Groundwater Systems	**Medium to High (Negative)**	**Negligible**
OPERATIONAL PHASE			
• Change in ambient concentrations.	Air quality	**High (Negative)**	**Medium to High (Negative)**
• Increase in ambient noise level.	Noise	**Medium (Negative)**	**Medium (Negative)**
• Change in landscape and related visual aspects.	Visual	**Low (Negative)**	**Low (Negative)**
• Contamination to baseflow and groundwater systems.	Baseflow and groundwater systems	**Medium (Negative)**	**Low (Negative)**
• Contamination to ground- and surface water sources.	Ground- and surface water sources	**Medium to High (Negative)**	**Low (Negative)**
• Increased surface run-off and erosion from the TSFs. • Downstream sedimentation. • Failing stormwater infrastructure. • Establishment of alien plants on disturbed areas.	Freshwater Systems	**Low (Negative)**	**Low (Negative)**
CLOSURE, REHABILITATION AND POST CLOSURE PHASE			
• Change in ambient concentrations.	Air quality	**Medium (Negative)**	**Medium (Negative)**
• Increase in ambient noise level.	Noise	**Medium to High (Negative)**	**Medium (Negative)**
• Change in landscape and related visual aspects.	Visual	**Low (Negative)**	**Low (Negative)**
• Contamination to ground- and surface water systems.	Groundwater and Surface Water Systems	**Medium to High (Negative)**	**Negligible**
• Final landscaping and shaping.	Freshwater Systems	**Low (Negative)**	**Low (Negative)**

Assuming that all phases of the project adhere to the mitigation and management commitments stipulated in this BAR and EMPr Report, it is believed that significant impacts identified during the impact assessment phase can be mitigated and managed to reduce the level of significance of the initial impact.

It is therefore the EAP's opinion that based on the process that was followed and the findings of the impact assessment, in conjunction with the proposed mitigation measures, impacts can be effectively managed. Over the operational life of TSF 2 and TSF 2 Extension, additional permanent job opportunities may be created. Apart from the direct opportunities such as potential employment during construction, there are opportunities for indirect benefits such as providing goods and services to the construction project and operational phase.

Should the proposed project not be implemented, the positive impacts such as expected revenue, economic development, employment creation, skills development, poverty alleviation and the continued upliftment of the surrounding communities would not be realised. Additionally, it would be impossible to discard the tailings, and therefore the mine would have to cease its operation, as there would be limited waste storage area when the current operational (TSF 2 Extension) reaches its end of life.

CLOSURE LIABILITY CALCULATION

The amount that is required to both manage and rehabilitate the environment in respect of rehabilitation, for the proposed TSF 2 and TSF 2 Extension is **R37 282 455,50 (including VAT).**

ENVIRONMENTAL IMPACT STATEMENT AND CONCLUSION

This report serves to detail the outcome of impact assessment requirements for the proposed **TSF 2 and TSF 2 Extension project**. Various alternatives have been identified and were carried through for investigation in this BA process. The Draft BAR and EMPr Report was subjected to PPP for review by all identified I&APs.

The following activities will take place as part of the ongoing BA process:

- All comments received during the review of the Draft BAR and EMPr Report have been incorporated into this Final BAR and EMPr Report for submission to the DMRE for approval.
- The DMRE will then decide on the submission. The decision will then be communicated to all stakeholders.

The BA process associated with the proposed TSF 2 and TSF 2 Extension was undertaken in terms of the relevant EIA requirements. The BA process is underpinned by PPP with in-depth consultation undertaken through various forms of engagement.

Tharisa Mine is an existing operational mine, and therefore, mine personnel are presently managing impacts in line with the existing environmental management requirements. The impacts assessed in this Final BAR and EMPr Report for the proposed TSF 2 and TSF 2 Extension are of a similar nature to the impacts presently being managed in the operation of the mine's infrastructure.

It is the opinion of the EAP that although the proposed TSF 2 and TSF 2 Extension may cause adverse environmental impacts, provided that the proposed mitigation measures are implemented effectively and in line with the EMPr, these will be outweighed by the long-term positive impacts. Based on the findings of the Impact Assessment, the EAP sees no reason why the amended EA and WML should not be granted for the proposed project to proceed, as the impacts which have been identified can be mitigated through the implementation of the identified management measures. Additionally, the proposed TSF 2 and TSF 2 Extension are unlikely to result in the generation of any significant cumulative impacts when managed in accordance with the management measures specified in the EMPr.

Should the proposed project not be implemented, the positive impacts such as expected revenue, economic development, employment creation, skills development, poverty alleviation and the continued upliftment of the surrounding communities would not be realised. Additionally, it would be impossible to discard the tailings, and therefore the mine would have to cease its operation, as there would be limited waste storage area when the current operational (TSF 2 Extension) reaches its end of life.

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LIST OF ABBREVIATIONS

AFM	African Faith Mission

AIPs	Alien and Invasive Plant Species (AIPs)
AQSRs	Air Quality Sensitive Receptors
BA	Basic Assessment
BAR	Basic Assessment Report
BBBEE	Broad Based Black Economic Empowerment
BDM	Bojanala Platinum District Municipality
BIC	Bushveld Igneous Complex
BIDs	Background Information Documents
BPEO	Best Practicable Environmental Option
CA	Competent Authority
CARA	Conservation of Agricultural Resources Act (Act No. 43 of 1983)
CBA	Critical Biodiversity Area
CCP	Critical Control Parameters
CEC	Cation exchange capacity
CER	Contractor's Environmental Representative
CMA	Catchment Management Agency
CoC	Constituents of Concern
CPI	Consumer Price Index
CRR	Comments and Responses Report
CV	Curriculum Vitae
dB	decibels
DACE	North West Department of Agriculture, Conservation and Environment
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DEDECT	Department of Economic Development, Environment, Conservation and Tourism
DFFE	Department of Forestry, Fisheries and the Environment
DME	Department of Minerals and Energy
DMRE	Department of Mineral Resources and Energy
DMS	Dense Media Separation
DPM	Di Methoxy Propanol
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EAPASA	Environmental Assessment Practitioners Association of South Africa
ECO	Environmental Control Officer
EER	Environmental Representative
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
EPA	(Environmental Protection Agency
ESA	Ecological Support Area
FEPAs	Freshwater Ecosystem Priority Areas
FoS	Factor of Safety
FSL	Full Supply Level
GDARDE	Gauteng Department of Agriculture, Rural Development and Environment
GDP	Goss Domestic Product
GGP	Gross Geographic Product
GISTM	Global Industry Standard on Tailings Management
GLCs	Ground level concentrations
GNR.	Government Notice Regulation
GRA	Groundwater Resources Association
Ha	Hectares
HCs	Hydrocarbons
HDPE	High-density polyethylene
HIA	Heritage Impact Assessment
ID	Inside diameter
IDP	Integrated Development Plan

IEM	Integrated Environmental Management
IFC	International Finance Corporation
IPAP	The Industrial Policy Action Plan
IWUL	Integrated Water Use Licence
IWWMP	Integrated Water and Waste Management Plan
I&APs	Interested and Affected Parties
kPa	kilopascal
LCT	Leachable concentrations thresholds
LG	Lower Group
LoM	Life of Mine
MC	Manyabe Consultancy (Pty) Ltd
MEC	Member of the Executive Committee
MG	Middle Group
MHSA	Mine Health Safety Act, 1996 (Act No. 29 of 1996)
MPa	Megapascal
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MR	Mining Right
MRA	Mining Right Area
NAAQS	National Ambient Air Quality Standards
NDCR	National Dust Control Regulations
NDP	National Development Plan
NEAC	New Earth Apostolic Church
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEMAQA	National Environmental Management Air Quality Act, 2004 (Act No. 39 of 2004)
NEMBA	National Environmental Management: Biodiversity Act, 20024 (Act No. 10 of 2004)
NEMWA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NFEPA	National Freshwater Ecosystem Priority Areas
NGP	National Growth Path
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NSRs	Noise sensitive receptors
NSSD	National Strategy for Sustainable Development
NWA	National Water Act, 1998 (Act No. 36 of 1998)
NWBSP	North West Biodiversity Sector Plan
OG	Above Ground
OHSA	The Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)
PAHs	Polycyclic Aromatic Hydrocarbons
PCD	Pollution Control Dam
PES	Present Ecological Status
PGEs	Platinum Group Elements
PGM	Platinum Group Metals
POPI	Protection of Personal Information Act, 2013 (Act No. 4 of 2013)
PPP	Public Participation Process
PSD	Particle Size Distribution
QCA	Quaternary Catchment Area
RE	Resident Engineer
READ	North West Department of Rural, Environment and Agricultural Development
RoD	Record of Decision
RoM	Run of Mine
SACNASP	South African Council for Natural Scientific Professions
SADC	Southern African Development Community
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SANS	South African National Standard
SDF	Spatial Development Framework
SHE	Safety, Health and Environmental
SLP	Social and Labour Plan
SQR	Spatial Quaternary Region
SPLP	Synthetic Precipitation Leaching Procedure

Stats SA	Statistics South Africa
STP	Sewage Treatment Plant
SWD	Storm Water Diversion
SWMP	Stormwater Management Plan
S&EIR	Scoping and Environmental Impact Reporting
TAC	Ts'enolo Apostolic Church
TBC	The Biodiversity Company
TCT	Total concentration thresholds
TDS	Total Dissolved Solids
Tharisa	Tharisa Minerals (Pty) Ltd
TSF	Tailings Storage Facility
TSP	Total suspended particulates
TUT	Tshwane University of Technology
TWQGR	Target Water Quality Guideline Ranges
UG	Upper Group
UNISA	University of Southern Africa
URC	Uniting Reform Church
VOCs	Volatile Organic Compounds
VTSD	Villages, Townships, and Small Dorpies
WMA	Water Management Area
WML	Waste Management License
WRF	Weather Research and Forecasting
WRD	Waste Rock Dump
WUL	Water Use License
WULA	Water Use License Application
WWTP	Waste Water Treatment Plant
XRD	X-Ray Diffraction

PART A:

SCOPE OF ASSESSMENT AND BAR

SECTION 1: PROJECT INTRODUCTION AND BACKGROUND

1-1 BACKGROUND AND INTRODUCTION

Tharisa Minerals (Pty) Ltd (Tharisa) has an opencast mining operation that produces chrome and platinum group metals (PGM) concentrate. The mine is located on Farms K/Kraal 342 JQ, Rooikoppies 297 JQ and Elandsdrift 467 JQ, south of Marikana in the North West Province.

Tharisa holds existing environmental authorisations (EAs) and licenses under the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA), the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA), the National Environmental Management: Waste Act, 2008 (Act. 59 of 2008) (NEMWA) and the National Water Act, 1998 (Act. No 36 of 1998) (NWA) for the mining activities of East, West and Far West open pits, and operation of associated infrastructure.

Tharisa Mine has been in operation since November 2009, having an initial Mining Right 49/2009 (MR) effective 19 September 2008, issued on 13 August 2009 by the then the Department of Minerals and Energy (DME). Tharisa subsequently applied for an amendment of the MR with the Reference Number: NW/30/5/1/2/2/358 MR, stamped 28 July 2011. This MR was however only registered in 2016.

Tharisa is subdivided into East and West Mine by the Sterkstroom river and the D1325 – Marikana Road both running from south to north through the mine boundary. Tailings Storage Facility (TSF) 2 and TSF 2 Extension, along with the majority of the mine infrastructure, are located at the East Mine. Tharisa extracts and processes the Middle Group (MG) 1 to 4 ores of the PGM in the Bushveld Igneous Complex. The mine currently operates three (3) processing plants, namely Genesis, Voyager and Vulcan. Genesis and Voyager are able to process 100 kt and 300 kt per month, respectively. The waste product produced by both plants is sent to the Vulcan plant for further extraction of chrome, after which, the tailings material is hydraulically pumped to TSF 2 Extension for storage.

It is expected that the current active TSF 2 Extension will reach its Full Supply Level (FSL) by December 2025 based on the current tailings production.

Manyabe Consultancy (Pty) Ltd (MC) has been appointed by Tharisa as an independent Environmental Assessment Practitioner (EAP), to undertake a Section 102 amendment application in terms of the MPRDA in order to amend the Environmental Management Programme (EMPr); to undertake Environmental Impact Assessment (EIA) to amend an EA in terms of the NEMA; to amend the Waste Management License (WML) in terms of the NEMWA; and to amend a Water Use License (WUL) in terms of the NWA.

The Competent Authority (CA) for the proposed **raising of the walls of TSF 2 and TSF 2 Extension project** is the Department of Mineral Resources and Energy (DMRE) for the issuance of an amended EA and WML (Integrated EA and WML); and the Department of Water and Sanitation (DWS), for the issuance of the amended WUL.

Tharisa holds the following approvals:

Approval	Reference	Licence Type	Approval Date
EIA and EMPr for a Proposed PGM Mine, Metago Project Number: T014-01, June 2008.	DMRE Reference Number: NW30/5/1/2/3/2/1/358EM	MR	19 September 2008
	North West Department of Agriculture, Conservation and Environment (DACE[2]) Reference Number: NWP/EIA/159/2007	EA	23 October 2009

[2] North West Department of Agriculture, Conservation and Environment (now known as the DEDECT).

Approval	Reference	Licence Type	Approval Date
Amendment of the EA, 23 October 2009 to incorporate additional listed activities previously excluded: Transmission and distribution of above ground electricity (120KV or more).	DACE Reference Number: NWP/EIA/159/2007	EA and EMPr Amendment	30 August 2011
EIA and EMPr for changes to the pit, tailings dam and waste rock facilities; a chrome sand drying plant and other operational and surface infrastructure.	Department of Economic Development, Environment, Conservation and Tourism (DEDECT) Reference Number: NWP/EIA/50/2011	EA	29 April 2015
	DMRE Reference Number: NW30/5/1/2/3/2/1/358EM	EA and EMPr Amendment and WML	24 June 2015
WUL.	DWS Reference Number: 03/A21K/ABCGIJ/1468	First issue of WUL (Superseded by 2020 Integrated WUL - IWUL)	16 July 2012
EIA Report and EMPr Amendment 3: Inclusion of Portion 113 of the Farm K/Kraal 342 JQ and increase of waste rock quantities.	DMRE Reference Number: NW30/5/1/2/3/2/1/358	EA and EMPr Amendment and WML	01 September 2020
WUL Amendment.	DWS Reference Number: 03/A21K/ABCGIJ/1468	WUL Amendment (Superseded by 2024 IWUL)	12 November 2020
Amendment of an EA for Increase Storage Capacity of Tailings Facility and Waste Rock Dump (WRD) and increase the authorised Fuel Storage Capacity in respect of Farm Rooikoppies JQ 297, Elandsdrift JQ 467 And K/Kraal JQ 342, within the Magisterial District of Bojanala, North West Province.	DMRE Reference Number: NW30/5/1/2/3/2/1/358EM	EA and EMPr Amendment and WML	03 August 2021
EA for the establishment of a mixed-use township development on portion 149 of the farm Rooikoppies 297.	NWP-EIA-60-2022 EA	EA	25 April 2023
Tharisa Additional Waste Rock Storage EIA and EMPr. • The expansion of the existing and approved Far West WRD 1 by a footprint of 109 ha. The expanded area will be referred to as the West Above Ground (OG) WRD. Portions of the West OG WRD will be located on backfilled areas of the West Pit; and • The establishment of a WRD (referred to as the East OG WRD) on backfilled portions of the East Pit. The proposed East OG WRD will cover an area of approximately 72 ha.	DMRE: NW 30/5/1/2/3/2/1/358EM	EA and EMPr Amendment and WML	31 May 2023
EA for TSF 3 WRD Extension 1.	DMRE: NW 30/5/1/2/3/2/1/358EM	EA and EMPr Amendment and WML	05 December 2024
WUL Amendment.	DWS Reference Number: 03/A21K/ABCGIJ/1468	Supersedes the 12 November 2020 WUL	12 November 2024
WUL for TSF3 WRD Extension 1.	DWS Reference Number: 03/A21K/ABCGIJ/1468	WUL	17 September 2024

Approval	Reference	Licence Type	Approval Date
TSF 3 Construction and Operation.	DMRE: NW 30/5/1/2/3/2/1/358EM	EA and EMPr Amendment and WML	Signed 02 February 2025. Received on 04 March 2025
Supporting Infrastructure			
EA for the diversion of an existing 275kV powerline and associated infrastructure.	Department of Environmental Affairs (DEA) . Record of Decision (RoD) Reference Number: 14/12/16/3/3/3/408	EA	15 November 2012
Amendment of an EA in respect of the upgrade of the existing Waste Water Treatment Plant (WWTP) in respect of the Farm Rooikoppies JQ 297, Elandsdrift JQ 467 and K/kraal JQ 342 JQ.	DMRE RoD Reference Number: NW30/5/1/2/3/2/1/358EM	Amendment of an EA	14 August 2020
Rectification of an unlawful commencement of a listed activity for the storage of dangerous goods of more than 80m^3 but les then 500m^3.	DMRE: NW 30/5/1/2/3/2/1/358EM	EA and EMPr	10 August 2021

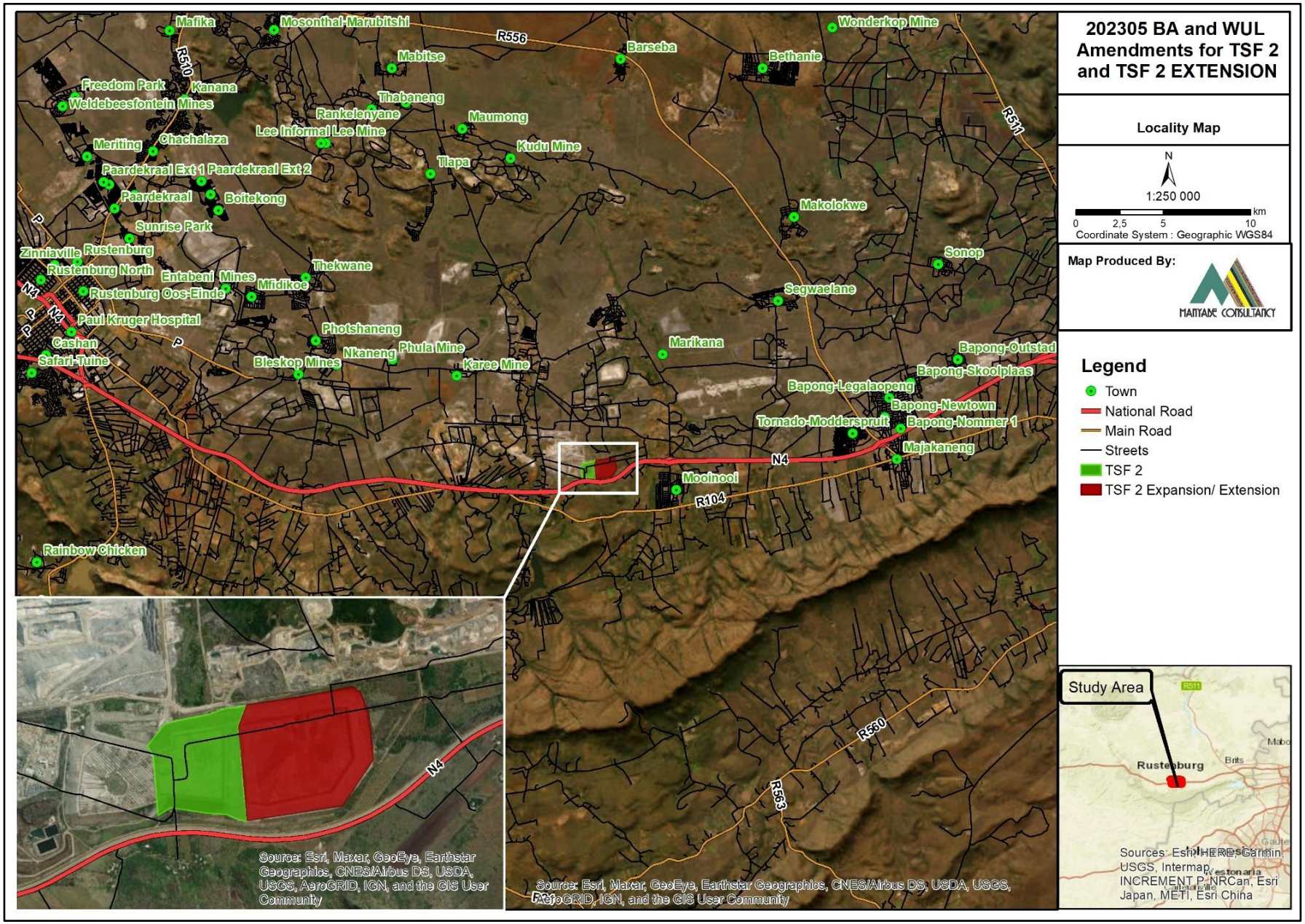


Figure 1: Locality Map for TSF 2 and TSF 2 Extension

Table 1: Mining Method

Mining Activities	
Method	Tharisa is an opencast mine, which comprises two sections namely the East Mine and West Mine. The mining method at Tharisa comprises a standard open pit truck and shovel method.
Access to Ore	Access to the mining face is by means of haul roads and boxcuts with ramps. Steady state open pit dimensions will differ between the east and west sections because of the varying dip of the target ore body. In the western section, the dimensions are expected to be 360m wide, 1km in length along the outcrop with a final high wall averaging at approximately 180m. On the eastern section, the dimensions are expected to be 580m wide, 1km in length along the outcrop with a final high wall averaging at approximately 180m. The general mining direction is north.
Removal of topsoil	All topsoil is dozed into stockpiles along the low wall (outcrop) sides of the open pits. Topsoil is stockpiled separately for use in rehabilitation
Drilling and blasting	Once the topsoil is removed, the area is drilled as per the drill design. Charges are designed to prevent excessive ground vibration, airblast and fly rock. The remaining waste rock and the ore is drilled and blasted together.
Removal of waste rock	The removal of waste rock above the ore body is undertaken as a bulk operation by load and haul with large equipment. The material is placed on WRDs.
Removal of ore	Run of Mine (RoM) ore is stockpiled according to RoM type, prior to being sent to the concentrator plant for processing.
Mineral Processing - Concentrator Plant	
Crushing and screening	Chrome RoM material is tipped into a receiving bin for crushing by a primary jaw crusher. The crushed material is then conveyed to the secondary jaw crusher circuit. Oversized material from the secondary circuit is returned to the primary crusher feed conveyor for reprocessing. Correctly sized material from the secondary crushing process is separated into different fractions using a double deck screen. The lumpy and chips from the screening process report to the Dense Media Separation (DMS) section, while the undersized report to a mill feed stockpile for milling prior to spiral plant treatment. The PGM plant crushing facility consists of a primary gyratory crusher and a secondary cone crusher. Material is discharged directly into the primary gyratory crusher to be crushed. Following primary crushing, the material is stored in a stockpile. Ore is extracted from the stockpile by feeders onto a conveyor for transport to a sizing screen. The crushed material is screened with the oversized material reporting to the secondary crusher for further crushing (closed circuit). The undersized material from the screen reports to a silo for storage prior to milling.
DMS - chrome plant only	The chrome lumpy material is treated in a DMS plant, while the chip fraction is treated in a cyclone plant. A drum gives good separation at the lumpy size fraction as the cyclone does for the smaller chip fraction. The recovered lump and chip material is conveyed to separate stockpiles, while the discard (float) material is transported to a discard bin for removal to the waste rock stockpile.
Milling	The Chrome undersized material from the secondary screening process is fed at a controlled rate to a ball mill for grinding. Product from the ball mill is screened with oversize returning to the grinding circuit and undersize reporting to the spirals plant. PGM ore from the silo is fed onto the mill feed conveyor by three variable speed feeders. The primary ball mill receives both feed material, as well as mill water for flushing the ore into the mill. Material from the mill discharges onto a screen where the oversize is collected in a bin and the undersize pumped through a cyclone. The cyclone overflow is filtered with the oversized material being recycled and the undersize material reporting to a screen together with the cyclone sinks. Undersized material from the screen reports to the agitated rougher flotation feed tank, while the oversized material reports to the secondary mill feed.
Floating – PGM plant only	The flotation plant consists of a rougher, cleaner, re-cleaner and scavenger section. Chemicals are added at the various stages to the feed material, allowing the Platinum Group Elements (PGEs) to attach to the foam. In some cases, a depressant may be required to prevent other minerals from attaching to the carrier-bubbles. Underflow material is rejected to the PGE spirals plant whilst the concentrate is pumped to the product thickener for dewatering. The PGE concentrate is pumped to a storage tank for loading by truck.
Spiral	The PGM underflow material from the floatation section is pumped to cyclones with the underflow gravitating into the spirals and the overflow reporting to the tailing's thickener. Two streams leave the spirals plant; a product stream and tailings. The product stream is dewatered and stockpiled (8000t). Water is recovered from these stockpiles and is returned to the PGM plant for water and product recovery. Tailings are dewatered in the PGE tailings thickener for water recovery, with the underflow reporting to the tailings dam. Approximately 40 000 tonnes of PGM concentrate is produced per year. The chrome material from the grinding section is pumped to cyclones with the underflow gravitating into the spirals and the overflow reporting to the tailing's thickener. Two streams leave the spirals plant; a product stream (Met and Chem grade chromite) and tailings. The product stream is pumped to four cyclones to produce two fine material stockpiles (8000t met grade and 2000t chem. grade). Drainage from these stockpiles is returned to the MG1 plant for water and product recovery. Tailings are dewatered in the tailing's thickener for water recovery, while the underflow is pumped to the tailings dam. Approximately 1.5 million tonnes of chrome concentrate is produced per year.
Dispatch	
Method	Railway transportation of product is the preferred option for the mine. The nearest railway is to the north of the mine at the Marikana Siding (the siding has been upgraded in consultation with Transnet to cater for Tharisa's requirements). Product is transported via 30-tonne trucks with an estimated rate of 320 trucks/day for chrome

	concentrate and 8 trucks/day for PGM. Chrome is dispatched to Richards Bay via the Marikana Railway siding and/ or the N4. PGM is dispatched to smelters in the region.
Waste disposal	
Tailings dam	Slurry from the secondary rougher flotation process is discarded as tailings. It is thickened and pumped to a tailings facility for deposition by means of conventional spigotting. Tailings production is approximately 4 million tonnes per year. Process water from the tailings dam is recycled to the plant for use in the process.
Rehabilitation	
Method	Rehabilitation is concurrent with mining. Waste rock/ overburden is used to backfill voids where required. Overburden material is used to cater for any settlement. Once the backfill material has settled, topsoil is placed on top of the overburden for vegetation to re-established.

The raised facilities allow for the majority of the existing infrastructure components to remain in place and function as intended, as follows:

- Rockfill Embankment;
- Waste Rock Buttress;
- Toe drains;
- Seepage cut-off drains;
- Decant System;
- Penstock Energy Dissipator;
- Pool wall and Wing Walls;
- Catwalk;
- Geofabric;
- Solution Trench;
- Collection Sump;
- Collection Manhole;
- Drainage design;
  - *Pipe Loading;*
  - *Penstock outfall pipeline bearing capacity;*
  - *Penstock rings;*
  - *Penstock outfall valves;*
  - *Drainage Sizing;*
  - *Outlet Piping; and*
  - *Filter Compatibility.*
- Geofabric Separation Layer; and
- Barrier system.

The relevant aspects of the raised TSFs' stage capacity curves are summarised below:

- Maximum tailings height:
  - TSF 2 = ± 41 m
  - TSF 2 Extension = ± 45 m
- Additional capacity at maximum height:
  - TSF 2 = 1 686 784 tonnes (4.85 months)
  - TSF 2 Extension = 1 893 966 tonnes (5.44 months)

Before Tharisa can commence with the proposed raising of the walls of TSF 2 and TSF 2 Extension, amendments to the existing approvals need to be undertaken in terms of the following national legislation:

- The NEMA, for the listed activities stipulated in the NEMA EIA Regulations of 2014, as amended;
- The MPRDA, for the amendment of the EMPr in accordance with Section 102 of the Act;
- The NEMWA, for waste management activities stipulated in Government Notice Regulation (GNR.) 921, promulgated under the Act; and
- The NWA for water uses identified under Section 21.

The approvals in terms of the NEMA, NEMWA and MPRDA are being applied for to the North West DMRE. The approval in terms of the NWA is being applied for to the North West DWS.

1-2 DETAILS AND EXPERTISE OF THE APPOINTED EAP

Below are the details of the appointed independent EAP by Tharisa. For the expertise of the EAP, please refer to Appendix 4 for a Curriculum Vitae (CV).

EAP Company Name:	Manyabe Consultancy (Pty) Ltd
Registration Number:	2014/063679/07
Contact Person:	Mpho Manyabe
Telephone Number:	011 863 1079
Email Address:	mpho@manyabeconsultancy.com
Postal Address:	7682 I-Nkwaza Street, Vosloorus, 1475
Physical Address:	Corner Paul Smith Street and 10th Avenue, Unit 269, Block F, Ravenswood Mews, Boksburg North,1459

1-2.1 Qualifications and experience of the EAP

Qualifications
BSc.Honours in Environmental Management, UNISA, 2016.
National Diploma Environmental Sciences, TUT, 2008
SACNASP Registered Scientist: Reg No. 117719
EAPASA Registered EAP: Reg No. 2019/700

1-2.2 Summary of the EAP's Experience

MC is a 100% black female owned entity which offers sustainable development solutions to both public and private sectors, including parastatals. The company was founded in 2014 by the Managing Director, Mpho Manyabe. MC seeks to maintain its strategic position in the Environmental Management Services sector by providing service of excellence to its clients. This is achieved by providing: a professional and efficient service; the highest possible level of customer care; the highest ethical and moral principles in our actions, words and thoughts; and the highest possible level of integrity.

The objective of MC is to create an environment in which enthusiastic, highly skilled and motivated professionals seek professional opinions for contribution to the environmental, social and economic development in South Africa. MC currently has a turnover of less than R10 million rand and is a Level 1 contributor with 135% Broad Based Black Economic Empowerment (BBBEE) procurement.

Mpho Manyabe: BSc Honours in Environmental Management, University of South Africa (UNISA), 2016; National Diploma Environmental Sciences, Tshwane University of Technology (TUT), 2008

Mpho Manyabe currently holds a BSc Honours Degree in Environmental Management from the University of South Africa (UNISA); and National Diploma in Environmental Sciences, from TUT, 2008. She has seventeen (17) years of work experience in the field of Environmental Management from different consulting companies.

She was previously nominated to be in the Gauteng Department of Agriculture, Rural Development and Environment (GDARDE) EIA EAP committee which was launched on 31 March 2015 comprising of EAPs and GDARDE officials to provide quarterly reports to the Executive Authority (Member of the Executive Committee (MEC)) on issues identified as blockages to the improved efficiencies the department seeks to achieve.

She was also a member of the Academic Advisory Committee for the Environmental Science programme in the Department of Environmental, Water and Earth Sciences in the Faculty of Science at the TUT, to serve for a period of three (3) years, where she assisted with preparation and provision of relevant, high quality teaching and learning content for students. She was identified based on her expertise in the field of Environmental Sciences/ Management to make a positive contribution to what TUT was offering students in terms of course

content and on how to better run programmes to the benefit of students. She is registered with South African Council for Natural Scientific Professions (SACNASP) as a Certificated Natural Scientist, and she is also a registered EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA).

She is the Lead EAP on the project.

Please refer to Appendix 4 for the EAPs CV.

1-3 THARISA DETAILS

Contact Person	Mr. Patrick Sibuyi
Designation	Environmental Coordinator
Email Address:	psibuyi@tharisa.com
Telephone Number:	+2714 572 0700
Tharisa Mne Physical Address:	Portion 84, Farm 342-JQ, Marikana, 0284, South Africa
TSF 2 and TSF 2 Extension Farm Portions:	TSF 2 and TSF 2 Extension are located on the following farm portions: • Portion 185 of Farm K/K 342 of the Major Region JQ (Title Deed Number T50806/2011). • Portion 186 of Farm K/K 342 of the Major Region JQ (Title Deed Number T102908/2008). • Portion 187 of Farm K/K 342 of the Major Region JQ (Title Deed Number T57904/2011). • Portion 193 of Farm K/K 342 of the Major Region JQ (Title Deed Number T70210/2011). • Portion 224 of Farm K/K 342 of the Major Region JQ (Title Deed Number T17597/1940). • Portion 225 of Farm K/K 342 of the Major Region JQ (Title Deed Number T17597/1940). • Portion 226 of Farm K/K 342 of the Major Region JQ (Title Deed Number T17585/940). • Portion 242 of Farm K/K 342 of the Major Region JQ (Title Deed Number T5977/2010). • Portion 317 of Farm K/K 342 of the Major Region JQ (Title Deed Number T22984/1960). • Portion 89 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T26184/2013). • Portion 90 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T42193/2013). • Portion 92 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T76043/2008). • Portion 176 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T66004/2011). • Portion 177 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T66004/2011). • Portion 227 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T27501/2017). • Portion 228 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T27503/2017). • Portion 229 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T27504/2017). • Portion 230 of Farm Elandsdrift 467 of the Major Region JQ (Title Deed Number T62022/2017). TSF 2 and TSF 2 Extension fall within the Rustenburg and the Madibeng Local Municipalities under the jurisdiction of Bojanala Platinum District Municipality (BDM).

1-4 PURPOSE OF THE FINAL BAR AND EMPR

This Final BAR and EMPr Report has been compiled in terms of Appendix 1 of the NEMA EIA Regulations of 2014, as amended, as well as the requirements of the BAR and EMPr Report template issued by the DMRE. All comments received during the review of the Draft BAR and EMPr Report have been incorporated into this Final BAR and EMPr Report for submission to the DMRE.

A summary of the requirements of a BAR and EMPr including cross-references to sections in this report where these requirements have been addressed is provided in Table 2 and Table 3.

Table 2: Content of the BAR as per Appendix 1, GNR. 982, as amended

Content of the BAR	Section of this Draft BAR Complying to the Regulations
(a) details of—(i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae.	Section 1-2 and Appendix 4
(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 2-1

Content of the BAR	Section of this Draft BAR Complying to the Regulations
(c) a plan which locates the proposed activity or activities applied for as well as associated structures and infrastructure at an appropriate scale.	Figure 1, Figure 2, Figure 3 & Appendix 1
(d) a description of the scope of the proposed activity, including (i) all listed and specified activities triggered and being applied for; and (ii) a description of the activities to be undertaken including associated structures and infrastructure.	SECTION 2:
(e) a description of the policy and legislative context within which the development is proposed including (i) an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments that are applicable to this activity and have been considered in the preparation of the report; and (ii) how the proposed activity complies with and responds to the legislation and policy context, plans, guidelines, tools frameworks, and instruments.	SECTION 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 location.	SECTION 4:
(g) a motivation for the preferred site, activity and technology alternative.	SECTION 5:
(h) a full description of the process followed to reach the proposed preferred alternative within the site, including.	SECTION 17:
(i) details of the alternatives considered.	SECTION 17:
(ii) details of the public participation process (PPP) undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs.	SECTION 6:
(iii) a summary of the issues raised by interested and affected parties (I&APs), and an indication of the manner in which the issues were incorporated, or the reasons for not including them.	Table 22
(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	SECTION 7:
(v) the impacts and risks identified for each alternative, 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;	SECTION 8: and SECTION 13:
(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	SECTION 9:
(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;	SECTION 13:
(viii) the possible mitigation measures that could be applied and level of residual risk;	SECTION 10:
(ix) the outcome of the site selection matrix;	SECTION 5:
(x) if no alternatives, including alternative locations for the activity were investigated, the motivation for not considering such; and	SECTION 5:
(xi) a concluding statement indicating the preferred alternatives, including preferred location of the activity;	SECTION 12:
(i) full description of the process undertaken to identify, assess and rank the impacts the activity will impose on the preferred location through the life of the activity, including—	SECTION 17:
(i) a description of all environmental issues and risks that were identified during the EIA process; and	SECTION 17:
(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 17:
(j) an assessment of each identified potentially significant impact and risk, including—	SECTION 13:
(i) cumulative impacts;	SECTION 13:
(ii) the nature, significance and consequences of the impact and risk;	SECTION 13:
(iii) the extent and duration of the impact and risk;	SECTION 13:
(iv) the probability of the impact and risk occurring;	SECTION 13:
(v) the degree to which the impact and risk can be reversed;	SECTION 13:
(vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and	SECTION 13:
(vii) the degree to which the impact and risk can be avoided, managed or mitigated;	SECTION 13:
(k) where applicable, a summary of the findings and impact management measures identified in 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 report;	SECTION 18:
(l) an environmental impact statement which contains—	SECTION 19:
(i) a summary of the key findings of the EIA;	SECTION 18:
(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 site indicating any areas that should be avoided, including buffers; and	Appendix 1
(iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	SECTION 18:

Content of the BAR	Section of this Draft BAR Complying to the Regulations
(m) based on the assessment, and where applicable, impact management measures from specialist reports, the recording of the proposed impact management outcomes for the development for inclusion in the EMPr;	SECTION 18:
(n) 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 22:
(o) a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed;	SECTION 23:
(p) 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 24:
(q) where the proposed activity does not include operational aspects, the period for which the EA is required, the date on which the activity will be concluded, and the post construction monitoring requirements finalised;	SECTION 25:
(r) an undertaking under oath or affirmation by the EAP in relation to—	SECTION 38:
(i) the correctness of the information provided in the reports;	SECTION 37:
(ii) the inclusion of comments and inputs from stakeholders and I&APs.	SECTION 38:
(iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and	SECTION 38:
(iv) any information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by I&APs; and	SECTION 38:
(s) where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	SECTION 26:
(t) any specific information that may be required by the CA; and	SECTION 36:
(u) any other matters required in terms of section 24(4)(a) and (b) of the Act.	SECTION 28:

Table 3: Content of the EMPr as per Appendix 4, GNR. 982, as amended

Content of the EMPr	Section of this EMPr Complying to the Regulations
(1) An EMPr must comply with section 24N of the Act and include— .(a) details of– (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Section 1-2 and Appendix 4
(b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 2-1
(c) a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that should be avoided, including buffers;	Figure 1, Figure 2, Figure 3 & Appendix 1
(d) a description of the impact management outcomes, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the EIA process for all phases of the development including—	Section 29-4
(i) planning and design;	
(ii) preconstruction activities;	
(iii) construction activities;	
(iv) rehabilitation of the environment after construction and where applicable post closure; and	
(v) where relevant, operation activities;	
(f) a description of proposed impact management actions, identifying the manner in which the impact management outcomes contemplated in paragraph (d) will be achieved, and must, where applicable, include actions to —	SECTION 31:
(i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation;	
(ii) comply with any prescribed environmental management standards or practices;	
(iii) comply with any applicable provisions of the Act regarding closure, where applicable; and	
(iv) comply with any provisions of the Act regarding financial provision for rehabilitation, where applicable;	
(g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	SECTION 33:
(h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	SECTION 34:
(i) an indication of the persons who will be responsible for the implementation of the impact management actions;	SECTION 33:
(j) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	SECTION 33:

Content of the EMPr	Section of this EMPr Complying to the Regulations
(k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	SECTION 33:
(l) a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	SECTION 33:
(m) an environmental awareness plan describing the manner in which—	SECTION 35:
(i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and	SECTION 35:
(ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and	SECTION 35:
(n) any specific information that may be required by the CA.	SECTION 36:

SECTION 2: DESCRIPTION OF THE SCOPE OF THE ACTIVITY

The proposed project activities are listed in Table 4 below. Table 5 details all the listed activities in terms of the EIA Regulations, 2014, as amended, in accordance with the NEMA which are applicable to the proposed project. The proposed area to be approved, including the infrastructure layout plan is provided in Appendix 1.

Table 4: Summary of Project Activities

Phase of the Project	Activity
Construction Phase	• Establishment of laydown areas. • Stockpiling soil resources in line with Tharisa's soil management programme. • Bulldozing activities. • Establishing and maintaining temporary access tracks. • Installation of penstock pipelines. • Excavations and compaction. • Construction of the raised embankments of the existing TSFs. Approved construction materials to be obtained from suitable sources and borrow pits. • Construction of decant tower lift for TSF 2 and TSF 2 Extension. • Construction of emergency isolation valves at the penstock outfall pipe discharge point for TSF 2. • Raising the catwalk on TSF 2 and TSF 2 Extension.
Operational Phase	• Delivery and disposal of tailings via existing pipelines. • Control of stormwater within the boundaries of the TSFs. • Operation and maintenance of the TSFs. • Handling and storage of general and hazardous waste at project sites in line with waste management procedure.
Closure and Rehabilitation Phase	• Dismantling and demolition of all infrastructure (unless alternative end land use is identified during the detailed closure planning). • Maintenance and Monitoring which will be undertaken in accordance with the approved EMPr which will include some of the following key activities: o Fertilisation of rehabilitated areas. o Surface and Ground Water Quality Monitoring. o Fauna and flora monitoring. o Alien and Invasive Plant Species (AIPs) monitoring and control. o General maintenance, including rehabilitation of cracks and subsidence. o Annual environmental performance assessment report development. o Environmental closure report development. o Annual environmental aspect reporting. o Final closure application development and motivation.

Table 5: Listed Activities to be undertaken for the proposed project

Name of Activity (E.g. For prospecting - drill site, site camp, ablution facility, accommodation, equipment storage, sample storage, site office, access route etc…etc…etc E.g. for mining,- excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, storm water control, berms, roads, pipelines, power lines, conveyors, etc…etc…etc.)	Aerial extent of the activity (Ha or m²)	Listed Activity Mark with an X where applicable or affected.	Applicable Listing Notice Listing Notice 1 (GNR.983); Listing Notice 2 (GNR.984) and Listing Notice 3 (GNR.985), as amended by: Listing Notice 1(GNR.327); Listing Notice 2 (GNR.325) and Listing Notice 3 (GNR.324)	Waste Management Authorisation (Indicate whether an authorisation is required in terms of the Waste Management Act). (Mark with an X)
Triggered activities listed under GNR.327 (Listing Notice 1)				
The proposed project is for the expansion of the current TSFs which requires an amendment of the approved EMPr by way of lodging a Section 102 application. Any activity including the operation of that activity which requires an amendment or variation to a right or permit in terms of section 102 of the Mineral and Petroleum Resources Development Act, as well as any other applicable activity contained in this Listing Notice or in Listing Notice 3 of 2014, required for such amendment.	160 hectares	X	Listing Notice 1 (GNR. 983), as amended by Listing Notice 1 (GNR. 327) Activity 21D	An Integrated EA and WML Application is being lodged with the DMRE.
The proposed project is for the expansion of the current TSFs which requires an amendment of the approved EMPr by way of lodging a Section 102 application. The proposed project is for the raising of walls of TSF 2 and TSF 2 Extension to increase the capacity of waste storage. The expansion of existing facilities or infrastructure for any process or activity where such expansion will result in the need for a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the release of emissions, effluent or pollution, excluding— (i) where the facility, infrastructure, process or activity is 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; (ii) the expansion of existing facilities or infrastructure for the treatment of effluent, wastewater, polluted water or sewage where the capacity will be increased by less than 15 000 cubic metres per day; or (iii) the expansion is directly related to aquaculture facilities or infrastructure where the wastewater discharge capacity will be increased by 50 cubic meters or less per day.	160 hectares	X	Listing Notice 1 (GNR. 983), as amended by Listing Notice 1 (GNR. 327) Activity 34	An Integrated EA and WML Application is being lodged with the DMRE.
The total expansion area for all TSFs = 262.5m² The expansion of—(i) infrastructure or structures where the physical footprint is expanded by 100 square metres or more; or (ii) dams or weirs, where the dam or weir, including infrastructure and water surface area, is expanded by 100 square metres or more; where such expansion 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 expansion of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; (bb) where such expansion activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies; (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 expansion occurs within an urban area; or (ee) where such expansion occurs within existing roads, road reserves or railway line reserves.	Embankments will be constructed using selected waste rock from open-pit mining operations, with a height of 5m for TSF 2, and 3m for TSF 2 Extension. The embankments will have a crest width of 15m with 1V:3H and 1V:2H downstream and upstream slopes, respectively. I.e. Area of expansion for TSF 2 = 75m²; Area of expansion for TSF 2 Extension = 45m² The total expansion = 195m² With the 1.5m high starter embankments, I.e. TSF 2 = 97.5m²; Area of expansion for TSF 2 Extension = 67.5m² The total expansion = 262.5m²	X	Listing Notice 1 (GNR. 983), as amended by Listing Notice 1 (GNR. 327) Activity 48	An Integrated EA and WML Application is being lodged with the DMRE.
The project will entail, *inter alia*, the development of 1.5m high starter embankments along the upstream toe of the existing embankments, constructed from selected in-situ soils in compacted layers. The raised facilities will include the addition of embankments constructed using selected waste rock from open-pit mining operations, with a height of 5m for TSF 2 and 3m for TSF 2 Extension. The expansion of a dam where (i) the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, was originally 5 metres or higher and where the height of the wall is increased by 2,5 metres or more; or (ii) where the high-water mark of the dam will be increased with 10 hectares or more.	The Maximum tailing height of TSF 2 = ± 41 m; and that of TSF 2 Extension = ± 45 m. The additional capacity at maximum height of TSF 2 = 1 686 784 tonnes (4.85 months); and that of TSF 2 Extension = 1 893 966 tonnes (5.44 months).	X	Listing Notice 1 (GNR. 983), as amended by Listing Notice 1 (GNR. 327) Activity 66	An Integrated EA and WML Application is being lodged with the DMRE.

2-1 LOCATION OF THE OVERALL ACTIVITY

Affected Farm Name (s)	The mining operation is located on the Farms K/Kraal 342 JQ, Rooikoppies 297 JQ and Elandsdrift 467 JQ, approximately 95 kilometres (km) north-west of Johannesburg and 35 km east of Rustenburg, accessible via the R104 regional road just off the N4 toll road. The TSFs are located on Farms K/Kraal 342 JQ and Elandsdrift 467 JQ (refer to Figure 1 for the Locality Map).	
Farms Owners	Tharisa Minerals (Pty) Ltd	
District Municipality	Bojanala Platinum District Municipality	
Local Municipality	Rustenburg and Madibeng Local Municipalities	
Distance and direction from nearest town (s)	Tharisa Mine is located approximately 4 km to the south of Marikana Town, in the North West Province	
Province	North West	
21 digit Surveyor General Code	T0JQ00000000034200185 T0JQ00000000034200186 T0JQ00000000034200187 T0JQ00000000034200193 T0JQ00000000034200224 T0JQ00000000034200225 T0JQ00000000034200226 T0JQ00000000034200242 T0JQ00000000034200317 T0JQ00000000046700089 T0JQ00000000046700090 T0JQ00000000046700092 T0JQ00000000046700176 T0JQ00000000046700177 T0JQ00000000046700227 T0JQ00000000046700228 T0JQ00000000046700229 T0JQ00000000046700230 Refer to Figure 3 below for a map indicating directly and indirectly affected properties.	
Application Area (Ha)	160 hectares	
Facility Co-ordinates	TSF 2 25°44'30.75"S 27°30'51.67"E	TSF 2 Extension 25°44'28.47"S 27°31'23.34"E

2-2 EXISTING PROJECT INFRASTRUCTURE

Mining at Tharisa Mine is undertaken using conventional open pit truck and shovel methods. The two (2) mining sections (East and West) are separated by a tributary of the Sterkstroom River and the D1325 (Marikana Road). The waste rock from the open pit areas is stockpiled at various WRDs and TSFs. Some in-pit dumping of waste rock has taken place at East Mine.

The existing mining infrastructure includes the following:

- West WRD (64.89 ha);
- Far-West WRD (32.90 ha);
- Far-West Pit (48.03 ha);
- West Pit (39.47 ha);
- Central WRD /Eastern WRD 1 (76.3 ha);
- Eastern WRD (63.23 ha);
- East Pit (211.43 ha);
- RoM pad (15.84 ha);
- Concentrator plant (Genesis and Voyager) (28.43 ha);
- Vulcan plant (3.29 ha);

- TSF1 Phase 1 and 2 (115.99 ha);
- TSF 2 Phase 1 (TSF 2) and 2 (TSF 2 Extension) (101.91 ha);
- Haul roads;
- Various product stockpiles;
- Topsoil stockpiles;
- Stormwater dam;
- Pollution Control Dam (PCD);
- Hernic quarry (stormwater dam);
- Sewage Treatment Plant (STP); and
- Supporting Infrastructure such as:
  - Offices;
  - Workshops;
  - Change houses; and
  - Access control facilities.

A network of roads exists within the mine. A 275 kV powerline and associated Eskom servitude cross through the eastern part of the mining area in a north-south direction. Smaller rural power and telephone lines currently service the residential areas within the western and eastern sections of the project area. Infrastructure (pipes and canals) associated with the Buffelspoort Irrigation Board traverses various sections of the project area in a south-north direction. TSF 2 and TSF 2 Extension, along with the majority of the mine infrastructure, are located in the East Mine (refer to Figure 2 below).

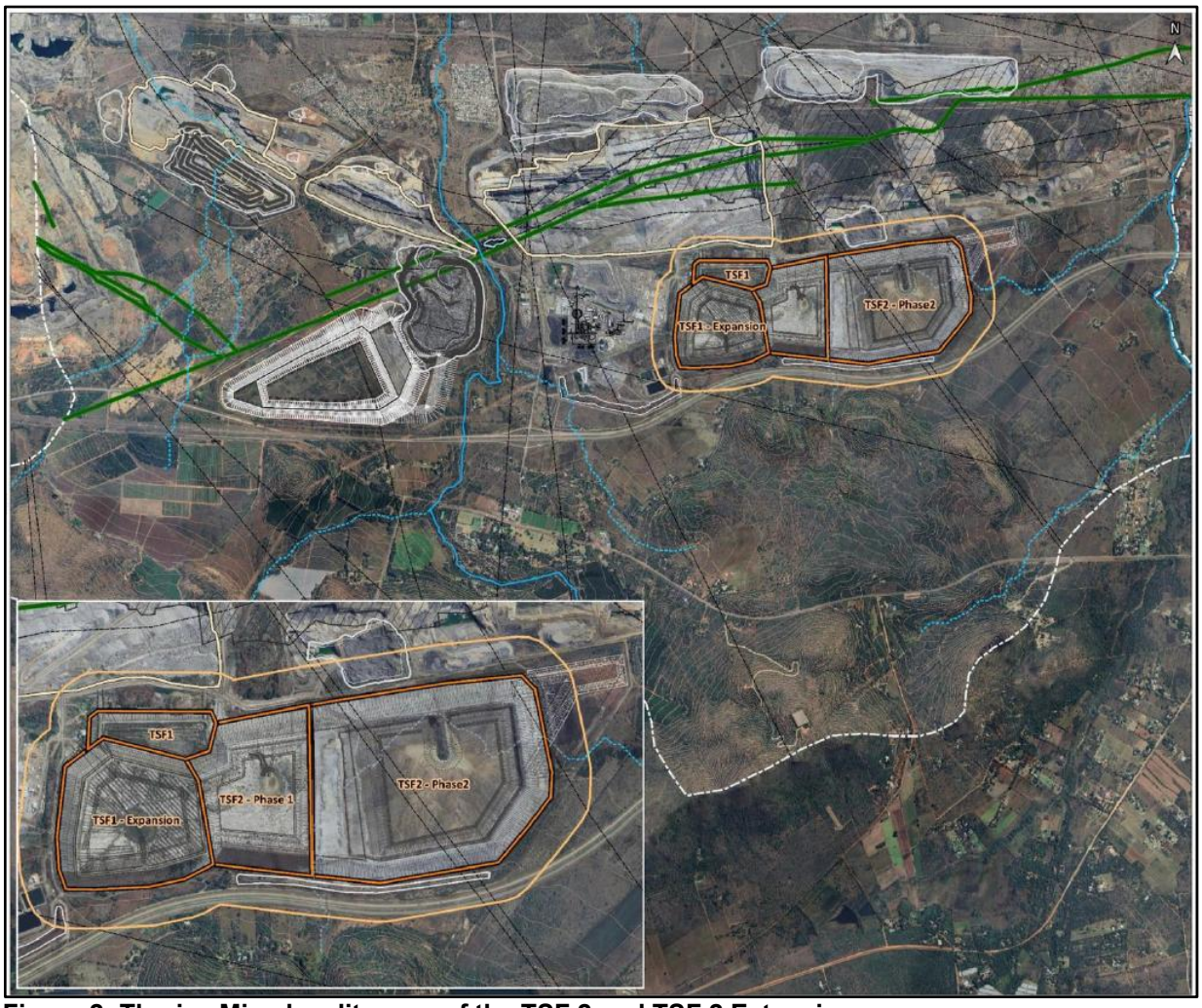


Figure 2: Tharisa Mine locality map of the TSF 2 and TSF 2 Extension

The activities associated with the current mining method are tabulated in Table 1.

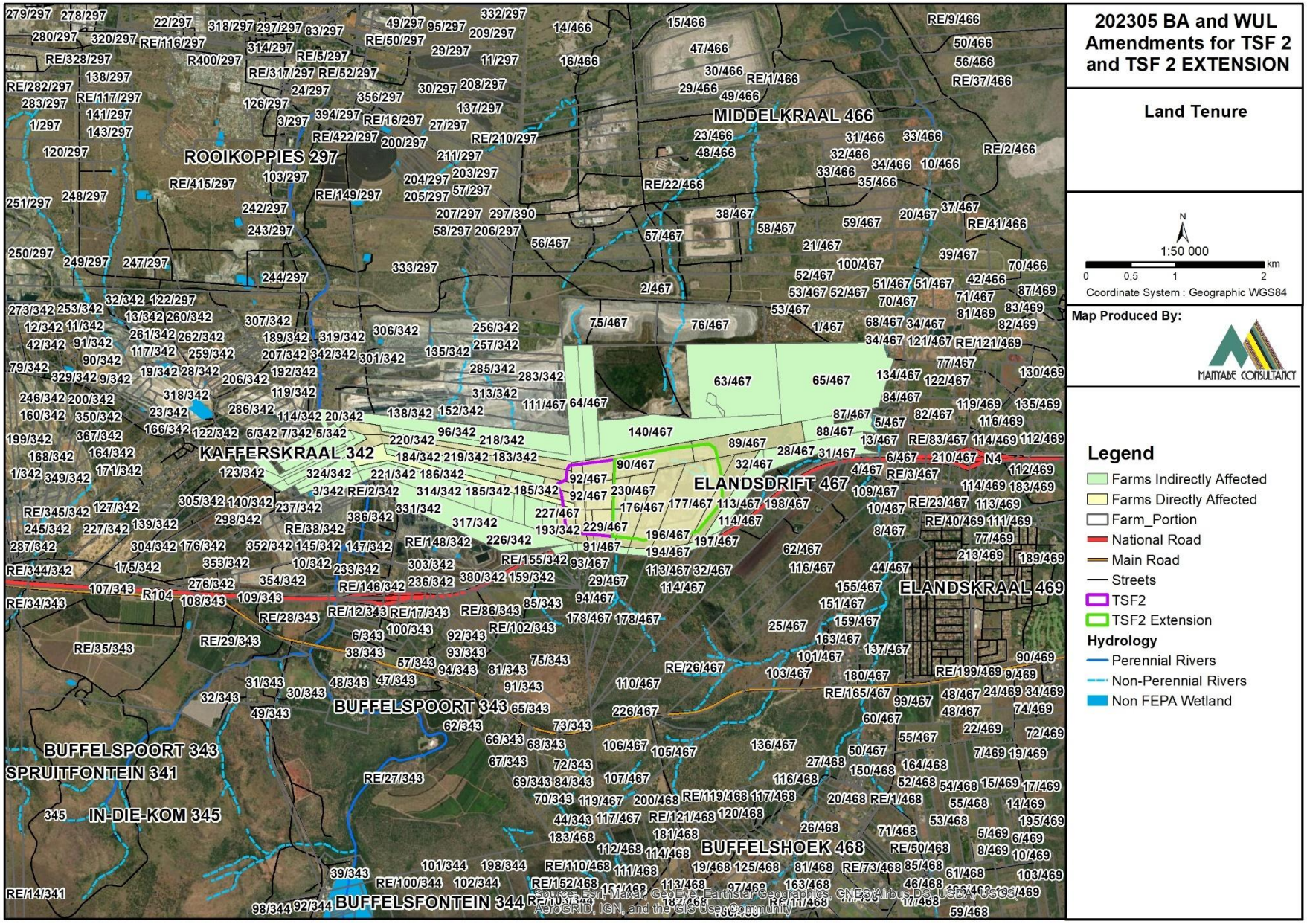


Figure 3: Land Tenure Map

2-3 DESCRIPTION OF PROPOSED ACTIVITIES TO BE UNDERTAKEN

This Final BAR and EMPr Report has been compiled to fulfil the Integrated EA and WML application process requirements relating to MR NW30/5/1/2/3/2/1/358. The infrastructure and activities associated with the proposed **raising of the walls of TSF 2 and TSF 2 Extension project** require an amendment to the existing mine's EA, WML and EMPr, to authorise the following key infrastructure and project related activities:

The relevant aspects of the raised TSFs' stage capacity curves are summarised below:

- Maximum tailings height:
  - TSF 2 = ± 41 m
  - TSF 2 Extension = ± 45 m
- Additional capacity at maximum height:
  - TSF 2 = 1 686 784 tonnes (4.85 months)
  - TSF 2 Extension = 1 893 966 tonnes (5.44 months)

The TSF 2 and TSF 2 Extension will consist of the following works (refer to Figure 5, Figure 6 and Figure 7):

2-3.1 Rockfill embankments

The material used for constructing the waste rock embankment is to be sourced from the mine open pit mining operations. This material is to be visually assessed to ensure that fine material is placed on the upstream face of the embankment, well-graded material in the centre of the embankment, with the coarse material placed on the downstream face as depicted in Figure 4 below.

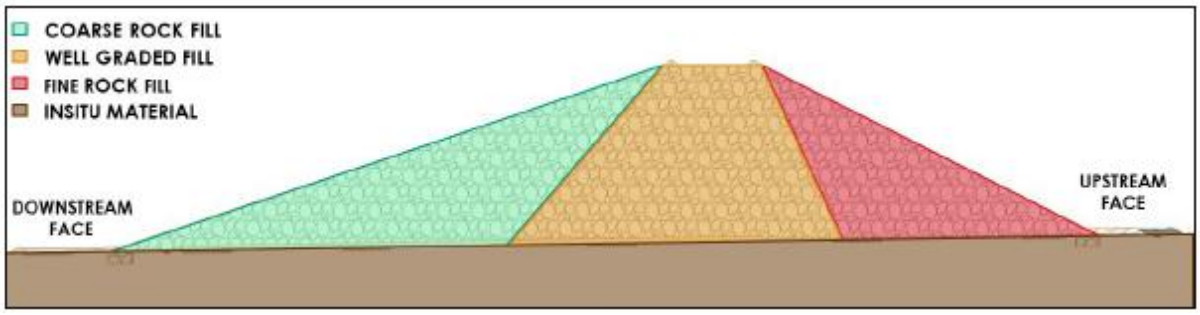


Figure 4: Typical cross-section through the rock fill embankment depicting the placement of different grades of material.

The rock fill is to be constructed in layers not exceeding 2 meters in thickness after compaction. The material is to be dumped on the layer currently under construction, 4 m from the edge and dozed into position to allow for mixing of the material as depicted in Figure 8 below.

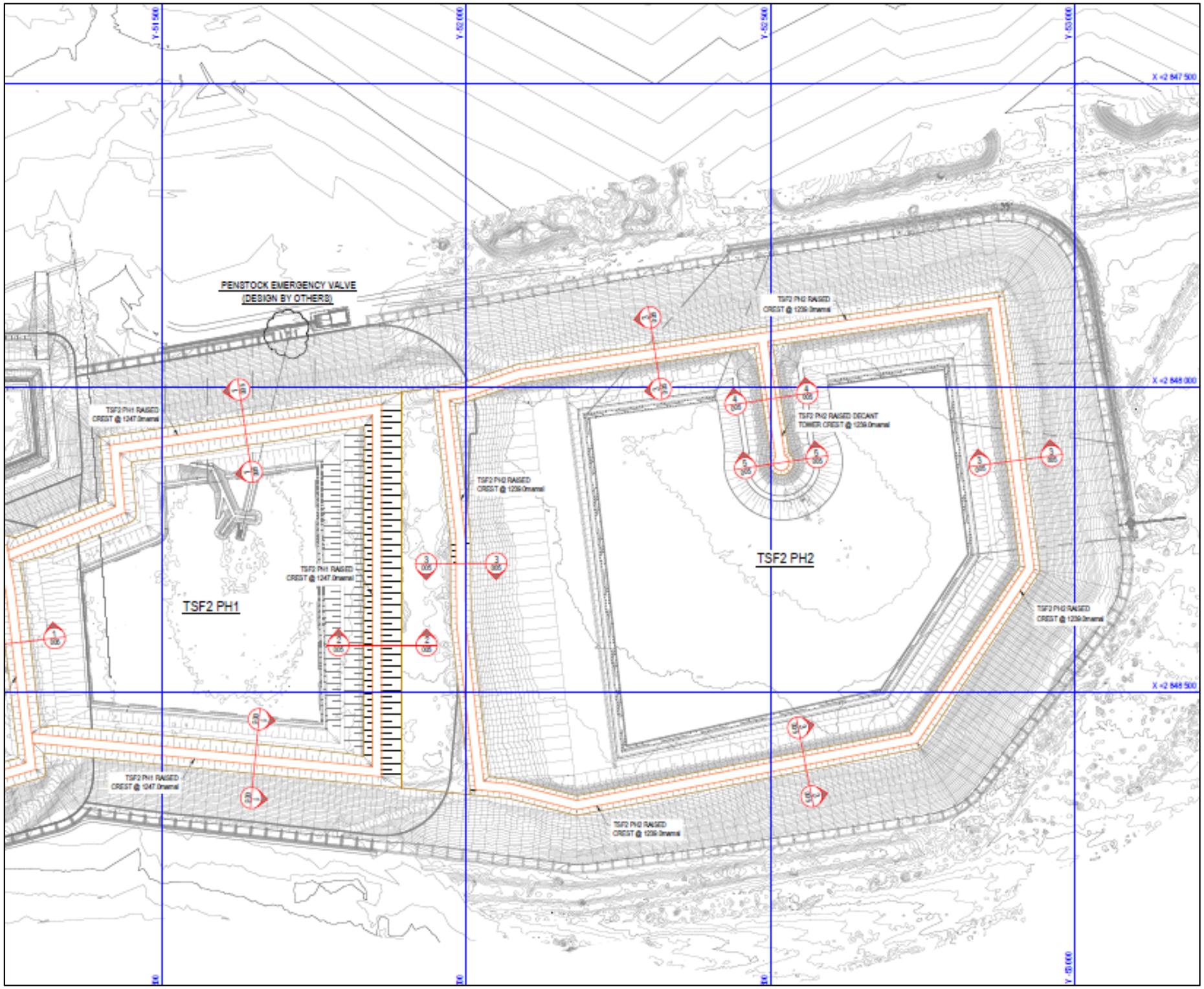


Figure 5: General Arrangement

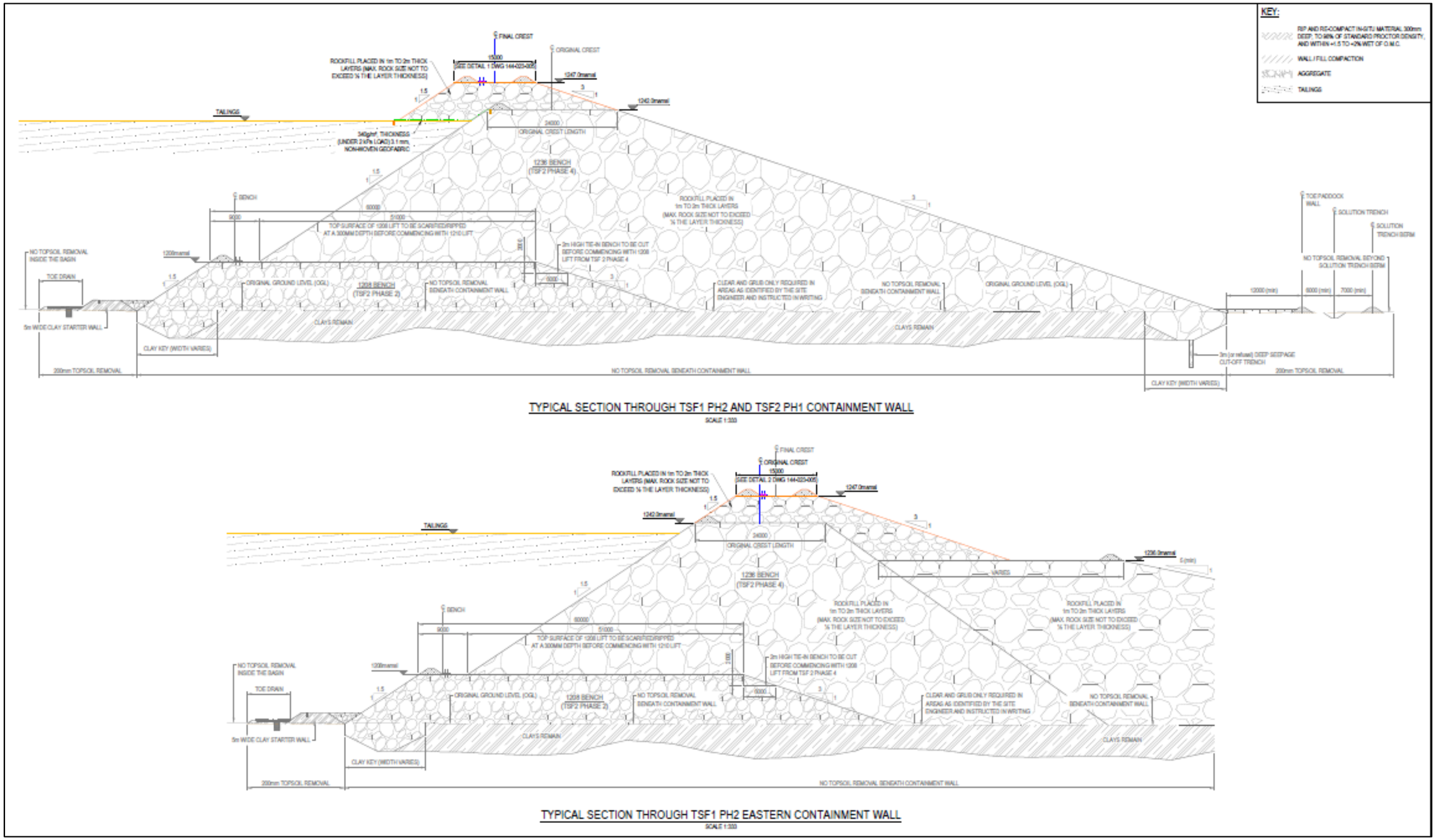


Figure 6: Raising of TSFs cross sections 1

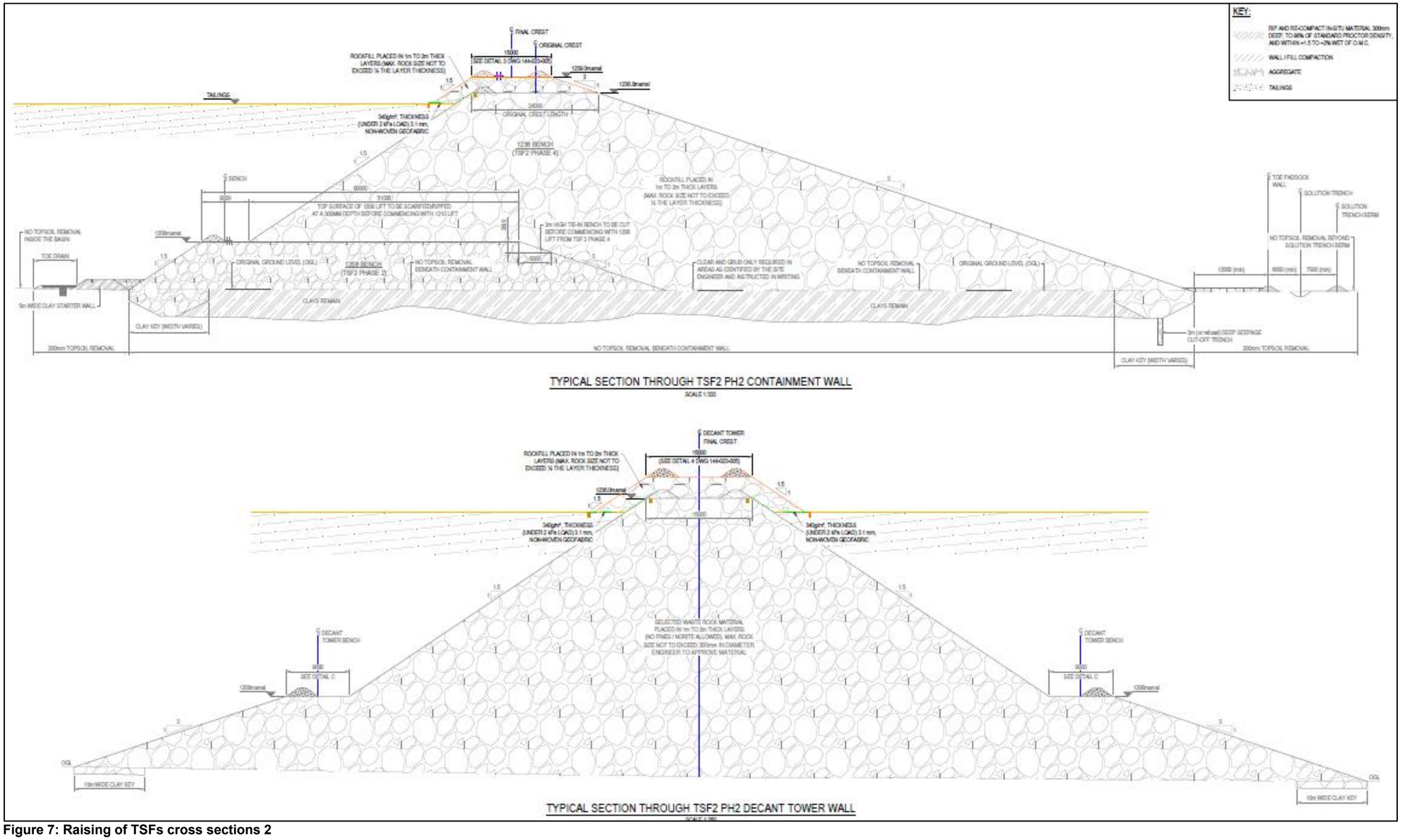


Figure 7: Raising of TSFs cross sections 2

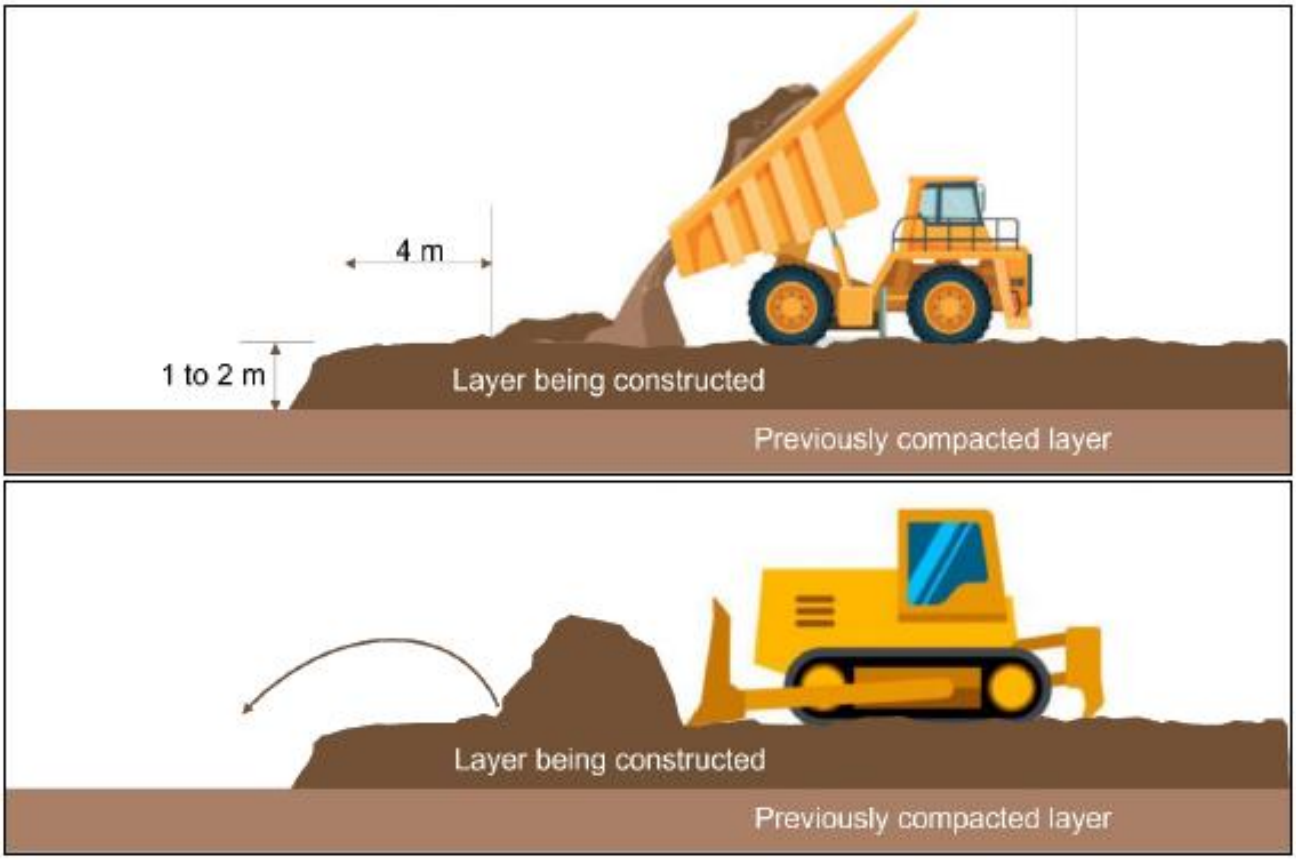


Figure 8: Operating methodology of dumping and dozing of rock fill material.

The rock fill is to be spread so that a uniform layer thickness is obtained. The layer is then given no less than six passes of a twenty-tonne (static weight) vibrating roller, as determined by utilising test pads to measure the change in settlement per roller pass or equivalent specification as described by the Engineer. A roller pass consists of rolling in a longitudinal direction over the whole width of the formation so that each roll laps half the width of the previous roll. The final layer is compacted and graded so as to ensure that the surface is trafficable in both transverse and longitudinal directions.

Even though care will be taken during construction to compact the structure in layers, differential settlement along the final crest will be observed with time which will require reinstatement to design height. Surveys should be undertaken on a yearly basis to ensure that the minimum required freeboard is met at all times.

The downstream and upstream side-slopes of the raised TSFs are 1V:3H and 1V:2H, respectively.

2-3.2 Waste Rock Buttress

The addition of a waste rock buttress along the downstream face of the north embankment of Phase 2 of TSF 2 (TSF 2 Extension) is required to achieve the mine target factors of safety. It should be noted that the achieved targets of safety, excluding the buttress, meet regulatory requirements. However, the mine requires Factor of Safety (FoS) of 1.3 and 1.75 for undrained and undrained seismic load cases, respectively, should mining activities be present downstream of the respective embankment. The buttress will have a constant height of 15 m with a crest of 25 m and a downstream slope of 1V:2.5H.

2-3.3 Toe drains

Resulting seepage from the deposition of tailings material into the basin of the facility is collected primarily through the use of toe drains along the upstream toe of each facility. The toe drains function as a means to reduce the amount of water that could potentially migrate into the embankment of the facility. This could affect

the stability of the downstream face or lead to environmental contamination if the water exits the toe of the embankment in an uncontrolled manner.

The toe drains consist of 3 or 4 corrugated High-Density Polyethylene (HDPE) pipes, depending on the facility, with perforated sidewalls surrounded by a 19 mm stone matrix. The 19 mm stone is overlain by a 6 mm stone matrix and a filter sand layer respectively. The sand filter layer prevents the ingress of tailings material into the drainage system, thus decreasing the risk of blinding the drainage system. The toe drains feed into toe drain outlets that discharge the captured seepage water into the solution trench.

The details of the toe drains for each facility are listed in Table 6 below.

Table 6: Toe drain description

DESCRIPTION	TSF 2	TSF 2 Extension
TOE DRAIN		
Trench	1000 – 1250 mm width, 750 mm depth (below ground level to pipe invert)	1000 – 1250 mm width, 500 mm depth
Filter sand layer	5800m wide and 250 mm thick	6500m wide and 250 mm thick
Stone layer (Fine aggregate)	1000 – 1250 mm width, 750 mm thick	1000 – 1250 mm width, 400 mm thick
Stone layer (Coarse aggregate)	1000 – 1250 mm width, 500 mm thick	1000 – 1250 mm width, 500 mm thick
Geofabric	A4 separating soil and filter layers	A4 separating soil and filter layers
Drainage pipes	2 - 4 corrugated 160 mm HDPE pipes (perforated)	3 - 4 corrugated 160 mm HDPE pipes (perforated)
TOE DRAIN OUTLETS		
Trench	1250 mm width, depth varies	1000 – 1750 mm width, depth varies
Stone layer (Coarse aggregate)	1250mm width, 500 mm thick	1000 – 1750 mm width, 500 mm thick
Geofabric	A4 separating soil and filter layers	A4 separating soil and filter layers
Drainage pipes	3-4 corrugated 160 mm HDPE pipes (non-perforated)	3, 4, and 6 corrugated 160 mm HDPE pipes (non-perforated)

2-3.4 Seepage cut-off drains

Seepage cut-off drains below the downstream toe of each facility were constructed as a means to capture seepage water migrating through the embankment and potential seepage water not captured by the upstream toe drains. This prevents water from entering the downstream environment and reduces the risk of piping along the downstream embankment slope. The seepage cut-off trenches for TSF 2 Phase 1 (TSF 2) and Phase 2 (TSF 2 Extension) have been excavated to a depth of 3 m. The trenches were backfilled with selected waste rock material. Water captured in these drains report to collection manholes equipped with dewatering pumps.

2-3.5 Decant System

Water from the supernatant pool is decanted from the facility through a gravity fed penstock system for TSF 2 Phase 1. TSF 2 Phase 2 (TSF 2 Extension) makes use of a decant tower consisting of a 2.1m diameter slotted steel pipe surrounded by coarse rockfill selectively sourced from the mine's waste rock material.

The details of the penstock system for TSF 2 Phase 1 (TSF 2) are as follows:

- 600 ND class 150D reinforced concrete spigot and socket outfall pipeline.
- 510 ID machined fibre-reinforced concrete penstock rings.
- 1 single intermediary intake structure approximately 0.5m above natural ground level and
- 1 double final intake structure approximately 7m above natural ground level.

2-3.6 Penstock Energy Dissipator

An energy dissipator is located at the outlet of the penstock pipeline for TSF 2 Phase 1 (TSF 2). The dissipator retards the flow velocity discharged at the outlet, preventing the decant water from eroding the solution trench, and assisting in settling out fines decanted from the TSF. The dissipator for TSF 2 Phase 1 (TSF 2) is lined with

300mm of reinforced concrete, allowing for the removal of settled fines with the use of an excavator. Due to TSF 2 Phase 2 (TSF 2 Extension) utilizing a decant tower, the water is pumped from the decant tower to a discharge point upstream of the sump for TSF 2 Phase 1 (TSF 2), from where it is conveyed to the plants as return water.

2-3.7 Pool wall and Wing Walls

Waste rock walls extend from the southern embankments of TSF 2 Phase 1 (TSF 2). The walls extend towards the final intake towers, forming a pool wall with diagonally extended wing walls. The pool walls, constructed of the same waste rock as the TSF embankments, allow for access to the decant inlets. The wing walls increase the flow path length of tailings from the discharge point to the decant point, resulting in the formation of a low point around the intake tower. This design aids in maintaining the position of the pool during initial operating conditions i.e. before tailings deposition has broken ground.

A waste rock pool wall constructed along the Northern wall of TSF 2 Phase 2 (TSF 2 Extension) provides access to the decant tower.

2-3.8 Catwalk

Wooden catwalks were constructed off the edge of the access ramp, extending to the intermediate and final intakes, with a platform around each intake. The catwalk extends up to the final penstock tower and is raised as the level of the tailings increases. No catwalk is used at TSF 2 Phase 2 (TSF 2 Extension).

2-3.9 Geofabric

In order to reduce the risk of piping through the rockfill embankment, geofabric was placed on the upstream faces of the TSFs, extending from the crest of the starter bund to the crest of the facility. The specific placement location and orientation thereof are:

TSF 2

- Placed along the entire upstream face of the northern embankment.
- Extended 200m onto the eastern embankment
- Installed along the entire vertical junction where the north and south embankments intercept the eastern embankment of TSF 1 Expansion.

TSF 2 Extension

- Placed on the upstream face of the facility, extending from the crest of the clay starter wall to the top of the waste rock embankment.

2-3.10 Solution Trench

Water released from the toe drains through the toe drain outlets, along with the discharge from the energy dissipator, is conveyed in the solution trench. The solution trench for each facility is detailed below:

TSF 2:

- Located along the Northern embankment;
- 1000 mm base width;
- 1V:1.5H trench side slopes; and
- Partially lined with 300 mm thick concrete.

TSF 2 Extension:

- Originating along the Northern embankment and extending along the Eastern embankment;
- 1000 mm base width; and
- 1V:1.5H trench side slopes.

2-3.11 Collection Sump

Water is discharged from the solution trench into a reinforced 300mm thick dual concrete chamber sump that functions as a silt trap. The chambers are constructed with access ramps allowing access for a front end loader for cleaning purposes. Water overflows from the sump into a wet chamber, equipped with pumps, from where it is directly pumped to the process plant.

2-3.12 Drainage design

Subsoil drains were designed to control the phreatic surface in the tailings and embankment, as well as to aid in the draining of water from the tailings. All facilities comprise a toe drain situated along the upstream toe of the starter bund with a seepage cut-off drain situated below the downstream toe of each facility.

2-3.13 Pipe Loading

A finite element model was developed to predict the load that would be exerted by the placed tailings on an HDPE pipe. The rock matrix surrounding the HDPE pipes provides high stiffness that absorbs most of the exerted load and as a result, provides additional support to ensure the integrity of the drainage system will be able to accommodate the exerted load. It was determined that a maximum axial force of 93 kN will be exerted on the pipe with the maximum expected deflection of the pipe void being only 1.3%, as shown in Figure 9. The observed maximum axial force and deflection do not exceed the maximum permissible values for a 160 mm HPDE pipe of 5% and 150 kN, respectively. Therefore, the existing drainage design will be sufficient to ensure that the pipes do not crush under loading.

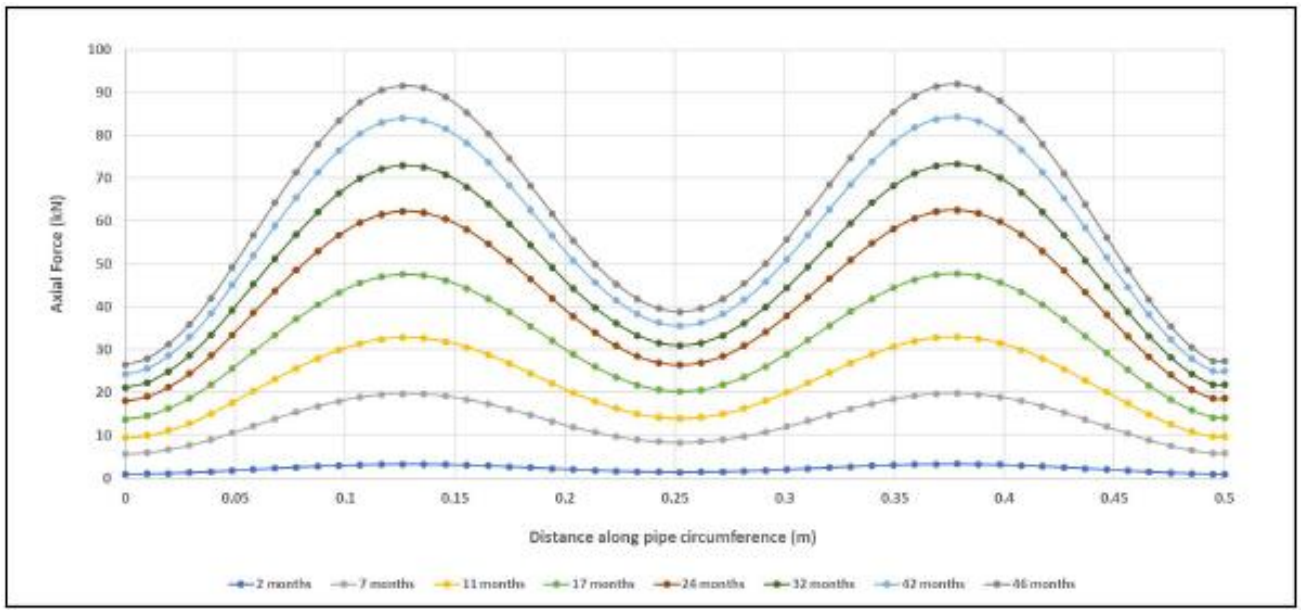


Figure 9: Pipe Loading results

2-3.13.1 Penstock outfall pipeline bearing capacity

Raising the current facilities to accommodate additional tailings storage, causes an additional surcharge load to be applied to the penstock decant system for TSF 2. Bearing capacity calculations were based on the methodology proposed by the South African National Standard (SANS) 10102-2:2011 for the "*Selection of Pipes*

for Buried Pipelines" and verified using the methodology proposed by the British Standard (BS EN) (BS EN 1295-1:1997) for *the "Structural Design of Buried Pipelines under various conditions of loading*". Table 7 lists the characteristics of the existing penstock outfall pipelines as well as the input parameters to the calculations.

Table 7: Existing penstock outfall pipeline characteristics

PARAMETER	UNITS	TSF 2
Nominal diameter	m	600
Inside Diameter	m	550
Wall thickness	mm	75
Strength Class	-	150D
Average Slope	m/m	0.004
Bedding Class	-	A
Final tailings depth	m	40.8
Soil Unit Weight	kN/m^3	22
Trench Width	m	1.3
Soil internal friction angle	Degrees	32

Both pipeline systems were installed so that negative projection conditions exist. For both TSFs, the plane of equal settlement exists above the level of the final tailings and as a result, complete negative projection conditions exist, as shown in Table 8.

Table 8: Pipeline bearing capacity results

PARAMETER	UNITS	TSF 2
Total expected soil load, Wc	kN/m	96.9
Total expected soil load including surcharge	kN/m	197.1
Bedding factor	-	2.6
Required pipe strength	kN/m	77.3
Allowable pipe crushing strength	kN/m	90.0
FoS	-	1.2

It was concluded that the applied surcharge loads do not exceed the maximum permissible crushing strength of 90 kN/m for a 150D pipeline.

It is important to note that contingencies will be put in place in the case of a penstock failure. These contingencies include:

- A floating barge system to pump excess water from the TSFs to the return water sump or plant; and
- A penstock outfall isolating valve at the outlet of the penstock pipeline to seal the pipeline should a failure occur, to prevent tailings discharged into the environment.

2-3.13.2 Penstock rings

Concrete penstock rings that are not placed with absolutely parallel sides, or placed carelessly, can cause uneven stressing of the concrete. This can cause the rings to crush or spall, resulting in piping and leakage of solids into the penstock shaft, or complete collapse and blocking of the shaft (Blight, 2009).

A method proposed by Blight (2009) to calculate the total downward pressure on the penstock tower, considers the submerged tailings unit weight, the height of the tailings and the shearing resistance angle of the soil. Table 9 lists the input parameters and subsequent bearing capacity of the penstock rings.

Table 9: Concrete penstock rings bearing capacity

PARAMETER	SYMBOL	UNITS	VALUE
Unit weight of water	γw	kN/m^3	9.81
Submerged unit weight of tailings	γ'	kN/m^3	28.6
Angle of shearing resistance	φ'	Degrees	28
Assumed tailings depth above penstock tower	h	m	20
Penstock ring wall thickness	t	m	0.1

PARAMETER	SYMBOL	UNITS	VALUE
Total vertical frictional load	V	kN/m	2627.8
Vertical compressive stress	σv	Megapascal (MPa)	26.28
Concrete crushing strength	σc	MPa	30

It was observed that the penstock rings should have sufficient bearing capacity as the crushing strength of the concrete (30 MPa) exceeds the vertical compressive stress exerted by the tailings (26.3 MPa). All penstock intakes at Tharisa have been reinforced through internal sleeving with 30 MPa concrete and a steel lost shutter. This improves the structural integrity of the system as well as reduces the risk of tailings migration through the rings.

2-3.13.3 Penstock outfall valves

A comprehensive design has been undertaken for the penstock isolating valve, mitigating the potential risk of an environmental spill should the structural integrity of the existing penstock be jeopardised. The outfall pipelines to TSF 2 Phase 1 (TSF 2) will include a 500 mm diameter gate valve to prohibit the outflow of tailings. The valve will be in an open position during normal operations and closed if an emergency occurs.

The existing outfall pipeline, with an inside diameter (ID) of 585 mm, will be slip-lined with a DN 500 (OD of 508 mm) steel pipe, grouted in position with a non-shrink cementitious grout. The DN500 pipe will be fitted with a corresponding DN500 flange and the DN500 gate valve bolted to the flange. Refer to Figure 10 for an isolated view of the above-discussed components.

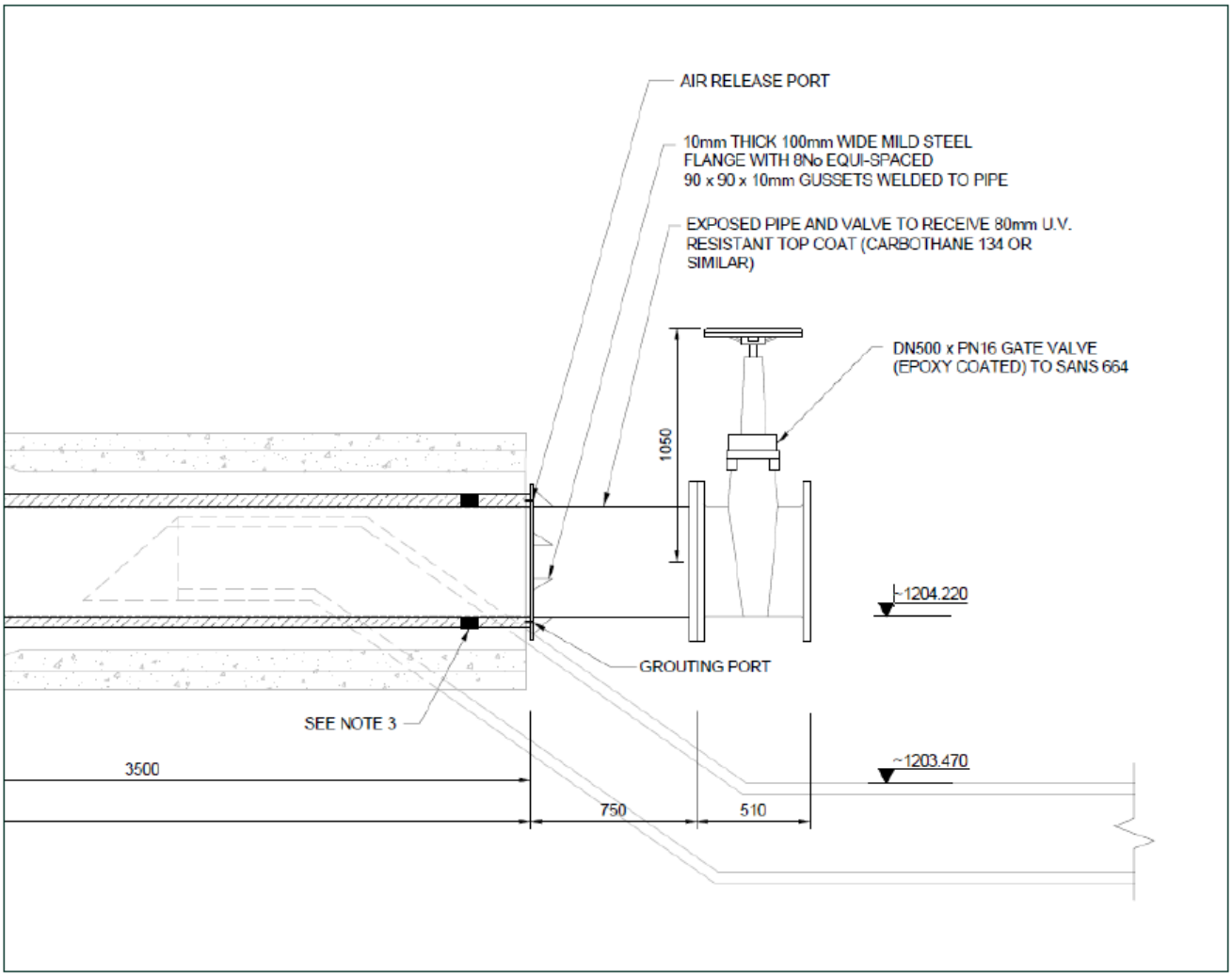


Figure 10: Penstock outfall pipeline isolating valve

The system would be able to manage the longitudinal force imposed by the constant through flow of return water. The most critical element would be at the steel grout interface with an allowable shear stress of 0.35 N/mm^2. The maximum shear stress exerted on this interface was determined to be 0.0089 N/mm^2 which indicates the system would be able to accommodate the forces imposed by the decant water.

2-3.13.4 Drainage Sizing

The drains have been sized to accommodate the potential seepage emanating from the supernatant pool during the design of the existing facilities. The plan area of the drains, together with the permeability of the tailings and hydraulic gradient, dictates the flow rate into the drains.

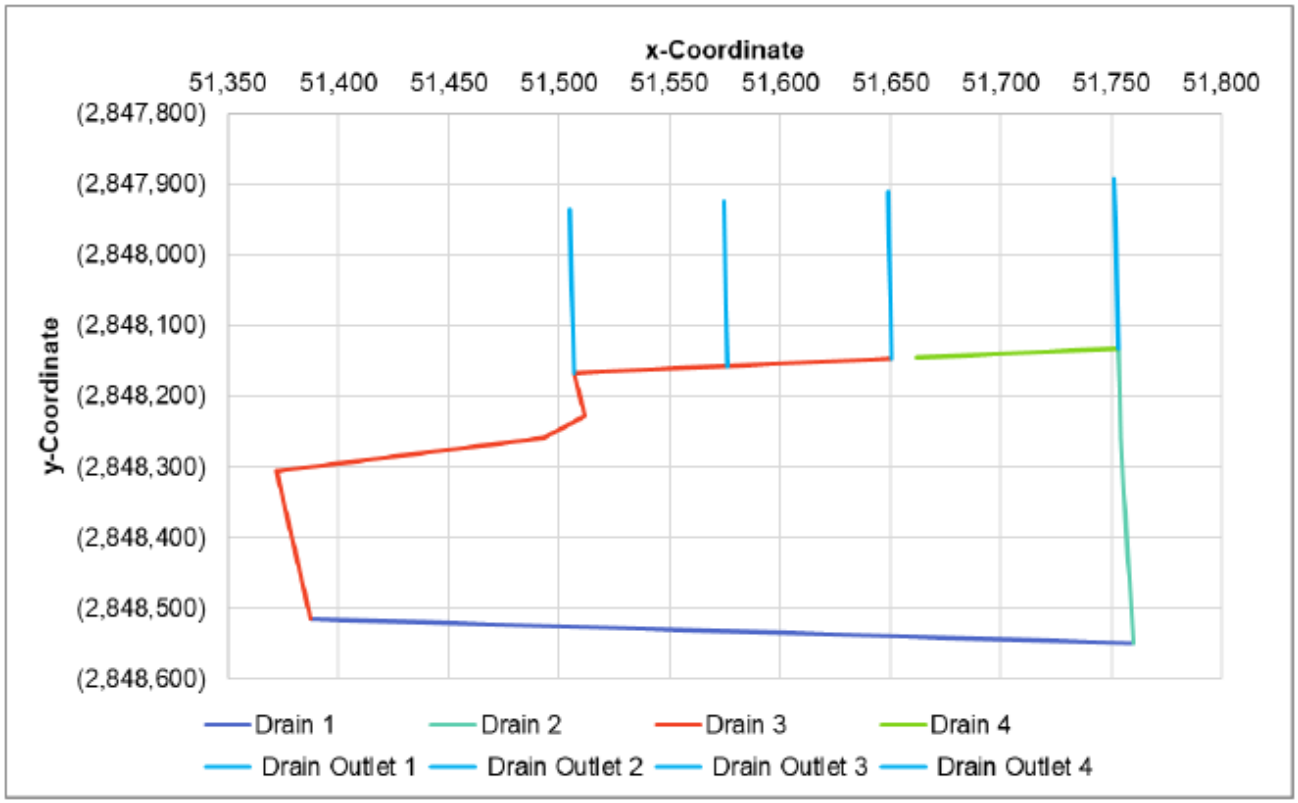


Figure 11: TSF 2 Drainage layout

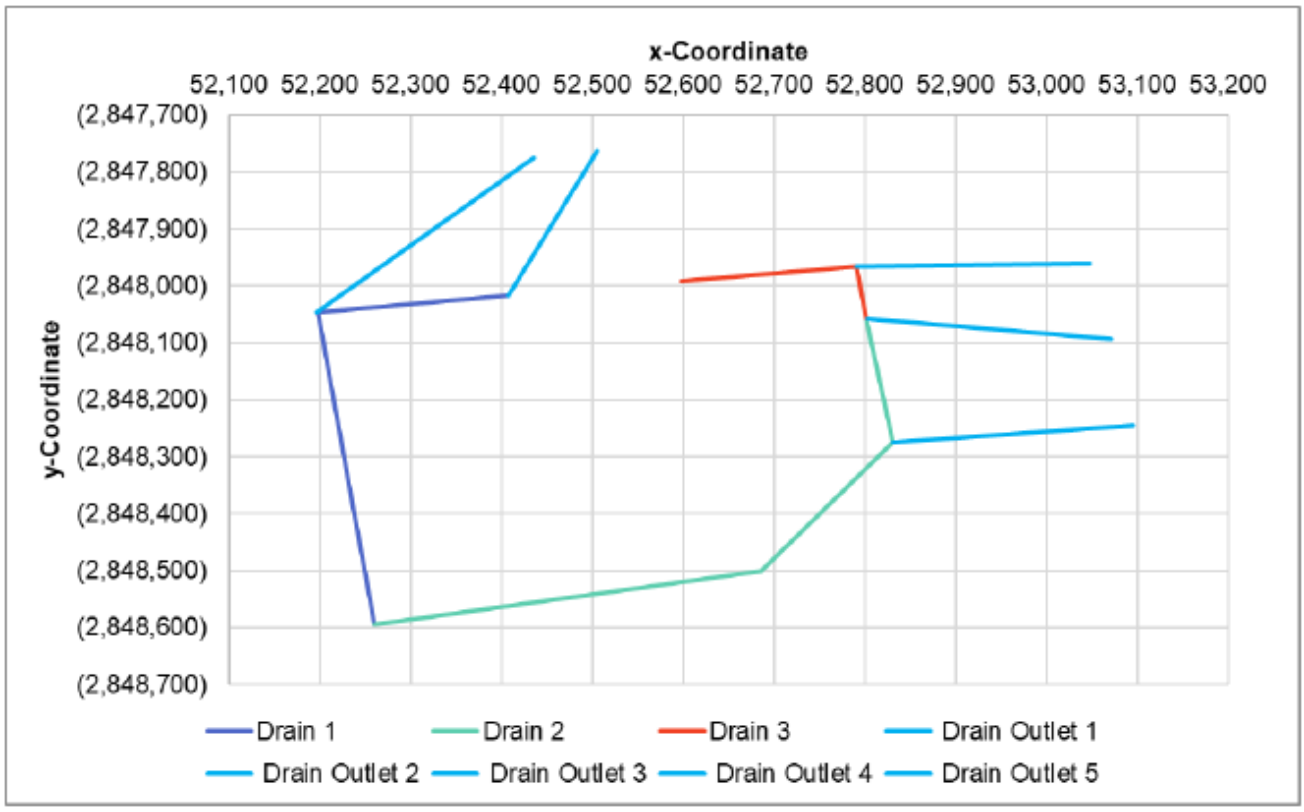


Figure 12: TSF 2 Extension drainage layout

Table 10 shows the available flow rate for each drain segment, as well as the possible flow rate from the supernatant pool for each facility.

Table 10: Drain Capacity

DRAIN	DESCRIPTION	POOL-GENERATED FLOW RATE (M^3/DAY)	DRAIN AREA (M^2)	DRAIN AVAILABLE FLOW RATE (M^3/DAY)
TSF 2				
Drain 1	South Embankment	151	2438	902
Drain 2	East Embankment	188	2717	1127
Drain 3	West and partial North Embankment	188	2841	1405
Drain 4	Partial North Embankment	43	605	1402
TSF 2 Extension				
Drain 1	West and partial North Embankment	110	4 973	1 495
Drain 2	South and partial East Embankment	152	6 006	1 855
Drain 3	Partial North Embankment	54	1 872	1 776
TAILINGS PERMEABILITY (m/s)		4.84E-7		
SAND PERMEABILITY (m/s)		1.00E-5		

It is shown that the toe drains still have sufficient capacity to cater for the seepage originating from the supernatant pool. It must be noted that the seepage originating from the pool is for normal operating conditions. The seepage rates, as listed in Table 10, align well with what is recorded monthly from the existing facilities.

The flow rate that would be expected in each pipe, based on the pool generated seepage, is given in Table 11 and illustrates that sufficient flow capacity is provided by the pipes.

Table 11: Drain flows

DRAIN	DESCRIPTION	PIPE FLOW RATE (M^3/DAY)	FLOW DEPTH IN PIPES (%)
TSF 2			
Drain 1	South Embankment	50.2	16.5
Drain 2	East Embankment	46.9	14.4

DRAIN	DESCRIPTION	PIPE FLOW RATE (M^3/DAY)	FLOW DEPTH IN PIPES (%)
Drain 3	West and partial North Embankment	62.8	14.9
Drain 4	Partial North Embankment	21.5	8.9
TSF 2 EXTENSION			
Drain 1	West and partial North Embankment	27.6	9.7
Drain 2	South and partial East Embankment	50.7	11.7
Drain 3	Partial North Embankment	18.0	7.3

The following is noted:

- Given the size of the drain's trench, the stone matrix surrounding the pipes will also provide additional drainage capacity over and above the pipe flow volume which has not been accounted for.
- The service life of the drains is expected to be greater than the operational life of the facility. This is ensured by undertaking a comprehensive filter design to prevent the washing-out of filter material from the drains.
- The clogging of drain pipelines is managed with periodic jet rodding.
- Upturns or goosenecks are installed at the drain outlets to prevent oxygen from entering the pipeline, reducing the growth of vegetation within the pipes and discourages animals from nesting in the pipelines.

2-3.13.5 Outlet Piping

Outlet pipes have been located at intervals around the TSFs. The locations of the outlets considered the elevations of the drain and the outlet elevations to ensure there is a minimum slope of 1V:400H. Each outlet comprises a 160 mm diameter HDPE pipe, with a ring stiffness of 450 kilopascal (kPa). The pipe is surrounded by 19 mm stone and wrapped in a 210 g/m^2 nonwoven geofabric. Flow rates were based on the flow through the pipe only, with the potential flow through the stone being ignored.

2-3.13.6 Filter Compatibility

In order to ensure compatibility of the filter sand and tailings, the filter sand and the 6 mm stone, and the 6 mm stone with the 19 mm stone, a filter design was undertaken during the detailed design of the respective facilities. The required grading envelopes of the filter sand, 6 mm stone and 19 mm stone applicable to TSF 2 and TSF 2 Extension are shown in Figure 13.

2-3.14 Geofabric Separation Layer

The raising of the TSFs, following the current facilities reaching their respective capacities, will include the placement of a geotextile on the consolidated tailings along the perimeter of the facility prior to the placement of waste rock. This will reduce the risk of tailings ingress and seepage through the rockfill embankment. The geotextile will be anchored on the crest of the existing facility and within the tailings at the downstream toe of the raised embankment. The geotextile will extend approximately 0.5m from the downstream toe of the raised embankment and will be anchored in a trench of approximately 600 mm deep and 300 mm wide. The geotextile will also be anchored in the same manner within the existing embankment prior to the placement of waste rock. A geotextile with a density of 750 g/m^2 was specified.

2-3.15 Barrier system

The design of the existing facilities was accepted as a class-D liner due to the nature of the tailings material and the presence of a thick "black turf" layer beneath the footprint of the facilities. The black turf is known for its low permeability, which ranges from 1E-9 m/sec to 4.7E-10 m/sec while maintaining a high plasticity index ranging between 32 and 72.

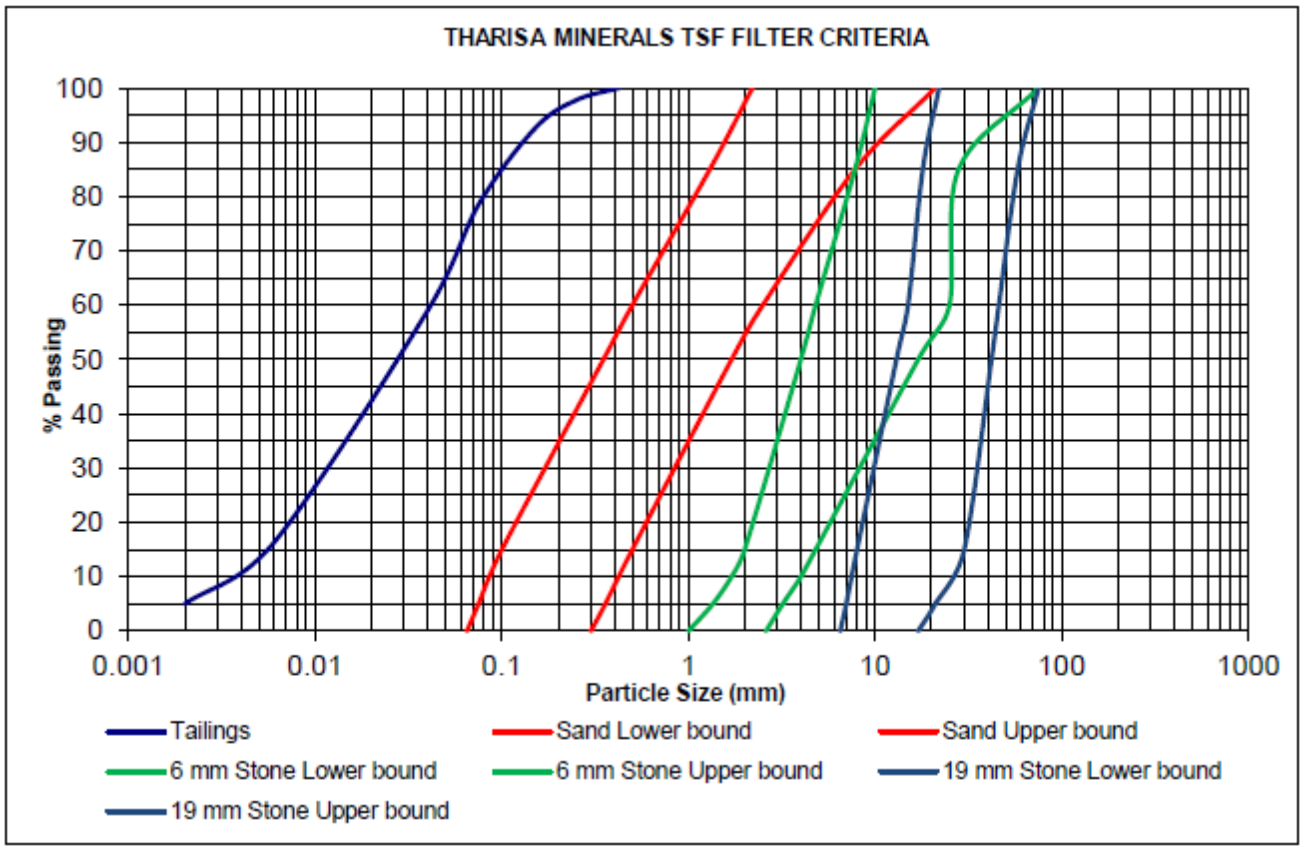


Figure 13: TSF 2 filter design

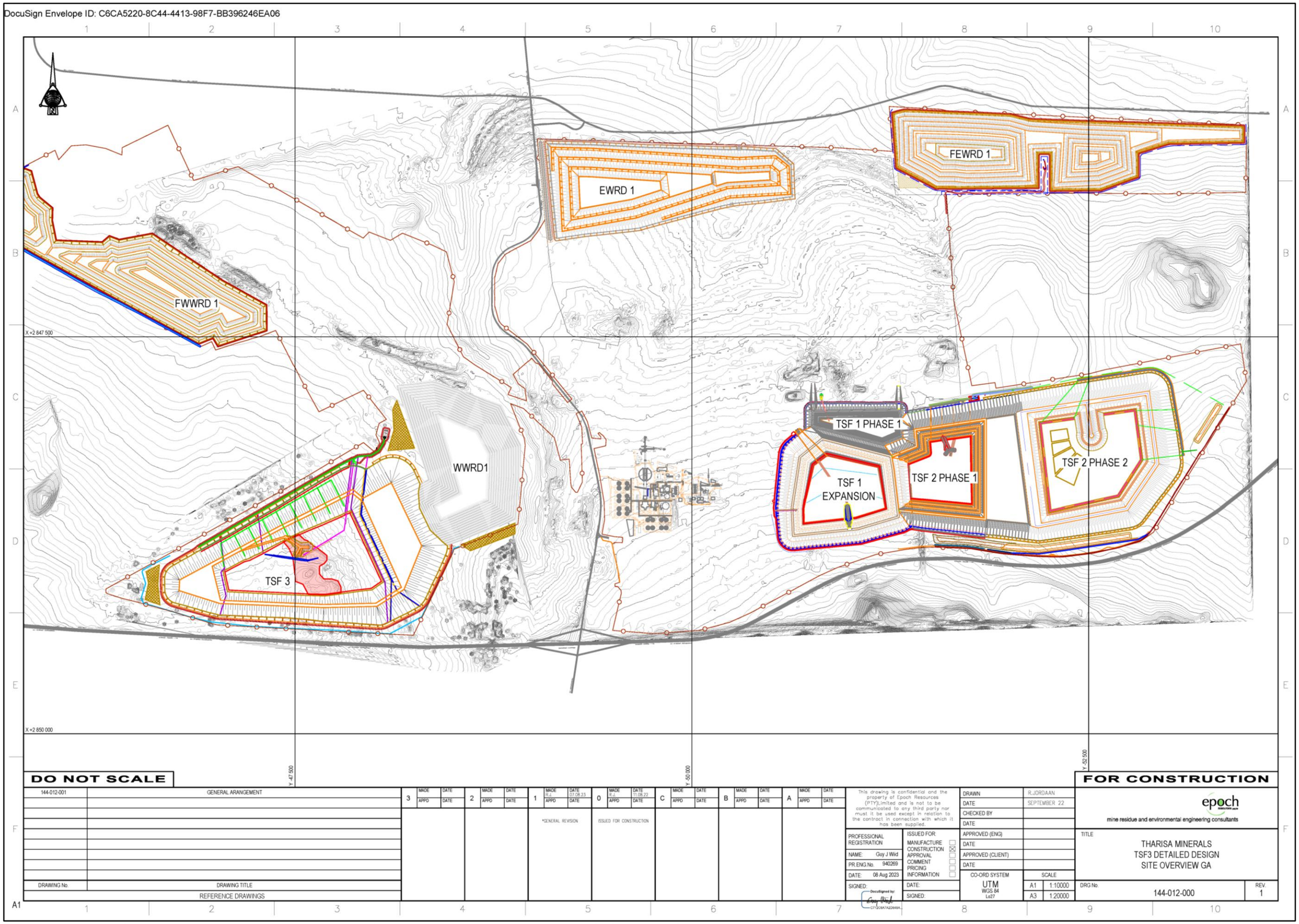


Figure 14: Design of the Tharisa Mine operations (existing infrastructure) and proposed raising of TSF 2 and TSF 2 Extension

SECTION 3: POLICY AND LEGISLATIVE CONTEXT

The purpose of this section is to list legislation, principles and policies that may relate to the management of anticipated impacts resulting from the proposed raising of the walls of TSF 2 and TSF 2 Extension. The reason for this is to ensure that the DMRE have access to the rich picture in terms of legislation. Legislation principles and policies as listed hereunder are relatively detailed.

Table 12 below lists the applicable legislation, policies and guidelines identified as relevant to the proposed **raising of the walls of TSF 2 and TSF 2 Extension project**. In addition, a description of how the proposed activity complies with and responds to the legislation and policy context is given. This list is not exhaustive but rather presents the most applicable legislation relevant to the proposed **raising of the walls of TSF 2 and TSF 2 Extension project**.

Table 12: Policy and legislative context of the proposed project

Applicable legislation and guidelines	Reference where applied	How does this development comply with and respond to the legislation and policy context	Authority
The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) (The Constitution).	• Throughout the BAR.	Section 24 of the Constitution states 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 generations through reasonable legislative and other measures that (c) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*" This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development.	Government of the Republic of South Africa.
MPRDA.	• Section 3-3.	Tharisa has been in operation since November 2009 having an initial MR 49/2009 effective 19 September 2008, issued on 13 August 2009 by the then the DME (now referred to as the DMRE). Tharisa subsequently applied for an amendment of the MR with the Reference Number: NW/30/5/1/2/2/358 MR, stamped 28 July 2011. This MR was however only registered in 2016. The original EMPr was compiled by Metago in 2008 in terms of NEMA and the MPRDA. The following approvals have been granted under the MPRDA: • A MR (Reference No.: NW30/5/1/2/3/2/1/358) issued by the DMRE on 19 September 2008 and amended in July 2011; • An approved EMPr (Reference No.: NW 30/5/1/2/3/2/1/358EM) issued by the DMRE on 19 September 2008; • An addendum to the EIA and EMPr (Ref No.: NW/30/5/1/2/3/2/1/358EM) issued by the DMRE on 24 June 2015; • An addendum to the EIA and EMPr (Ref No.: NW/30/5/1/2/3/2/1/358EM) issued by the DMRE on 03 August 2020; • An addendum to the EIA and EMPr (Ref No.: NW/30/5/1/2/3/2/1/358EM) issued by the DMRE on 01 September 2020; • An addendum to the EIA and EMPr (Ref No.: NW/30/5/1/2/3/2/1/358EM) issued by the DMRE on 03 August 2021; • An addendum to the EIA and EMPr (Ref No.: NW/30/5/1/2/3/2/1/358EM) issued by the DMRE on 10 August 2021; • An addendum to the EIA and EMPr (Ref No.: NW/30/5/1/2/3/2/1/358EM) issued by the DMRE on 31 May 2023; and • An addendum to the EIA and EMPr (Ref No.: NW/30/5/1/2/3/2/1/358EM) issued by the DMRE on 05 December 2024. The proposed EMPr amendment is being undertaken under the MPRDA.	North West DMRE.
NEMA and the EIA Regulations, 2014, GNR 984, as amended.	• Throughout the BAR; • SECTION 2: of this report details the proposed project description and the listed activities triggered; and • Table 5 details the listed activities to be authorised according to NEMA.	Section 24 of the NEMA i.e. control of activities which may have a detrimental effect on the environment and Section 28 of the NEMA i.e. duty of care and remediation of environmental damage have been taken in consideration of. Tharisa has EAs authorised under NEMA. The following EAs have been granted under the NEMA: • An EA (Ref No.: NWP/EIA/159/2007) issued by the North West DEDECT on 23 October 2009, amended on 30 August 2011; • An EA (Ref No.: 14/12/16/3/3/2/408) issued by the Department of Forestry, Fisheries and the Environment (DFFE) on 15 November 2012; • An EA (Ref No.: NWP/EIA/50/2011) issued by the North West DEDECT on 29 April 2015; • An EA (Ref No.: NW/30/5/1/2/3/2/1/358EM) issued by the DMRE on 14 August 2020; • An EA (Ref No.: NW30/5/1/2/3/2/1/358EM) issued by the DMRE on 03 August 2023; • A Section 24G EA (Ref No.: NW/30/5/1/2/3/2/1/358EM) issued by the DMRE on 10 August 2021; • An EA (Ref No.: NWP-EIA-60-2022 EA) issued by the North West DEDECT on 25 April 2023; • An EA (Ref No.: NW/30/5/1/2/3/2/1/358EM) issued by the DMRE on 31 May 2023; and • An EA (Ref No.: NW/30/5/1/2/3/2/1/358EM) issued by the DMRE on 05 December 2024. The proposed **raising of the walls of TSF 2 and TSF 2 Extension project** triggers activities listed in GNR. 983, as amended, which requires that an EA from the DMRE be granted prior to undertaking the activities. **Triggered activities listed under GNR.327 (Listing Notice 1) are as follows:** Activities 21D, 34, 48 and 66. The Integrated EA and WML application is being undertaken under the NEMA and the NEMWA.	
DFFE Integrated Environmental Management (IEM) Guideline Series, Guideline 5: Assessment of the EIA Regulations, 2012 (Government Gazette 805). IEM Guideline Series 11, published by the DFFE in 2004. Review in EIA IEM, Information Series 13, Department of Environmental Affairs and Tourism (DEAT), Pretoria.	• Throughout the BAR.	Environmental impacts will be generated in all phases on the project. These have been assessed as part of the proposed project. A Basic Assessment (BA) is required for the proposed project as activities are triggered under GNR. 983, as amended.	North West DMRE.
DFFE 2017, Public Participation guideline in terms of NEMA EIA Regulations.	• Throughout the BAR.	PPP is a requirement of the BA and is being conducted for the proposed project.	North West DMRE.
NWA.	• Throughout WULA – pertaining to water related aspects. As mentioned above, the proposed project requires that an amended WUL be applied for. A WULA is currently being	A WUL (Licence No. 03/A21K/ABCGIJ/1468) was issued by the DWS to Tharisa on 16 July 2012 for the following Section 21 water uses: Section 21 (a), (b), (c), (i), (g), (j). An amended IWUL to the issued WUL was issued by the DWS on 12 November 2020, for the same water uses, as originally applied for. Another amended WUL was issued on 12 November 2024, which supersedes the 12 November 2020 WUL was also issued. Additionally, a WUL for TSF3 WRD Extension 1 was issued on 17 September 2024.	DWS.

Applicable legislation and guidelines	Reference where applied	How does this development comply with and respond to the legislation and policy context	Authority
	undertaken in parallel with the Integrated EA and WML Application, and Section 102 EMPr amendment for the **raising of the walls of TSF 2 and TSF 2 Extension** project. • Section 3-5.	The proposed **raising of the walls of TSF 2 and TSF 2 Extension** project requires a Section 21 (g) WULA. The triggering of these water uses require an amendment to the existing WUL to be applied for.	
NEMWA.	• Throughout the BAR. • SECTION 2: of this report details the proposed project description and the listed activities triggered. • Section 3-4.	The proposed **raising of the walls of TSF 2 and TSF 2 Extension** project triggers activities listed in under GNR.921 [Category B (4)] and requires a WML from the DMRE. According to GNR. 921 of the NEMWA, activities listed in GNR.921 (Category B) require that a Scoping and Environmental Impact Reporting (S&EIR) be undertaken. Triggered activities listed under GNR.921 [Category B (4)] are as follows: • Activities 7 and 10. It must be noted that the current application is for the amendment of the existing approvals. It is for this reason that an Integrated EA and WML application is being lodged, and a BA process is being followed. TSF 2 and TSF 2 Extension are existing TSFs. TSF 2 Extension is currently being operated under the existing approvals.	North West DMRE, through the Integrated application process.
National Environmental Management Air Quality Act, 2004 (Act No. 39 of 2004) (NEMAQA).	• SECTION 7:- Environmental Attributes.	Air quality management: Section 32 – Dust control; Section 34 – Noise control; and Section 35 – Control of offensive odours. No approvals are required from the district municipality for the proposed project.	DFFE.
Mine Health Safety Act, 1996 (Act No. 29 of 1996) (MHSA).	• Sections 2-3.2 and 3-4.4.	The MHSA aims to provide for protection of the health and safety of all employees and other personnel at the mines of South Africa. The proposed project is located within a mining area and Tharisa will therefore need to ensure that employees, contractors, sub-contractors and visiting personnel, adhere to this Act and subsequent amendment regulations on site.	North West DMRE.
Conservation of Agricultural Resources Act (Act No. 43 of 1983) (CARA).	• SECTION 7:- Environmental Attributes.	The act makes provision for the control measures for erosion; and control measures for alien and invasive plant species.	DAFF.
National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA).	• SECTION 7:- Environmental Attributes.	A Heritage Impact Assessment (HIA) screener and Exemption of Palaeontological Impact Assessment has been undertaken for the project, to identify whether there are any areas of historical importance or of palaeontological importance. The area proposed for development has been previously surveyed for heritage resources and as such, it is very unlikely that the proposed development will impact negatively on any significant archaeological heritage resources. No further assessment of impact to archaeological heritage is recommended.	North West Heritage Resource Authority.

3-1 THE CONSTITUTION OF SOUTH AFRICA, 1996 (ACT NO. 108 OF 1996)

Section 24 of the Constitution of South Africa, 1996 (Act No. 108 of 1996) (here after referred to as the Constitution) states 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 generations through reasonable legislative and other measures that (c) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."*

This protection encompasses preventing pollution and promoting conservation and environmentally sustainable development.

3-2 NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998)

The NEMA provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by State Departments and to provide for matters connected therewith.

In 2014 on 8 December, new EIA Regulations came into effect and replaced the previous EIA Regulations of 18 June 2010. The Regulations are as follows:

- GNR. 982 provides for the methodology and format which needs to be considered when conducting a BA and S&EIR processes;
- GNR. 983 (Listing Notice 1) provides for activities which require a BA process to be followed;
- GNR. 984 (Listing Notice 2) provides for activities which require a S&EIR to be followed; and
- GNR. 985 (Listing Notice 3) also provides for activities which require a BA process to be followed.

The Minister of Environmental Affairs has again made amendments to the EIA Regulations, 2014, published under GNR. 982, GNR. 983, GNR. 984 and GNR. 985 of 4 December 2014, in terms of sections 24(5) and 44 of the NEMA through the promulgation of GNR. 324, GNR. 325, GNR. 326 and GNR. 327 of 07 April 2017.

The NEMA EIA Regulations define two broad processes for an EIA, namely: BA and S&EIR.

- A BA is required for projects with less significant impacts or impacts that can easily be mitigated.
- S&EIR is applicable to all projects likely to have significant environmental impacts due to their nature or extent, activities associated with potentially high levels of environmental degradation, or activities for which the impacts cannot be easily predicted.

The proposed project entails the undertaking of a BA in terms of the NEMA EIA Regulations, 2014, as amended (GNR. 983) and the NEMWA. The BA consists of the identification of potential issues which are investigated by undertaking specialist studies. These activities are identified as actions that may not commence without an EA from the relevant competent authorities, in this case, the DMRE.

3-2.1 Listed and specified activities for the proposed Project

The listed activities associated with the proposed project in respect of NEMA are provided in Table 5 above. The design of the infrastructure that will trigger these listed activities is provided in Figure 5, Figure 6 and Figure 7. Based on the nature and extent of the listed activities, MC on behalf of Tharisa has undertaken an integrated application process.

3-2.2 DFFE Screening Tool

According to Regulation 16(1)(v) of the NEMA EIA Regulations, 2014, as amended, an application for EA must be accompanied by a report generated by the national web based environmental screening tool. The custodian of this report is the DFFE. A copy of the DFFE screening report is attached to this report as Appendix 6.

3-2.3 Duty of Care

NEMA also places a duty of care on all persons who may cause significant pollution or degradation of the environment. Specifically, Section 28 of the Act states that *(1) Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment. (2) Without limiting the generality of the duty in subsection (1), the persons on whom subsection (1) imposes an obligation to take reasonable measures, include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises on which or in which- (a) any activity or process is or was performed or undertaken; or (b) any other situation exists, which causes, has caused or is likely to cause significant pollution or degradation of the environment."*

Consequently, Tharisa must take "reasonable steps" to prevent pollution or degradation of the environment which may result from the proposed activities. These reasonable steps include the investigation and evaluation of the potential impact, and identification of means to prevent an unacceptable impact on the environment, and to contain or minimise potential impacts where they cannot be eliminated.

3-3 MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT NO. 28 OF 2002)

The MPRDA aims to make provision for equitable access to, and sustainable development of, the nation's mineral and petroleum resources. This Act outlines the procedural requirements that need to be met to acquire mineral and petroleum rights in South Africa. The MPRDA governs the sustainable utilisation of South Africa's mineral resources.

Tharisa has been in operation since November 2009 having an initial MR 49/2009 effective 19 September 2008, issued on 13 August 2009 by the then the DME (now referred to as the DMRE). Tharisa subsequently applied for an amendment of the MR with the Reference Number: NW/30/5/1/2/2/358 MR, stamped 28 July 2011. This MR was however only registered in 2016.

The proposed project requires that a Section 102 Application process be undertaken to incorporate the proposed project activities into the EMPr.

Section 102 of the MPRDA states that "*a reconnaissance permission, prospecting right, MR, mining permit, retention permit, technical corporation permit, reconnaissance permit, exploration right and production right work programme; mining work programme, EMPr, and Environmental Management Plan (EMP) may not be amended or varied (including by extension of the area covered by it or by the addition of minerals or a share or shares or seams, mineralised bodies, or strata, which are not at the time the subject thereof) without the written consent of the Minister*".

It must be noted that Activity 21D has been included into Listing Notice 1 on the NEMA EIA Regulations, of 2014, as amended, which now requires that a **BA** must be undertaken as part of the amendment process in terms of section 102 of the MPRDA.

Section 1 of the Act has made provision for the following definitions:

"**Residue deposit**" means any residue stockpile remaining at the termination, cancellation or expiry of a prospecting right, MR, mining permit, exploration right, production right or an old order right.

"**Residue stockpile**" means any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, beneficiation plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated for potential re-use, or which is disposed of, by the holder of a MR, mining permit, production right or an old order right.

The TSF 2 and TSF 2 Extension are residue stockpiles. The stockpiles can become residue deposits at some time in the future upon closure if the material is not recovered.

3-3.1 Regulations regarding the planning and management of residue stockpiles and residue deposits from a prospecting, mining, exploration, or production operation (GNR. 632 of 2015), as amended

The purpose of these Regulations is to regulate the planning and management of residue stockpiles and residue deposits from a prospecting, mining, exploration, or production operation. The identification and assessment of environmental impacts arising from the establishment of residue stockpiles and residue deposits must be done as part of the EIA conducted in terms of the NEMA. A risk analysis based on the characteristics and the classification must be used to determine the appropriate mitigation and management measures. The design of the TSFs will need to meet the requirements of GNR. 632 of 2015. The detailed design report has been provided in Appendix 9.

3-4 NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008 (ACT 59 OF 2008)

NEMWA regulates waste management in South Africa and provides reasonable measures for pollution prevention resulting from waste activities.

The NEMWA defines Waste as (a) *any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or (b) any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette, but any waste or portion of waste, referred to in paragraphs (a) and (b), ceases to be a waste- (i) once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered; (ii) where approval is not required, once a waste is, or has been re-used, recycled or recovered; (i) where the Minister has, in terms of section 74, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or, (ii) where the Minister has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste*.

3-4.1 List of Waste Management Activities

The Acting Minister of the DFFE under section 19 (1) of the NEMWA, has published a List of Waste Management Activities which have, or are likely to have a detrimental effect on the environment in GNR. 921 of 29 November 2013.

The schedule has listed activities in three different categories, i.e. Category “A”, Category “B” and Category “C”.

For **Category “A”** activities, a person who wishes to commence, undertake or conduct an activity listed under this Category, must conduct a BA process, as stipulated in the NEMA EIA Regulations under section 24 (5) of the NEMA as part of a waste license application.

For **Category "B"** activities, a person who wishes to commence, undertake or conduct an activity listed under this Category, must conduct a NEMA S&EIR process, as stipulated in the EIA regulations under section 24(5) of the NEMA as part of a waste license application.

The listed activities associated with the proposed project in respect of NEMWA are provided in Table 13 below.

Table 13: Triggered Activities Listed Under GNR.921 [Category B (4)]

Activity Number	Description
Activity 7	The disposal of any quantity of hazardous waste to land.
Activity 10	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).

It must be noted that the current application is for the amendment of the existing approvals. It is for this reason that an Integrated EA and WML application is being lodged, and a BA process is being followed. TSF 2 and TSF 2 Extension are existing TSFs. TSF 2 Extension is currently being operated under the existing approvals.

For **Category "C",** a person who wishes to commence, undertake or conduct a waste management activity must comply with relevant requirements or standards determined by the Minister listed below:

a) Norms and Standards for Storage of Waste, 2013;
b) Standards for Extraction, Flaring or Recovery of Landfill Gas, 2013; or
c) Standards for Scrapping or Recovery of Motor Vehicles, 2013.

The following definitions have been provided:

Schedule 3 of the Act includes the following definition under Category A:

"**Hazardous waste**" means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles as outlined below:

"**Residue deposits**" means any residue stockpile remaining at the termination, cancellation or expiry of a prospecting right, MR, 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 MR, mining permit or, production right or an old order right, including historic mines and dumps created before the implementation of this Act.

Residue deposits and residue stockpiles include: (a) wastes from mineral excavation b) wastes from physical and chemical processing of metalliferous minerals (c) wastes from physical and chemical processing of nonmetalliferous minerals (d) wastes from drilling muds and other drilling operations.

The TSFs are residue stockpiles and are thus also "waste" according to the Act.

Since 24 July 2015, a WML must be obtained for the establishment, reclamation, expansion or decommissioning of residue stockpiles or residue deposits resulting from activities requiring a right/ permit in terms of the MPRDA. **Existing residue stockpiles and deposits can be managed in terms of an approved EMPr**.

The Minister of Environmental Affairs published the amendment regulations regarding the Planning and Management of Residue Stockpiles and Residue Deposits on 21 September 2018. The purpose of the amendment regulations is to amend the regulations regarding the Planning and Management of Residue Stockpiles and Residue Deposits of 2015, with the main aim to allow for the pollution control measures required for residue stockpiles and residue deposits, to be determined on a case-by-case basis, based on a risk analysis conducted by a competent person.

In terms of the transitional arrangements, any application for a WML relating to the establishment of a residue stockpile or residue deposit, lodged before 21 September 2018, must be dealt with in terms of the Regulations as amended by these amendment regulations.

The regulations regulate the assessment of impacts and analyses of risks relating to the management of residue stockpiles and residue deposits, the characterisation of residue stockpiles and residue deposits, the classification of residue stockpiles and residue deposits, the investigation and selection of site for residue stockpiling, the design of the residue stockpiles and residue deposits, impact management, the duties of the holder of right or permit, the monitoring and reporting system for residue stockpiles and residue deposits, dust management and control, decommissioning, closure and post closure management of residue stockpiles and residue deposits.

3-4.2 Waste Assessment and Classification

The objective of the waste assessment is underpinned by the legal provisions of the NEMWA, which prescribes the following in terms of waste streams:

- Undertake a waste type assessment in terms of GNR. 635 (23 August 2013); and
- Determine the barrier requirements as per GNR. 636. (23 August 2013).

The National Norms and Standards for the Assessment of Waste for Landfill Disposal, published in GNR. 635 of 2013, prescribe the requirements for the assessment of waste prior to disposal to landfill. Although these regulations may not specifically apply to residue stockpiles and residue deposits, the requirements thereof have been considered for guideline purposes in this BA.

GNR. 635 requires that all wastes that are to be disposed of in landfills be assessed in terms of their composition and leaching properties. The total concentrations and leachable concentrations of specified analytes are used to assess the waste. These values are then compared to threshold values to determine the waste type.

The Total concentration thresholds (TCT) and Leachable concentrations thresholds (LCT) are determined through geochemical testing by an accredited laboratory and categorised according to the threshold limits. The three TCT and four LCT limit categories (according to NEMWA) are listed in Table 14 and Table 15 respectively, alongside the results of the waste assessment on the Vulcan tailings as completed by SLR.

Table 14: Total Concentration Threshold Limits and Vulcan tailings results (SLR, 2022)

ANALYTES	UNIT	TCT0	TCT1	TCT2	TH-TSF 2	TH-TSF 2-Extension
As, Arsenic	mg/kg	5,8	500	2000	1,2	<0,400
B, Boron	mg/kg	150	15000	6000	<10	<10
Ba, Barium	mg/kg	62,5	6250	25000	44,4	34,5
Cd, Cadmium	mg/kg	7,5	260	1040	<0,400	<0,400
Co, Cobalt	mg/kg	50	5000	20000	69,9	76,0
CrTotal, Chromium Total	mg/kg	46000	800000	N/A	31200,0	22000,0
Cu, Copper	mg/kg	16	19500	78000	10,0	18,0
Hg, Mercury	mg/kg	0,93	160	640	<0,400	<0,400
Mn, Manganese	mg/kg	1000	25000	100000	809,7	1103,0
Mo, Molybdenum	mg/kg	40	1000	4000	<10	<10
Ni, Nickel	mg/kg	91	10600	42400	410,0	470,4

ANALYTES	UNIT	TCT0	TCT1	TCT2	TH-TSF 2	TH-TSF 2-Extension
Pb, Lead	mg/kg	20	1900	7600	1,4	1,0
Sb, Antimony	mg/kg	10	75	300	<0,400	<0,400
Se, Selenium	mg/kg	10	50	200	<0,400	<0,400
V, Vanadium	mg/kg	150	2680	10720	377,1	296,3
Zn, Zinc	mg/kg	240	160000	640000	127,3	119,1
Cr(VI), Chromium (VI)	mg/kg	6,5	500	2000	<2	<2
Total Fluoride [o]	mg/kg	100	10000	40000	21,6	<0,5
Total Cyanide as CN [o]	mg/kg	14	10500	42000	<1,55	<1,55

Table 15: Leachate Concentration Threshold Limits and Vulcan tailings results (SLR, 2022)

ANALYTES	UNIT	LCT0	LCT1	LCT2	LCT3	THTSF 2	THTSF 2 Extension
As, Arsenic	mg/l	0,01	0,5	1	4	<0,001	<0,001
B, Boron	mg/l	0,5	25	50	200	<0,025	<0,025
Ba, Barium	mg/l	0,7	35	70	280	<0,025	<0,025
Cd, Cadmium	mg/l	0,003	0,15	0,3	1,2	<0,001	<0,001
Co, Cobalt	mg/l	0,5	25	50	200	<0,025	<0,025
CrTotal, Chromium Total	mg/l	0,1	5	10	40	<0,025	<0,025
Cr(VI), Chromium (VI)	mg/l	0,05	2,5	5	20	<0,010	<0,010
Cu, Copper	mg/l	2	100	200	800	<0,010	<0,010
Hg, Mercury	mg/l	0,006	0,3	0,6	2,4	0,003	<0,001
Mn, Manganese	mg/l	0,5	25	50	200	<0,025	<0,025
Mo, Molybdenum	mg/l	0,07	3,5	7	28	<0,025	<0,025
Ni, Nickel	mg/l	0,07	3,5	7	28	<0,025	<0,025
Pb, Lead	mg/l	0,01	0,5	1	4	<0,001	<0,001
Sb, Antimony	mg/l	0,02	1	2	8	<0,001	<0,001
Se, Selenium	mg/l	0,01	0,5	1	4	0,001	<0,001
V, Vanadium	mg/l	0,2	10	20	80	<0,025	<0,025
Zn, Zinc	mg/l	5	250	500	2000	<0,025	<0,025
Chloride as Cl	mg/l	300	15000	30000	120000	<2	4
Sulphate as SO4	mg/l	250	12500	25000	100000	2	<2
Nitrate as N	mg/l	11	550	1100	4400	0,2	<0,1
Fluoride as F	mg/l	1,5	75	150	600	0,2	0,2
Total Cyanide as CN [o]	mg/l	0,07	3,5	7	28	<0,07	<0,07
Total Dissolved Solids*	mg/l	1000	12500	25000	100000	412	60
pH	mg/l	-	-	-	-	9,2	9,1
Paste pH	mg/l	-	-	-	-	9,4	9,4
Moisture %	mg/l	-	-	-	-	18,1	4,5

Based on the waste assessment completed by SLR, the following elements/compounds exceeded the TCT0 limits:

- Co, Cobalt (TC < TCT1).
- Cu, Copper (TC < TCT1).
- Mn, Manganese (TC < TCT1).
- Ni, Nickel (TC < TCT1).
- V, Vanadium (TC < TCT1).
- No elements exceed the LCT0 limit.

SLR conducted a Synthetic Precipitation Leaching Procedure (SPLP) test in addition to the total and leachate concentration test. The test is used to determine the mobility/leachability of low volatility organic and inorganic substances and assess the leachability of metals into ground and surface water.

The results of the SPLP test were compared to the following water quality and effluent standards as a preliminary indicator of the potential environmental risk:

- SANS 241 Drinking Water (SANS 241:2015).
- Department of Water Affairs and Forestry (DWAF) (now DWS) livestock target water quality guidelines [Target Water Quality Guideline Ranges (TWQGR)].

It should be noted that the comparison with drinking water standards does not indicate that the leachates and drainage from the TSFs can be used for drinking water purposes.

The SPLP concentrations for the Tharisa tailings samples returned no “Constituents of Concern” (CoCs) except for a marginal exceedance of Aluminium as per SANS 241: Operational requirements for sample THTSF 2 (fresh Vulcan tailings).

There are five waste types, numerically ordered from Type 0 to Type 4. Type 0 waste being most hazardous in respect of landfilling risk, and Type 4 being the least hazardous. The waste types are determined as shown in Table 16 below.

Table 16: Waste Type Classification According to Concentration Thresholds (GNR. 635 of 2013)

Concentration Level	Waste Type	Disposal Requirements
LC > LCT3 or TC > TCT2	Type 0	Disposal at landfills is not allowed. Waste be treated and reassessed.
LCT2 < LC ≤ LCT3 or TCT1 < TC ≤ TCT2	Type 1	Class – A Hh/HH Waste disposal facility
LCT1 < LC ≤ LCT2 and TC ≤ TCT1	Type 2	Class – B GLB+ Waste disposal facility
LCT0 < LC ≤ LCT1 and TC ≤ TCT1	Type 3	Class – C GLB+ Waste disposal facility
TC>TCT2 or TCT1 or TCT0 and LC<TCT0		
LC ≤ LCT0 AND TC ≤ TCT0 for metal ions and inorganic anions and all chemical substances are below the total concentration limits provided for organics and pesticides listed	Type 4	Class – D GLB- Waste disposal facility

Based on the above limits, the waste assessment conducted by SLR (2022) for the tailings can be compared to Type 3 waste, based only on some TCT0 limits being slightly exceeded. The 2022 waste classification report by SLR can be found in Appendix B of Appendix 9 of this report.

No LCT0 limits have been exceeded and Aluminium only marginal exceeded the SANS 241: Operational requirements. The tailings material is classified as inert and non-acid generating. This is in line with the original findings. These findings support the 2012 approval of a Class-D liner system being implemented beneath the TSF which was granted due to the quality of leachate and the presence of thick in-situ, low permeability clays (< 10-9m/s). A typical Class-D barrier system is illustrated in Figure 15.

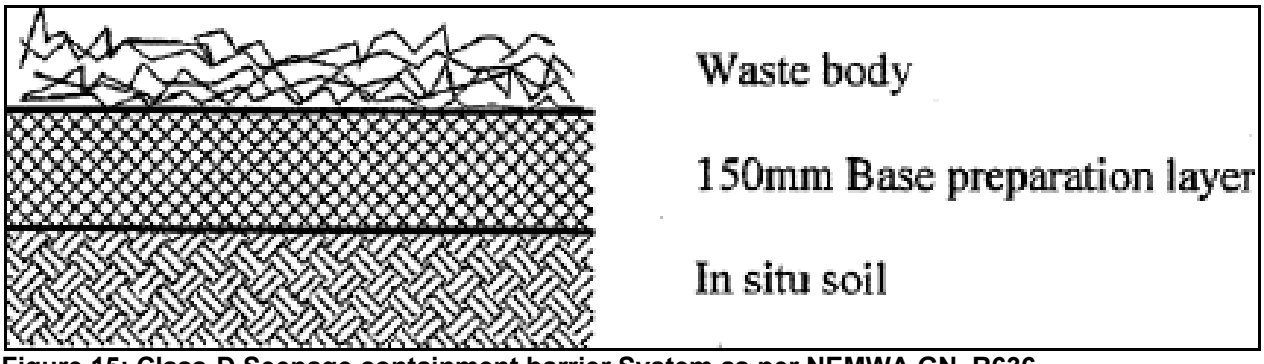


Figure 15: Class-D Seepage containment barrier System as per NEMWA GN. R636

As previously discussed, the design of the existing facilities was accepted as a class-D liner due to the nature of the tailings material and the presence of a thick “black turf” layer beneath the footprint of the facilities. The black turf is known for its low permeability, which ranges from 1E-9 m/sec to 4.7E-10 m/sec while maintaining a high plasticity index ranging between 32 and 72.

The 2022 classification of the Vulcan tailings, conducted by SLR, reveals no significant deviations from the 2016 classification. This reaffirms that the barrier requirements of the facilities conform to the approved design standards.

3-4.3 Waste Acceptance Criteria for Disposal to Landfill

The waste types determine the class of landfill to which they may be disposed. The National Norms and Standards for Disposal of Waste to Landfill, gazetted in GNR. 636 of 2013, stipulate the applicable classes, as presented in Table 17. It must be noted that the Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits, 2015, GNR. 632 of 2015, subsequently amended by GNR. 990 of 2018, stipulate the means by which the pollution control, mitigation, and management measures must be determined for residue deposits and stockpiles. The leachable concentrations are of particular significance for mineral residue deposits and stockpiles.

Table 17: Landfill Requirements Based on Waste Type (per GNR. 636 of 2013)

Waste Type	Landfill Requirements
Type 0	The disposal of Type 0 waste to landfill is not allowed. The waste must be treated and re-assessed in terms of the Norms and Standards for Assessment of Waste for Landfill Disposal.
Type 1	Type 1 waste may only be disposed of at a Class A landfill designed in accordance with Section 3(1) and (2) of these Norms and Standards, or, subject to Section 3(4) of these Norms and Standards, may be disposed of at a landfill site designed in accordance with the requirements for a Hh/HH landfill, as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., DWAF, 1998).
Type 2	Type 2 waste may only be disposed of at a Class B landfill designed in accordance with Section 3(1) and (2) of these Norms and Standards, or, subject to Section 3(4) of these Norms and Standards, may be disposed of at a landfill site designed in accordance with the requirements for a GLB+ landfill, as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., DWAF, 1998).
Type 3	Type 3 waste may only be disposed of at a Class C landfill designed in accordance with Section 3(1) and (2) of these Norms and Standards, or, subject to Section 3(4) of these Norms and Standards, may be disposed of at a landfill site designed in accordance with the requirements for a GLB+ landfill, as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., DWAF, 1998).
Type 4	Type 4 waste may only be disposed of at a Class D landfill designed in accordance with Section 3(1) and (2) of these Norms and Standards, or, subject to Section 3(4) of these Norms and Standards, may be disposed of at a landfill site designed in accordance with the requirements for a GLB landfill, as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., DWAF, 1998).

3-4.4 Factor of Safety

The FoS against slope or sliding failure is typically defined as the ratio of the total forces resisting destabilisation of the tailings stored within the embankments, to the total destabilising forces. In other words, if the cumulative forces resisting destabilisation exceed the cumulative destabilising forces, the FoS will be greater than 1.0 and therefore deemed safe. On the other hand, a FoS of 1.0 or less, indicates that the destabilising forces exceed the forces resisting destabilisation and, therefore, a situation of incipient failure arises (SANCOLD, 2020).

According to NEMWA, the legislated FoS against slope failure for a tailings dam is 1.5 and any deviation from this must be technically valid and adequately motivated. In addition to this, SANCOLD released guidelines titled: “Your Tailings Dam” in which it is stated the minimum FoS should be 1.5 for static conditions and 1.1 for transient or seismic (pseudo-static) conditions (SANCOLD, 2020).

The target factors of safety for the mine were adapted depending on the possible downstream impacts. The target factors of safety in the case where mining operations could be impacted were increased to above the legislated targets of 1.5 and 1.1 for static and pseudo-static conditions, respectively. The target factors of safety assuming static conditions vary between 1.5 and 2.0. Pseudo-static factors of safety vary between 1.1 and 1.5.

3-5 NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998)

The NWA guides the management of water in South Africa as a common resource. The Act aims to regulate the use of water and activities, which may impact water resources through the categorisation of 'listed water uses' encompassing water extraction, flow attenuation within catchments, as well as the potential contamination of water resources.

A WUL (Licence No. 03/A21K/ABCGIJ/1468) was issued by the DWS to Tharisa on 16 July 2012 for the following Section 21 water uses: Section 21 (a), (b), (c), (i), (g), (j). An amended IWUL to the issued WUL was issued by the DWS on 12 November 2020, for the same water uses, as originally applied for. Another amended WUL was issued on 12 November 2024, which supersedes the 12 November 2020 WUL was also issued. Additionally, a WUL for TSF3 WRD Extension 1 was issued on 17 September 2024.

As mentioned above, a WULA process is being undertaken, for Section 21 (g): *"disposing of waste in a manner which may detrimentally impact on a water resource"* i.e., raising of the walls of TSF 2 and TSF 2 Extension, as the activity is listed as a water use under Section 21 of the NWA, for the issuance of an amended WUL.

Other provisions of the NWA have been taken into account, specifically relating to Part 4 (Section 19), which deals with pollution prevention, in particular situations where pollution of a water resource occurs or might occur as a result of activities on land. A person who owns, controls, occupies, or uses the land in question, is responsible for taking measures to prevent pollution of water resources. If these measures are not taken, the Catchment Management Agency (CMA) concerned may itself do whatever is necessary to prevent the pollution or to remedy its effects, and to recover all reasonable costs from the persons responsible for the pollution.

The NWA stipulates that the contamination of clean water may not occur more than once in 50 years. Deterministically. this is equivalent to a 2% probability of annual occurrence and is achieved with the implementation of engineered measures such as a 2m freeboard between the crest of the facility and the FSL, storm water diversion channels to prevent contact between the waste rock embankment and the downstream environment, a seepage capturing system and supernatant water decant system.

3-5.1 GN. 704 – Regulation of mine water management

Regulation 704 of 4 June 1999 was promulgated under the NWA, with the primary goal of ensuring water resource protection from poorly effected mine water management. The requirements of GN. 704 must be seen as the minimum requirements to fulfil the above stated goal and apply to Tharisa's activities. The TSFs activities are well outside the 1:100 year flood line, and more than 100m from the Sterkstroom River.

3-5.2 Minimum Freeboard

The NWA has also made provision for a minimum freeboard of 0.8m 1:50-year recurrence interval (2% probability of exceedance), in a 24-hour duration storm. The SANCOLD guidelines recommend factoring in consideration for the following elements affecting available freeboard:

- Wind-generated waves;
- Wind setup;
- Seiches (resonance);
- Flood surges;
- Landslide-induced waves; and
- Earthquake-induced waves.

According to the NWA, all mining activities must prevent the contamination of clean water sources, and all designs must prevent the spillage of dirty water into the environment and contamination of clean water

sources from occurring more than once every 50 years. Surface water run-off that is affected by the presence of the TSF must thus be diverted around the disturbed footprint to prevent contamination over land by mining activity and infrastructure.

3-5.3 Stormwater Diversion

A cut-to-fill Storm Water Diversion (SWD) was constructed for TSF1 and TSF 2, to divert clean water run-off from the upstream catchment of the TSF complex, preventing interaction with the TSF footprint, as shown in Figure 16 below. The SWD follows the natural topography and has been designed to accommodate the 1 in 50-year recurrence storm event.

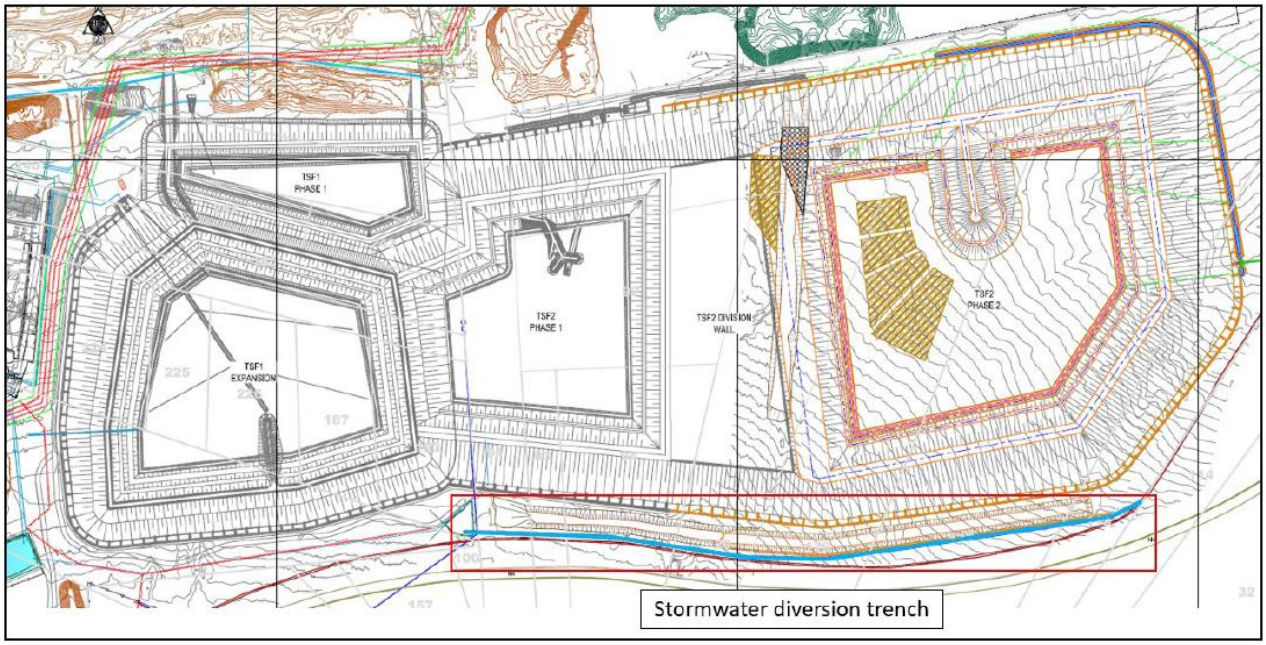


Figure 16: SWD Trench

The stormwater diversion trench and berm comprise:

- Length: 869 m.
- Trench:
  - Side slopes: 1V:1.5H.
  - Base width: 200 m.
  - Minimum depth: 1 m.
- Berm:
  - ○ Side slope: 1V:1.5H.
  - ○ Crest wide: 1 m.
  - ○ Minimum height: 1.2 m.

3-6 NATIONAL ENVIRONMENTAL AIR QUALITY ACT, 2004 (ACT NO. 39 OF 2004), AS AMENDED

Air Quality Management in South Africa is primarily regulated through the NEMAQA. The object of this Act is: (a) 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 (b) 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.

NEMAQA has made provision for the following definitions:

"**Atmospheric emission**" or "**emission**" means any emission or entrainment process emanating from a point, non-point or mobile source that results in air pollution.

"**Air pollution**" means any change in the composition of the air caused by smoke, soot, dust (including fly-ash), cinders, solid particles of any kind, gases, fumes, aerosols and odorous substances;"

NEMAQA is an effects-based legislation; consequently, activities that result in atmospheric emissions are to be managed through the setting of environmental health based ambient air quality standards. Facilities with potential impacts on air quality should ideally be assessed, not only in terms of its individual contribution, but in terms of its additive contribution to baseline ambient air quality i.e. cumulative effects must be considered.

3-6.1 Dustfall and Dust Control Regulations

Measures relating to dust control have been published in terms of National Dust Control Regulations, GNR. 827 2013. The Regulations prescribe general measures for the control of dust in all areas. Dustfall Standards for Acceptable Dustfall Rates are given in Table 18, for residential and non-residential areas. The Regulations also provide a method to be used for measuring dustfall rate and guidelines for locating sampling points. The method to be used is AST D1739:1970, or an equivalent method approved by any internationally recognised body.

Table 18: GNR. 827:2013 Acceptable Dust Fall Rates

Concentration Level	Waste Type	Disposal Requirements
Restriction Areas	Dustfall Rate (D) (mg/m^2/day, 30-days average)	Permitted Frequency of Exceeding Fall Rate
Residential area	D <600	Two within a year, not sequential months
Non-residential area	600< D <1200	Two within a year, not sequential months

These Regulations are of particular relevance to the raising of the walls' activities. This is when potentially significant dust may be generated.

3-6.2 National Norms and Standards

Section 9 of NEMAQA has made provision for the Minister to identify substances or mixtures of substances in ambient air which through ambient concentrations, bioaccumulation, deposition or in any other way, present a threat to health, well-being or the environment or which the Minister reasonably believes present such a threat; and, in respect of each of those substances or mixtures of substances, to establish national standards for ambient air quality, including the permissible amount or concentration of each such substance or mixture of substances in ambient air.

The Minister of Water and Environmental Affairs published limits for ambient air quality in GN.1210 of 24 December 2009, in terms of Section 9 (1) of NEMAQA, as shown in Table 19 below.

Table 19: National Ambient Air Quality Standards – GN. 1210:2009

Pollutant	Averaging Period	Concentration (µg/m^3)	Permissible FOE*
Particulate Matter $(PM)_{10}$	24-hours	75	4
	Annual	40	0
NO_2	1-hour	200	88
	Annual	40	0
SO_2	10-min (running)	500	526
	1-hour	350	88
	24-hours	125	4
	Annual	50	0
CO	1-hour	30	88
	8-hours (running)^	10	11
Pb	Annual	0.5	0
* FOE – Permitted Frequency of Exceedance in occurrences per year ^ Calculated on 1-Hourly Averages			

The Minister of Water and Environmental Affairs further published limits for $PM_{2.5}$ on 29 June 2012, in terms of Section 9 (1) of NEMAQA, as shown in Table 20.

Table 20: National Ambient Air Quality Standards for $PM_{2.5}$ - GN 486:2012

Pollutant	Averaging Period	Concentration (µg/m³)	Permissible FOE*
$PM_{2.5}$	24-hours	60	4
		40	4
		25	4
	Annual	25	0
		20	0
		15	0
* FOE – Permitted Frequency of Exceedance in occurrences per year.			

Tharisa is required to ensure that the impacts from the TSFs do not result in impacts on ambient air quality exceeding these standards.

3-7 NATIONAL POLICY AND PLANNING FRAMEWORK

3-7.1 National Development Plan 2030

The National Development Plan (NDP) 2030 promotes an economy that will create more jobs, improving infrastructure, transition to low carbon economy, an inclusive and integrated rural economy, reversing the spatial effects of apartheid, improving the quality of education, training and innovation, quality health for all, social, protection, building safer communities and reforming the public sector.

The NDP 2030 provides the context for all growth in South Africa. The NDP provides a broad strategic framework, setting out an overarching approach to confronting poverty and inequality through the promotion of development, based on the six focused and interlinked priorities. One of the key priorities is “faster and more inclusive economic growth”. To transform the economy and create sustainable expansion for job creation, an average economic growth exceeding 5% per annum is required.

It is also acknowledged that environmental challenges are in conflict with some of these development initiatives. As such, it is emphasised that there is also a need to:

- Protect the natural environment.
- Enhance the resilience of people and the economy to climate change.
- Reduce carbon emissions in line with international commitments.
- Make significant strides toward becoming a zero-waste economy.
- Reduce greenhouse gas emissions and improve energy efficiency.

Government has set development goals aimed at reducing poverty, unemployment, and inequality. The mining sector is a big contributor to the economy of South Africa as well as the region. The proposed project to be implemented has many positive benefits and spinoffs during the construction, operational and closure phases. The benefits and positive impacts have a countrywide reach. The impacts of the positive benefits of the proposed project have long-term benefits starting from the lowest unit, which is the individual, graduating to households and/or family unit, to the local level up to the country level.

3-8 PROVINCIAL PLANS

3-8.1 North West Spatial Development Framework

The North West Spatial Development Framework (SDF) needs to be conducive for sustainable development and provides for the execution of specific objectives. Those applicable to the proposed project are listed:

iii. Giving spatial effect to objectives set by National Government Policies on Sustainability to support the optimal integration of the aspects of social, economic, institutional, political, physical and engineering services. The objectives include:

a. The NDP 2030 which promotes an economy that will create more jobs, improving Infrastructure, transition to low carbon economy, an inclusive and integrated rural economy, reversing the spatial effects of apartheid ,improving the quality of education, training and innovation, quality health for all, social, protection, building safer communities and reforming the public sector.

b. The National Strategy for Sustainable Development (NSSD) promoting the integration between social demands, natural resource protection, sustainable use and economic development.

iv. Restructuring and eliminating the disparate spatial development patterns provided by apartheid planning.

v. Creating an enabling environment for sustainable employment and economic growth and infrastructure development, promoting the objectives of the National Growth Path (NGP), The Industrial Policy Action Plan (IPAP) and The National Infrastructure Plan.

x. The optimal utilisation of natural resources by the objectives of:

a) Protecting biodiversity from the development of mines, forestry, urban and rural development, agriculture set by the North West Biodiversity Sector Plan (NWBSP).

b) Enhancing the quantity and protecting the quality of water resources.

c) Utilising the mineral resources in a responsible way attending to the effect of it on the environment.

d) Protecting high and unique potential agriculture land and the reduction of available land due to the development of mines, urban and rural areas and forestry.

Five strategic objectives have been identified to provide a foundation for spatial development strategies in the North West. These objectives are outlined below:

- **Strategic Objective 1**: Focus development on regional spatial development initiatives, development corridors, development zones and nodes.
- **Strategic Objective 2**: Protect biodiversity, water and agricultural resources.
- **Strategic Objective 3**: Promote Infrastructure Investment.
- **Strategic Objective 4**: Support economic development and job creation guiding the spatial development pattern of North West.
- **Strategic Objective 5**: Balance urbanisation and the development of rural areas within North West.

To achieve high growth scenarios and strategic objectives above, seven (7) development mechanisms were identified. These include land use planning and management, settlement planning, economic development, infrastructure investment, human resources development, facilitative governance and industrialisation. These mechanisms will ensure that the province enjoys high growth by shifting from social needs-based policy to infrastructure and economic growth-based policies.

3-9 MUNICIPAL PLANS

3-9.1 Bojanala Platinum District Municipality Integrated Development Plan (2022 – 2027)

BDM is one of the four district municipalities in the North West Province. BDM is situated on the eastern part of the North West province, and it shares provincial boundaries with Limpopo, Mpumalanga and Gauteng Provinces and a national boundary with Botswana in the northern side. Its geographic size covers 18 333km², with a population of 1 657 148 (2016, Statistics SA) and this makes it the most populous of the four districts of the North West Province.

The main economic drivers of the district municipality are agriculture, tourism, manufacturing, mining and the service industry. BDM is located along the Merensky Reef, which account for the district municipality being the leader in the production of PGMs. As a result mining is the biggest employer in the district. The tourism industry also plays a major role in the economy of the district due to the number of world class public and private game parks. Sun City in Moses Kotane is also one of the region's tourist attractions.

The N4 freeway also play a role in linking the district with major economic centres in Gauteng Province. Furthermore, The N4 freeway that traverses the boundaries of three local municipalities in BDM is unique as it spans the central section of the only coast-to-coast corridor in Africa. The east-west corridor runs from Maputo in the east to Walvis Bay, Namibia in the west and connects the capital cities of four countries of the Southern African Development Community (SADC), namely Maputo in Mozambique, Pretoria in South Africa, Gaborone in Botswana and Windhoek in Namibia.

A number of challenges affecting the local economic development key performance area in the district were identified as follows:

- Lack/poor tourism infrastructure development.
- Driving difficulties and poor visibility at major tourism activities within the district.
- No proactive measures to initiate activities that could attract or promote tourism.
- Poor Integrated tourism information management system.
- Widening gap between commercial and emerging farmers.
- Not transferring assets to the local municipality/traditional authority for purpose of maintenance and operation.
- Lack of support for farmers to do game farming.
- Poor tenure development support.
- Poor coordinate, monitoring and implementation of Social and Labour Plans (SLPs).
- No mineral beneficiation for enterprises.
- Lack of coordination job creation stats by private sector e.g. Mines, Retails, manufacturing, etc.

3-9.2 Rustenburg Local Municipality Integrated Development Plan (2022 – 2027)

The Rustenburg Local Municipality is a category B municipal council consisting of 45 wards. It occupies the central part of the BDM and houses the main offices of the district municipality. The major settlements of Rustenburg Local Municipality are the Rustenburg town, Phokeng, Tlhabane, Hartebeesfontein and Marikana.

The N4 freeway passes through the town of Rustenburg and also links the municipality with the main centres of Johannesburg and Tshwane metros. Rustenburg is home to large mining operations by companies such as Anglo Platinum, Impala Platinum, Glencore and Lonmin. Approximately 97% of the total platinum production occurs in Rustenburg, with the mining sector providing more than 50% of all formal employment.

The Rustenburg Local Municipality's Integrated Development Plan (IDP) identifies strategic focus areas it has identified as the cornerstones of a successful and thriving council within the developed Master Plan 2040, and which form the foundation of its Five-year IDP. The approved master plan has 5 goals which reads as follows:

- City of vibrant and diversified economy;
- City of identity;
- City of smart liveable homes;
- City of excellence in Education and sport; and
- City of sustainable resources management.

The IDP identifies agriculture, mining, manufacturing, utilities, trade, transport, finance, community and personal services, general government services and tourism as sectors that contributes to local economic development. Of relevance to the project is opportunities identified in terms of recycling and rehabilitations of mines which could contribute to the local economic development.

The Rustenburg area has a large concentration of mining activities, with the mining sector creating the biggest job opportunities.

3-9.3 Madibeng Local Municipality Integrated Development Plan (2020 – 2021)

Madibeng is classified as a category B Municipality, functioning through the Executive Mayoral System. The Municipality was recently demarcated into 41 wards and the Municipal Council comprises of 82 Councillors, (of which 10 are members of the Mayoral Committee), with a full-time Speaker, Chief Whip and Executive Mayor.

Madibeng consists of several urban and rural areas, 9 000 farm portions, as well as a proper established and serviced industrial area. According to the Municipal Villages, Townships, and Small Dorpies (VTSD) plan there are 43 villages, 6 Townships and 7 small dorpies.

The N4 (Platinum highway) is the only national freeway found in Madibeng Local Municipality. It stretches on the south of Brits and the north of Magaliesberg mountain range. On the west in links to Rustenburg until the Trans-Kalahari Corridor, while it links up to City of Tshwane Metropolitan Municipality. On the Southern side N4, the R104 runs parallel until it merges into R560. The latter road stretches from the south of Magaliesberg and ends south of the N4 where it merges into the R511. From the R51, the R513 runs similarly to the R104 but in the easterly direction. The R566 (Pendoring Street) in the south east of Brits links Madibeng to the Ga- Rankuwa in City of Tshwane Metropolitan Municipality. In the westerly side, the R566 branches off on from the N4 at Modderspuit and spreads in a north westerly direction. In the northern side of Madibeng Local Municipality, the R511 (Hendrick Verwoerd) is the only regional route that stretches along the Crocodile River and all the way to Elandsberg. The north eastern side of the Madibeng Local Municipality is dominated with secondary gravel roads.

The following Traditional Authorities are situated within the jurisdiction of Madibeng.

- Mmakau Tribal Office
- Baapo ba Mogale Tribal Office, Bapong
- Bakwena ba Mogopa, Jericho
- Bakwena Ba Mogopa Tribal Office, Hebron
- Batang Tribal Office Maboloka

One of the advantages of Madibeng is its central location in the North West province, with Pretoria, Johannesburg, Rustenburg and Krugersdorp as bordering neighbours. As the neighbouring towns are easily accessible through road networks, residents are not confined to employment in the Madibeng jurisdiction alone but can easily commute to workplaces in the cities and other towns. Furthermore the Lanseria Airport is situated a mere 40 kilometres from Brits.

Today Madibeng is characterised by a various economy, including vibrant agriculture, mining, and manufacturing as well as tourism sectors. Nonetheless, these sectors at present contribute a huge percentage to the total Gross Geographic Product (GGP), they are capable and have potential to encourage and accommodate economic growth and development. Madibeng is the world's third largest chrome producer and includes the richest PGM Reserve (situated on the Merensky Reef). Manufacturing is the dominant sector, with motor industry related activities predominant. Madibeng Local Municipality, in particular Brits Town is a more formal urban area which has vibrant economic nodes.

There are local economic objectives identified within Madibeng Local Municipality as follows:

- Reinforcing the current Brits economic cluster for maximising the existing competitive advantages;
- Defining the economic development role of Madibeng Local Municipality;
- Investigating and implementing incentives for the retention and support businesses currently existing in Madibeng Local Municipality;
- Identification and creation of investment opportunities;
- Ensuring that resources in mining, tourism, agro-industries and manufacturing are utilised economically as well as in an environmentally sustainable manner;

- Establishment of politically and technocratic leadership that will connect the potential of the region's main economic sectors and natural resource base;
- Determining economic priorities and establish simplified, user-friendly processes to encourage economic development;
- Creation, promotion and sustaining a single economic forum which is all- inclusive;
- Marketing Madibeng Local Municipality as an attractive investment destination;
- Reforming bureaucracy and reducing regulations that affect businesses;
- Finding ways and means to invest in rural economic infrastructure and to redress development imbalances;
- Improving physical access to Madibeng by road and rail; and
- Development of various fast track programmes that stimulate short-term economic opportunities.

In order to attain the above objectives, the Madibeng Local Municipality SDF's objective is to identify and demarcate areas that have high potential level for economic development as well as ensuring that the required movement networks are proposed to support these Economic Activity Areas. Economic Activity Areas within the municipality are divided into three categories:

- Mining;
- Economic Corridors; and
- Tourism Areas.

The Madibeng economic activity is dependent on industrial, farming, tourism and mining activities. The two key economic activities in Madibeng Local Municipality are agriculture (17.7%) and manufacturing (13.3%).

3-10 OTHER ENVIRONMENTAL PLANNING AND MANAGEMENT GUIDELINES

A number of planning and management guidelines have been developed that need to be considered as part of the BA process, including:

- DWS, 2010. Operational Guideline: Integrated Water and Waste Management Plan (IWWMP). Resource Protection and Waste;
- DWAF, 2007. Best Practice Guideline A2: Water Management for Mine Residue Deposits;
- DWAF, 2007. Best Practice Guideline A4: Pollution control dams;
- DWAF, 2008. Best Practice Guideline A6: Water Management for Underground Mines;
- DWAF, 2006. Best Practice Guideline G1 Storm Water Management;
- DWAF, 2006. Best Practice Guideline G2: Water and Salt Balances;
- DWAF, 2006. Best Practice Guideline G3. Water Monitoring Systems;
- DWAF, 2008. Best Practice Guideline G4: Impact Prediction;
- DWAF, 2008. Best Practice Guideline H1: Integrated Mine Water Management;
- DWAF, 2006. Best Practice Guideline H3: Water Reuse and Reclamation;
- DEAT. 2002. IEM, Information series 2: Scoping. DEAT. 2002;
- DEAT. 2002. IEM, Information series 3: Stakeholder Engagement. DEAT. 2002;
- DEAT. 2002. IEM, Information series 4: Specialist Studies. DEAT. 2002;
- DEAT. 2002. IEM, Information series 12: EMPrs. DEAT. 2002;
- DFFE. 2012. Companion to the EIA Regulations 2010, IEM Guideline Series 7, DEA; and
- DFFE. 2017. Guideline on Need and Desirability, DEA, Pretoria, South Africa.

SECTION 4: NEED AND DESIRABILITY OF THE ACTIVITY

Tharisa Mine is growing its mining output and as such, more tailings are being produced. The current facilities are nearing their full capacity, hence the need to raise the walls of TSF 2 and TSF 2 Extension facilities. The increasing capacity of TSF 2 and TSF 2 Extension will ensure the Life of Mine (LoM) is extended by providing waste storage. The proposed raising of the walls of TSF 2 and TSF 2 Extension will occur within the approved footprint, which will result in minimal negative impacts on the physical environmental while contributing positively to the socio-economic environment.

The mineral extraction at Tharisa is considered by the company to be in the best interest of the public at large as it will generate earning power both locally and internationally. The chrome and PGM concentrate are sold overseas. In addition, the mine also has a positive impact on the economic growth of the North West Province, particularly in the communities around the mine and through its rates and taxes to the National fiscus.

Tharisa is considered to have a positive socio-economic benefit through employment of locals. Unskilled and semi-skilled labour is sourced mainly from the local communities and surrounding areas. Mining is one of the major employers within the area, and many mining companies in close proximity to Tharisa Mine i.e. Western Platinum, Marikana Platinum and Samancor mines, exist.

If the proposed **raising of the walls of TSF 2 and TSF 2 Extension project is** authorised and implemented, direct economic benefits may be derived from retaining employment opportunities, wages, taxes and profit. Indirect economic benefits may be associated with the procurement of goods and services. This project supports the ultimate need and desirability of the greater mine, where the activities being applied for are supportive of the mining operations undertaken, as the operation of the mine will continue to contribute towards the fiscus and employment within the area.

4-1 BACKGROUND

The DFFE guideline on need and desirability (GNR. 891, 20 October 2014) notes that while addressing the growth of the national economy through the implementation of various national policies and strategies, it is essential that these policies take cognisance of strategic concerns such as climate change, food security, as well as the sustainability in supply of natural resources and the status of the ecosystem services. In 2017, the DFFE published an updated guideline on project need and desirability, although this is yet to be formally gazetted. The 2017 guideline on need and desirability provides that addressing the need and desirability of a development is a way of ensuring sustainability – in other words, that a development is ecologically sound and socially and economically justifiable.

Thus, the over-arching framework for considering the need and desirability of development in general is taken at the policy level through the identification and promotion of activities/ industries/ developments required by civil society as a whole. The DFFE guideline further notes that at a project level (as part of an EIA process), the need and desirability of the project should take into consideration the content of regional and local plans, frameworks, and strategies. Consistent with the aim and purpose of the BA, the concept of “need and desirability” relates to, amongst others, the nature, scale, and location of the development being proposed, as well as the wise use of land and natural resources.

4-2 NATIONAL POLICY AND PLANNING FRAMEWORK

4-2.1 National Development Plan 2030

The NDP 2030 promotes an economy that will create more jobs, improving infrastructure, transition to low carbon economy, an inclusive and integrated rural economy, reversing the spatial effects of apartheid, improving the quality of education, training and innovation, quality health for all, social, protection, building

safer communities and reforming the public sector.

The mining sector is a big contributor to the economy of South Africa as well as the region. The proposed project to be implemented has many positive benefits and spinoffs both during the construction and operational phases. The benefits and positive impacts have a countrywide reach. The impacts of the positive benefits of the proposed project have long-term implications starting from the lowest unit, which is the individual, graduating to households and/or family unit, to the local level up to the country level.

4-3 PROVINCIAL PLANS

4-3.1 North West Spatial Development Framework

The North West SDF needs to be conducive for sustainable development and provides for the execution of specific objectives. Those applicable to the proposed raising of the walls of TSF 2 and TSF 2 Extension area listed:

- Giving spatial effect to objectives set by National Government Policies on Sustainability to support the optimal integration of the aspects of social, economic, institutional, political, physical and engineering services.
- Restructuring and eliminating the disparate spatial development patterns provided by apartheid planning.
- Creating an enabling environment for sustainable employment and economic growth and infrastructure development, promoting the objectives of the NGP, the IPAP and the National Infrastructure Plan.

The optimal utilisation of natural resources by the objectives of Protecting biodiversity from the development of mines, forestry, urban and rural development, agriculture set by the North West Biodiversity Sector Plan; enhancing the quantity and protecting the quality of water resources; utilising the mineral resources in a responsible way attending to the effect of it on the environment; and protecting high and unique potential agriculture land and the reduction of available land due to the development of mines, urban and rural areas and forestry.

4-4 MUNICIPAL PLANS

4-4.1 Bojanala Platinum District Municipality Integrated Development Plan (2017- 2022)

The main economic drivers of the district municipality are agriculture, tourism, manufacturing, mining and the service industry. BDM is located along the Merensky Reef, which account for the district municipality being the leader in the production of PGMs. As a result mining is the biggest employer in the district.

4-4.2 Rustenburg Local Municipality Integrated Development Plan (2017- 2022)

The Rustenburg Local Municipality's IDP identifies agriculture, mining, manufacturing, utilities, trade, transport, finance, community and personal services, general government services and tourism as sectors that contributes to local economic development. Of relevance to the project is opportunities identified in terms of recycling and rehabilitations of mines which could contribute to the local economic development. The Rustenburg area has a large concentration of mining activities, with the mining sector creating the biggest job opportunities.

4-4.3 Madibeng Local Municipality Integrated Development Plan (2020 – 2021)

The Madibeng Local Municipality's IDP indicates that agriculture, tourism and mining are the main primary economies within the municipality. The mining sector is dominated by platinum and chromium mining as well as quarrying activity. Platinum mining activity is located on the south eastern side of the side of Brits while quarrying is spread around the municipal area. The primary economic activities have to be managed in such a manner as to make sure that their impact on the natural environment and resources is controlled.

4-5 NATIONAL ENVIRONMNETAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) PRINCIPLES

NEMA is the statutory framework to enforce Section 24 of the Constitution of the Republic of South Africa. The NEMA is intended to promote co-operative governance and ensure that the rights of people are upheld but also recognising the necessity of economic development. Section 2 of NEMA sets out a series of sustainable development principles that all organs of state must apply in all matters relating to the environment. Table 21 lists all the NEMA principles and their relevance in the project proposal.

Table 21: Relevance of the NEMA principles to the project proposal

National Environmental Management Principles	Comment
(2) Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural, and social interests equitably.	Mining has long been one of the key drivers of economic growth and employment in South Africa. The proposed project activities would continue to support the day-to-day operations of the Tharisa Mine while ensuring that environmental management principles are implemented during operation. The EIA process identifies the needs and interests of potentially affected parties and attempts to address issues and concerns raised through the course of the study.
(3) Development must be socially, environmentally, and economically sustainable.	Government has set development goals aimed at reducing poverty, unemployment, and inequality. The NGP identifies the mining value chain as one of the seven key economic sectors for job creation. Mining is promoted in the national, regional, and local policy and planning frameworks; thus, the proposed project activities support the continuation of the mine's operation and aims to find acceptable environmental management strategies that promote sustainable development.
(4)(a) Sustainable development requires the consideration of all relevant factors including the following: (i) that disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied; (ii) that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied; (iii) that the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied; (iv) that waste is avoided, or where it cannot be altogether avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner; (v) that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource; (vi) that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised.	The BA process considers biophysical, cultural and socio-economic impacts resulting from the proposed project. Mitigation measures to avoid, minimise and/or remedy potential pollution and/or degradation of the environment that may occur as a result of the proposed project have been detailed in this Final BAR and EMPr Report.
(4)(a)(vii) that a risk-averse and cautious approach is applied, which considers the limits of current knowledge about the consequences of decisions and actions.	This Final BAR and EMPr Report has incorporated a description of any assumptions, uncertainties, and gaps in knowledge which relate to the assessment and mitigation measures proposed.
(4)(a)(viii) that negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.	The BA process considers biophysical, cultural and socio-economic impacts resulting from the proposed project. Mitigation measures to avoid, minimise and/or remedy potential pollution and/or degradation of the environment that may occur as a result of the proposed project have been detailed in this Final BAR and EMPr Report.
(4)(b) Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option.	The BA process that is being followed is an integrated application and has acknowledged that all elements of the environment are linked and interrelated. The decision's conditions by the DMRE will be complied with during all project phases and all aspects of the environment and all people in the environment would have been considered by the decision.
(4)(c) Environmental justice must be pursued 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.	Tharisa has been made aware of the importance of fair treatment and meaningful involvement of all people regardless of race, colour, national origin, or income, with respect to the proposed raising of the walls of TSF 2 and TSF 2 Extension project. The implementation, and enforcement of environmental laws, regulations, and policies is critical during all phases of the raised walls of TSF 2 and TSF 2 Extension.

National Environmental Management Principles	Comment
(4)(d) Equitable access to environmental resources, benefits, and services to meet basic human needs and ensure human well-being must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination.	Tharisa Mine does not impact on the equitable access to environmental resources, benefits, and services to meet basic human needs by the surrounding communities. It must be noted that Tharisa has employed some of the community members in order to ensure access to job opportunities.
(4)(e) Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.	For the TSF 2 and TSF 2 Extension project, Tharisa must comply with environmental health and safety policy obligations during all the phases of the project.
(4)(f) The participation of all I&APs in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured.	PPP process is being undertaken in terms of regulation 41 of the EIA 2014 Regulations, as amended, for the proposed project triggering listed activities under the NEMA, MPRDA and NEMWA. MC on behalf of Tharisa considered all relevant guidelines applicable to PPP as contemplated in section 24J of the NEMA.
(4)(g) Decisions must take into account the interests, needs and values of all I&APs, and this includes recognizing all forms of knowledge, including traditional and ordinary knowledge.	PPP process is being undertaken in terms of regulation 41 of the EIA 2014 Regulations, as amended, for the proposed project triggering listed activities under the NEMA, MPRDA and NEMWA. MC on behalf of Tharisa considered all relevant guidelines applicable to PPP as contemplated in section 24J of the NEMA. The decision's conditions by the DMRE will be complied with during all project phases and that all aspects of the environment and all people in the environment would have been considered by the decision. Comments from the I&APs have been incorporated into all reports for decision making.
(4)(h) Community wellbeing and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means.	PPP process is being undertaken in terms of regulation 41 of the EIA 2014 Regulations, as amended, for the proposed project triggering listed activities under the NEMA, MPRDA and NEMWA. MC on behalf of Tharisa considered all relevant guidelines applicable to PPP as contemplated in section 24J of the NEMA. The decision's conditions by the DMRE will be complied with during all project phases and that all aspects of the environment and all people in the environment would have been considered by the decision. Comments from the I&APs have been incorporated into all reports for decision making. During operation, the community wellbeing and empowerment will be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means. The Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) (OHSA) and the NEMA requirements will be implemented, and toolbox talks will incorporate environmental and safety aspects of the project.
(4)(i) The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment.	This Final BAR and EMPr Report has identified, assessed and evaluated the potential social, economic and environmental impacts of the proposed raising of the walls of TSF 2 and TSF 2 Extension, including disadvantages and benefits. This Final BAR and EMPr Report is being submitted to the DMRE for decision making.
(4)(j) The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected.	The OHSA and the NEMA requirements will be implemented, and toolbox talks will incorporate environmental and safety aspects of the project. The mine workers must be trained to understand that they have rights and can refuse work if the work is harmful to the health or the environment. Training on safety and environmental potential dangers must be provided during operation and decommissioning activities.
(4)(k) Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law.	PPP process is being undertaken in terms of regulation 41 of the EIA 2014 Regulations, as amended, for the proposed project triggering listed activities under the NEMA, MPRDA and NEMWA. MC on behalf of Tharisa considered all relevant guidelines applicable to PPP as contemplated in section 24J of the NEMA.

National Environmental Management Principles	Comment
	The decision's conditions by the DMRE will be complied with during all project phases and that all aspects of the environment and all people in the environment would have been considered by the decision. Comments from the I&APs have been incorporated into all reports for decision making. MC will ensure that all registered I&APs are provided with access to the decision and the reasons for such a decision. I&APs will be drawn to the fact that an appeal may be lodged against the decision in terms of the National Appeals Regulations of 2015 as amended, if such appeal is available in the circumstances of the decision.
(4)(l) There must be intergovernmental co-ordination and harmonisation of policies, legislation and actions relating to the environment.	The CA for the Integrated EA and WML amendment is the DMRE. The DWS is the CA for WULA. The NEMA provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by State Departments and to provide for matters connected therewith. It must be noted that the Draft BAR and EMPr Report was subjected to PPP for commenting by the general public and state departments in parallel with its submission to DMRE for commenting. Comments and objections received from stakeholders have been recorded accordingly in the Comments and Responses Report (CRR) (Appendix F of Appendix 3).
(4)(m) Actual or potential conflicts of interest between organs of state should be resolved through conflict resolution procedures.	Should such conflicts of interest between organs of state arise, they will be resolved through conflict resolution procedures.
(4)(n) Global and international responsibilities relating to the environment must be discharged in the national interest.	Tharisa is ascribing to the Global Industry Standard on Tailings Management (GISTM). The standard strives to achieve the ultimate goal of zero harm to people and the environment with zero tolerance for human fatality. It requires operators to take responsibility and prioritise the safety of tailings facilities, through all phases of a facility's lifecycle, including closure and post-closure. It also requires the disclosure of relevant information to support public accountability. A design report has been compiled by the appointed engineers, and the GISTM has been applied to the design of TSF 2 and TSF 2 Extension.
(4)(o) The environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage.	The Best Practicable Environmental Option (BPEO), as per the NEMA, is defined as the option that causes less harm to the environment at a cost acceptable to the society in the short and long term. Tharisa had conducted a feasibility study to determine the BPEO as being the proposed raising of the walls of TSF 2 and TSF 2 Extension project. MC has tested the proposed site by incorporating specialists' findings which have provided with scientific evidence to prove that the lifting of the walls of TSF 2 and TSF 2 Extension is the BPEO. The impacts associated with the proposed raising of the walls of TSF 2 and TSF 2 Extension project have been assessed. Mitigation measures have been prescribed on how to best address each impact. MC puts the environment and its people at the forefront.
(4)(p) The costs of remedying pollution, environmental degradation, and consequent adverse health effects and of preventing, controlling or minimizing further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.	Tharisa will be responsible for the implementation of the measures that have been included in the EMPr.
(4)(q) The vital role of women and youth in environmental management and development must be recognised and their full participation therein must be promoted.	PPP process is being undertaken in terms of regulation 41 of the EIA 2014 Regulations, as amended, for the proposed project triggering listed activities under the NEMA, MPRDA and NEMWA. MC on behalf of Tharisa considered all relevant guidelines applicable to PPP as contemplated in section 24J of the NEMA. Tharisa has been made aware of the importance of fair treatment and meaningful involvement of all people

National Environmental Management Principles	Comment
	regardless of race, colour, national origin, or income, with respect to the proposed raising of the walls of TSF 2 and TSF 2 Extension project. The implementation, and enforcement of environmental laws, regulations, and policies is critical during all phases of the TSF 2 and TSF 2 Extension. The BA process is not discriminatory towards women and the youth.
(4)(r) Sensitive, vulnerable, highly dynamic, or stressed ecosystems, such as coastal shores, estuaries, wetlands and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.	The proposed site is not located on a stressed ecosystem, such as coastal shores, estuaries, wetlands and similar systems. It must however be noted that this BAR and EMPr Report has identified relevant sensitive and/or vulnerable areas and assessed potential impacts if applicable. Appropriate mitigation measures have been proposed where required.

4-6 ENSURING ECOLOGICAL SUSTAINABLE DEVELOPMENT AND USE OF NATURAL RESOURCES

The mine falls within the Marikana Thornveld which is an important vegetation type that requires careful consideration when developing mining projects. The project area includes a terrestrial Critical Biodiversity Area (CBA) and a critically endangered river (the Sterkstroom) defined by the North-West Province 2009 biodiversity assessment, and a High Biodiversity area in terms of the recently published Mining Biodiversity Guidelines. It is important to note that these national guidelines and assessments were published after the mine was approved in 2008.

The area has been transformed by agricultural and mining activities (both on the project site and in the surrounding areas). Though the CBA and Ecological Support Area (ESA) map shows the project area overlapping ESA1 and ESA2 areas, the area has been disturbed.

4-7 PROMOTING JUSTIFIABLE ECONOMIC AND SOCIAL DEVELOPMENT

The mining sector is a big contributor to the economy of South Africa as well as the region. The area has a large concentration of mining activities, with the mining sector creating the biggest job opportunities. The proposed project to be implemented has many positive benefits and spinoffs both during the construction and operational phases. The benefits and positive impacts have a countrywide reach. The impacts of the positive benefits of the projects have long-term implications starting from the lowest unit, which is the individual, graduating to households and/or family unit, to the local level up to the country level.

Given that the proposed project forms part of existing approved operations and will not generate significant employment opportunities, negative project-related socio-economic impacts including inward migration are not expected to occur. In addition, the proposed project is required to provide additional capacity for storage of waste to allow for the optimisation of mining.

SECTION 5: MOTIVATION OF THE PREFERRED SITE, ACTIVITIES AND TECHNOLOGY ALTERNATIVE.

In terms of the Appendix 2 of the NEMA EIA Regulations, 2014, as amended, all environmental reports must contain a description of any feasible and reasonable alternatives that have been identified, including a description and comparative assessment of the advantages and disadvantages that the proposed activity and alternatives will have on the environment and on the community, that may be affected by the activity.

Every BA process must therefore identify and investigate alternatives, with feasible and reasonable alternatives to be comparatively assessed. If no alternatives exist, proof that an investigation was undertaken and motivation indicating that no reasonable or feasible alternatives other than the proposal/ preferred option and the no-go option exist must be provided.

The following alternatives have been considered and investigated:

5-1 DETAILS OF THE DEVELOPMENT FOOTPRINT ALTERNATIVES CONSIDERED

Tharisa Mine is subdivided into East and West Mine by the Sterkstroom river that runs from south to north through the mine boundary. TSF 2 and TSF 2 Extension, along with the majority of the mine infrastructure, are located on the East Mine as illustrated in Figure 17 below.

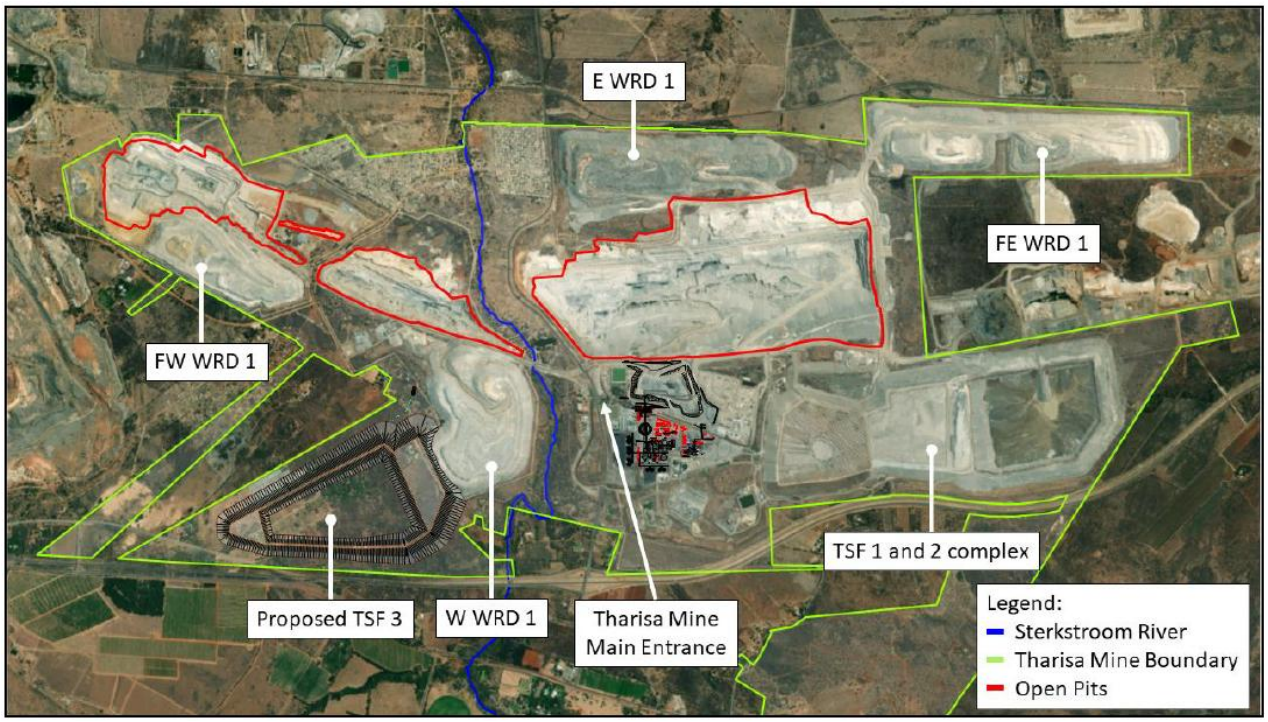


Figure 17: TSF 2 and TSF 2 Extension (depicted as TSF 2 Complex) Location

The mine currently operates three (3) processing plants, namely Genesis, Voyager and Vulcan. Genesis and Voyager are able to process 100 kt and 300 kt per month, respectively. The waste product produced by both plants is sent to the Vulcan plant for further extraction of chrome, after which, the tailings material is hydraulically pumped to TSF 2 Extension for storage. The following alternatives were considered as part of the proposed project:

5-1.1 Design Alternatives:

Design alternatives have not been considered for the proposed raising of the walls of TSF 2 and TSF 2 Extension, for the following reasons:

The TSF 2 and TSF 2 Extension are already existing, and the EA and WML were approved previously. The raised TSFs are designed as single paddock, full containment facilities. The existing infrastructure associated with the TSFs comprises the following:

- Single, full containment, engineered paddocks, constructed with selected waste rock from the open-pit mining operations.
- 1.5m high starter embankments along the upstream toe of the existing embankments, constructed from selected in-situ soils in compacted layers.
- Structural key-cuts along the upstream and downstream toe of the TSF embankments, replacing the in-situ soils with engineered rockfill.
- Penstock gravitation water decanting systems for TSF 2 and a decant tower for TSF 2 Extension.

The raised facilities will include the addition of:

- Embankments constructed using selected waste rock from open-pit mining operations, with a height of 5m for TSF 2, and 3m for TSF 2 Extension. The embankments will have a crest width of 15m with 1V:3H and 1V:2H downstream and upstream slopes, respectively.
- Geofabric separation layer (750 g/m^2) below the raised embankment at the tailings interface.
- Penstock outfall isolating valves.

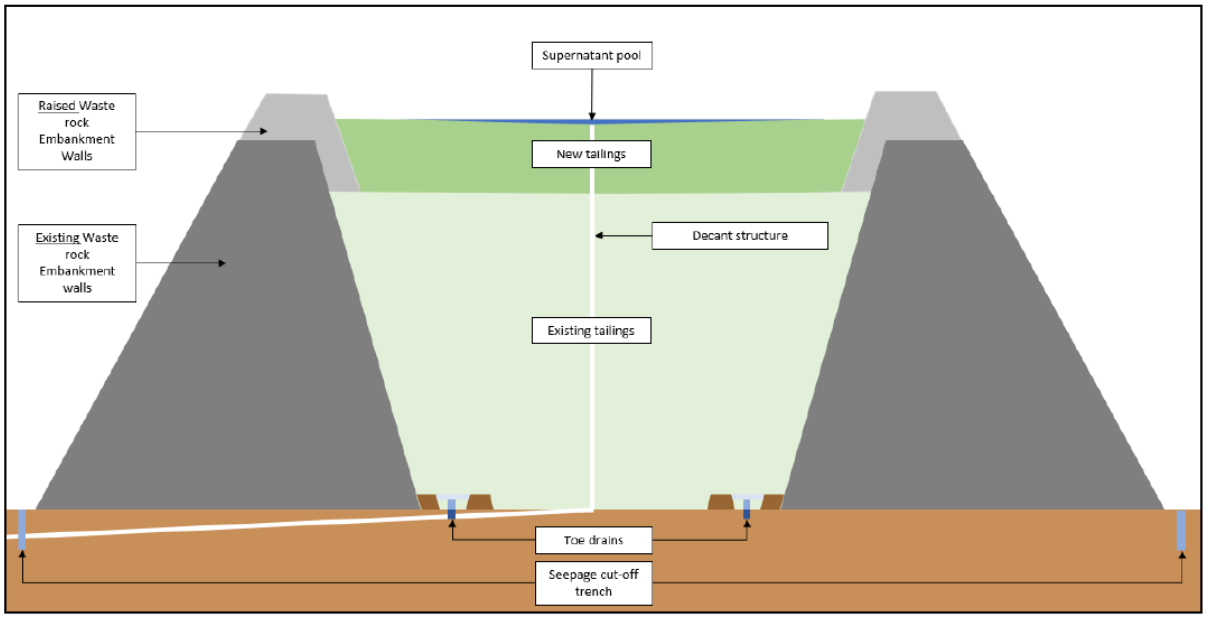


Figure 18: Raised TSF construction methodology

This option is therefore the most preferred option.

5-1.2 Site Alternatives

It is expected that the active TSF at the mine (TSF 2 Extension) (also known as TSF 2 Phase 2) will reach its FSL by December 2025 based on the current tailings production rate. A decision was made to lift the embankments of TSF 2 and TSF 2 Extension through an upstream construction methodology, thus increasing the capacity of the facilities. The raised facilities allow for the TSF footprint areas to remain unchanged with the continued utilisation of the existing decanting infrastructure.

Additionally, Tharisa MR boundary has significant space constraints due to the existing infrastructure. The area surrounding the mine is largely characterised by mining activities including the Marikana Platinum Mine to the west, Western Platinum Mine to the north and Samancor Western Chrome Mine to the east. The N4 and farming community of Buffelspoort is located to the South of Tharisa Mine.

For these reasons, no location alternatives for the proposed project could be considered. Given that the project components relate mainly to storage of waste material in order for mining to effectively take place and optimising approved mining activities, no real site alternatives for this project exist.

5-1.3 Technology Alternatives

5-1.3.1 Briquetting

Technological alternatives available for the disposal of tailings include the briquetting of tailing (fines). The briquetting of material can be undertaken either by uniaxial pressing or via roll pressing. Various binders are required for the processes, such as lime, molasses, magnesium lignosulfonate, and bentonite. Concerns of storing for periods in excess of five (5) weeks present issues associated with mildew formation, but as the mine is located in an area with a negative water balance, this is unlikely to be of concern. For this method to be effective, Tharisa would require a press to bind the materials as well as the relevant binders.

Disposal of tailings in TSFs is the method that is currently in place at the mine. The additional benefit of this process is that there is existing institutional knowledge for this process of disposal. Based on the existing infrastructure and knowledge in place, the disposal to tailings is seen as the preferable method.

5-1.3.2 The use of waste rock for the raising of the walls

The raised facilities will include the addition of, *inter alia*, embankments constructed using selected waste rock from open-pit mining operations, with a height of 5m for TSF 2, and 3m for TSF 2 Extension. The embankments will have a crest width of 15m with 1V:3H and 1V:2H downstream and upstream slopes, respectively. The tailings will be deposited behind the embankment, into the basin.

This is the method that is currently in place at the mine, and there have not been any reported dams' failures. This is therefore the most preferable method.

5-1.4 The option of not implementing the activity/ No – Go Alternative

The option of the project not proceeding would mean that the environmental and social status would remain the same as current. This implies that both negative and positive impacts would not take place. The positive impacts such as expected revenue, economic development, employment creation, skills development, poverty alleviation and the continued upliftment of the surrounding communities would not be realised.

SECTION 6: DETAILS OF THE PUBLIC PARTICIPATION PROCESS

The PPP was undertaken in terms of Chapter 6, regulation 41 of the EIA 2014 Regulations, as amended, for the proposed project triggering listed activities under the NEMA, NEMWA, MPRDA and NWA. MC on behalf of Tharisa considered all relevant guidelines applicable to the PPP as contemplated in section 24J of the NEMA. Notices were given to all potential I&APs to participate in the project, as follows:

The Protection of Personal Information Act, 2013 (Act No. 4 of 2013) (POPI), which aims to promote protection of personal information, came into effect on 01 July 2021. The EIA Regulations, 2014, as amended, require, inter alia, transparent disclosure of registered stakeholders and their comments. In terms of the EIA Regulations, 2014, as amended, stakeholders who submit comments, attend a meeting or request registration in writing are deemed registered stakeholders who must be added to the project stakeholder database. By registering, stakeholders are deemed to give their consent for relevant information (including contact details) to be processed and disclosed, in fulfilment of the requirements of the EIA Regulations, 2014, as mended and the National Appeal Regulations, 2014.

6-1 LEGAL REQUIREMENTS OF THE PPP AS REQUIRED BY SECTION 41 OF THE NEMA

41 (1) This regulation only applies in instances where adherence to the provisions of this regulation is specifically required.

(2) The person conducting a PPP must take into account any relevant guidelines applicable to public participation as contemplated in section 24J of the Act and must give notice to all potential I&APs of an application or the proposed application which is subjected to public participation by:

(a) fixing a notice board at a place conspicuous to and accessible by the public at the boundary, on the fence or along the corridor of (i) the site where the activity to which the application or proposed application relates is or is to be undertaken; and (ii) any alternative site;

(b) giving written notice, in any of the manners provided for in section 47D of the Act, to (i) the occupiers of the site and, if the proponent or applicant is not the owner or person in control of the site on which the activity is to be undertaken, the owner or person in control of the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken; (ii) owners, persons in control of, and occupiers of land adjacent to the site where the activity is or is to be undertaken and to any alternative site where the activity is to be undertaken; (iii) the municipal councillor of the ward in which the site and alternative site is situated and any organisation of ratepayers that represent the community in the area; (iv) the municipality which has jurisdiction in the area; (v) any organ of state having jurisdiction in respect of any aspect of the activity; and (vi) any other party as required by the CA;

(c) placing an advertisement in (i) one local newspaper; or (ii) any official that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations;

(d) placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or district municipality in which it is or will be undertaken: Provided that this paragraph need not be complied with if an advertisement has been placed in an official referred to in paragraph (c)(ii); and

(e) using reasonable alternative methods, as agreed to by the CA, in those instances where a person is desirous of but unable to participate in the process due to (i) illiteracy; (ii) disability; or (iii) any other disadvantage.

(3) A notice, notice board or advertisement referred to in subregulation (2) must (a) give details of the application or proposed application which is subjected to public participation; and (b) state (i) whether a BA or S&EIR procedures are being applied to the application; (ii) the nature and location of the activity to which the application relates; (iii) where further information on the application or proposed application can be obtained; and (iv) the manner in which and the person to whom representations in respect of the application or proposed application may be made.

(4) A notice board referred to in subregulation (2) must (a) be of a size of at least 60cm by 42cm; and (b) display the required information in lettering and in a format as may be determined by the CA.

6-2 DURING IMPACT ASSESSMENT PHASE

6-2.1 Announcement of the project and the Draft BAR and EMPr Report availability

The objectives of PPP are to provide sufficient and accessible information to I&APs in an objective manner to enable them to raise comments, issues of concern and suggestions for enhanced benefits. I&APs also have an opportunity to provide input into the specialist studies reports, and to contribute relevant local and traditional knowledge to the BA process.

The project was announced to the public from **Friday, 09 February 2024 to Monday, 11 March 2024**, by means of the placement of a newspaper advertisement and site notices. Background Information Documents (BIDs) were distributed to I&APs to create awareness of the proposed project. The Draft BAR and EMPr Report including specialist studies were subjected to a PPP of at least 30 days and this Final BAR and EMPr Report reflects the incorporation of comments received, including any comments from the competent and commenting authorities.

The following processes were undertaken to announce the project and the availability of the Draft BAR and EMPr Report:

- An I&AP database was compiled and is being maintained and includes all I&APs in respect of the application in accordance with Regulation 42.
- Letters were sent to all I&APs, written in any of the manners provided for in section 47D of the NEMA, announcing the project and the availability of the Draft BAR and EMPr Report, containing project information, a locality map to the municipal councillor, community members, the local and district municipality, state departments and all other stakeholders as required by the CA, including adjacent communities' members.
- Telephonic consultation was undertaken with I&APs to obtain comments and to share information about the Project.
- Affected parties who could not be reached via mail, fax or e-mail of the proposed project, were visited for delivery of the letters. The letters attached sheets which allowed I&APs to register and/ or/ comment on the Draft BAR and EMPr Report.
- Four (4) site notice boards were fixed at places conspicuous to and accessible by the public at the boundary of the site where the activity to which the application relates. Site notices were written in English and Setswana.
- One (1) advertisement (translated into both English and Setswana) was placed in the Rustenburg Herald Local newspaper.
- The Draft BAR and EMPr Report was also made available on the MC website (https://manyabeconsultancy.com/stakeholder-engagement/); and at the Marikana Public Library.

- SMS notifications of the availability of the Draft BAR and EMPr Report for public comment were distributed.

Subsequent to the 30 days' period, all comments and representations received from I&APs were considered and recorded in the CRR. All I&APs who participated in the PPP were thanked, and their comments acknowledged.

The NEMA EIA Regulations, 2014, as amended, require identification of and consultation with communities and I&APs. Specific state departments were identified and recognised as commenting authorities on aspects of the proposed project. Representatives from these departments are included in the stakeholder database.

I&APs identified in previous environmental processes, together with lists of stakeholders that Tharisa has regular contact with, formed the basis for the development of the stakeholder database.

The stakeholder database was reviewed and updated during the BA process. Box 1 below provides more information regarding the distinction between I&APs and registered I&APs.

Box 1. Distinction between I&APs and Registered I&APs

I& APs, as stated in Section 24(4)(d) of the NEMA include: (a) any person, group of persons or organisation interested in or affected by an activity; and (b) any organ of state that may have jurisdiction over any aspect of the activity. In terms of the Regulations "registered I&APs" means: An I& AP whose name is recorded in the register opened for that application.

For that purpose, an EAP managing an application must open and maintain a register which contains the names, contact details and addresses of:

(a) All persons who have submitted written comments or attended meetings with the applicant or EAP;

(b) All persons who have requested the applicant or EAP managing the application, in writing, for their names to be placed on the register; and

(c) All organs of state which have jurisdiction in respect of the activity to which the application relates.

6-2.2 Invitation to public meetings for the review of the Draft BAR and EMPr Report

Two (2) focus group meetings were hosted with the surrounding community members, to discuss the Draft BAR and EMPr Report and the project.

Public meetings were convened at the following public venues:

Venue	Date	Times
Mmaditlhokwa Village: **Open Space**	10 February 2024	10:00 - 12:00
Lapologang Village: **Sports Ground**	10 February 2024	14:00 - 16:00

The minutes of the meetings are attached to this report as Appendix H of Appendix 3.

The proceedings of the public meetings, as well as all comments submitted have been captured in a CRR which is attached to this Final BAR and EMPr Report (Appendix F of Appendix 3) which is being submitted to the DMRE for decision-making.

Comments from the DMRE on the Draft BAR and EMPr Report were received on 12 June 2025, as summarised below, and have been addressed in this Final BAR and EMPr Report:

- The DMRE confirmed having received the application for an EA on 18 November 2024 via email together with the Draft BAR and EMPr Report on 07 February 2025.
- The lifting of the walls of the TSF would be 3 to 5 meters high. How high would the TSF be, including the current approval? Furthermore, how would the extension affect the footprint of the approved TSF.

- Since there is an application for uplifting the walls in order to increases the capacity of the TSF, the EAP is required to clarify if the proposed project would trigger the WUL or not, since there would be a change in respect of the approved capacity of the material.
- The visual impacts around the area would be highly affected by the proposed project and the air quality within the area has been heavily impacted by the mining activities. What could be the measure to curb such impacts.
- The Draft BAR and EMPr Report has been evaluated. The EAP is required to include the report on PPP according to regulation 41 (1) of the EIA Regulation, 2014 as amended. The report should reflect the process undertaken as per the regulation 41 (2) of the said Regulations. The report must reflect all the comments and the response thereof, as required in terms of regulation 44(1) of the EIA Regulations. The CA expect that the report would be covering both projects as it has been reflected on the reference numbers.
- The EAP is required to recalculate the quantum for financial provision with the use of the 2024 master rate. The revised quantum must be attached to the Final BAR and EMPr.

6-3 ANNOUNCEMENT OF THE SUBMISSION OF THE FINAL BAR AND EMPR REPORT TO THE COMPETENT AUTHORITY

- The Draft BAR and EMPr Report was updated based on the comments and inputs received during the review and commenting period of the Draft BAR and EMPr Report. The Final BAR and EMPr Report is being made available for public comment from **Friday, 04 July 2025 to Monday, 04 August 2025**.
- The Final BAR and EMPr Report is concurrently being submitted to the DMRE for decision-making on **Friday, 04 July 2025**.
- All registered I&APs are being notified of the Final BAR and EMPr Report's submission and its availability on the MC website for review and comment. Additional comments received will be forwarded to the DMRE.

6-4 ANNOUNCEMENT OF THE DECISION

MC will ensure that all registered I&APs are provided with access to the decision and the reasons for such decision. I&APs will be drawn to the fact that appeals may be lodged against the decision in terms of the National Appeals Regulations of 2014 (GNR. 993), if such appeals are available in the circumstances of the decision. The decision will be advertised through the following methods:

- Personalised letters to individuals and organisations on the stakeholder database; and
- Placement of a newspaper advert in the same local newspaper where the project and the availability of the Draft BAR and EMPr Report was announced, translated in both English and Setswana.

Table 22: Summary of issues raised by Interested and Affected Parties

Interested and Affected Parties	Date comments received	Issues raised	EAPs responses to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and or responses were incorporated
INTERESTED AND AFFECTED PARTIES				
Landowner/s	None to date.	None to date.	None to date.	N/A
Lawful occupiers/s of the land	None to date.	None to date.	None to date.	N/A
Landowners or lawful occupiers on adjacent properties	None to date.	None to date.	None to date.	N/A
Municipal councillor	None to date.	None to date.	None to date.	N/A
Municipality	None to date.	None to date.	None to date.	N/A
Organ of state (responsible for infrastructure that may be affected): **Eskom** **Rand Water**	**REFER TO THE CRR FOR COMMENTS RAISED AND RESPONSES TO COMMENTS BY MC**			
Communities (Lapologang Village)				
Communities (Mmaditlhokwa Village)				
Dept. Land Affairs	None to date.	None to date.	None to date.	N/A
Traditional Leaders	None to date.	None to date.	None to date	N/A
Dept. environmental Affairs	None to date.	None to date.	None to date.	N/A
Other Competent Authorities affected	None to date.	None to date.	None to date.	N/A
OTHER AFFECTED PARTIES				
	None to date.	None to date.	None to date	N/A

SECTION 7: ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE DEVELOPMENT FOOTPRINT

An overview of the biophysical and socio-economic environment of the proposed **raising of the walls of TSF 2 and TSF 2 Extension project** is given below. This information was obtained from the existing data presented in the approved environmental reports and specialist studies reports which were compiled for the proposed project.

7-1 GEOLOGY

The Bushveld Igneous Complex (BIC), a massive intrusive body, has undergone erosion and tilting, and now emerges along the apparent boundary of a large basin measuring nearly 350km across. The BIC is comprised of eastern and western lobes, with a northern and far western extension. Additionally, a buried limb, known as the Bethal Limb, exists based on borehole intersections. All five limbs were formed approximately 2,000 million years ago. The eastern and western limbs exhibit striking similarities. This extensive complex originated when vast amounts of molten rock (magma) from the Earth's mantle ascended to the surface through vertical cracks and conduits in the crust. Upon reaching the surface, it differentiated, cooled, and solidified, resulting in a vast layered igneous body with a predominance of Chromite, thus forming the rare rock type known as chromitite.

Chromite deposits in the BIC are found as stratified layers of massive chromitite. These significant chromitite layers are located in the lower section of the BIC known as the Critical Zone. They are categorised into three groups based on their proximity to each other (Figure 19). The Lower Group (LG) consists of seven chromitite layers, the MG has four main chromitite layers, and the Upper Group (UG) contains two chromitite layers (some sources also mention a third layer - UG3). The naming convention assigns ascending numbers to the layers within each group, starting from the bottom layer (e.g., LG1, LG2, and so on, up to UG2 at the top). This naming convention reflects the concept that the lowermost layers are considered the oldest.

The Merensky Reef, situated at some distance above the UG2 chromitite layer, is the uppermost layer of economic interest in the Critical Zone. However, the Merensky Reef is mainly composed of Pyroxenite with only a few thin chromite stringers near its base.

The individual chromitite layers can vary in width from a few centimetres to over 2 meters in localised areas, but they generally range around 1 meter in thickness, seldom exceeding 2 meters. As a general trend, the average chrome content and Cr/Fe ratio of the layers decrease as the sequence progresses upward, while the PGMs content increases. The chromitite layers in the MG exhibit intermediate concentrations of both chrome and PGE mineralisation, but there is a general decrease in grain size from the lowermost to the uppermost layers.

Traditionally, chrome production primarily focused on exploiting the layers of the LG, while PGE production typically targeted the uppermost Merensky Reef and the underlying UG2 chromitite layer from the UG. From an economic perspective, the chrome and PGE concentrations in the MG chromitite layers are considered marginal on an individual basis.

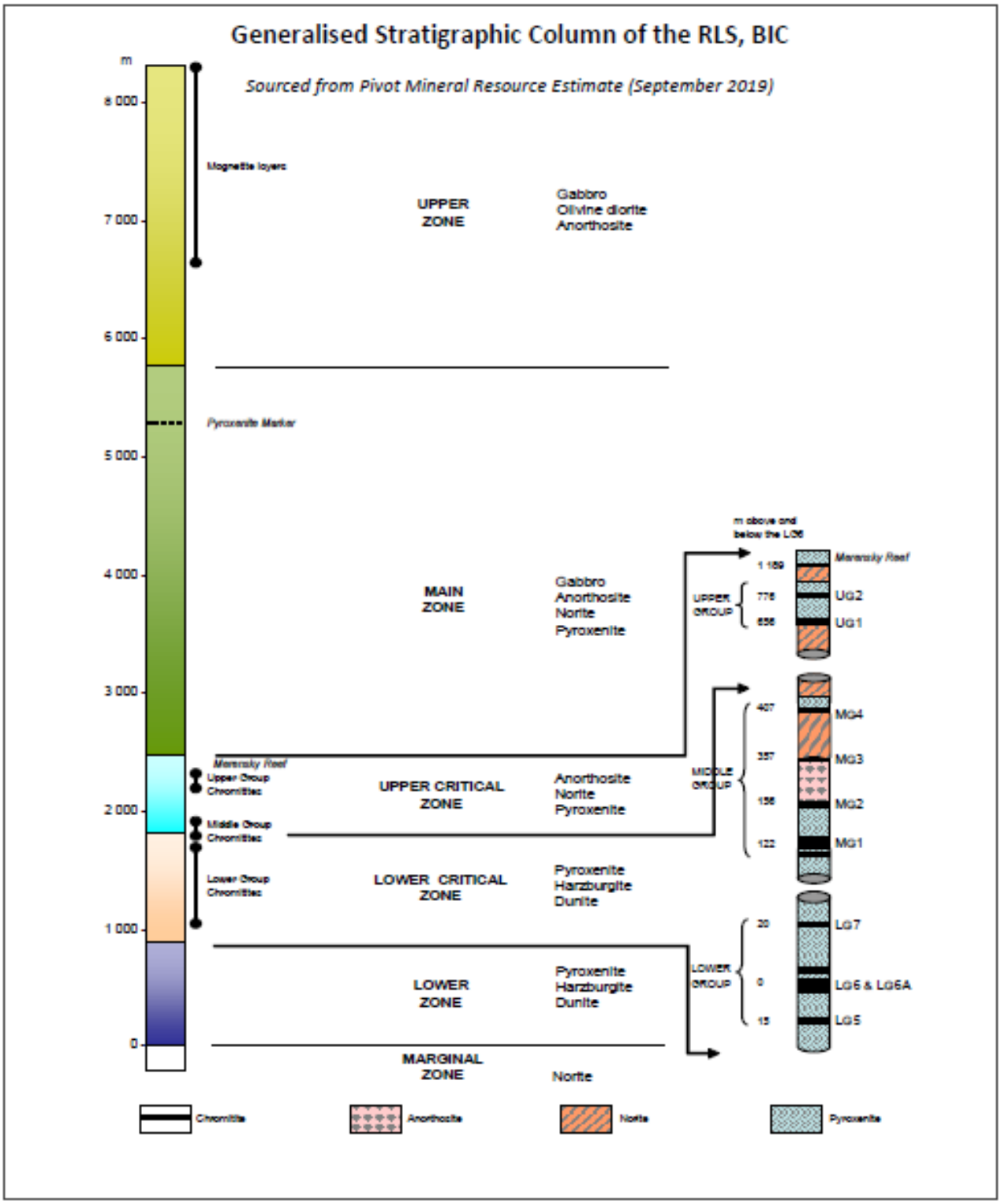


Figure 19: Stratigraphy of the Regional Geology

The open cast operations of Tharisa are located on Farm K/Kraal 342JQ where chromitite layers of the MG and UG1 (for which Tharisa holds the MR) is outcropping on the property. The MR for these layers extends northward underground onto Rooikoppies 297JQ. Both properties are situated in the Marikana Section of the southwestern limb of the Bushveld Complex. The Marikana Section is separated from the Brits Section by Wolhuterskop in the east, and from the Rustenburg Section by the Spruitfontein “upfold” in the west. Tharisa Mine property is positioned on the western side of the Marikana Section, with its westernmost area falling within the Rustenburg Section.

7-2 TOPOGRAPHY, VEGETATION AND LANDUSE

7-2.1 Topography

Tharisa Mine is situated on slightly undulating plains and located to the east and west of the perennial Sterkstroom River (Figure 21). Small sections of original vegetation remain intact on the site, although most of the site represents old, cultivated land. The major land uses of the project area as classified by the Environmental Potential Atlas of South Africa (2000) are mining and vacant/unspecified land (AGES, 2023b).

7-2.2 Regional Vegetation

Tharisa Mine is situated within the Savanna biome which is the largest biome in Southern Africa. The Savanna Biome is characterised by a grassy ground layer and a distinct upper layer of woody plants (trees and shrubs).

The most recent classification of the area by Mucina and Rutherford (2006) shows that the mine is classified as Marikana Thornveld. The Marikana Thornveld vegetation type is considered Endangered. While the national conservation target for this vegetation type is 19%, less than 1% is statutorily conserved. This vegetation type has been transformed (48%), mainly by cultivation and urban or built-up areas. Most agricultural development of this area is in the western regions towards Rustenburg, while in the east industrial development is a greater threat. Alien invasive plants are localised in high densities, especially along drainage lines, in this vegetation type.

The Marikana Thornveld vegetation type is characterised by open Vachellia karroo woodland, valleys and slightly undulating plains and some lowland hills. Shrubs are denser along drainage lines, on termitaria and rocky outcrops or in other habitats protected from fire.

7-2.3 Land Use

Tharisa's operations, land use in the area was a mixture of farming, residential, mining, small business, and general community activities. Similar land uses still take place adjacent to the mine infrastructure and activity areas (Metago, 2008; SLR, 2014).

Mining activities occur to the North and immediate West and East of Tharisa Mine. Amongst the mining activities is open land mostly owned by mining companies and the community of Marikana (GLYA, 2023). Immediately West of the mining area, in the MR footprint, is the Lapologang community.

The predominant land cover types in the area are listed below:

- Mine: Extraction Pits and Quarries;
- Mine: Surface Infrastructure;
- Mine: Tailings and Resource Dumps; and
- Commercial Annual Crops rainfed/dryland.

As a result of this, the area may be described as significantly transformed by mining.

The TSF footprint area was historically cultivated and consisted of farming infrastructure, however no agricultural activities were observed during the site assessment. In addition, the areas in the immediate surrounding are also not under cultivation. Refer to Figure 20 for some of the current land uses associated with the footprint areas.

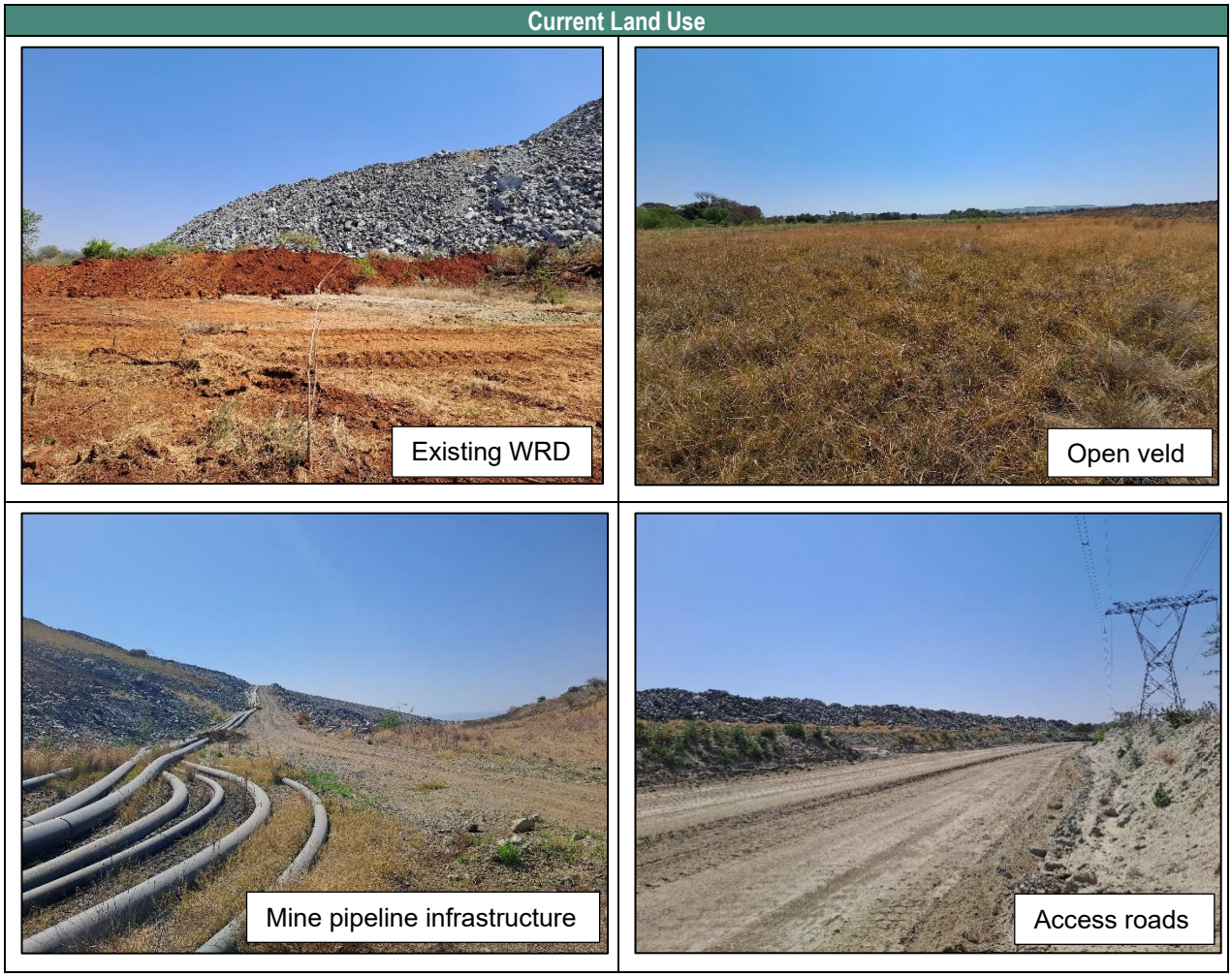


Figure 20: Photographs illustrating the dominant land use associated with the proposed footprint area and surrounding areas.

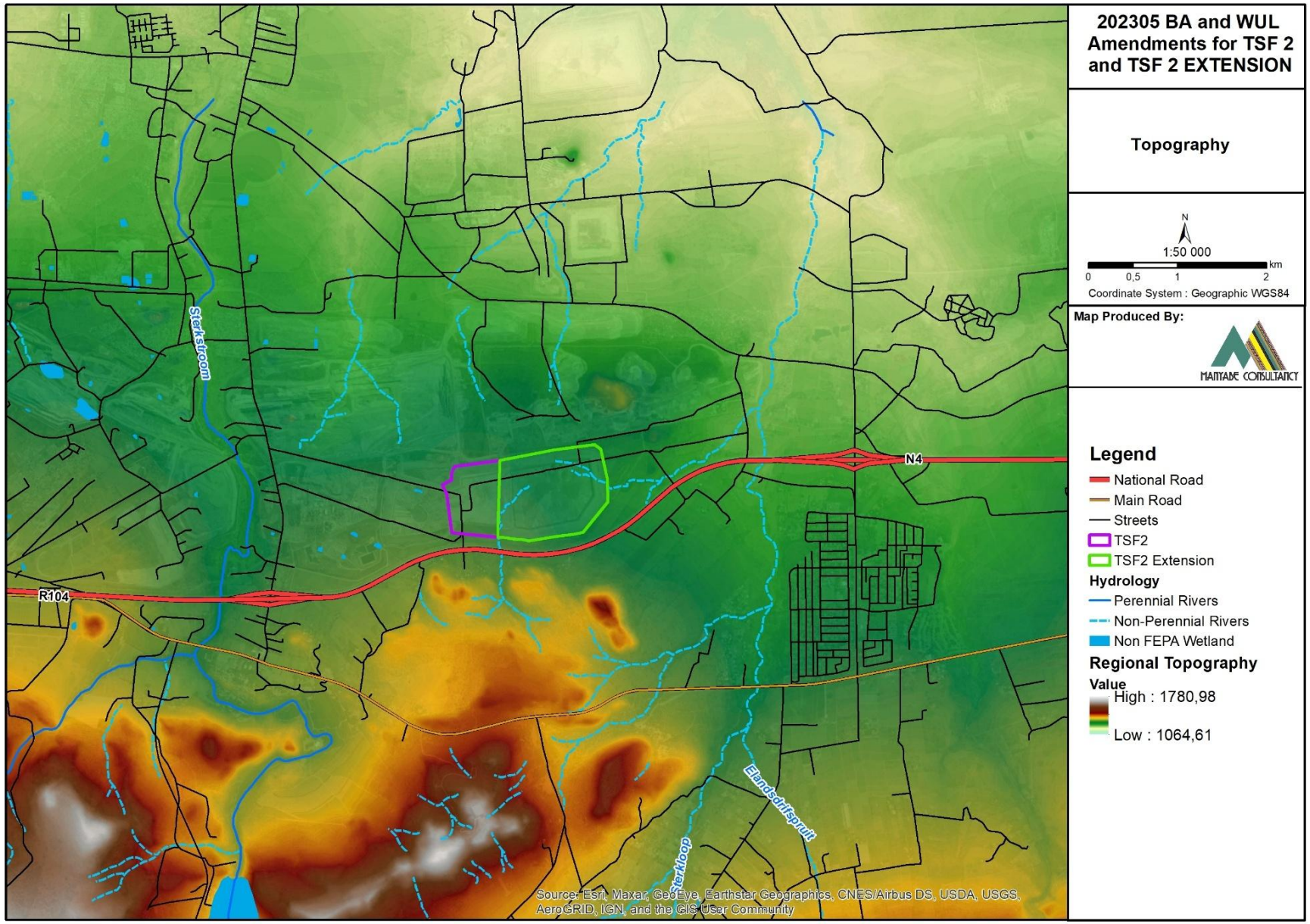


Figure 21: Topographical Map

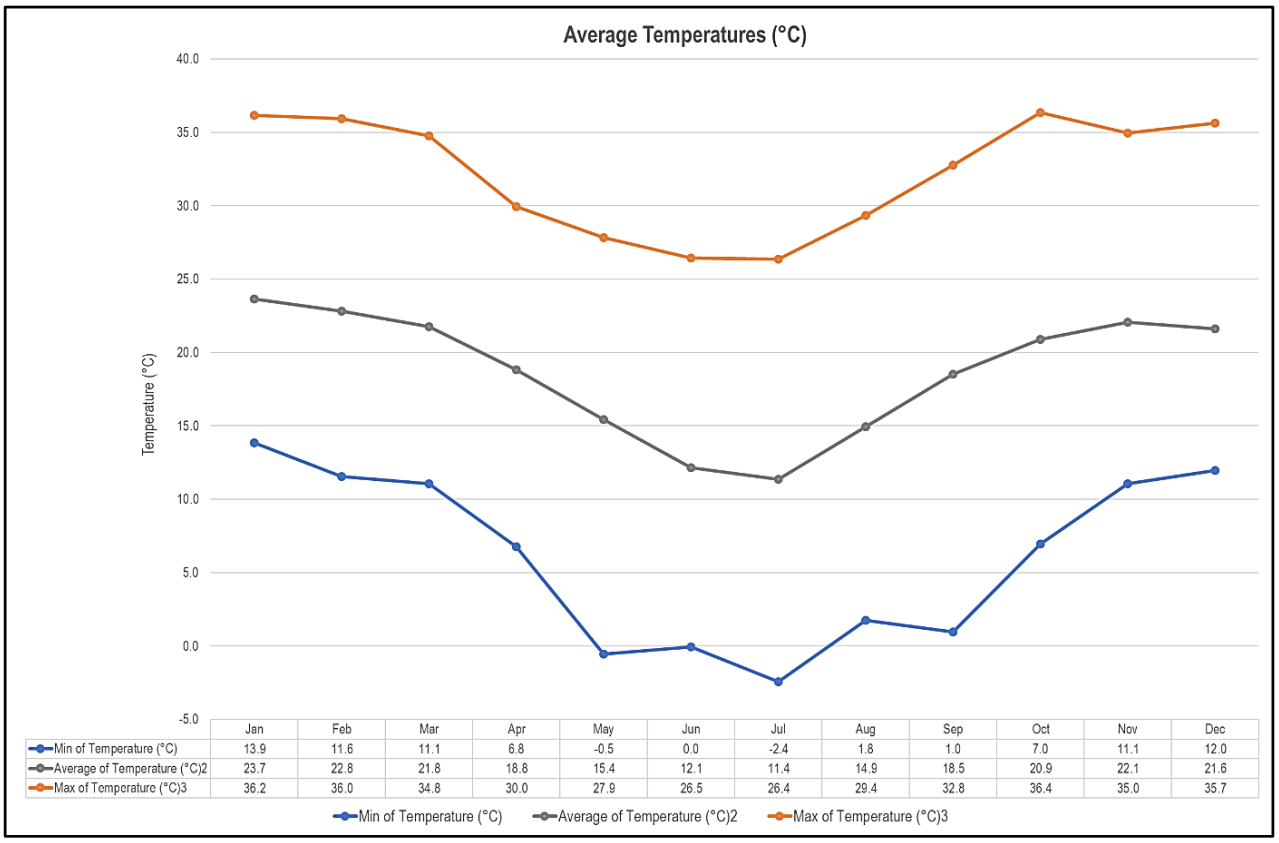
7-3 CLIMATE

7-3.1 Regional Climate

Tharisa Mine falls within the Highveld Climatic Zone (semi-tropical region) which is characterised by moderately warm temperatures, with mild dry winters and hot summers. The Buffelspoort weather station (Station No. 0511 855 W) is the closest station to Tharisa. The rainy season typically occurs in summer during October to March, with afternoon thundershowers occurring often from August to March.

7-3.2 Ambient Temperature

The area experiences hot temperatures during summer, with a maximum of 36.4°C for October. Winter temperatures are relatively low especially in May to July. The monthly temperature pattern is provided in Figure 22.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min of Temperature (°C)	13.9	11.6	11.1	6.8	-0.5	0.0	-2.4	1.8	1.0	7.0	11.1	12.0
Average of Temperature (°C)2	23.7	22.8	21.8	18.8	15.4	12.1	11.4	14.9	18.5	20.9	22.1	21.6
Max of Temperature (°C)3	36.2	36.0	34.8	30.0	27.9	26.5	26.4	29.4	32.8	36.4	35.0	35.7

Figure 22: Minimum, Average and Maximum Temperatures Over the Project Area [Weather Research and Forecasting (WRF) Data; 2019 to 2021]

7-3.3 Rainfall and Elevation

The average annual precipitation in the region ranges from 873 mm and 939 mm (Airshed Planning Professionals, 2023a). Rainfall is generally in the form of thunderstorms. These can be of high intensity with lightening and strong gusty south-westerly winds. The frequency of hail is also high with approximately 4-7 hailstorms per season.

Precipitation is important to air pollution studies since it represents an effective removal mechanism for atmospheric pollutants and inhibits dust generation potentials. Monthly rainfall for the project site (based on WRF data for 2019 – 2021) is given in Figure 23. Months wherein the most rain occurred stretched from October to April (Airshed Planning Professionals, 2023a).

Relatively high levels of evaporation occur because of the elevated solar radiation levels experienced. The maximum evaporation rate occurs in December, with a mean rate of more than 7mm per day. Evaporation is greater than rainfall for all months of the year resulting in a marked moisture deficit in the region.

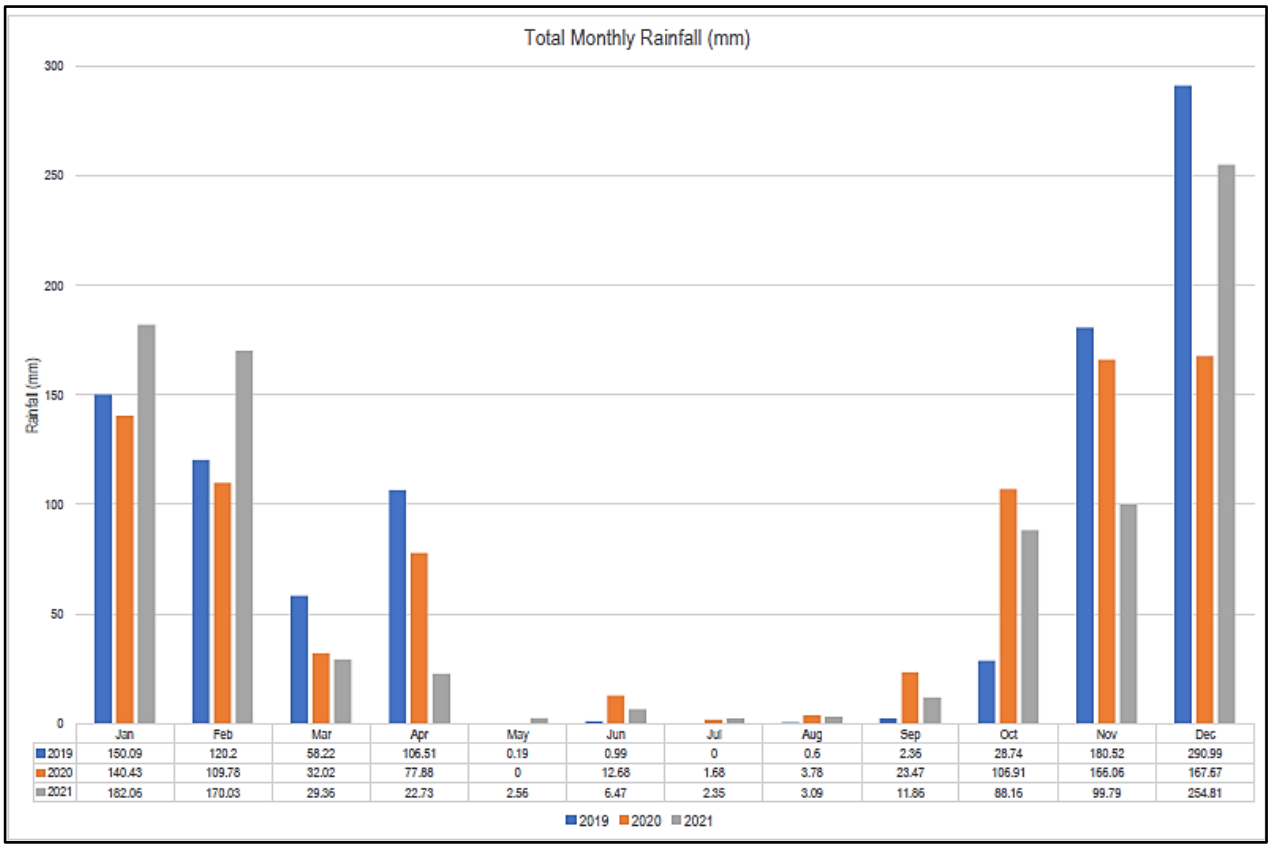


Figure 23: Monthly Precipitation over the Project Area (WRF Data; 2019 to 2021)

7-3.4 Wind Speed

The annual Wind roses comprise 16 spokes which represent the directions from which winds blew during a period of time. The average wind speed at the project site is 3.29 m/s and calm conditions (<0.5 m/s) occurred for some 1.2% of the time. Wind speed capable of causing wind erosion i.e., ≥5.4 m/s occurred for about 8.8% of the time (Figure 24). This equates to about 32 days in a year. The prevailing winds are from the northeast (10.2%) and east (9.4%), east northeast (9.3%) respectively. Secondary contributions are from the southeast (9.2%) and east-southeast (9.1%).

Hourly meteorological data was analysed and used to understand the prevailing wind patterns in the project area. Data was used to assess the wind speed and wind direction regime on site. The diurnal, seasonal and periodic wind roses for the project area are depicted in Figure 25 (diurnal and seasonal wind roses).

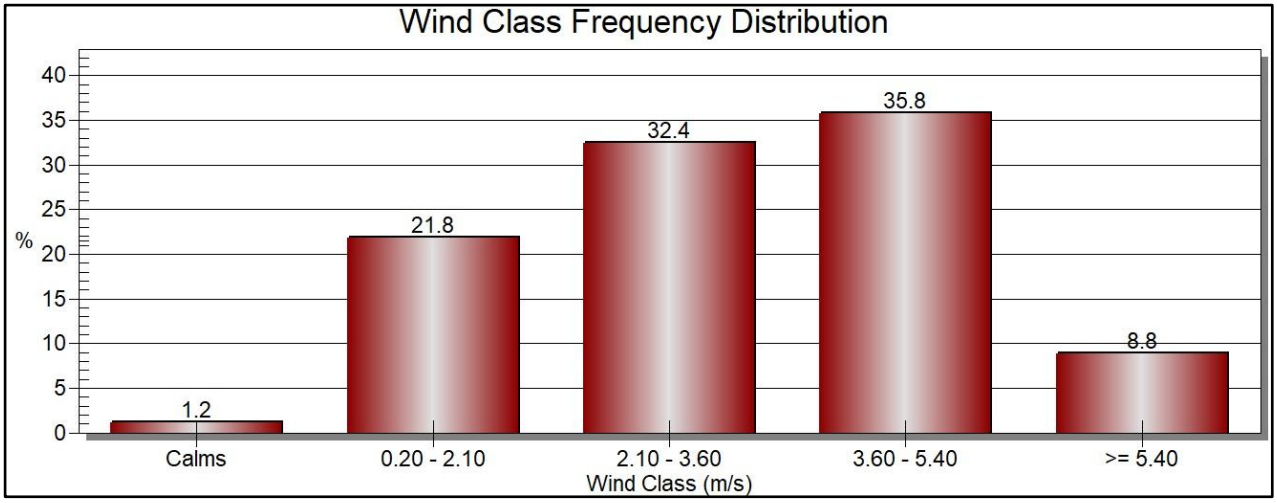


Figure 24: Wind Class Frequency Distribution

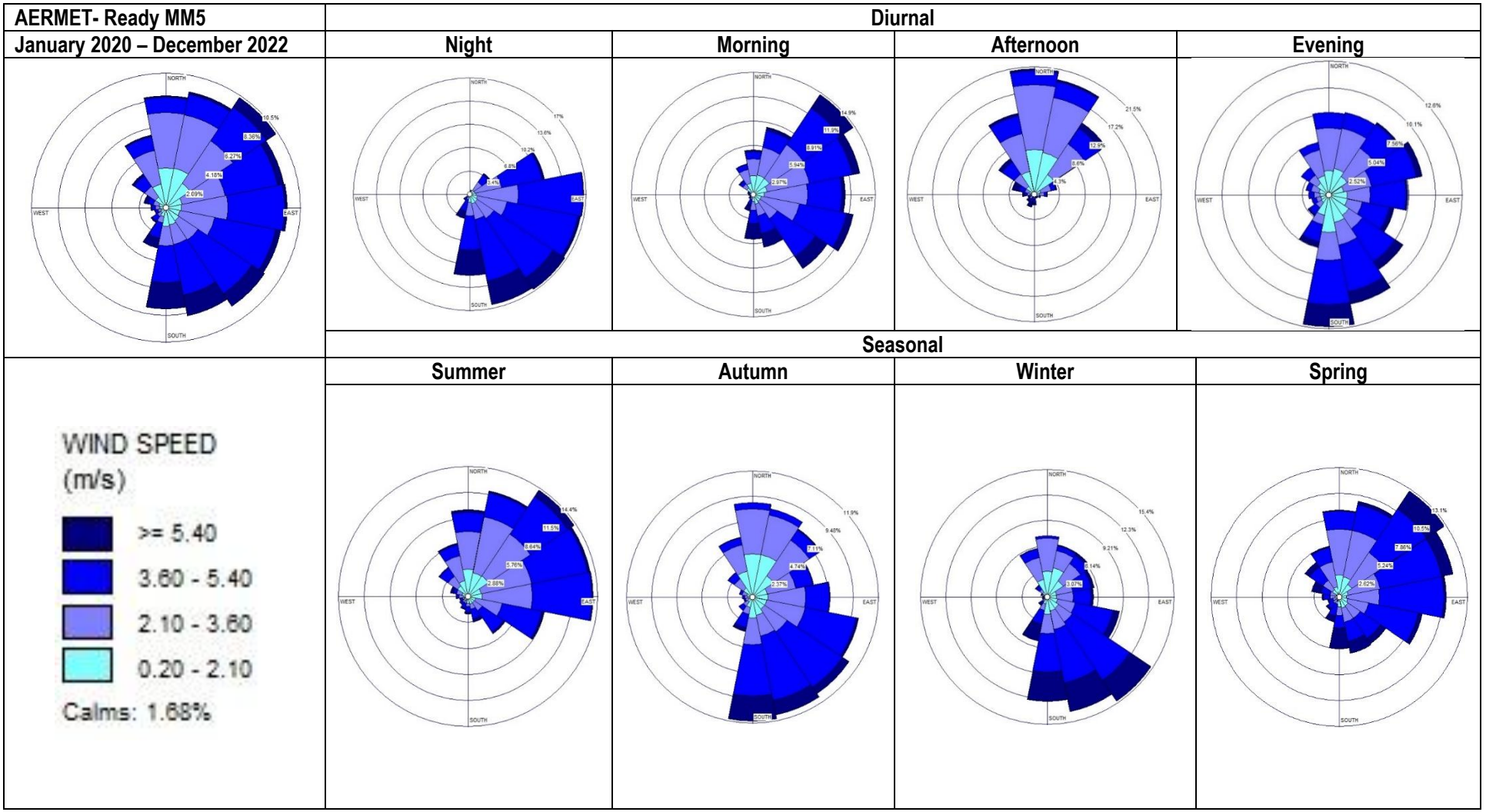


Figure 25: Diurnal and Seasonal Wind Roses

7-3.5 Extreme Weather Conditions

Rainfall conditions are highly variable, and droughts and floods do occur.

7-3.6 Atmospheric Stability

During the daytime, the atmospheric boundary layer is characterised by thermal turbulence due to the heating of the earth's surface and the predominance of an unstable layer. During unstable conditions, ground level pollution is readily dispersed thereby reducing ground level concentrations. Night-times are characterised by weak vertical mixing and the predominance of a stable layer. These conditions are normally associated with low wind speeds and less dilution potential. During windy and/or cloudy conditions, the atmosphere is normally neutral (which causes sound scattering in the presence of mechanical turbulence).

For low level releases, such as activities associated with mining operations, the highest ground level concentrations would occur during weak wind speeds and stable (night-time) atmospheric conditions. However, windblown dust is likely to occur under high winds (neutral conditions).

7-4 SURFACE WATER

Tharisa Mine is located in the Crocodile (West) and Marico Water Management Area (WMA) and is located mainly in the Quaternary Catchment Area (QCA) A21K. The Crocodile River is a major tributary of the Limpopo River (Drainage Region A) which discharges into the Indian Ocean (Mozambique). The Pienaars, Apies, Moretele, Jukskie, Hennops, Magalies and Elands rivers are all major tributaries of the Crocodile River which make up the A20 tertiary hydrological catchment with its 39 quaternary catchments.

The main river upstream of the project site is the Sterkstroom River, which is a source of water for the Buffelspoort Dam. The water quality of the Sterkstroom River (a tributary of the Crocodile River) must be continuously monitored to assess the impacts of the mine on water quality.

This river originates in the headwaters of the A21K quaternary catchment, which then flows through the Buffelspoort Dam (approximately 5.8 km upstream) and then traverses the mine and continues towards the Crocodile River. The Sterkstroom River has an ecological category of Class C (DWS, 2014). Class C means the river system is moderately modified and a loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged (Kleynhans, Louw, & Graham, 2008).

Water quality was described from existing monthly water quality results for 2022. Water quality was analysed for a total of 11 sampling points located within the Sterkstroom River and in Tharisa Mine water circuits. The sampling locations are provided in Table 23 and Figure 26.

Table 23: Sampling Locations

Sampling Point	Description	Latitude	Longitude
SW01	Upstream on the Sterkstroom River	-25.75711	27.48329
SW02	Downstream on the Sterkstroom River	-25.72562	27.48292
SW03	Middle Stream (Sterkstroom River)	-25.73562	27.486
SW07	Old Hernic Quarry	-25.7366	27.48786
SW08	Sewage Treatment Plant	-25.73878	27.49435
SW10	MCC Dam	-25.7395	27.50306
SW11	TSF Dissipator	-25.73963	27.5048
SW12	Raw Water	-25.74643	27.50217
SW13	Stormwater Dam	-25.73836	27.49333
SW14	Process Water Dam	-25.74096	27.49308

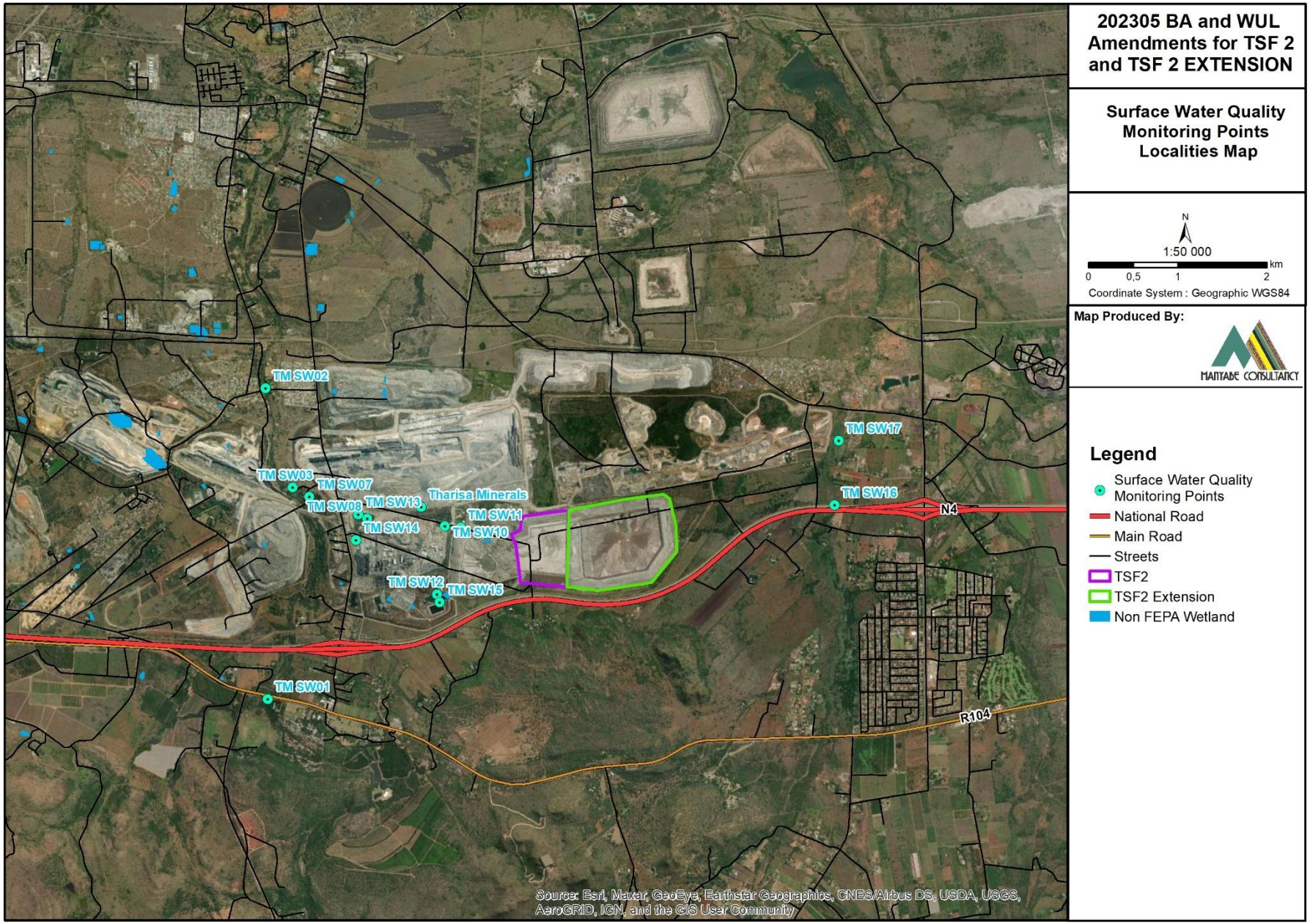


Figure 26: Surface Water Monitoring Points

7-5 GROUND WATER

Groundwater is defined as water which is located beneath the ground surface in soil/rock pore spaces and in the fractures of lithological formations and is a valuable resource. In arid areas, groundwater is frequently the sole source of water and thus essential to agriculture and other developments. Groundwater quality and quantity are key indicators of the resource value and status and can have significant effect on the suitability and availability for use. Mine-related activities have the potential to influence the quality and availability of groundwater through seepage of contaminants that may reach underlying aquifers.

Groundwater enters the mine as direct recharge from rainfall or as seepage from the TSFs or WRDs. According to the Groundwater Resources Association (GRA) II datasets, the average recharge for the entire catchment is about 28 mm/a, or about 0.000077 m/d (SLR, 2014).

Due to mine dewatering, the local groundwater flow directions in the deeper fractured aquifer are generally re-directed towards the mine. The general groundwater flow direction is from south to north, or southeast to northwest. Groundwater within the mining area is neutral (pH~7.8) and non-saline [average Total Dissolved Solids (TDS) of 340 mg/l]. The average sulphate concentration is ~38.9 mg/l and the average nitrate as N concentration is ~5.8 mg/l.

7-5.1 Aquifer Classification

Tharisa Mine is underlain by a shallow upper weathered aquifer and a deeper fractured aquifer. The weathered overburden is highly variable in thickness from 3m to more than 30m based on existing borehole logs and evidence of borehole depths. The deeper fractured bedrock aquifer is characterised by very low matrix permeability, poorly connected joints/fractures and dolerite/diabase dykes (that may act as barriers to groundwater flow).

In the vicinity of the water courses, alluvium either fully or partially, replaces the weathered overburden and the watercourses do lose and gain water to the alluvium aquifer. Recharge of the alluvial aquifers is also through lateral groundwater flow from the shallow weathered aquifer and by rainfall events. The thickness of the alluvial sediments has been estimated at 3 to 5m with its lateral distribution restricted to the immediate banks of the current active channel.

The interface between the overlying weathered or alluvial aquifer and the deeper fractured aquifer features is relatively impermeable. Its effective permeability is determined by interconnected and open fracture systems. These fracture systems can potentially allow for rapid vertical groundwater flow from the weathered overburden as well as surface water bodies to greater depths. Whilst in general the weathered aquifer and lower fractured aquifer are poorly connected; this is not always the case.

The aquifer system is defined as a minor aquifer region with potential for higher yielding zones (defined by the groundwater specialist in accordance with Parsons (1995). Pump tests of a range of boreholes indicated that the average upper aquifer yield is between 1 and 2.5 litres /second.

7-5.2 Groundwater Recharge

Quaternary catchment A21K receives an estimated average annual groundwater recharge of 24.4 million m^3 (Mm^3), of which 3.4 Mm^3 per annum or 13.8% is required for the Reserve, consisting of both basic human needs (estimated at 0.5Mm^3/a) and an ecological component (estimated at 2.9Mm^3/a). This equates to an approximate recharge across the catchment of about 28 mm/a.

7-5.3 Groundwater Levels

The groundwater elevations within the mining area range ~1 175 to 1 210 mamsl. During the September 2021 to March 2023 monitoring period stable groundwater levels were observed in TM GW COMM 01, TM GW COMM 02, TM GW COMM 05, TM GW MCC, TM GW New Well and TM GW RPM. A significant decrease (~20 m) in groundwater level is observed in TM GW MCC from July 2022 to August 2022. Seasonal variation in groundwater levels is observed in the remainder of the monitoring boreholes (TM GW Dissipator 1, TM GW Dissipator 2, TM GW HP5 and TM GW Sec) during the September 2021 to March 2023 monitoring period (refer to Table 24 and Figure 27 for the monitoring points localities).

Table 24: Summary of Groundwater Monitoring Localities

Monitoring Locality ID	Co-ordinates		Elevation (mamsl)	Description	
TM GW COMM 01	27° 29' 35.1600" E	25° 44' 59.6760" S	1 218	Community boreholes south of the mine	South of the plant and to the east of the PGMs Smelter Plant.
TM GW COMM 02	27° 30' 56.7360" E	25° 44' 53.9760" S	1 224		South of TSF 1 and TSF 2.
TM GW COMM 05	27° 28' 33.0060" E	25° 44' 20.9700" S	1 211		Located at Retief Primary School, to the west of West WRD 1.
TM GW Dissipator 1	27° 30' 15.8040" E	25° 44' 22.4520" S	1 208		Located east of the mining concentrator area and north-west of the TSF1.
TM GW Dissipator 2	27° 30' 15.2460" E	25° 44' 21.0480" S	1 207		The dissipator borehole is located east of the mining concentrator area and west of the TSF 1.
TM GW HP5	27° 30' 05.4360" E	25° 44' 31.9560" S	1 212	Mine Boreholes located east of the mining concentrator area and north-west of TSF1.	Located north of the plant and south of the mining concentrator area.
TM GW MCC	27° 30' 10.0620" E	25° 44' 28.4040" S	1 211		Groundwater monitoring at Hardpark is located east of the mining concentrator area and west of the TSF 1.
TM GW MEW	27° 29' 58.5960" E	25° 44' 53.0520" S	1 220		The borehole is located at the Marikana Engineering Workshop- south of the plant and to the east of the PGMs Smelter Plant.
TM GW New Well	27° 29' 58.5960" E	25° 44' 53.0520" S	1220		The borehole is located at the Marikana Engineering Workshop- south of the plant and to the east of the PGMs Smelter Plant.
TM GW RPM	27° 30' 09.4320" E	25° 44' 22.7760" S	1 207		Located at the RPM Workshop.
TM GW Sec	27° 29' 25.9800" E	25° 44' 23.5680" S	1 205		The borehole is located to the northwest of the plant.
TM GW TSF 01	27° 29' 58.3440" E	25° 44' 52.5900" S	1 219		West of TSF 1 and east of the PGMs Smelter Beneficiation Plant.
TM GW SBH	27° 30' 43.2720" E	25° 43' 35.9400" S	1 188		Samancor Borehole is located south of the Far East WRD 2.
TM GW WM 03	27° 29' 18.8160" E	25° 44' 31.6080" S	1 198		In line with west mine activities

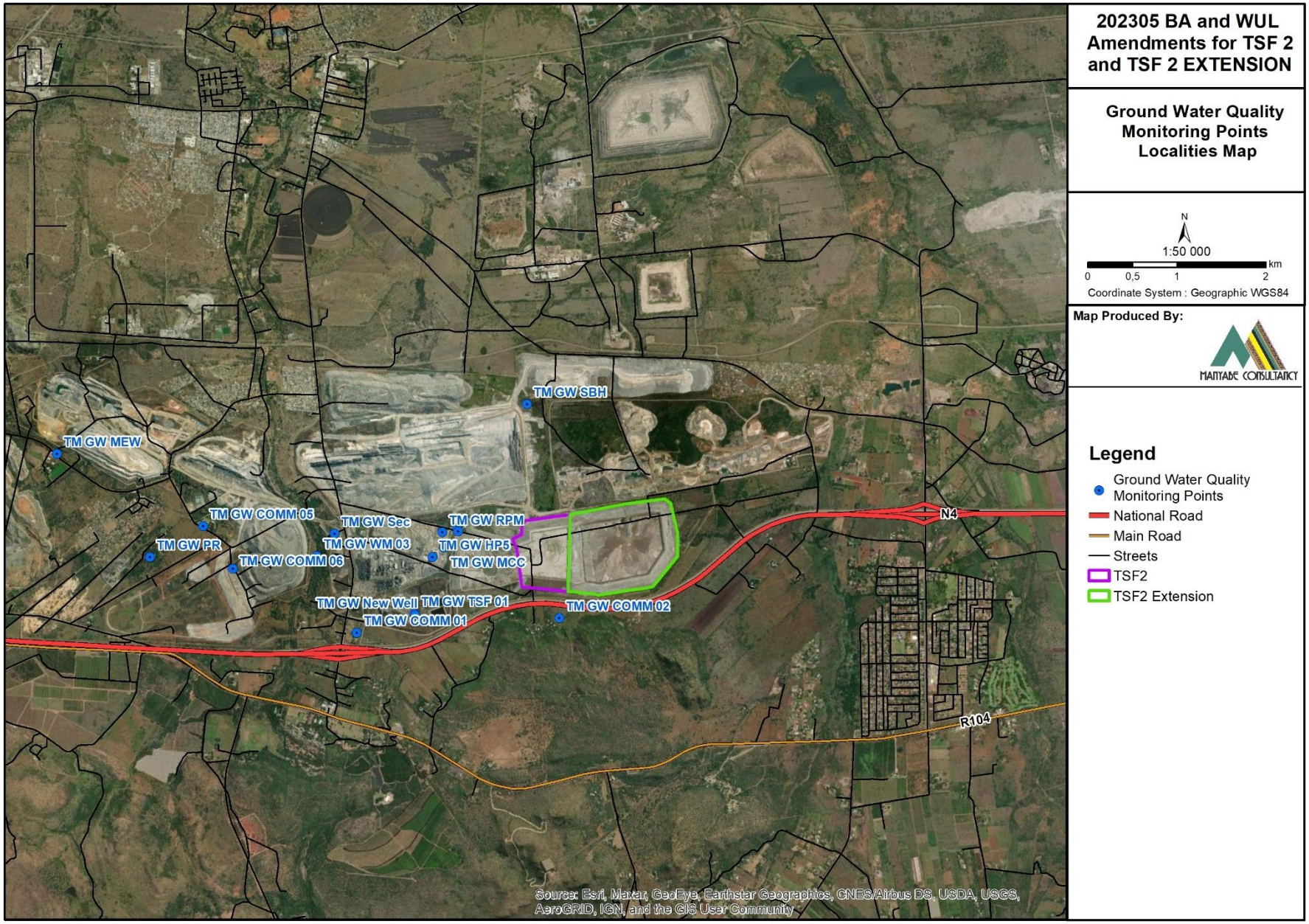


Figure 27: Ground Water Monitoring Points

7-5.4 Groundwater Use

Most of the boreholes are used for domestic and agricultural (livestock and irrigation) purposes. The weathered aquifer, as well as the alluvial aquifer along the Sterkstroom River, supports most irrigation and domestic water-supply boreholes throughout the region. Boreholes (community boreholes/third party) located within the Tharisa MR area are used for domestic purposes and agricultural purposes (livestock and irrigation).

7-5.5 Groundwater Quality

In general, groundwater in the community boreholes can be described as neutral (pH ~7.6) and saline (average TDS of 430 mg/l). The sulphate concentration in the community boreholes is low (below 70 mg/l) except for TM GW Comm 06. The sulphate concentration in TM GW Comm 06 increased to ~95 mg/l in September 2022. Low nitrate as N concentrations (below 10 mg/l) are observed in all community boreholes except TM GW Comm 06. The nitrate as N concentration in TM GW Comm 06 increased to 57 mg/l in September 2022. The time series of the sulphate and nitrate as N concentration from September 2021 to March 2023 in the community boreholes is shown in Table 25.

7-5.6 Hydrogeology

The site geological and hydrogeological setting consists mainly of a shallow weathered bedrock aquifer system with intergranular porosity and permeability is present. The shallow semi-confined aquifer formed because of weathering of the norites, anorthosites and pyroxenites (i.e., regolith). It includes the differentially weathered and fractured bedrock underlying the regolith and is treated as a single weathered aquifer unit (SLR – Dewatering strategy, 2021).

The deeper solid/fractured bedrock aquifer comprises of the fractured and faulted norites, anorthosites and pyroxenites. The intact bedrock matrix itself is assumed to have very low matrix permeability, while its effective bulk permeability is enhanced by faults and mine openings.

There are also several hydrogeological significant structures in close proximity to the proposed raising of the walls of TSF 2 and TSF 2 Extension project site. Most of the faults strike NW to SE, with a prominent dyke structure striking W to E and N to S. The dyke contacts are inferred to be more permeable and therefore could act as preferential flow zones for potential mass migration towards the east pit.

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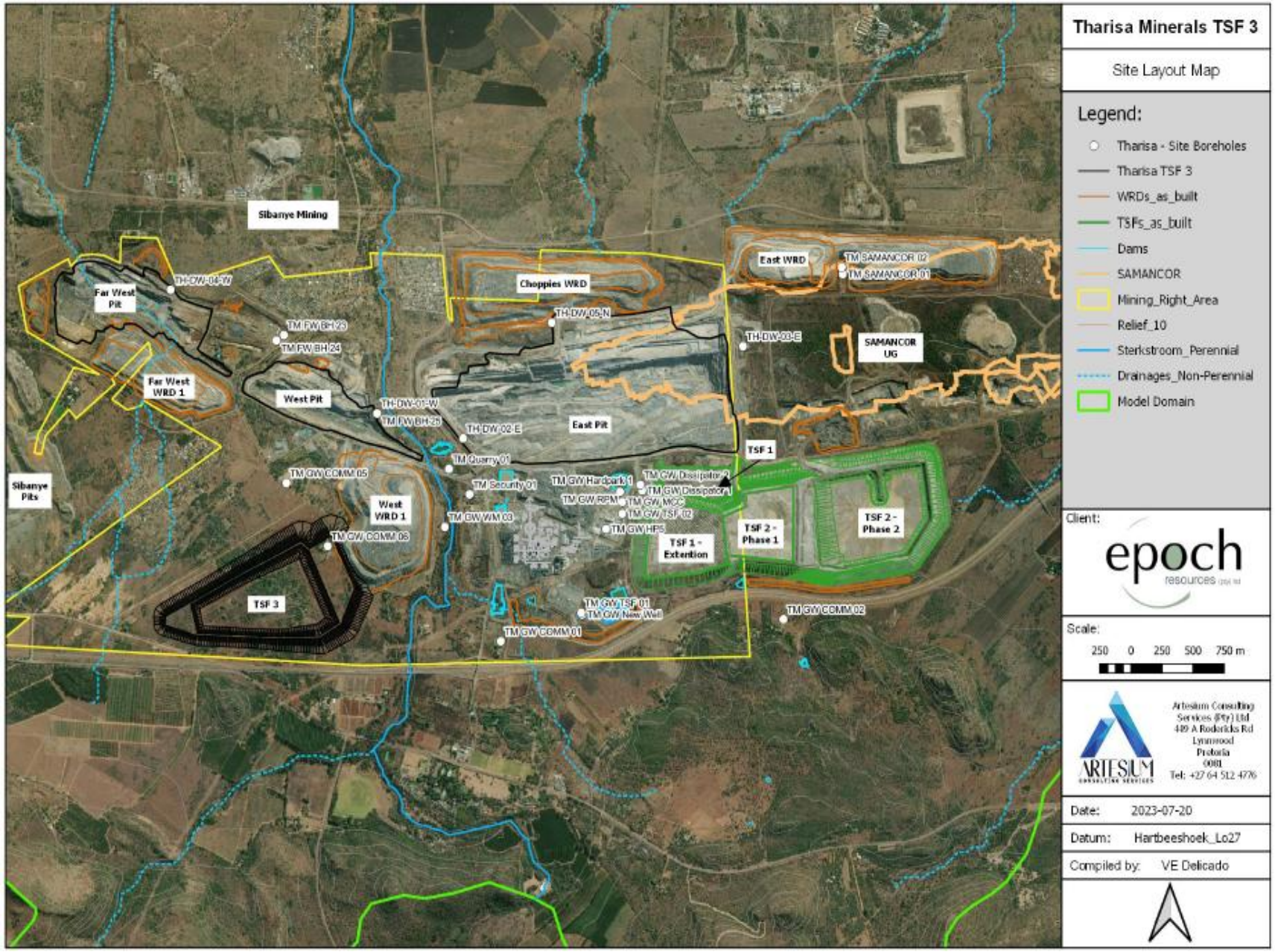

Figure 28: Tharisa Mine locality map of the existing and planned infrastructure

Table 25: Groundwater Quality Results (March 2023).

Site Name	Tharisa GW Guidelines (WUL 2020)	TM GW COMM 01	TM GW COMM 02	TM GW COMM 05	TM GW Dissipator 1	TM GW Dissipator 2	TM GW HP5	TM GW MCC	TM GW MEW	TM GW New Well	TM GW PR	TM GW RPM	TM GW SBH	TM GW Sec	TM GW TSF 01	TM GW WM 03
pH	6-9	7.53	7.90	7.57	8.19	8.22	8.26	8.23	7.98	8.39	8.01	8.33	8.27	7.73	7.56	7.97
EC mS/m	70	65.00	53.80	**78.20**	**74.90**	**127.50**	**92.00**	**133.70**	55.30	51.50	29.35	**114.40**	**156.70**	**170.70**	38.80	**140.40**
TDS mg/l	-	423.41	350.45	509.40	487.90	830.54	599.29	870.92	360.22	335.47	191.19	745.20	1020.74	1111.94	252.74	914.57
Ca mg/l	32	23.34	**34.46**	**45.12**	**33.85**	**40.84**	**64.21**	**58.49**	**50.61**	**38.60**	29.87	**41.99**	**108.79**	**68.89**	22.66	**67.56**
Mg mg/l	50	**52.94**	32.62	**56.68**	**55.06**	**77.85**	**102.92**	**109.80**	**51.92**	49.55	19.33	**74.74**	**101.96**	**193.65**	24.06	**93.52**
Na mg/l	20	10.12	11.32	9.38	**24.15**	**60.14**	**20.01**	**23.23**	10.04	14.35	6.34	**114.16**	**91.64**	18.84	7.77	18.68
K mg/l	-	0.49	0.28	0.57	1.43	0.31	0.26	0.73	0.80	0.83	1.15	5.82	11.74	1.05	0.68	0.93
Cl mg/l	30	20.35	12.70	26.34	18.98	**76.22**	24.94	**67.23**	6.96	12.86	**<1.62**	**50.62**	**76.21**	**164.34**	7.79	**59.44**
SO_4 mg/l	70	**72.86**	15.90	60.82	40.88	**119.48**	**78.78**	**120.19**	8.79	36.79	3.54	**119.85**	**189.28**	**163.31**	25.40	**126.43**
NO_3 as N mg/l	6	**7.84**	<0.459	2.96	3.87	**29.61**	**9.51**	**21.07**	1.60	1.58	**7.13**	**52.14**	**86.21**	**30.42**	1.52	**79.61**
NO_3 as NO_3 mg/l	-	34.69	<2.03	13.09	17.13	131.08	42.08	93.28	7.10	6.99	31.56	230.81	381.62	134.68	6.75	352.41
F mg/l	0.5	**0.52**	<0.466	<0.466	<0.466	<0.466	<0.466	<0.466	<0.466	<0.466	<0.466	<0.466	<0.466	**0.67**	<0.466	<0.466
Al mg/l	-	0.08	0.09	0.10	0.13	0.11	0.01	0.11	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.08	0.09
Fe mg/l	-	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Mn mg/l	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total Hardness mg/l	-	276.29	220.35	346.06	311.26	422.57	584.17	598.21	340.16	300.42	154.18	412.63	691.54	969.47	155.65	553.83
Cd mg/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Co mg/l	-	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
Cr mg/l	0.05	<0.007	<0.007	<0.007	0.01	<0.007	0.04	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
Cu mg/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Ni mg/l	-	0.01	0.02	0.02	0.01	0.02	<0.005	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01
Pb mg/l	-	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Zn mg/l	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.07	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Red bold and shaded text: values exceed the WUL Guideline Limit.
< : Less than i.e., value is below the detection limit.
- : no guideline values.

7-6 TERRESTRIAL AND AQUATIC ECOLOGY (FLORA AND FAUNA), INCLUDING WETLANDS

The mine falls within the Marikana Thornveld which is an important vegetation type that requires careful consideration when developing mining projects. The project area includes a terrestrial CBA and a critically endangered river (the Sterkstroom) defined by the North-West Province 2009 biodiversity assessment, and a High Biodiversity area in terms of the recently published Mining Biodiversity Guidelines. It is important to note that these national guidelines and assessments were published after the mine was approved in 2008. The area has been transformed by agricultural and mining activities (both on the project sites and in the surrounding areas).

Tharisa Mine operations are drained by the A21K-01023 Spatial Quaternary Regions (SQR) of the Sterkstroom River and the A21K-01028 of the Maretlwana River. The project area is located approximately 3.7 km west of Maretlwana River, while the Sterkstroom River in the middle of the Tharisa West mine (proposed raising of the walls of TSF 2 and TSF 2 Extension project). Therefore, Sterkstroom River was considered as the main River system anticipated to be impacted by the proposed activities. The A21K-01023 SQR is considered as Phase 2 Freshwater Ecosystem Priority Areas (FEPA) river ecosystem type with Permanent/Seasonal - Bushveld Basin - Lower foothill and Upper foothill biodiversity feature. River FEPAs achieves biodiversity targets for river ecosystems and threatened/near threatened fish species and were identified in rivers that are currently in a good condition (A or B ecological category).

Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources. For river FEPAs the whole sub-quaternary catchment is shown in dark green, although FEPA status applies to the actual river reach within such a sub-quaternary catchment. The shading of the whole sub-quaternary catchment indicates that the surrounding land and smaller stream network need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach (Nel et al, 2011a).

Figure 30 indicates that there are National Freshwater Ecosystem Priority Areas (NFEPA) wetlands and other various small drainage lines around the proposed raising of the walls of TSF 2 and TSF 2 Extension project. These wetlands and drainage lines have been modified by the mining activities in the project area.

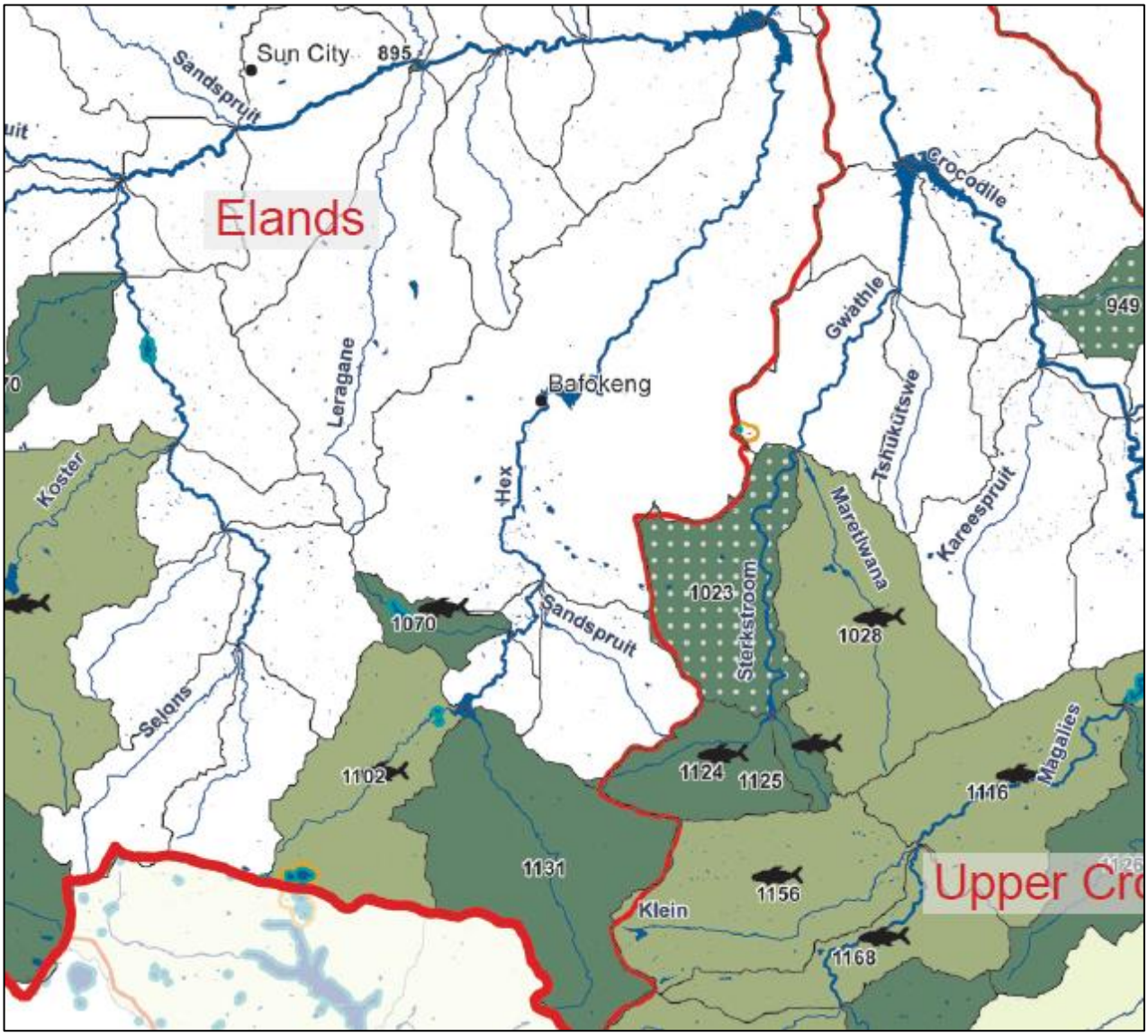

Figure 29: Illustration of NFEPAs for the project area (Purple oval) (Nel et al., 2011)

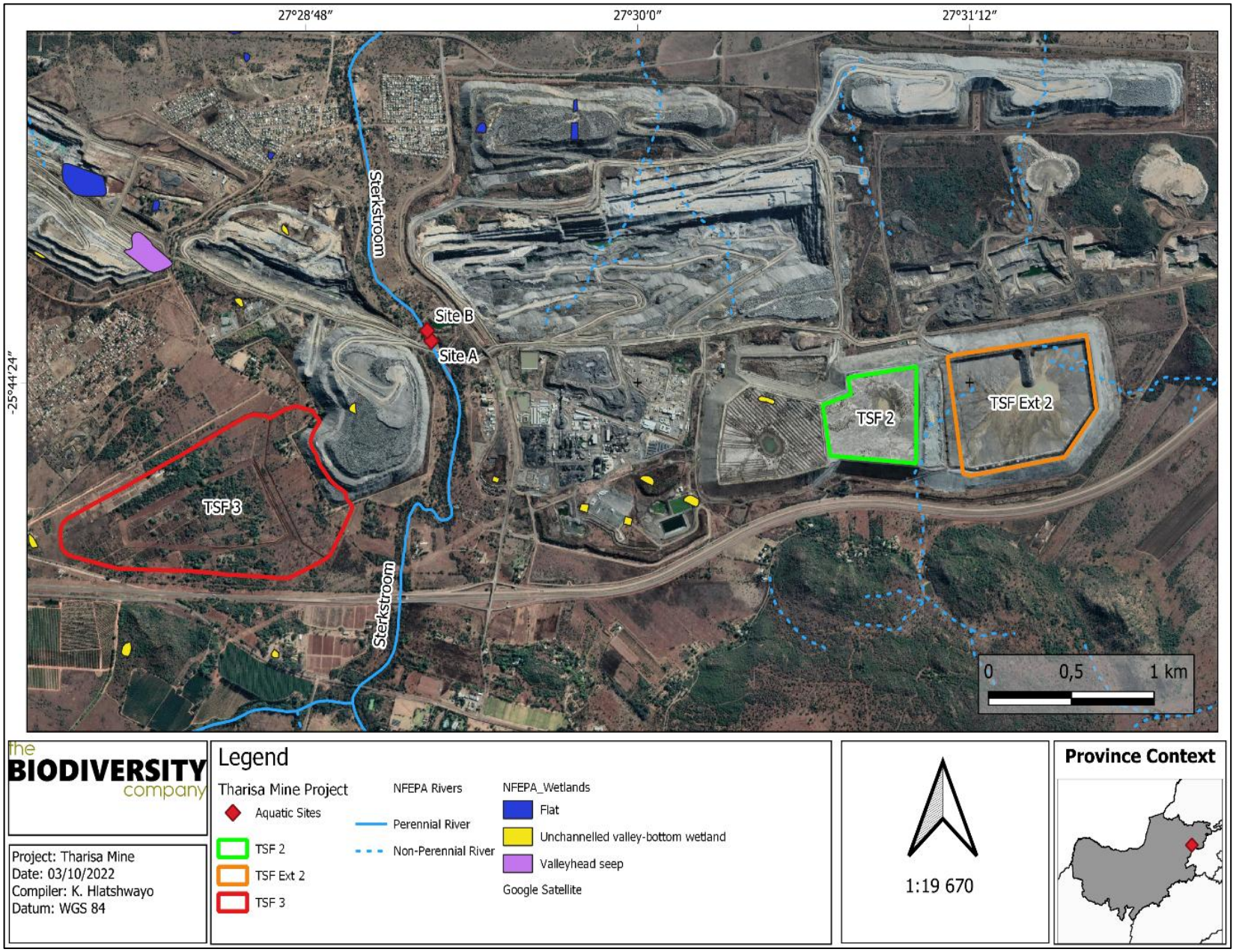

Figure 30: Map Illustrating NFEPA wetlands in the project area

7-6.1 Present Ecological Status of Sub-Quaternary Reach

The A21K-1023 SQR spans 27.14 km of the Sterkstroom River. The Present Ecological Status (PES) category of the reach is classed as largely modified (Class D). The largely modified state of the river reach was attributed to large impacts to impacts on physico-chemical conditions (water quality), flow modifications and large to moderate instream habitat, wetland and riparian zone continuity. Desktop information for SQR's was obtained from DWS (2014) with a summary presented in Table 26.

Table 26: Summary of the Present Ecological State of the SQRs associated with the project area

Present Ecological State		Ecological Importance		Ecological Sensitivity	
D (Largely Modified)		High		High	
Variable	**Status**	**Variable**	**Status**	**Variable**	**Status**
Modifications to Instream Habitat Continuity	Moderate	Fish species per sub quaternary catchment	11	Fish Physico-Chemical sensitivity description	High
Modifications to Riparian/ Wetland Zone Continuity	Moderate	Invertebrate taxa per sub quaternary catchment	41	Fish No-flow sensitivity description	High
Potential Instream habitat modifications	Large	Habitat Diversity Class	Low	Invertebrate Physico-Chemical sensitivity	Very High
Modifications to Riparian/ Wetland Zones	Large	Instream Migration Link Class	High	Invertebrate velocity sensitivity	Very High
Potential Flow Modifications	Large	Riparian-Wetland Zone Migration Link	High	Stream size sensitivity to modified flow/water level changes description	High
Potential Physico-chemical Modifications	Large	Instream Habitat Integrity Class	Moderate	Riparian-Wetland Vegetation intolerance to water level changes description	High
Anthropogenic Impacts					
The following impacts/ activities were identified: CRITICAL: None, SERIOUS: None, LARGE: Alien vegetation, Mining, Runoff/effluent: Mining, MODERATE: Abstraction, Algal growth, Bed and Channel disturbance, Small (farm) dams, Erosion, Irrigation, Runoff/effluent: Urban areas, Urbanisation, Vegetation removal, SMALL: Low water crossings, large dams, Overgrazing/trampling, Inundation, Runoff/effluent: Irrigation, Sedimentation.					

7-6.2 Vegetation

As shown in Figure 31, the project area overlaps ESA1 and ESA2 areas. It must be noted that the area has been disturbed. Tharisa Mine falls within the Savanna Biome, the Central Bushveld Bioregion and within the Marikana Thornveld, and Gold Reef Mountain Bushveld vegetation types.

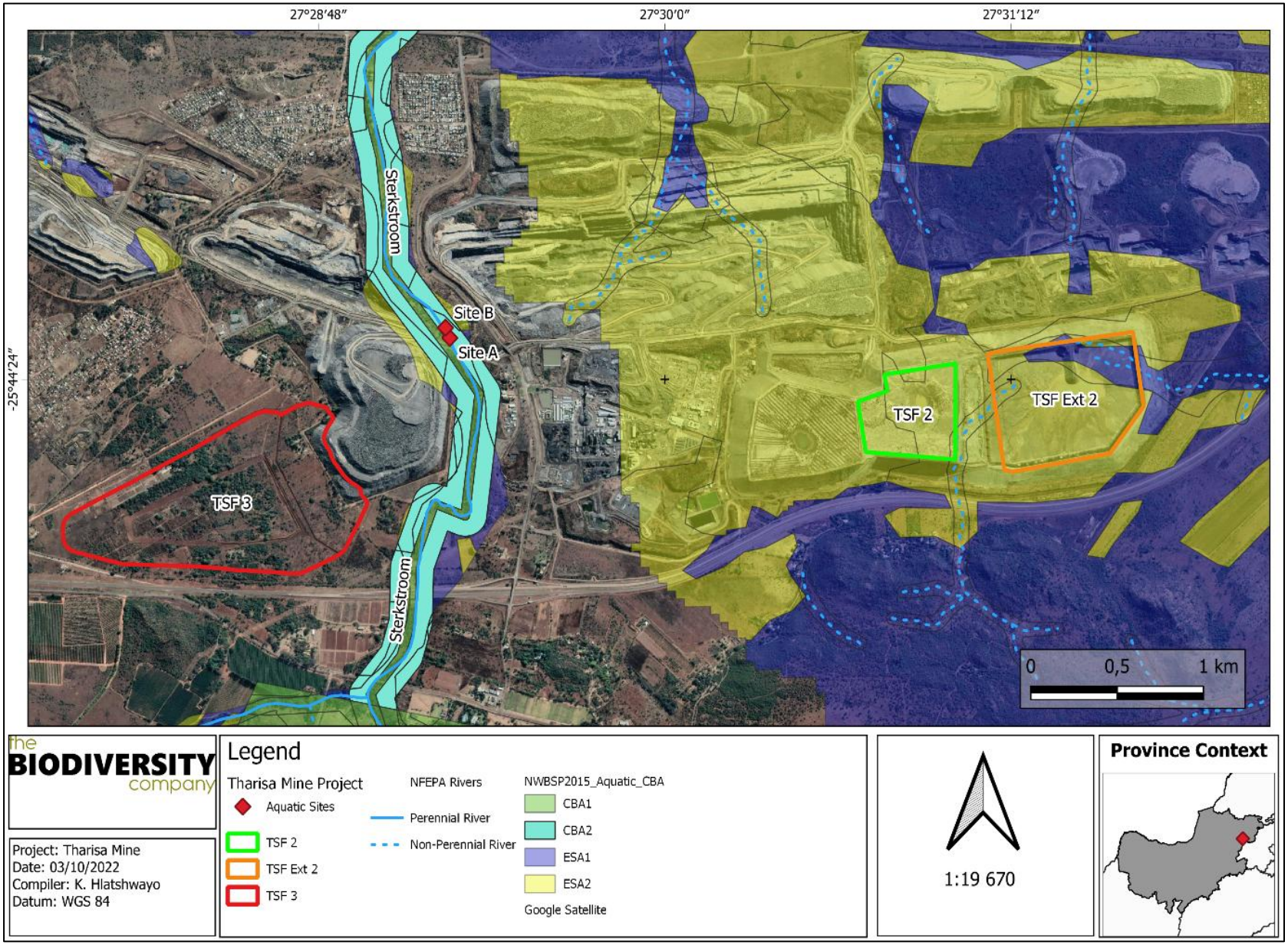
27°28'48"
27°30'0"
27°31'12"
-25°44'24"
Sterkstroom
Site B
Site A
TSF 2
TSF Ext 2
TSF 3
Sterkstroom
0
0,5
1 km
the BIODIVERSITY company
Project: Tharisa Mine
Date: 03/10/2022
Compiler: K. Hlatshwayo
Datum: WGS 84
Legend
Tharisa Mine Project
Aquatic Sites
TSF 2
TSF Ext 2
TSF 3
NFEPA Rivers
Perennial River
Non-Perennial River
NWBSP2015_Aquatic_CBA
CBA1
CBA2
ESA1
ESA2
Google Satellite
1:19 670
Province Context

Figure 31: The project area superimposed on the aquatics NWBSP (North West Department of Rural, Environment and Agricultural Development (READ), 2015)

7-6.3 Riparian Habitat Delineation and Buffer Zone

Riparian areas have high conservation value and can be considered as the most important part of a watershed for a wide range of values and resources. They provide important habitat for a large volume of wildlife and often forage for domestic animals. The vegetation they contain are an important part of the water balance for the hydrological cycle through evapotranspiration. Buffers are crucial for riverbank stability and in preventing erosion within the channel (Elmore, and Beschta, 1987). Therefore, they are considered as high priority areas and should be avoided. The delineation of the watercourse riparian zone extent observed in the study area and the recommended aquatic buffer are presented in Figure 32.

It is recommended that the proposed project complies with Regulation GN 704 of the NWA which contains regulations on use of water for mining and related activities aimed at the protection of water resources. GN 704 states that: *No person in control of a mine or activity may: locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year floodline or within a horizontal distance of 100 metres from any watercourse*. Therefore, the footprint of the proposed activities must fall outside of the 1:100 year floodline of the aquatic resource or 100m from the edge of the resource, whichever distance is the greatest. Therefore, the delineated riparian area and the buffer zone (Figure 32) are No-go areas for the proposed Tharisa Mine activities.

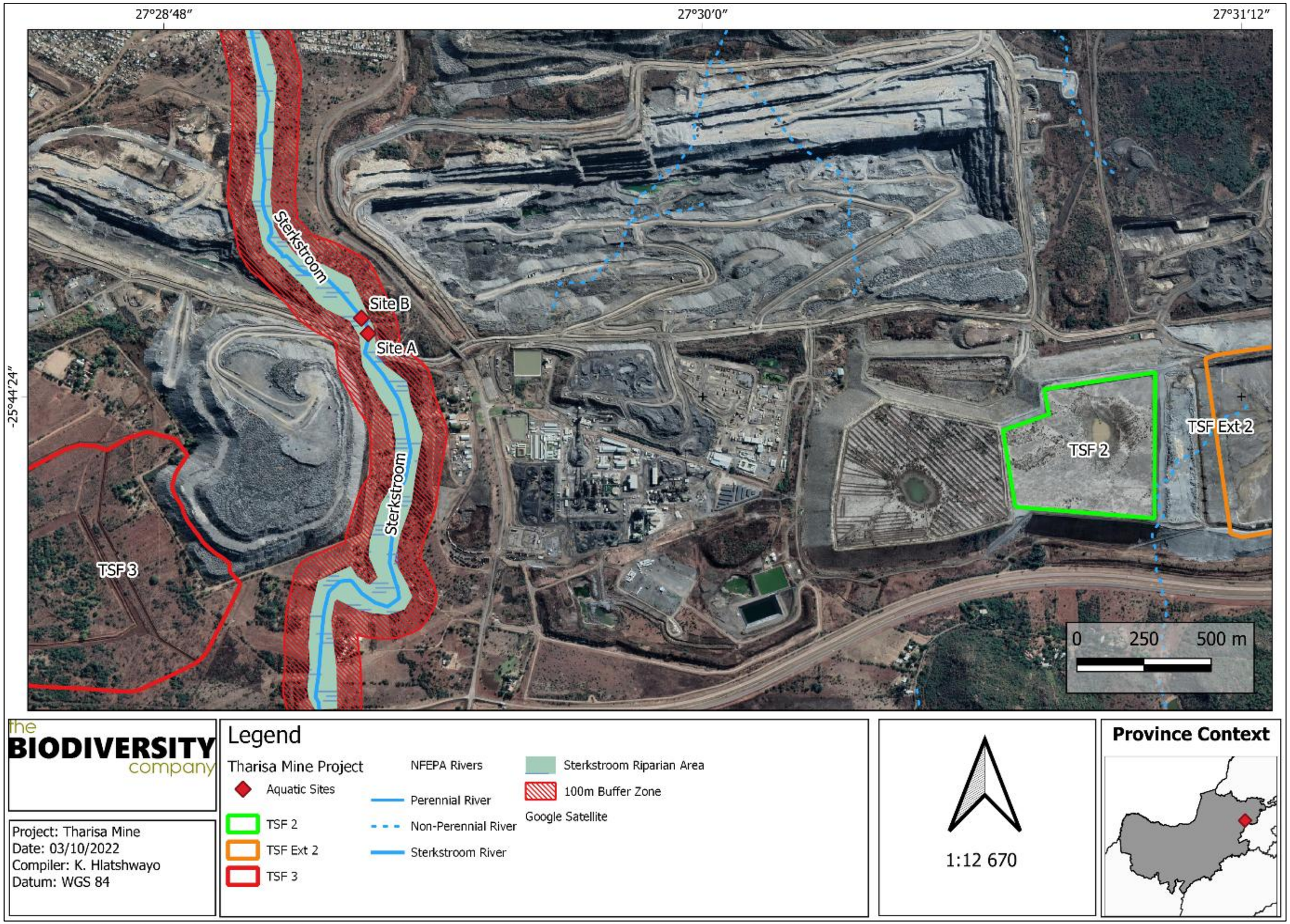

Figure 32: Map illustrating the riparian area and riparian buffer of the Sterkstroom River reach associated with the proposed activities

7-7 SOIL AND LAND CAPABILITY

Soils are structured with a high clay content. Land capable for use as grazing dominates the project area.

7-7.1 Soil Chemical Characteristics

The dominant soils at Tharisa Mine are neutral to slightly alkaline (pH of 5.2 to 7.3), which is within accepted range for good nutrient mobility. These soils tend to be saline in character. Due to the generally high clay content of the soils, the cation exchange capacity (CEC) of the soils is moderate to high. Majority of the soils within the Tharisa Mining Right Area (MRA) have moderate erodibility. These soils are not that prone to erosion, but compaction and contamination of these soils require assessment and mitigation.

7-7.2 Dry Land Agricultural and Irrigation Potential

Due to the general low levels of K, Zn and P in the soils, the dryland production potential, especially of the shallower Valsrivier, Swartland, Sterkspruit, and Mayo soil forms is low. In order to increase the productivity to a viable and sustainable cropping potential, additional fertilisers will be required. Majority of the pre-mining footprint had a grazing land capability. In terms of soil structure and drainage capability, the irrigation potential of the soils can be described as moderate. With adequate drainage and good water management, the soils can be economically cultivated. Existing infrastructure and mining related activities at Tharisa Mine have influenced the natural capability of the land.

The increase in the TSFs height is not anticipated to contribute to the loss of land capability directly, however increased soil erosion and subsequent sediment runoff during high rainfall events is known to occur can be anticipated to continue in perpetuity unless the TSFs are appropriately capped at closure. Similarly, seepage from the TSFs is deemed likely to impact on soil chemistry and fertility in perpetuity unless the TSFs are capped.

7-8 AIR QUALITY

This chapter provides details of the receiving environment which is described in terms of:

- The identification of Air Quality Sensitive Receptors (AQSRs) from available maps and Google Earth imagery.
- A study of the atmospheric dispersion potential of the area taking into consideration local meteorology, land-use and topography.
- The identification of existing sources of emissions in the study area.
- The analysis of all available ambient air quality information/data to determine pre-development ambient pollutant levels and dustfall rates.

The closest residential developments to Tharisa Mine and the proposed project consist of the Mmaditlhokwa and Lapologang communities, with the town of Marikana approximately 1.5 km to the north of the MR boundary. Individual farmsteads also surround the project area (Figure 33).

It is expected that various local and far-a-field sources are expected to contribute to ambient concentrations in the region. Local sources include wind erosion from exposed areas, fugitive dust from agricultural activities and mining activities, vehicles on roadways and veld burning. Long range particulates can result from remote tall stack emissions and from large scale biomass burning in countries to the north of South Africa. These have been found to contribute significantly to background fine particulate concentrations over the interior of South Africa (Andreae, 1996), (Garstang, 1996), (Piketh, Annegarn, & Kneen, 1996).

Particulates represent the main pollutant of concern in the assessment of mining operations. The particulates in the atmosphere may contribute to visibility reduction, pose a threat to human health, or simply be a nuisance due to their soiling potential.

7-8.1 Existing Sources of Emissions near the Project Site

Mining and processing activities, farming and residential land-uses occur in the region. These land-uses contribute to baseline pollutant concentrations via vehicle tailpipe emissions, household fuel combustion, biomass burning and various fugitive dust sources. Long-range transport of particulates, emitted from remote tall stacks and from large-scale biomass burning in countries to the north of South Africa, has been found to contribute to background fine particulate concentrations within the South African boundary (Andreae, et al., 1996; Garstang, Tyson, Swap, & Edwards, 1996; Piketh, Annegarn, & Kneen, 1996).

7-8.1.1 Mining and Industrial Operations

Fugitive emissions from opencast and underground mining operations mainly comprise of land clearing operations (i.e. scraping, dozing and excavating), materials handling operations (i.e. tipping, off-loading and loading, conveyor transfer points), vehicle entrainment from haul roads, wind erosion from open areas, drilling and blasting. These activities mainly result in particulates and dust emissions, with small amounts of oxides of NOx, CO, SO_2, methane and CO_2 being released during blasting operations.

Lonmin Platinum Mine is located approximately 1 km to the northeast of Tharisa and the Lonmin smelter approximately 3 km to the northwest. Samancor western chrome mine is roughly 3.3 km to the east, and Glencore WKP UG2 about 3.8 km to the west. Further afield are Bleskop Mines, Kroondal Mine, and Rustenburg Platinum Mine. Anglo Platinum Smelter Operation (Waterval Smelter) and Impala Platinum are all located around Rustenburg, about 20 km to the west-northwest. Rhovan Vanadium is to the north of Brits and Vanchem to the east, both with associated mining operations. Most of the smelters have mining operations associated with it, with TSFs, unpaved roads and other materials handling activities generating dust.

7-8.1.2 Agricultural operation

Agriculture is a land-use within the area surrounding the site. Particulate matter is the main pollutant of concern from agricultural activities deriving from windblown dust, biomass burning, and dust entrainment as a result of vehicles travelling along dirt roads. The quantity of windblown dust is a function of the wind speed, the extent of exposed areas and the moisture and silt content of such areas.

Amongst the mining and industrial operations between Brits and Rustenburg, there are a number of citrus farms and other agricultural activities. Crop farming and mixed crop farming include land tilling operations, fertiliser and pesticide applications, and harvesting. Land tilling includes dust entrainment on exposed surfaces, windblown dust and scraping and grading type activities resulting in fugitive dust releases. Both PM and gaseous air emissions (mainly NO, NO_2, NH_3, SO_2 and Volatile Organic Compounds (VOCs)) are generated from the application of nutrients as fertilisers or manures [Environmental Protection Agency (EPA), 1999]. Farm vehicles and equipment on unpaved roads further contribute to particulate emissions.

7-8.1.3 Unpaved Roads

Vehicle entrained dust emissions from paved and unpaved roads represent a potentially significant source of fugitive dust in the area surrounding Tharisa Mine. Unpaved roads include industrial, mine, local farming, and community access roads. The extent of particulate emissions from the main roads will depend on the number of vehicles using the roads and the silt loading on the roadways. The extent, nature and duration of road-use activity and the moisture and silt content of soils are required to be known in order to quantify fugitive emissions from this source.

7-8.1.4 Vehicle Tailpipe Emissions

Air pollution from vehicle emissions may be grouped into primary and secondary pollutants. Primary pollutants are those emitted directly into the atmosphere, and secondary, those pollutants formed in the

atmosphere as a result of chemical reactions, such as hydrolysis, oxidation, or photochemical reactions. Notable primary pollutants emitted by vehicles include CO_2, CO, hydrocarbons (HCs), SO_2, NOx, Di Methoxy Propanol (DPM) and Pb. Secondary pollutants include: NO_2, photochemical oxidants (e.g. ozone), HCs, sulphur acid, sulphates, nitric acid, nitric acid and nitrate aerosols. Hydrocarbons emitted include benzene, 1.2-butadiene, aldehydes and polycyclic aromatic hydrocarbons (PAH). Benzene represents an aromatic HC present in petrol, with 85% to 90% of benzene emissions emanating from the exhaust and the remainder from evaporative losses. Vehicle tailpipe emissions are localised sources and unlikely to impact far-field.

Both small and heavy private and industrial vehicles travelling along the N4 and the R104 as well as the unpaved roads, are notable sources of vehicle tailpipe emissions.

7-8.1.5 Household Fuel Burning

Domestic households are known to have the potential to be one of the most significant sources that contribute to poor air quality within residential areas. Pollutants arising from the combustion of wood include respirable particulates, CO and SO_2 with trace amounts of PAHs, in particular benzo(a)pyrene and formaldehyde. Particulate emissions from wood burning have been found to contain about 50% elemental carbon and about 50% condensed hydrocarbons.

Informal settlements in the region are likely to use coal and wood as energy sources. Coal burning emits a large amount of gaseous and particulate pollutants including SO_2, total and respirable particulates including heavy metals and inorganic ash, CO, PAHs, NO_2 and various toxins such as benzo(a)pyrene. Pollutants from wood burning include respirable particulates, NO_2, CO, PAHs, particulate benzo(a)pyrene and formaldehyde. Particulate emissions from wood burning have been found to contain about 50% elemental carbon and about 50% condensed hydrocarbons.

7-8.1.6 Crop Burning and Wildfires

Crop-residue burning, and general wildfires (veld fires) represent significant sources of combustion-related emissions associated with agricultural areas. Emissions are greater from sugar cane burning than from savannas wildfires due to sugar cane areas being associated with a greater availability of available material to be burned. The quantity of dry, combustible matter per unit area is on average 4.5 ton per hectare for savannas areas.

The quantification of background particulate concentration, which is of particular importance for the current study, is complicated due to the large number of sources in the region. Sources of particulates also include a significant proportion of fugitive emissions from diffuse sources (e.g. vehicle-entrained dust from roadways, wind-blown dust from stockpiles and open areas, dust generated by materials handling) which are more difficult to quantify than are emissions from point sources. Dust fallout typically impacts in close vicinity of the emission source (up to 3 km) whereas PM_{10} can remain in the atmosphere for days and impact far afield.

7-8.2 Air quality monitoring data

Tharisa Mine has a dustfall monitoring network in place and does passive sampling of NO_2 and SO_2 (Figure 33). Data analysed for the ambient air quality is limited to the period January to March 2021 and January to March 2022. Both NO_2 and SO_2 are screened against National Ambient Air Quality Standards (NAAQS) while dustfall is screened against the National Dust Control Regulations (NDCR). It should be noted that the ambient measurements account for all emission contributions in the region, not just the mine.

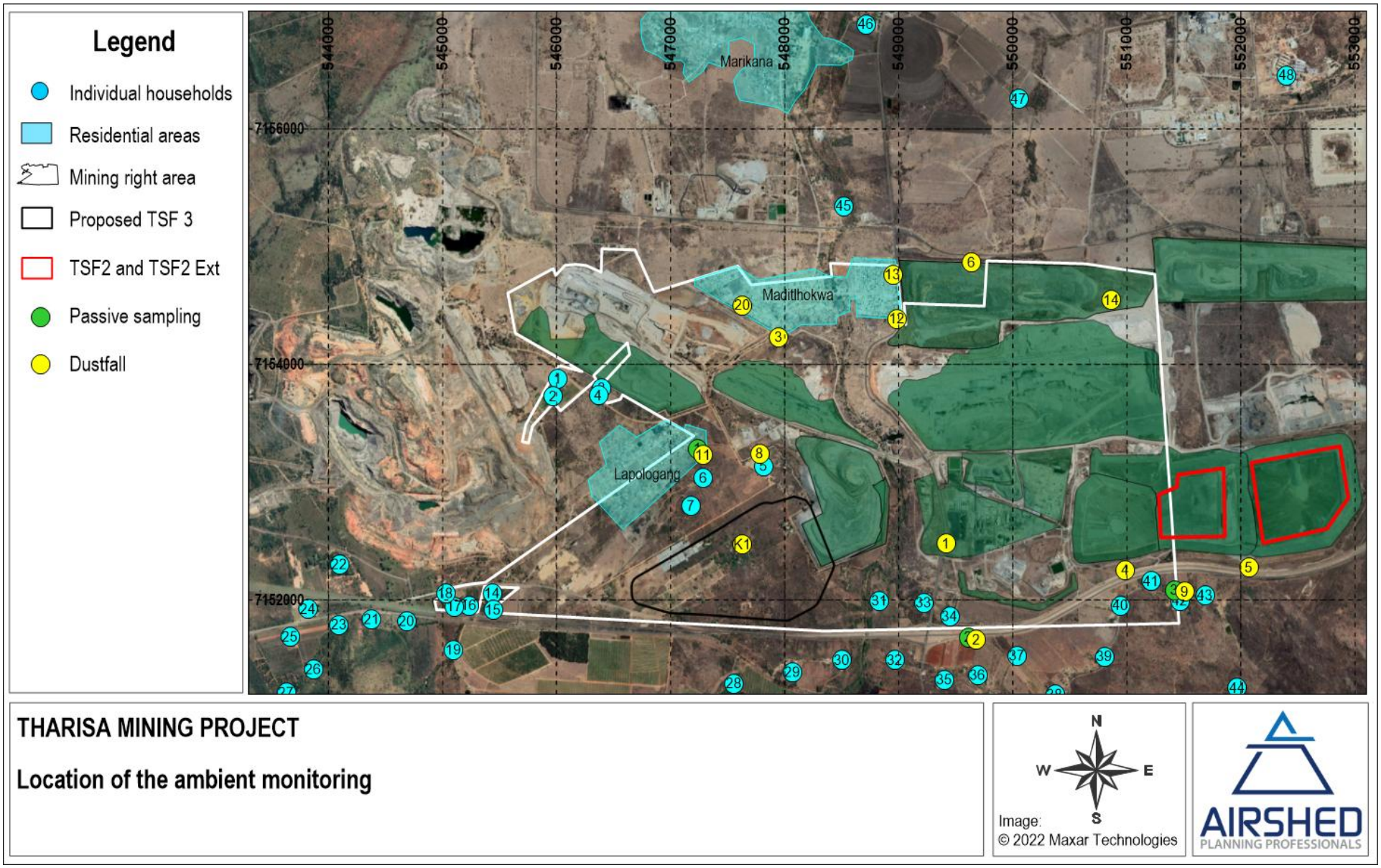

Figure 33: Tharisa Mine ambient monitoring network locations

7-8.2.1 Ambient NO_2 and SO_2 Concentrations

The current monitoring network comprises of three radiello® passive monitors for NO_2 and SO_2. The results of the NO_2 and SO_2 monitoring are represented in Table 27 and Table 28.

While you may not validly compare the NO_2 and SO_2 results obtained to the annual standard unless you continuously sampled for a year and obtained an average, the radiello® passives technique provide an indication of possible high incidences of NO_2 and SO_2 levels at Tharisa Mine. Results obtained for NO_2 and SO_2 for the months in review were well below the NAAQS.

Table 27: Summary of NO_2 concentrations for 2021

Station	Jan 2021 (µg/m³)	Feb 2021 (µg/m³)	Mar 2021 (µg/m³)	NAAQS Annual (µg/m³)
1.Lapologang village	5	3.7	7.1	40
2.Swanepoel	2.3	5.4	10.6	40
3.Glenross farmhouse	4.6	2.2	0.7	40

Table 28: Summary of SO_2 concentrations for 2021

Station	Jan 2021 (µg/m³)	Feb 2021 (µg/m³)	Mar 2021 (µg/m³)	NAAQS Annual (µg/m³)
1.Lapologang village	0.3	1.1	1.1	50
2.Swanepoel	1.4	0.3	3.9	50
3.Glenross farmhouse	0.7	0.9	1.6	50

7-8.2.2 Dustfall Monitoring Network

The latest results were taken from the available dustfall monitoring reports which included 15 single dust buckets at and around Tharisa Mine (Figure 33). Aquatico currently performs the dustfall sampling.

From the results of the monitoring campaign, it was found that dustfall at Sites 2 (toll gate) and 8 (school) (as depicted in Figure 33) exceeded the NDCR for residential areas (exceed 600 mg/m²/day) in January 2021 and in February 2021, respectively.

As the NDCR allow for a permitted frequency of exceeding the dustfall rate of two within a year (not sequential months), it cannot be determined if the site is compliant or not, as there is not a full year of data available.

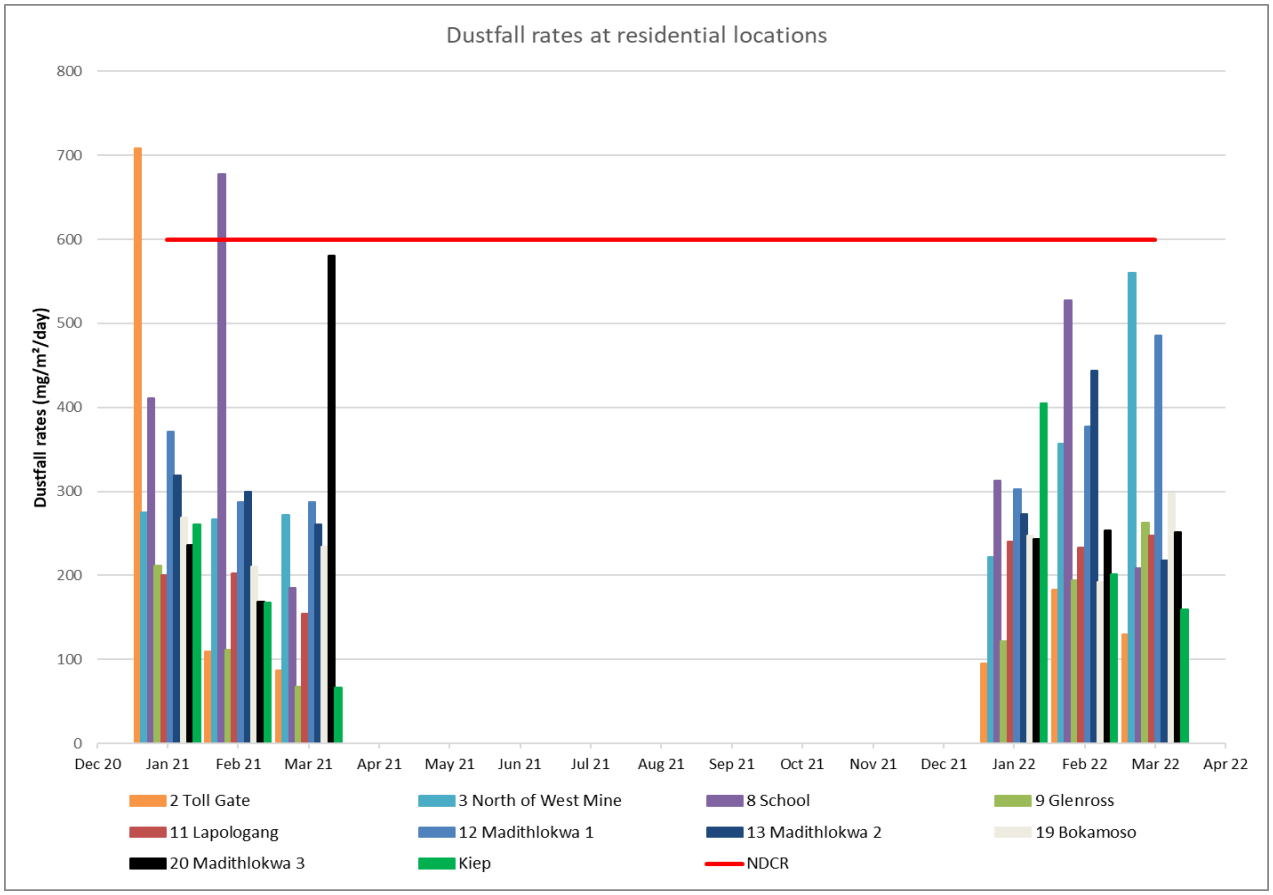

Figure 34: Results of the dustfall monitoring campaign – residential locations

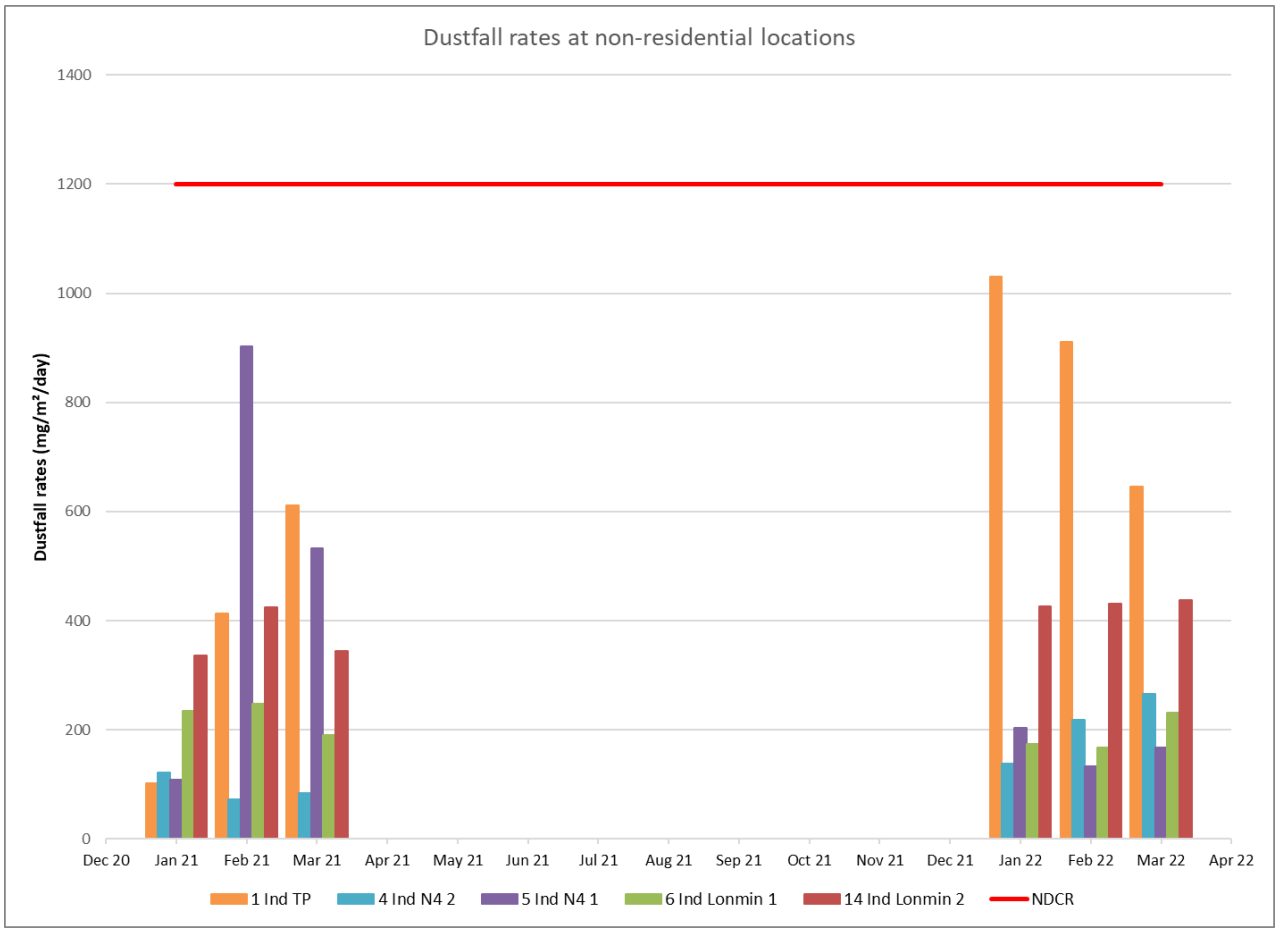

Figure 35: Results of the dustfall monitoring campaign – non-residential locations

7-9 NOISE

7-9.1 Noise Sensitive Receptors

Noise sensitive receptors generally include places of residence and areas where members of the public may be affected by noise generated by mining, processing, and transport activities.

The impact of an intruding industrial/mining noise on the environment rarely extends over more than 5 km from the source. The closest residential developments to the proposed project consist of the Mmaditlhokwa and Lapologang communities. Individual farmsteads also surround the project area (Figure 36 as identified from Google Earth). The location of selected sensitive receptors (individual homesteads) that have the potential to be impacted by the project have been provided in Table 29.

Figure 36: Potential noise sensitive receptors within the study area

Table 29: The location of individual sensitive receptors within the study area

Receptor	Easting	Northing
NSR1	25°43'56.58" S	27°27'31.47" E
NSR2	25°44'01.67" S	27°27'29.85" E
NSR3 (Wolvaardt Residence)	25°43'59.08" S	27°27'45.26" E
NSR4 (van der Hoven Residence)	25°44'01.20" S	27°27'44.10" E
NSR5 (Retief Primary School)	25°44'20.70" S	27°28'36.02" E
NSR6 (Pretorius Residence)	25°44'23.72" S	27°28'17.35" E
NSR7 (du Preez Residence)	25°44'31.14" S	27°28'13.41" E
NSR12	25°44'58.58" S	27°28'31.27" E
NSR13	25°45'03.48" S	27°28'21.24" E
NSR14	25°44'55.45" S	27°27'10.91" E
NSR15	25°45'00.53" S	27°27'11.63" E
NSR16	25°44'59.07" S	27°27'03.69" E
NSR17	25°44'59.51" S	27°26'58.78" E
NSR18	25°44'55.71" S	27°26'56.19" E
NSR19	25°45'11.56" S	27°26'58.59" E
NSR20	25°45'03.36" S	27°26'43.85" E
NSR21	25°45'02.97" S	27°26'33.10" E
NSR22	25°44'48.19" S	27°26'22.77" E
NSR23	25°45'04.49" S	27°26'22.60" E
NSR24	25°45'00.28" S	27°26'13.00" E
NSR25	25°45'07.92" S	27°26'07.43" E
NSR26	25°45'16.99" S	27°26'14.70" E
NSR27	25°45'23.14" S	27°26'06.55" E
NSR28	25°45'20.38" S	27°28'27.15" E
NSR29	25°45'17.14" S	27°28'45.59" E
NSR30	25°45'13.71" S	27°29'00.99" E
NSR31	25°44'57.59" S	27°29'13.07" E
NSR32	25°45'13.65" S	27°29'18.04" E
NSR33	25°44'57.76" S	27°29'26.85" E
NSR34 (Potgieter Residence)	25°45'01.54" S	27°29'35.04" E
NSR35	25°45'19.31" S	27°29'33.01" E
NSR36	25°45'17.58" S	27°29'43.51" E
NSR37	25°45'12.25" S	27°29'56.34" E
NSR38	25°45'23.00" S	27°30'08.07" E
NSR39	25°45'12.37" S	27°30'23.43" E
NSR40	25°44'58.18" S	27°30'28.74" E
NSR41	25°44'51.59" S	27°30'38.53" E
NSR42	25°44'57.06" S	27°30'47.42" E
NSR43	25°44'55.34" S	27°30'55.36" E
NSR44	25°45'21.11" S	27°31'05.52" E
NSR45	25°43'08.70" S	27°29'01.42" E
NSR46	25°42'18.33" S	27°29'07.99" E
NSR47	25°42'38.48" S	27°29'56.16" E
NSR48 (Lonmin Training Centre)	25°42'31.63" S	27°31'20.42" E

7-9.2 Environmental Noise Propagation and Attenuation Potential

7-9.2.1 Atmospheric Absorption and Meteorology

The main meteorological parameters affecting the propagation of noise include wind speed, wind direction and temperature. These, along with other parameters such as relative humidity, air pressure, solar radiation and cloud cover, affect the stability of the atmosphere and the ability of the atmosphere to absorb sound energy. Wind speed increases with altitude. This results in the 'bending' of the path of sound to 'focus' it on the downwind side and creating a 'shadow' on the upwind side of the source. Depending on the wind speed, the downwind level may increase by a few decibels (dB) but the upwind level can drop by more than 20 dB (Brüel & Kjær Sound & Vibration Measurement A/S, 2000). It should be noted that at wind speeds of more

than 5 m/s, ambient noise levels are mostly dominated by wind generated noise. Data from WRF data for the period 2019 to 2021 was used for the assessment (Figure 37). The modelled data set indicates wind flow primarily from the north for daytime. At night, wind shifted to be mostly from the south. On average, noise impacts are expected to be slightly more notable to the south during the day and to the north of the project activities during the night.

Temperature gradients in the atmosphere create effects that are uniform in all directions from a source. On a sunny day with no wind, temperature decreases with altitude and creates a 'shadowing' effect for sounds. On a clear night, temperatures may increase with altitude thereby 'focusing' sound on the ground surface. Noise impacts are therefore generally more notable during the night. Temperature gradients in the atmosphere create effects that are uniform in all directions from a source. On a sunny day with no wind, temperature decreases with altitude and creates a 'shadowing' effect for sounds. On a clear night, temperatures may increase with altitude thereby 'focusing' sound on the ground surface. Noise impacts are therefore generally more notable during the night (Figure 38). CadnaA requires the definition of both temperature and humidity. An average temperature of 19°C and a humidity of 60% were applied in simulations.

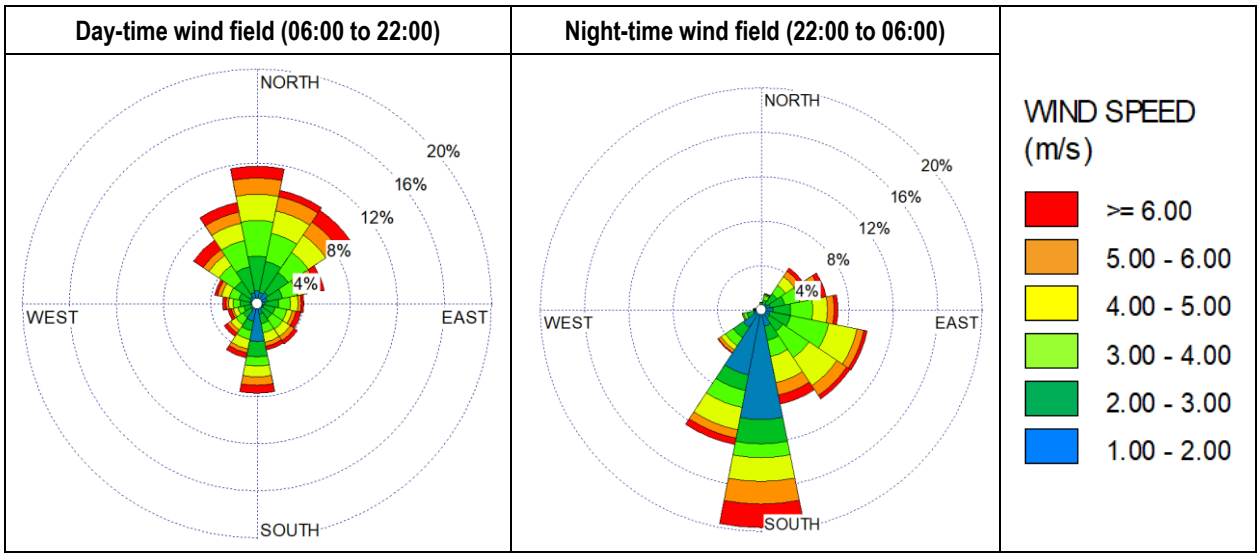

Figure 37: Wind rose for WRF data, 1 January 2019 to 31 December 2021

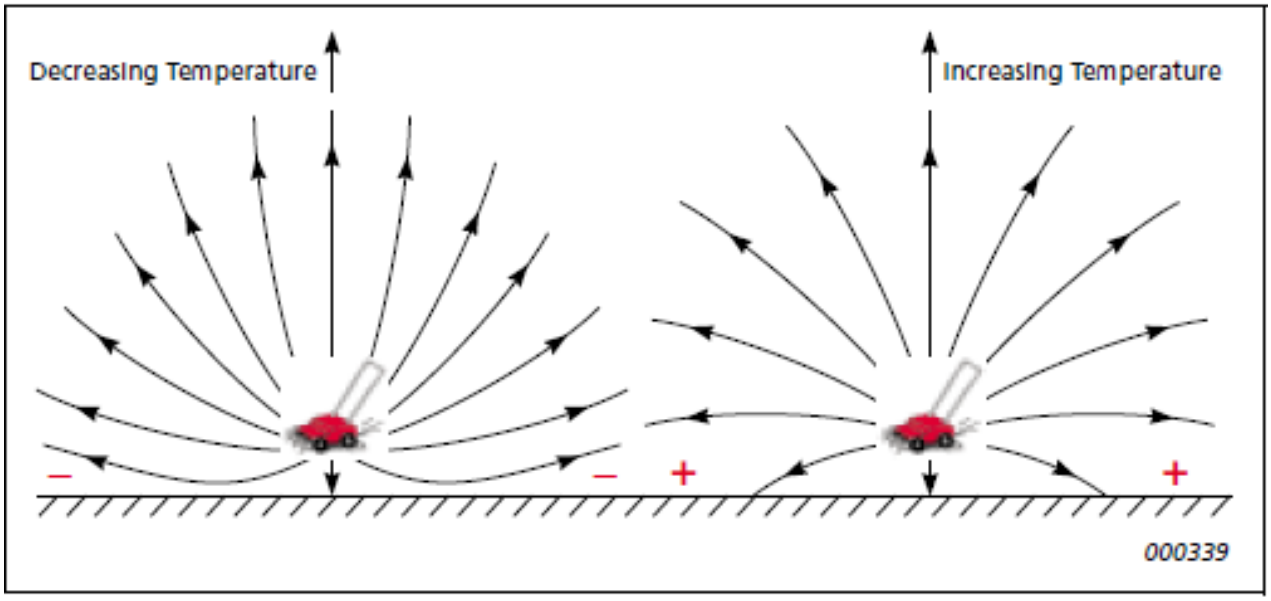

Figure 38: Bending the path of sound during typical day time conditions (image provided on the left) and night-time conditions (image provided on the right)

7-9.2.2 Terrain, Ground Absorption and Reflection

Noise reduction caused by a barrier (i.e., natural terrain, installed acoustic barrier, building) feature depends on two factors namely the path difference of a sound wave as it travels over the barrier compared with direct transmission to the receiver and the frequency content of the noise (Brüel & Kjær Sound & Vibration Measurement A/S, 2000).

Sound reflected by the ground interferes with the directly propagated sound. The effect of the ground is different for acoustically hard (e.g., concrete or water), soft (e.g., grass, trees or vegetation) and mixed surfaces. Ground attenuation is often calculated in frequency bands to take into account the frequency content of the noise source and the type of ground between the source and the receiver (Brüel & Kjær Sound & Vibration Measurement A/S, 2000). Based on observations made during the visit to site, ground cover was found to be acoustically mixed.

7-9.3 Baseline Noise Levels

7-9.3.1 Background Reference Conditions

Tharisa Mine is located in a district where the character of ambient noise is already affected by industrialisation and economic activity, which over time, has resulted in an increase in road traffic noise and noise generated by intensive mining activities. Road traffic noise emanates from the N4 and secondary roads, such as the D1325 between Buffelspoort and Marikana. The N4 has a wide noise footprint. It has a significant impact on people living within a zone of approximately 1.2 km either side of the road and is clearly audible in most of the study area. In addition, mining noise affects communities in the immediate surroundings of mines.

Against this background, the area surrounding Tharisa Mine in its current state cannot be considered a typical rural environment anymore. None of the district descriptions in SANS 10103 meaningfully applies to typical mining areas.

Moreover, background noise levels (i.e., excluding noise from Tharisa) in the assessment area are not homogeneous but vary over a considerable range. Depending on the locations and distances of houses or communities relative to the N4 and relative to other roads and other mines in the area, background noise levels measured in surveys conducted by Acusolv have been found to vary between broadly 50 to 60 dBA (daytime) and 40 to 55 dBA night-time, respectively.

Residences within a zone of 250m from the N4, for example, are subject to night-time road traffic noise levels of between 45 and 55 dBA, depending on topography and distance from the N4. This has been confirmed by noise surveys conducted in earlier studies.

The location of the noise sampling sites is provided in Table 30 and Figure 39.

Table 30: Location of the noise sampling sites for surveys conducted by Acusolv for the annual Tharisa Mine noise surveys (van Zyl, 2021)

Sampling Location	Description	Latitude	Longitude
M1	Mmaditlhokwa Village near church	25°43'39.6" S	27°29'18.6" E
M2	School	25°44'19.8" S	27°28'36.0" E
M3	Lapologang Village	25°44'14.1" S	27°28'14.4" E
M4	Bokamoso Village	25°43'27.0" S	27°32'01.9" E
M5	Residence Potgieter D	25°44'53.6" S	27°30'53.7" E
M6	Residence Potgieter H	25°45'00.7" S	27°29'35.2" E

Figure 39: Location of the noise sampling sites for surveys conducted by Acusolv for the annual Tharisa Mine noise surveys (van Zyl, 2021)

Although no formal baseline surveys had been carried out prior to the initial start-up of Tharisa Mine, various efforts have been made in previous surveys conducted by Acusolv to acquire data representative of prevailing background conditions (in the absence of Tharisa Mine). These estimated nominal background daytime and night-time noise levels under normal conditions (outside lockdown restrictions), are summarised in Table 31 and Figure 40.

Table 31: Estimated background levels in the areas surrounding Tharisa Mine (based on information obtained from the 2021 noise survey (van Zyl, 2021))

Sampling Location	Description	Main Sources of Background Noise	Background Noise Levels (dBA)	
			Daytime	Night-Time
M1	Mmaditlhokwa Village opposite East Pit mining operations	• D1325 Road Noise • Community activities • Distant mining activities in the area	60	50
M2	School and surroundings	• Community activities • Mining activities in the district	50	45
M3	Lapologang south of Tharisa Far West mining operations	• Community activities • Mining activities in the district	50	45
M4	Bokamoso Village in the vicinity of the dump operations north-east of Tharisa East Mine	• Road traffic noise from tarred public road • Community activities	55	45
M5	Residence Potgieter D south of the N4 opposite Tharisa TSF	• N4 highway traffic • Distant mining activities in the district	60	50
M6	Residence Potgieter H between Tharisa Mine and the N4	• N4 highway traffic • Distant mining activities in the district	60	50

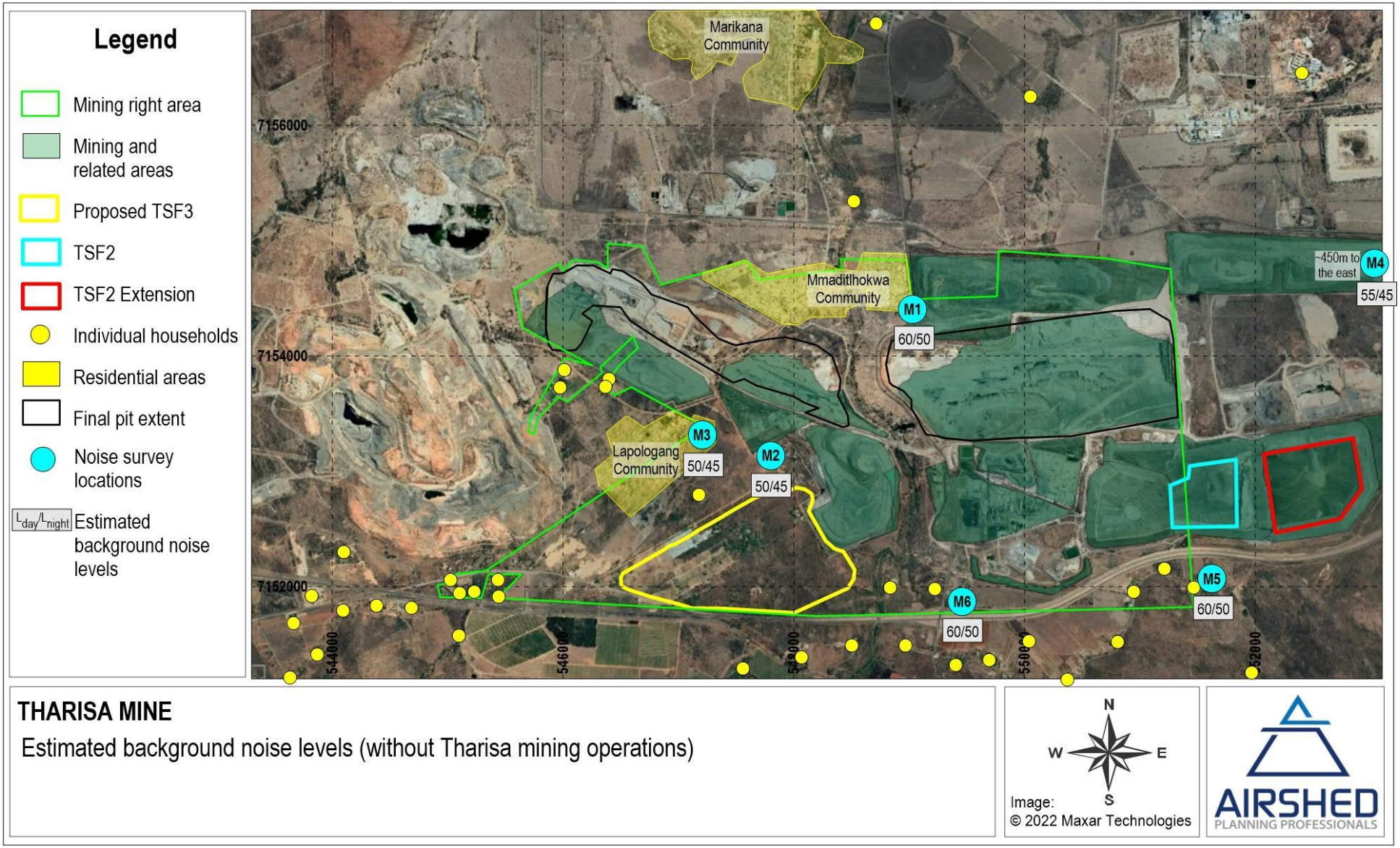

Figure 40: Estimated background levels in the areas surrounding Tharisa Mine (based on information obtained from the 2021 noise survey (van Zyl, 2021))

7-9.4 Measured Noise Levels for the 2022 Survey

Noise measurements were undertaken by Thlago Environmental Health and Safety Solutions (Thlago) on 24 and 25 May 2022 (Thlago Environmental Health and Safety Solutions, 2022) at five selected sampling locations (summarised in Table 32). A summary of the measured baseline noise levels for this period is provided in Table 33 and Figure 41.

Table 32: Location of the sampling sites for the noise survey conducted by Thlago for the Tharisa Mine in May

Sampling Location	Description	Latitude	Longitude
R1	Potgieter residence	25°45'00.39" S	27°29'35.89" E
R2	Pretorius residence	25°44'22.75" S	27°28'19.34" E
R3	van der Hoven residence	25°43'59.78" S	27°27'47.31" E
R4	Kgoitsi house (residence)	25°43'42.76" S	27°28'44.67" E
R5	Church	25°43'40.31" S	27°29'16.41" E

Table 33: Measured baseline noise levels for 2022 in the areas surrounding Tharisa Mine (based on information obtained from the 2022 noise survey (Thlago Environmental Health and Safety Solutions, 2022))

Sampling Location	Description	Measured noise levels obtained from the 2022 survey (dBA)	
		Daytime	Night-Time
R1	Potgieter residence	58.9	55.3
R2	Pretorius residence	59.7	54.7
R3	van der Hoven residence	60.0	55.7
R4	Kgoitsi house (residence)	58.3	55.6
R5	Church	58.1	56.5

Considering the estimated background noise levels, the noise levels measured at R2 (daytime), R3 (daytime) and R5 (night-time) are equivalent or exceed the 1992 Noise Control Regulations (The Republic of South Africa, 1992) “disturbing noise” definition (greater than 7dBA from ambient sound levels).

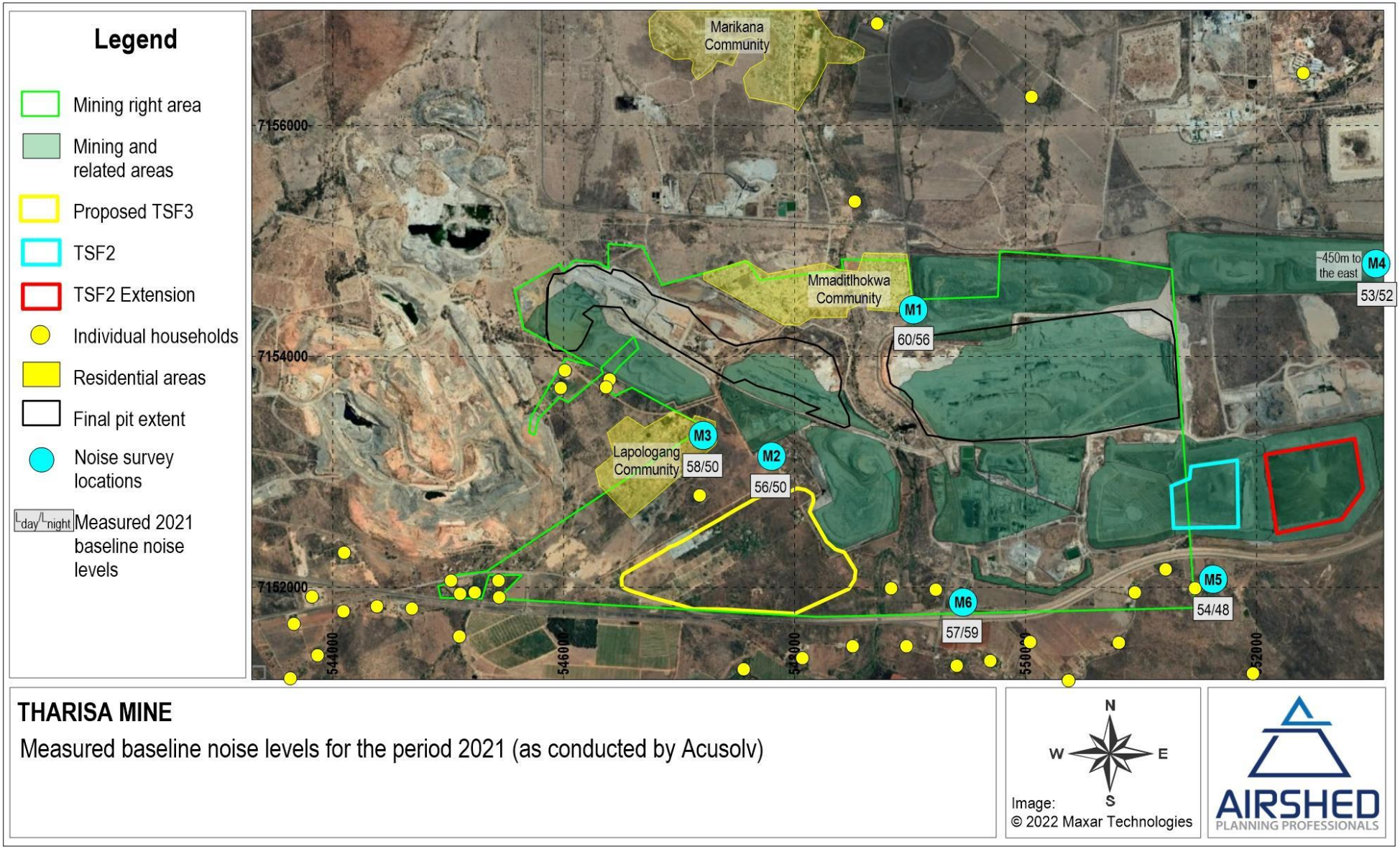

Figure 41: Measured baseline noise levels for 2022 in the areas surrounding Tharisa Mine (based on information obtained from the 2022 noise survey (Thlago Environmental Health and Safety Solutions, 2022))

7-10 VISUAL AESTHETIC

7-10.1 Landscape Character

Tharisa Mine is in the mining belt that stretches from north west of Rustenburg through to Brits and the proposed amendment activities will be contained to areas already approved for mine development or the existing TSF 2 and TSF 2 Extension in the far east of the mine and immediately adjacent to the Tharisa MRA.

The landscape character of the study is therefore dominated by mining infrastructure. Mining activities occur to the north, and immediate west and east of Tharisa Mine. Amongst the mining activities north of the mine is open land mostly owned by mining companies and the community of Marikana. Immediately north of the mine, in the MRA, is the Mmaditlhokwa Community.

Immediately south of the MRA, between the MRA and the N4 road, are nine homesteads and the Lapologang community, with its associated Retief Primary School. The eastern section of Lapologang is in the MRA. All homesteads except one, located south west of the mine, occur within the MRA. The residential areas comprise of Mooinooi (east of the mine), Bakamoso (east) and Marikana (north) (Figure 43).

South of the N4 is cultivated agricultural lands and open land, which extends to a series of foothills to the Magaliesberg.

The panoramas (viewing locations indicated in Figure 42) in Figure 44 to Figure 47 illustrate the existing nature of the landscape from various viewing points about the Project.

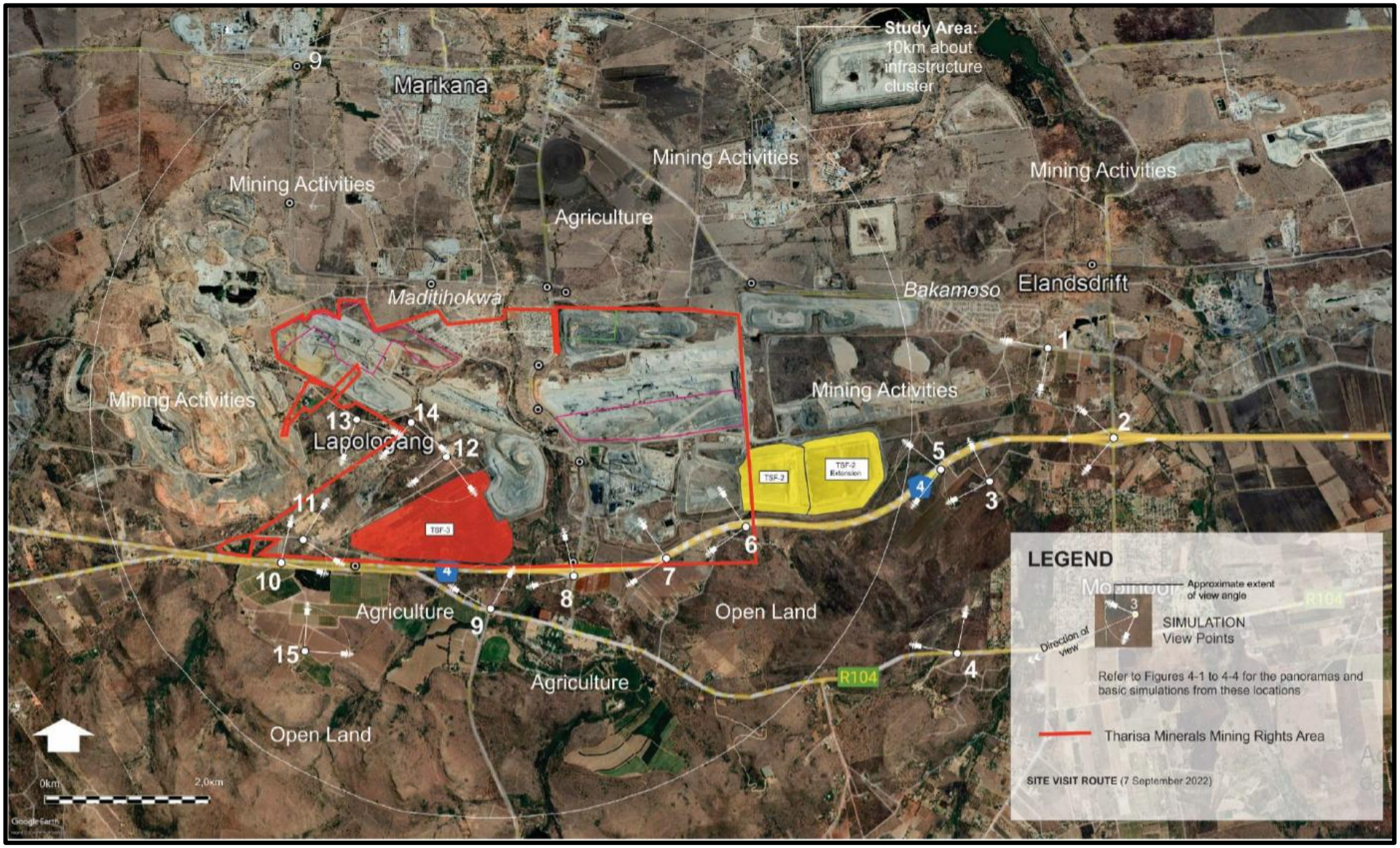

Figure 42: Landscape Context and View Sites

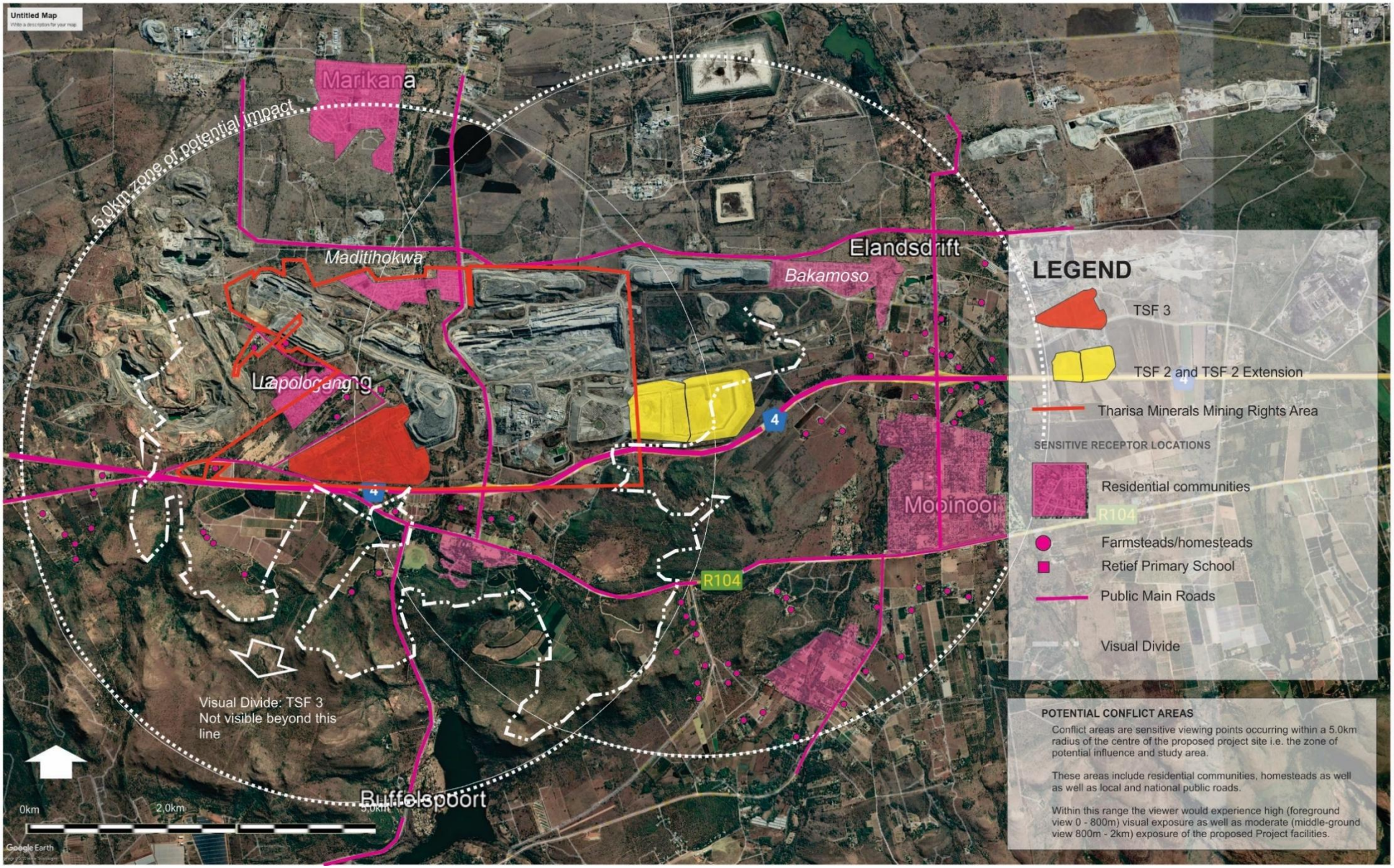

Figure 43: Sensitive Receptor Locations

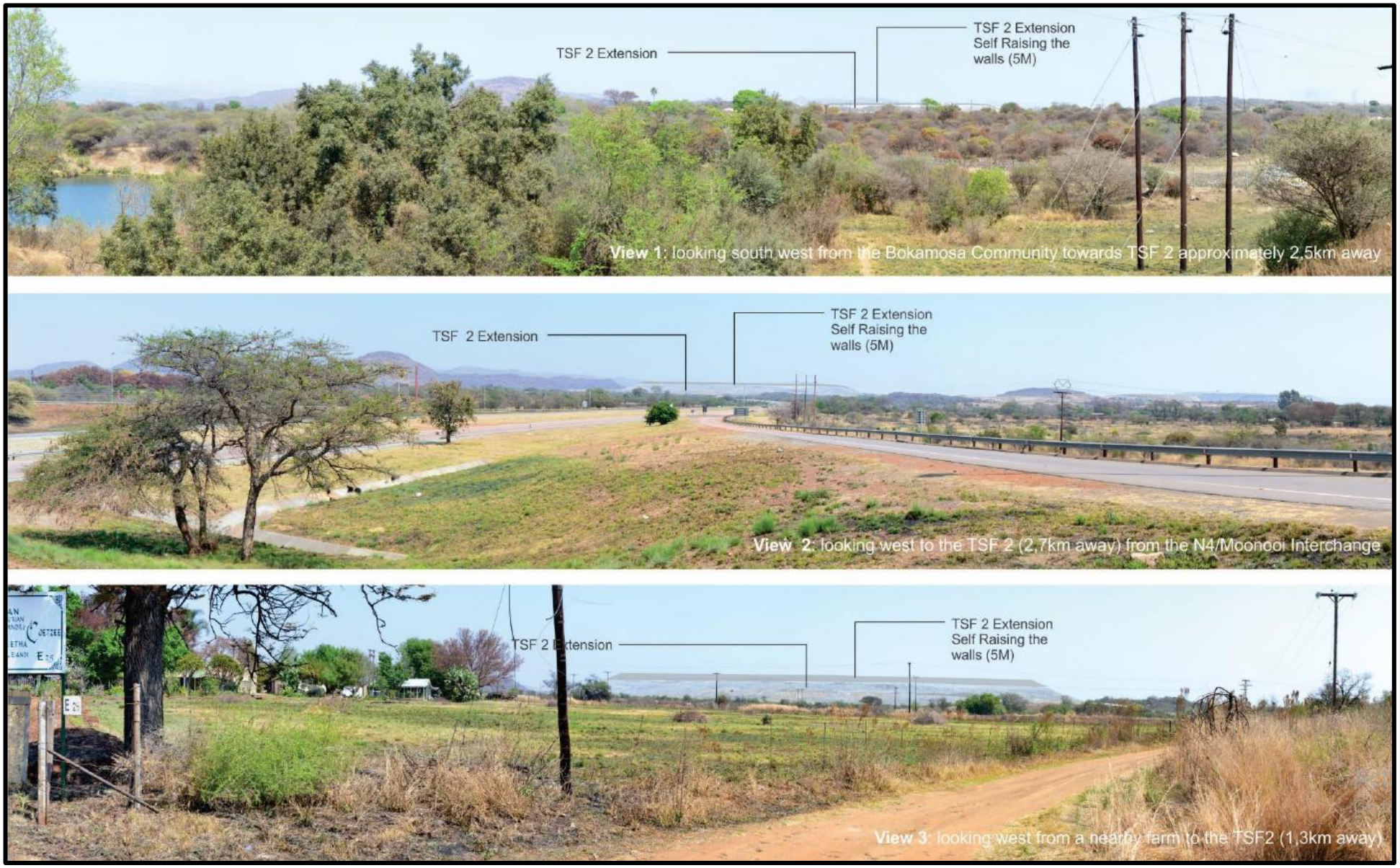

Figure 44: Landscape Character – Views 1, 2 and 3

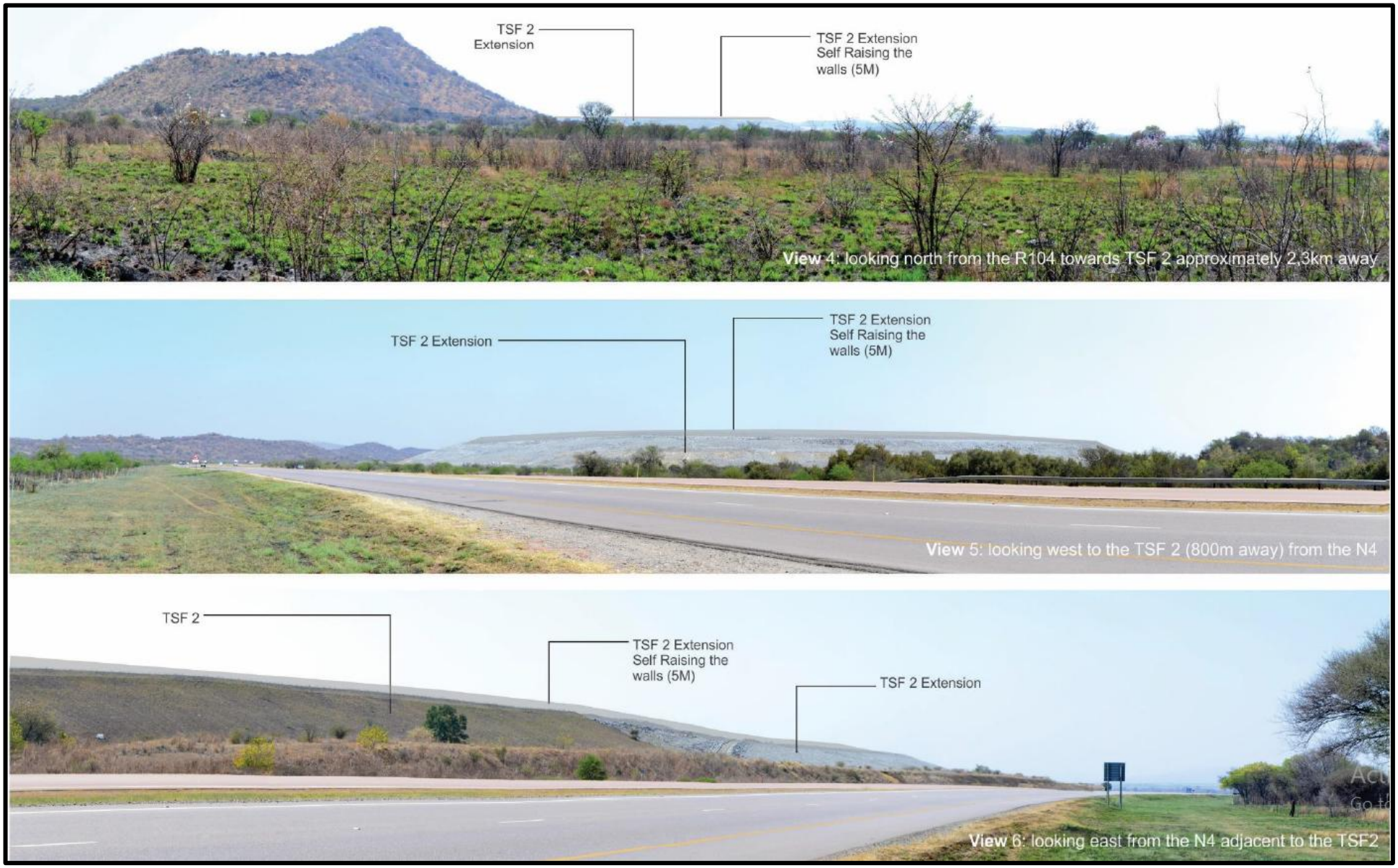

Figure 45: Landscape Character – Views 4, 5 and 6

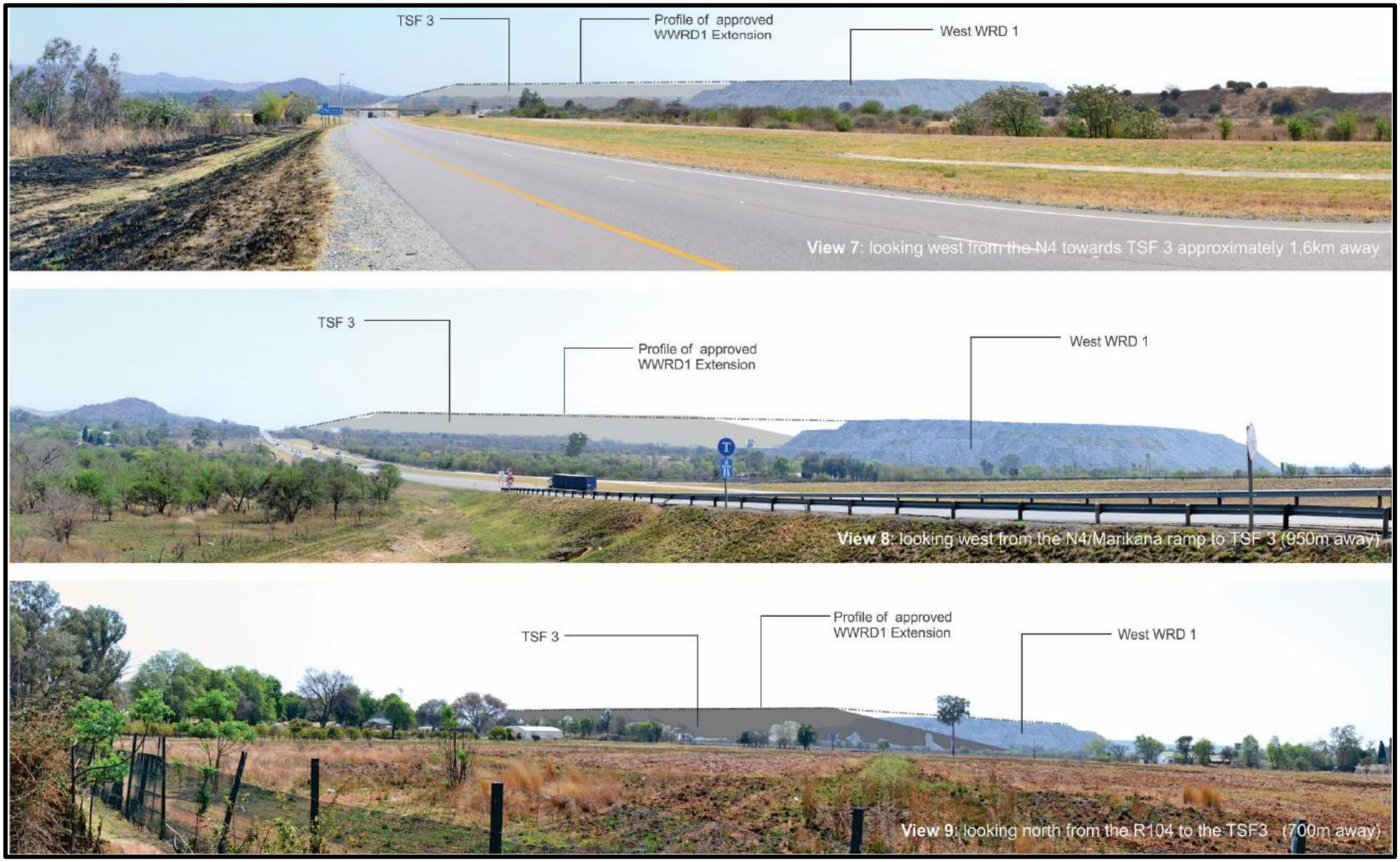

Figure 46: Landscape Character – Views 7, 8 and 9

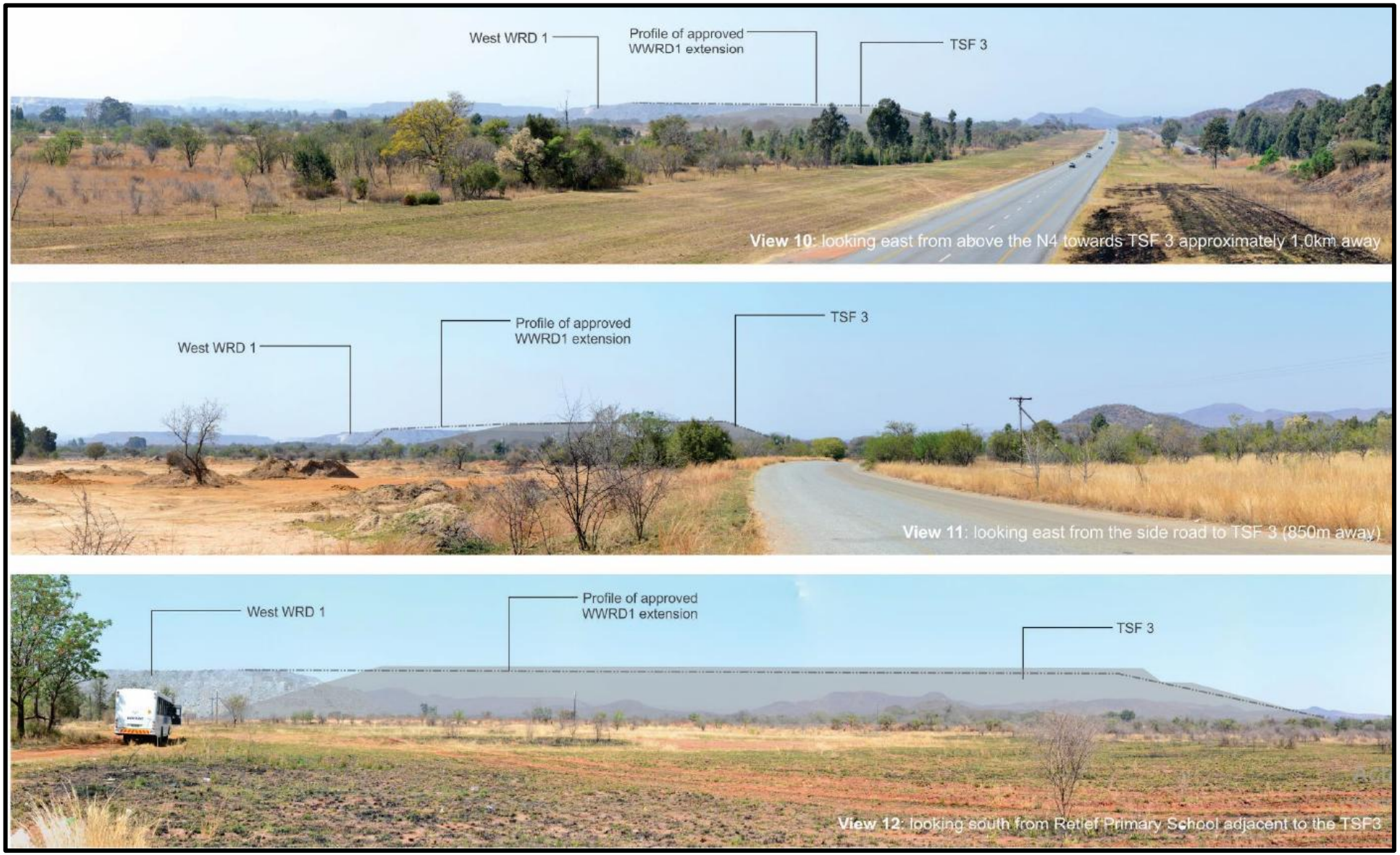

Figure 47: Landscape Character – Views 10, 11 and 12

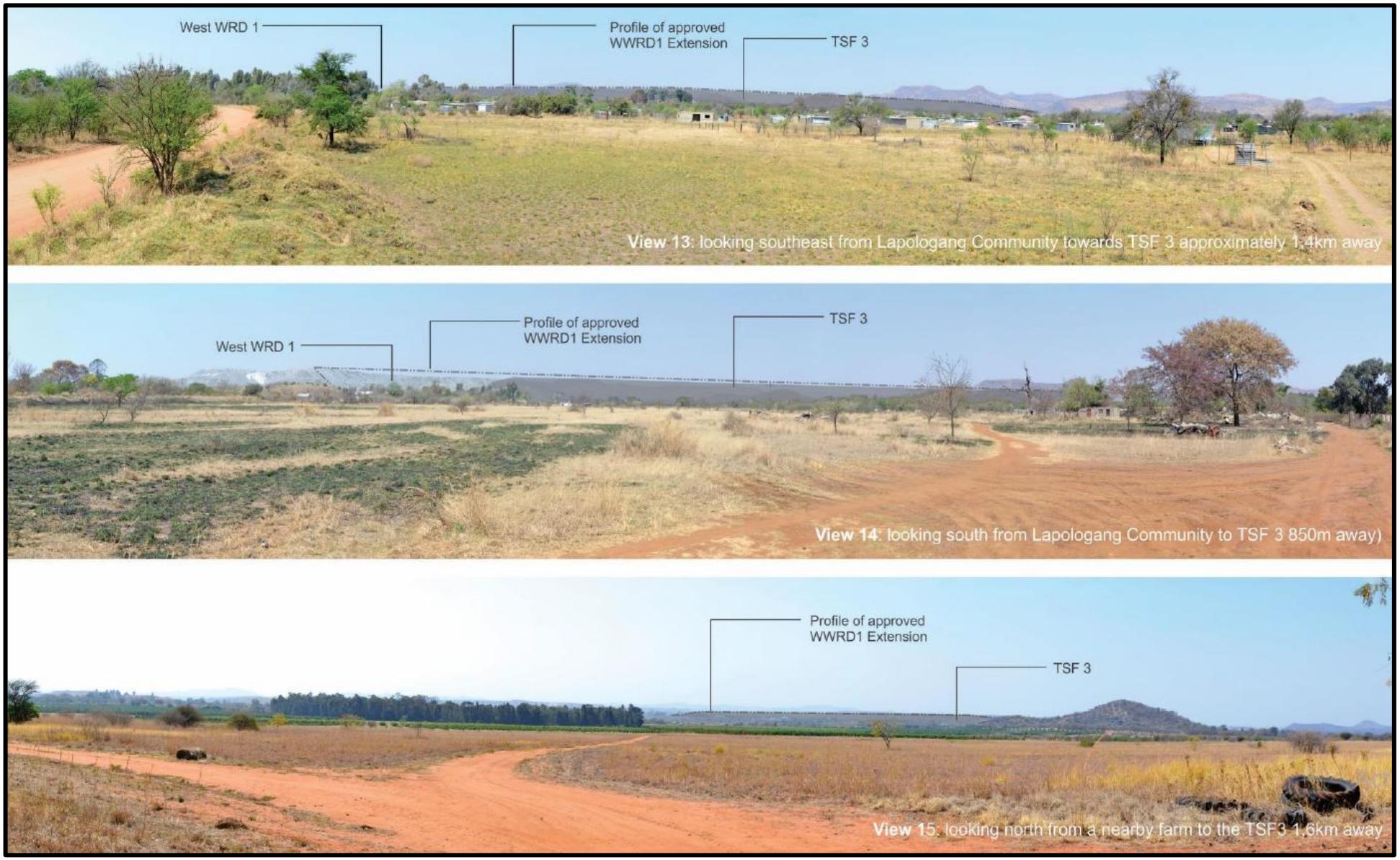

Figure 48: Landscape Character – Views 13, 14 and 15

7-10.2 Sense of Place

According to Lynch (1992), a sense of place is how a person can recognise or recall a place as being distinct from other places - as having a vivid, unique, or at least particular, character of its own. The sense of place for the study area derives from the local landscape character types described above, their relative 'intactness,' and their impact on the senses. The mining activities and land use in the study area are expected within the sub-region as they are well established and form part of the mining belt north of the N4 national road.

The combination of the mining, agricultural, open land and communities, create the sense of place for the study area. It comprises a variety of land uses common to the sub-region resulting in a landscape that exhibits little positive character, due to major evidence of alteration and degradation of its original natural features. The resultant sense of place is weak and of mixed character.

7-11 HERITAGE/ ARCHAEOLOGY AND PALAEONTOLOGY

This section describes the existing status of the heritage and cultural environment that may be affected by the project. Heritage (and cultural) resources include all human-made phenomena and intangible products that are the result of the human mind. Natural, technological or industrial features may also be part of heritage resources as places that have made an outstanding contribution to the cultures, traditions and lifestyles of the people or groups of people of South Africa.

The most important heritage resources discovered in the area were stone-walled settlements, graveyards, a historical village and homestead, mining heritage remains, isolated and randomly scattered stone tools, historical houses and outdated and discarded agricultural implements. Graveyards located within the mining area have since been relocated with all associated consultations and permits. Tharisa obtained a permit in terms of the NHRA, for the exhumation and relocation of graves to be disturbed by the mining of the east pit.

There are several churches within the MRA. These churches include the African Faith Mission (AFM), Uniting Reform Church (URC), New Earth Apostolic Church (NEAC) Ts'enolo Apostolic Church (TAC) and many other apostolic churches whose members assemble at various venues including private homes, schools and/or hired venues.

Although no paleontological resources are expected within the MRA, these resources are protected by national legislation and must be reported to the South African Heritage Resources Agency (SAHRA) should they be identified on-site.

7-11.1 Cultural Heritage Background

Tharisa Mine is located in the Central Bankeveld of the North West Province of South Arica. The Central Bankeveld is covered by older grabbo penetrated by younger volcanic magma which formed the series and chains of pyramid-shaped granite hills from the Pilanesberg in the north-west to Onderstepoort near Pretoria in the east. These hills, as part of the Magaliesberg valley, represent a unique ecozone characterised by grassveld, savannah veld and near wooded valleys. The region has abundant surface water supplies. The Pienaar, the Moretele, the Hex and the Apies Rivers all drain their waters into the Crocodile River.

Tharisa is also located to the north of the Magaliesberg Mountain range, which is known for its rich and diverse range of heritage resources. Various Stone Age sites are scattered along the Magaliesberg and are also located within caves and rock shelters within the mountain. Rock engraving sites have been located further towards Maanhaarrand and Rustenburg in the west.

Blockhouses along the Magaliesberg and colonial farm homesteads are still common in Marikana and on the outskirts of Brits (Madibeng). The most abundant heritage, however, are those that date from the Late Iron Age and which are associated with the numerous Tswana chiefdoms who occupied this region during the last four centuries.

7-11.2 Heritage and Palaeontological Resources at the Tharisa Mine

Tharisa Mine is located approximately 3km south of the town of Marikana. The town was laid out in 1870 on the farm Rooikoppies, and the settlement later expanded into seven white-owned farms. In 1933, the Buffelspoort Dam was built, allowing the local farmers to irrigate their crops. The farming community grew in the 1960s on the back of lucrative tobacco farming, but other diversified farming practices i.e. cattle, maize, chillies, paprika, soya, lusern and sunflower amongst the main groups was the main economic driver of the area. In the 1970s mining was introduced and grew to become the main industry in the region. As the application is for the expansion of existing TSFs within the mine area, the proposed raising of the walls of TSF 2 and TSF 2 Extension project is unlikely to change the character of the area.

In the assessment completed by Pistorius (2009) for the Tharisa Mine, he notes the following heritage resources that exist within the mine area: Stone walled settlements which date from the Late Iron Age; Historical structures such as farm houses with outbuildings, agricultural infrastructure and the van Rensburg School (now called the Retief Primary School); At least six graveyards as well as Objects with heritage significance such as outdated and discarded agricultural implements. All of the significant heritage resources identified by Pistorius (2009) have been extracted. None of these known sites is anticipated to be impacted by the proposed project.

Pistorius conducted an additional field assessment in 2014 for the proposed north-eastern WRD area which identified no heritage resources of significance. A subsequent heritage field assessment was conducted by Pelser (2018) for the proposed north-eastern WRD which included the Lapologang Village. Pelser (2018) identified a number of sites and structures, with only 2 (cemeteries) of any significance recorded. The others were the remains/ruins of fairly recent buildings and not deemed of any significance. Neither of the cemeteries identified by Pelser (2018) are likely to be impacted by the proposed project.

It is very unlikely that the proposed raising of the walls of TSF 2 and TSF 2 Extension project will impact negatively on any significant archaeological heritage resources. No further assessment of impact to archaeological heritage is recommended.

According to the South African Heritage Resources Information System (SAHRIS) Palaeosensitivity Map, the proposed area is underlain by sediments of zero palaeontological sensitivity. According to the extract from the Council of GeoScience Map for Rustenburg, the geology of the area consists of norite and norite-anthrocite which does not contain any fossil material.

7-12 SOCIO-ECONOMIC ENVIRONMENT

The mining sector is a big contributor to the economy of South Africa as well as the region. The area has a large concentration of mining activities, with the mining sector creating the biggest job opportunities. The proposed project to be implemented has many positive benefits and spinoffs both during the construction and operational phases. The benefits and positive impacts have a countrywide reach. The impacts of the positive benefits of the projects have long-term implications starting from the lowest unit, which is the individual, graduating to households and/or family unit, to the local level up to the country level.

The study area falls within Ward 32 of the Rustenburg Local Municipality and Ward 27 of the Madibeng Local Municipality, BDM, North West Province.

Ward 32 of the Rustenburg Local Municipality

According to the latest population census [Statistics South Africa (Stats SA), 2011], the total population for the ward is 14 017. The median age of the ward is 28 years of age, which is about 10% higher than that of North West (28). As can be seen from Table 34 below, the majority of Ward 32 population is aged between 20 and 29 (27.3%). The 80+ years of age population is relatively small (0.3%).

Table 34: Population by age category

Column	Rustenburg Ward 32		Bojanala		North West	
0-9	16.3%	2,175	20.2%	289,735	22%	736,650
10-19	11.1%	1,483	16.1%	230,766	18.5%	620,245
20-29	27.3%	3,639	20.2%	290,577	18%	602,157
30-39	20.7%	2,765	15.5%	223,059	13.7%	459,720
40-49	15.1%	2,017	12.3%	176,679	11.7%	392,045
50-59	6.6%	883	7.9%	113,328	7.8%	261,441
60-69	1.8%	241	4.3%	61,325	4.5%	150,360
70-79	0.7%	94	2.4%	34,455	2.6%	85,926
80+	0.3%	39	1.2%	16,656	1.2%	40,237

Source: Statistics South Africa, 2011

Table 35 below indicates that the majority (90.5%) of Ward 32 population is white, which is much higher than that of North West (89.8%) but less than that of Bojanala (91.4%). This number is followed by 8.4% white persons, which is higher than that of North West (7.3%) and Bojanala (7%).

Table 36 shows that the majority of persons within this ward speaks Setswana (28.4%) as their home language, which is about half the figure in Bojanala (54.3%) and North West (62.4%).

Table 35: Population group

Column	Rustenburg Ward 32		Bojanala		North West	
Black African	90.5%	12,686	91.4%	1,377,821	89.8%	3,152,063
Coloured	0.6%	84	0.7%	10,931	2%	71,409
Indian or Asian	0.3%	38	0.6%	8,576	0.6%	20,652
Other	0.3%	37	0.3%	4,904	0.3%	10,444
Unspecified	0%	0	0%	0	0%	0
White	8.4%	1,172	7%	105,274	7.3%	255,385

Source: Statistics South Africa, 2011

Table 36: Population by language most spoken at home

Column	Rustenburg Ward 32		Bojanala		North West	
Setswana	28.4%	3,975	54.3%	818,050	62.4%	2,191,230
Xitsonga	16.1%	2,258	7.9%	119,090	3.6%	127,146
IsiXhosa	15.6%	2,183	5.5%	82,701	5.4%	190,601
Sesotho	10.1%	1,420	4.5%	67,458	5.7%	201,153
Afrikaans	8.5%	1,194	7.1%	106,561	8.8%	309,867
Not applicable	4.4%	611	1.9%	29,219	1.5%	52,949
Other	17%	2,377	18.9%	284,426	12.5%	437,005

Source: Statistics South Africa, 2011

According to Stats SA (2011), Ward 32 has a total of 6 978 households. There is a total of 29.7% households in this ward that are classified as informal dwellings (shacks), a little higher than the rate in Bojanala (28.3%) and about 1.5 times the rate in North West (20.5%) Table 37.

Table 37: Households by type of dwelling

Column	Rustenburg Ward 32		Bojanala		North West	
House	45.3%	3,164	59%	309,104	67.3%	738,773
Shack	29.7%	2,074	28.3%	148,221	20.5%	224,975
Flat in backyard	16.9%	1,177	3.2%	16,944	2.7%	29,344
N/A	4.1%	284	3.9%	20,238	2.9%	31,798
Other	4%	281	5.6%	29,475	6.7%	73,330

Source: Statistics South Africa, 2011

From these households, Table 38 below shows that a large percentage (63.8%) are getting water from a regional or local service provider, which is about 90% of the rate in Bojanala (74.42%) and about 90% of the rate in North West (73.63%).

Table 38: Population by water source

Column	Rustenburg Ward 32		Bojanala		North West	

Service provider	63.8%	8,949	74.4%	1,121,813	73.6%	2,584,258
Borehole	20.9%	2,926	11.4%	171,129	15.5%	542,139
Tanker	10.5%	1,472	4.4%	65,819	4.4%	154,943
Other	2.6%	361	4.7%	70,570	3.3%	115,101

Source: Statistics South Africa, 2011

In terms of access to toilet facilities, as shown in Table 39 below, 73.7% of the population have access to flush or chemical toilets, which is nearly double the rate in Bojanala (38.04%) and about 1.5 times the rate in North West (46.16%). 6% of the population have no access to any toilets, which is about 25% higher than the rate in Bojanala (4.76%) and about the same as the rate in North West (6.03%).

Table 39: Population by toilet facilities

Column	Rustenburg Ward 32		Bojanala		North West	
Flush toilet	70.8%	4,943	37%	193,771	45.3%	497,447
Pit latrine without ventilation	12%	834	43.6%	228,631	33.8%	371,565
Pit latrine with ventilation (VIP)	6.1%	429	10.9%	56,929	11.2%	122,434
None	6%	416	4.8%	24,920	6%	66,262
Other	5.2%	360	3.8%	19,731	3.7%	40,510

Source: Statistics South Africa, 2011

Another variable to consider when looking at service delivery indicators is access to refuse disposal. Within Ward 32, 61.1% are getting refuse disposal from a local authority or private company, which is about 20% higher than the rate in Bojanala (50.33%), and about 25% higher than the rate in North West (48.09%) (Table 40 below).

Table 40: Population by refuse disposal

Column	Rustenburg Ward 32		Bojanala		North West	
Service provider (regularly)	57.8%	8,107	48.8%	735,817	46.7%	1,637,612
Own dump	27.8%	3,897	40%	602,524	42.3%	1,486,089
None	6.7%	943	6.1%	92,625	6.2%	217,765
Service provider (not regularly)	3.3%	462	1.5%	22,980	1.4%	50,422
Other	4.3%	608	3.6%	53,559	3.4%	118,064

Source: Statistics South Africa, 2011

In terms of economic indicators, one can see from Table 41 below that 87.5% of the population are employed are employed in the formal and informal sectors, which is more that the rate in Bojanala (84.5%), and North West (83.2%).

Table 41: Population by employment status

Column	Rustenburg Ward 32		Bojanala		North West	
Do not know	1.4%	90	2.3%	10,273	2.1%	18,290
In the formal sector	82.1%	5,409	71.1%	314,968	68.3%	585,824
In the informal sector	7.4%	485	13.3%	58,955	14.9%	128,017
Private household	9.2%	608	13.3%	58,875	14.7%	126,264
Unspecified	0%	0	0%	0	0%	0

Source: Statistics South Africa, 2011

The average annual income within Ward 32 is R57 500.00, which is nearly double the amount in Bojanala (R30 000.00) and North West (R30 000.00). When considering the monthly income of those that are employed (Table 42), the majority (31.8%) of the Ward 32 population earn between R40 000.00 – R75 000.00 per year.

Table 42: Annual household income

Column	Rustenburg Ward 32		Bojanala		North West	
R0	5.6%	363	7.6%	33,322	8.4%	70,643
Under R4800	1.8%	117	2.7%	11,655	3.3%	27,479
R5k - R10k	4.1%	269	5.5%	23,890	7.2%	60,597
R10k - R20k	11%	713	16.4%	71,687	20%	168,666
R20k - R40k	19.1%	1,243	21%	91,578	18.7%	157,273

Column	Rustenburg Ward 32		Bojanala		North West	
R40k - R75k	31.8%	2,074	22.1%	96,372	17.8%	150,385
R75k - R150k	13.8%	897	11.5%	50,121	11.4%	95,774
R150k - R300k	4.7%	307	5.8%	25,509	6.5%	54,668
R300k - R600k	1.4%	92	2.2%	9,431	2%	17,238
R600k - R1.2M	0.3%	17	0.6%	2,579	0.5%	4,578
R1.2M - R2.5M	0.1%	6	0.2%	904	0.2%	2,002
Over R2.5M	0.1%	7	0.2%	685	0.2%	1,572

Source: Statistics South Africa, 2011

Ward 27 of the Madibeng Local Municipality

According to the latest population census (Stats SA), 2011, the total population for the ward is 13 228. The median age of the ward is 29 years of age, which is about 10% higher than that of North West (27) and about 20% higher than the figure in North West (25). As can be seen from Table 43 below, the majority of Ward 27 population is aged between 20 and 29 (22.9%). The 80+ years of age population is relatively small (0.3%).

Table 43: Population by age category

Column	Madibeng Ward 27		Bojanala		North West	
0-9	16.5%	2,072	20.2%	289,735	22%	736,650
10-19	12.6%	1,589	16.1%	230,766	18.5%	620,245
20-29	22.9%	2,890	20.2%	290,577	18%	602,157
30-39	18.1%	2,274	15.5%	223,059	13.7%	459,720
40-49	16.4%	2,064	12.3%	176,679	11.7%	392,045
50-59	9.8%	1,240	7.9%	113,328	7.8%	261,441
60-69	2.5%	319	4.3%	61,325	4.5%	150,360
70-79	0.9%	115	2.4%	34,455	2.6%	85,926
80+	0.3%	36	1.2%	16,656	1.2%	40,237

Source: Statistics South Africa, 2011

Table 44 below indicates that the majority (74.3%) of Ward 27 population is Black persons, which is much less than that of North West (89.8%) but less than that of Bojanala (91.4%). This number is followed by 23.2% White persons, which is higher than that of North West (7.3%) and Bojanala (7%).

Table 44: Population group

Column	Madibeng Ward 27		Bojanala		North West	
Black African	74.3%	9,823	91.4%	1,377,821	89.8%	3,152,063
Coloured	1.3%	173	0.7%	10,931	2%	71,409
Indian or Asian	0.9%	115	0.6%	8,576	0.6%	20,652
Other	0.4%	49	0.3%	4,904	0.3%	10,444
Unspecified	0%	0	0%	0	0%	0
White	23.2%	3,068	7%	105,274	7.3%	255,385

Source: Statistics South Africa, 2011

Table 45 shows that the majority of persons within this ward speaks Afrikaans (22.9%) as their home language, which is about half the figure in Bojanala (36.9%) and North West (40.6%).

Table 45: Population by language most spoken at home

Column	Madibeng Ward 27		Bojanala		North West	
Afrikaans	22.9%	3,026	36.9%	818,050	40.6%	2,191,230
Setswana	17.2%	2,274	36.9%	818,050	40.6%	2,191,230
IsiXhosa	16.7%	2,204	3.7%	82,701	3.5%	190,601
Xitsonga	11.6%	1,538	5.4%	119,090	2.4%	127,146
Sepedi	10.7%	1,413	3.4%	75,539	1.6%	83,999
Sesotho	6.4%	850	3%	67,458	3.7%	201,153
Other	14.5%	1,924	10.7%	238,106	7.5%	405,955

Source: Statistics South Africa, 2011

According to Stats SA (2011), Ward 27 has a total of 4 850 households. There is a total of 46.8% households in this ward that are classified as informal dwellings (shacks), more than 1.5 times the rate in Bojanala (28.3%) and more than double the rate in North West (20.5%) (Table 46).

Table 46: Households by type of dwelling

Column	Madibeng Ward 27		Bojanala		North West	
Shack	46.8%	2,271	28.3%	148,221	20.5%	224,975
House	37.6%	1,825	59%	309,104	67.3%	738,773
Traditional	9%	438	0.8%	4,039	1.6%	17,529
Room or flatlet	2.1%	101	1%	4,963	0.7%	7,959
Other	4.5%	216	11%	57,655	9.9%	108,984

Source: Statistics South Africa, 2011

From these households, Table 47 below shows that a small percentage (46.1%) are getting water from a regional or local service provider, which is about three-fifths of the rate in Bojanala (74.42%) and about three-fifths of the rate in North West (73.63%).

Table 47: Population by water source

Column	Madibeng Ward 27		Bojanala		North West	
Service provider	46.1%	6,102	74.4%	1,121,813	73.6%	2,584,258
Tanker	24%	3,175	4.4%	65,819	4.4%	154,943
Borehole	20.6%	2,725	11.4%	171,129	15.5%	542,139
Other	4.1%	547	4.7%	70,570	3.3%	115,101

Source: Statistics South Africa, 2011

In terms of access to toilet facilities, as shown in Table 48 below, 33.9% of the population have access to flush or chemical toilets, which is about 90 percent of the rate in Bojanala (38.04%) and about three-quarters of the rate in North West (46.16%). 19.9% of the population have no access to any toilets, which more than double the rate in Bojanala (4.76%) and more than double the rate in North West (6.03%).

Table 48: Population by toilet facilities

Column	Madibeng Ward 27		Bojanala		North West	
Flush toilet	33.5%	1,625	37%	193,771	45.3%	497,447
Pit latrine without ventilation	30.2%	1,464	43.6%	228,631	33.8%	371,565
None	19.9%	965	4.8%	24,920	6%	66,262
Bucket latrine	9.1%	443	1%	5,254	1.1%	11,541
Other	7.3%	353	13.6%	71,406	13.8%	151,403

Source: Statistics South Africa, 2011

Another variable to consider when looking at service delivery indicators is access to refuse disposal. Within Ward 27, 34% are getting refuse disposal from a local authority or private company, which is about two-thirds of the rate in Bojanala (50.33%) and about two-thirds of the rate in North West (48.09%) (Table 49 below).

Table 49: Population by refuse disposal

Column	Madibeng Ward 27		Bojanala		North West	
Own dump	55.1%	7,290	40%	602,524	42.3%	1,486,089
Service provider (regularly)	30.9%	4,089	48.8%	735,817	46.7%	1,637,612
None	6.1%	800	6.1%	92,625	6.2%	217,765
Service provider (not regularly)	3%	401	1.5%	22,980	1.4%	50,422
Other	4.9%	647	3.6%	53,559	3.4%	118,064

Source: Statistics South Africa, 2011

In terms of economic indicators, one can see from Table 50 below that 54.5% of the population are employed are employed in the formal and informal sectors, which is more that the rate in Bojanala (42.42%), and North West (37.12%).

Table 50: Population by employment status

Column	Madibeng Ward 27		Bojanala		North West	
Do not know	1%	57	2.3%	10,273	2.1%	18,290
In the formal sector	61%	3,406	71.1%	314,968	68.3%	585,824
In the informal sector	28%	1,563	13.3%	58,955	14.9%	128,017
Private household	10%	557	13.3%	58,875	14.7%	126,264
Unspecified	0%	0	0%	0	0%	0

Source: Statistics South Africa, 2011

The average annual income within Ward 27 is R57 500.00, which is nearly double the amount in Bojanala (R30 000.00) and North West (R30 000.00). When considering the monthly income of those that are employed (Table 51), the majority (28.7%) of the Ward 27 population earn between R40 000.00 – R75 000.00 per year.

Table 51: Annual household income

Column	Madibeng Ward 27		Bojanala		North West	
R0	4.4%	245	7.6%	33,322	8.4%	70,643
Under R4800	1.6%	86	2.7%	11,655	3.3%	27,479
R5k - R10k	4.5%	250	5.5%	23,890	7.2%	60,597
R10k - R20k	10.8%	596	16.4%	71,687	20%	168,666
R20k - R40k	17.4%	962	21%	91,578	18.7%	157,273
R40k - R75k	28.7%	1,586	22.1%	96,372	17.8%	150,385
R75k - R150k	11.1%	614	11.5%	50,121	11.4%	95,774
R150k - R300k	9.6%	531	5.8%	25,509	6.5%	54,668
R300k - R600k	4.1%	224	2.2%	9,431	2%	17,238
R600k - R1.2M	0.6%	35	0.6%	2,579	0.5%	4,578
R1.2M - R2.5M	0.2%	9	0.2%	904	0.2%	2,002
Over R2.5M	0.3%	14	0.2%	685	0.2%	1,572
Unspecified	6.8%	375	4.3%	18,960	3.9%	32,494

Source: Statistics South Africa, 2011

7-12.1 Traffic

Traffic from mining projects has the potential to affect the capacity of existing road networks, as well as result in public road safety issues.

7-12.1.1 Road networks

A network of roads exists in and around Tharisa Mine. These include:

- N4;
- P2-4 (Old N4);
- D2565 – a gravel road in the far western section of the area;
- D1526/1566 - the main gravel road servicing the western part of the area;
- D1325 – Marikana Road;
- D108 – road between Marikana and Rustenburg;
- internal Lonmin tarred road to the north of the area, that runs east – west;
- D1270 – a gravel road linking the eastern part of the area with Mooinooi; and
- Various unnamed, private gravel/dirt roads.

Mine-related traffic is largely limited to internal mine roads. The mine does however make use of external roads for the transport of staff and PGMs for sale to third parties. The proposed raising of the walls project will not additionally affect negatively on existing roads.

SECTION 8: POTENTIAL IMPACTS AS A RESULT OF THE PROPOSED PROJECT

8-1 HISTORICAL IMPACTS AND MANAGEMENT MEASURES

Impacts which were identified as part of the existing mining activities and infrastructure are presented in previous approved EMPrs. The management measures identified within these EMPrs will still need to be complied with in terms of NEMA.

8-2 POTENTIAL IMPACTS AS A RESULT OF THE PROPOSED PROJECT

The following potential positive and negative impacts have been identified which have been considered. Typical impacts that have been investigated as part of this BA include:

CONSTRUCTION PHASE
• Change in ambient concentrations.
• Increase in ambient noise level.
• Change in landscape and related visual aspects.
• Contamination to ground- and surface water systems from oil, grease, and diesel spillages from construction vehicles.
• Storage of chemicals and building materials during construction of waste facility.
OPERATIONAL PHASE
• Change in ambient concentrations.
• Increase in ambient noise level.
• Change in landscape and related visual aspects.
• Contamination to baseflow and groundwater systems.
• Contamination to ground- and surface water sources.
• Increased surface run-off and erosion from the TSFs.
• Downstream sedimentation.
• Failing stormwater infrastructure.
• Establishment of alien plants on disturbed areas.
CLOSURE, REHABILITATION AND POST CLOSURE PHASE
• Change in ambient concentrations.
• Increase in ambient noise level.
• Change in landscape and related visual aspects.
• Contamination to ground- and surface water systems.
• Final landscaping and shaping.

Specialist baseline and impact assessments have been undertaken for these potential impacts.

SECTION 9: METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF ENVIRONMENTAL AND SOCIAL IMPACTS

The following methodology complies with Regulation 31(2)(l) of the NEMA, which has been utilised in the rating of significance of potential environmental and social impacts of the proposed project.

Extent

Rating	Description
Footprint/ site (1)	Extends only as far as the activity, such as footprint occurring within the total site area.
Local Area (2)	Affects the site.
Regional (3)	Affects the regions.
National (4)	Affects other provinces throughout the country.
International (5)	Affects other countries outside South Africa.

Intensity

Rating	Description
Very low (1)	Natural processes not affected
Low (2)	Natural processes slightly affected
Medium (3)	natural processes continue but in a modified manner A few times a month
Medium to High (4)	Natural processes are modified significantly
High (5)	Natural processes disturbed significantly so that they cease to occur (temporarily / permanently)

Duration

Rating	Description
Short-term- few days (1)	The impact will eventually not be felt due to the implementation of mitigation measures 0-5 years.
Short-term- few months (2)	The impact will eventually not be felt due to the implementation of mitigation measures 0-5 years.
Medium-term (3)	5 to 15 years from construction.
Long-term (4)	The impact will last for the entire operational phase but will end at the end of operational phase due to natural processes or human interventions.
Permanent (5)	Mitigation either by human or natural interventions/ processes will not occur in such a way or in such a time span that the impact can be considered transient.

Probability

Rating	Description
Improbable (1)	The probability of an impact occurring is none, either due to the design, historic circumstances, design, or experience.
Possible/ probable (2)	The probability is very low.
Likely (3)	The probability is low.
Highly probable/ possible (4)	It is most likely that the impact will occur.
Definite (5)	The impact will occur regardless of any prevention measures.

Determination of Significance without mitigation

Significance provides an indication of the importance of the impact in terms of both tangible and intangible characteristics. The significance of the impact without mitigation is the prime determinant of the nature and degree of mitigation required. Where the impact is positive, significance is noted as positive. Significance will be rated on the following scale:

SIGNIFICANCE = E+ I+ D + P

The minimum result should give a minimum value of 5, maximum of 25. This will determine whether the impact is negative or positive.

Rating	Description

No significance= <1	The impact is not substantial and does not require any mitigation action
Low = 1– 5	Low consequence, probably, minimal mitigation may be required.
Medium = 6 to 10	Medium consequence, probably, mitigation is advised/ preferred. The impact is of importance and is therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.
Medium to High = 11 to 15	Medium to High consequence, probably to very probable, mitigation is necessary. The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to acceptable levels.
High = 16 to 20	High consequence, probably / definite, mitigation is essential. The impact is of major importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential.

Mitigation

The impacts that are generated by the project activity can be minimised if measures are implemented to reduce the impacts. The mitigation measures ensure that the project activity considers the environment and the predicted impacts to minimise impacts and achieve sustainable development.

Determination of Significance with mitigation

Determination of significance with mitigation refers to the foreseeable significance of the impact after the successful implementation of the necessary mitigation measures. Significance with mitigation will be rated on the following scale:

Rating	Description
No significance:	The impact will be mitigated to the point where it is regarded as insubstantial.
Low	Low consequence, probably, the impact will be mitigated to the point where it is of limited importance.
Medium	Medium consequence, probably, the negative impact will remain of significance. However, taken within the overall context of the project, the persistent impact does not constitute a fatal flaw;
Medium to High	Medium to High consequence, probably to very probable, mitigation is necessary. The impact is of major importance but through the implementation of the correct mitigation measures, the negative impacts will be reduced to acceptable levels.
High	High consequence, probably/ definite, mitigation is essential. The impact is of major importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential.
Extreme	Very high consequence, definite, fatal flaw!

SECTION 10: POSSIBLE MITIGATION MEASURES THAT COULD BE APPLIED

The specialist studies assessed potential environmental and social impacts that may occur as a result of the proposed project. Appropriate mitigation and management measures to avoid and /or minimise the identified impacts associated with the project have been developed and have been included in the EMPr (Part B).

The mitigation hierarchy was applied throughout the BA Process. The mitigation hierarchy is an approach to mitigation planning and can be summarised into the following steps:

- Avoidance;
- Minimisation;
- Restoration; and
- Offsets.

In the Impact Assessment Phase, the findings and recommendations of the specialist studies have been used to develop the environmental and operational controls which are focused on impact minimisation and restoration (as part of mine rehabilitation and closure).

SECTION 11: MOTIVATION WHERE NO ALTERNATIVES WERE CONSIDERED

Refer to SECTION 5:.

SECTION 12: STATEMENT MOTIVATING THE PREFERRED SITE

Refer to Section 5-1.2.

SECTION 13: POSITIVE AND NEGATIVE IMPACTS OF THE PROPOSED ACTIVITY AND ALTERNATIVES

Design alternatives have not been considered for the proposed raising of the walls of TSF 2 and TSF 2 Extension, for the following reasons:

The TSF 2 and TSF 2 Extension are already existing, and the EA and WML were approved previously. The raised TSFs are designed as single paddock, full containment facilities. The existing infrastructure associated with the TSFs comprises the following:

- Single, full containment, engineered paddocks, constructed with selected waste rock from the open-pit mining operations.
- 1.5m high starter embankments along the upstream toe of the existing embankments, constructed from selected in-situ soils in compacted layers.
- Structural key-cuts along the upstream and downstream toe of the TSF embankments, replacing the in-situ soils with engineered rockfill.
- Penstock gravitation water decanting systems for TSF 2 and a decant tower for TSF 2 Extension.

The raised facilities will include the addition of:

- Embankments constructed using selected waste rock from open-pit mining operations, with a height of 5m for TSF 2, and 3m for TSF 2 Extension. The embankments will have a crest width of 15m with 1V:3H and 1V:2H downstream and upstream slopes, respectively.
- Geofabric separation layer (750 g/m^2) below the raised embankment at the tailings interface.
- Penstock outfall isolating valves.

13-1 CONSTRUCTION PHASE IMPACTS

This phase of the project involves all those activities related to preparation of the site, and subsequent construction/ establishment of the various project structures and associated surface infrastructure thereon, once prepared.

Potential impacts associated with construction, and general recommendations are summarised as follows:

- Large earthmoving vehicles will be on site during construction and staff must be made aware of the dangers involved with working near these large machines. Health and Safety procedures must be adhered to.
- The construction of the decanting systems on TSF 2 Extension will be undertaken by third party contractors while the mine will complete the construction of the embankments. It is expected these activities will be undertaken concurrently. A thorough traffic management plan should be developed to coordinate the interactions of construction vehicles and personnel from various construction teams.
- The dust generated by the works is to be monitored and if required dust suppression measures must be implemented.

13-1.1 Air Quality

Construction normally comprises a series of different operations including land clearing, topsoil removal, material loading and hauling, stockpiling, grading, bulldozing, compaction, etc (Table 52).

Table 52: Typical sources of fugitive particulate emission associated with construction

Impact	Source	Activity
Gases	Vehicle tailpipes	Transport and general construction activities
Dustfall, PM_{10} and $PM_{2.5}$		Levelling of area
		Wind erosion from open areas

Impact	Source	Activity
	Topsoil and waste rock stockpiles and TSF construction	Materials handling

Each of the operations in Table 52 has their own duration and potential for dust generation. It is anticipated that construction phase activities for this project will be limited. Hence, construction phase emissions were not quantified, and emissions are expected to be insignificant.

The construction activities were assessed qualitatively. Based on the significance methodology, the significance ratings for construction are expected to be medium without mitigation measures, and low with mitigation measures in place (Table 53).

13-1.1.1 Discussion, Significance Rating and Mitigation Measures

From an air quality perspective, although the dispersion modelling results indicated minor additional impacts from the proposed raising of the walls of TSF 2 and TSF 2 Extension project construction, the cumulative mine's operations result is non-compliance outside the MRA as well as at Mmaditlhokwa community and should therefore not be authorised until compliance outside the MRA is demonstrated, or the Mmaditlhokwa community is relocated.

Table 53: Significance rating for air quality impacts

POTENTIAL IMPACT:	AIR QUALITY IMPACTS
Significance rating of impacts (positive or negative):	Extent: Footprint/ Site - 1
	Intensity: Low - 2
	Duration: Short term few months - 2
	Probability: Possible/ probable - 2
	Without mitigation = E+ I + D + P= 1+2+2+2= 7 Medium (Negative) = 7
	With mitigation Medium (Negative)
Significance rating of impacts after mitigation:	Based on the significance methodology, the significance ratings for construction are expected to be medium with and without mitigation measures.
Risk of the impact and mitigation not being implemented	Impacts on human health and the environment.
Proposed mitigation:	• Air quality impacts during construction would be reduced through basic control measures such as limiting the speed of haul trucks; limit unnecessary travelling of vehicles on unpaved roads; and to apply water sprays on regularly travelled, unpaved sections. • When haul trucks need to use public roads, the vehicles need to be cleaned of all mud and the material transported must be covered to minimise windblown dust. • The access roads to the processing plants needs to be kept clean to minimise carry-through of mud on to public roads.

13-1.1.2 Cumulative Impacts

PM_{10} Ground level concentrations (GLCs) without mitigation in place exceed the daily NAAQS at 14 of the AQSRs, including the communities of Lapologang and Mmaditlhokwa, and the annual NAAQS at four (4) AQSRs. With mitigation in place the area of exceedance is reduced to fall mostly within the mining rights boundary with non-compliance of the daily and annual NAAQS only at Mmaditlhokwa.

Without mitigation measures in place, $PM_{2.5}$ GLCs exceed only the daily NAAQS outside the mining rights boundary and at Mmaditlhokwa. With mitigation in place, the impact area reduces to fall within the mining rights boundary with no exceedances at any of the AQSRs.

Dustfall rates only exceed the NDCR non-residential limit (1 200 mg/m²/day) and the residential limit (600 mg/m²/day) at the southeast of Mmaditlhokwa without mitigation and reduce to a small area in the southeast

of Mmaditlhokwa with mitigation in place. The Future Project operations will result in High significance without mitigation, reducing to Medium to High significance with mitigation measures in place.

13-1.2 Noise Impacts

The following activities will generate noise during the construction phase of the proposed raising of the walls of TSF 2 and TSF 2 Extension project and associated infrastructure:

- Earthmoving equipment;
- Hauling of material to and from the specific area; and
- Building activities during construction.

13-1.2.1 Discussion, Significance Rating and Mitigation Measures

Noise during preparation, excavation, installation, and assembly of proposed infrastructure and equipment, is expected to have no significant impact outside of the site, in cognisance of there being no proximal external receptors, and in cognisance of the existing noise levels and sources at the site.

The significance of construction phase noise impacts on nearby noise sensitive receptors (NSRs) is considered Medium to High without mitigation and medium with mitigation measures (Table 54).

Table 54: Significance rating for potential noise impacts

POTENTIAL IMPACT:	NOISE IMPACTS ON NSRS
Significance rating of impacts (positive or negative):	Extent: Local Area - 2
	Intensity: Medium - 3
	Duration: Short term few months - 2
	Probability: Highly probable/ possible - 4
	Without mitigation = E+ I + D + P= 2+3+2+4= 11 Medium – High (Negative) = 11
	With mitigation Medium (Negative)
Significance rating of impacts after mitigation:	The significance of construction phase noise impacts on nearby NSRs is considered Medium to High without mitigation and medium with mitigation
Risk of the impact and mitigation not being implemented	Increased noise levels.
Proposed mitigation:	• Routine monitoring of ambient noise and to comply with the relevant estimated background noise levels. • Construction staff need to be trained on noise control plan during health & safety briefings. • Low noise equipment, or methods of work is to be selected. • Avoid clustering of mobile plant near receptors and enforce rest periods for unavoidable maximum noise events. • Investigate use of alternatives to audible reversing alarms (such as broadband noise emitting models) or configure to maximise forward movements of mobile plant. • Regular inspection and maintenance of all equipment is to be established. • Avoid unnecessary equipment idling. • Where possible, limit activities to daytime working hours (6am – 6pm). • Establish community engagement and ensure all affected persons have been consulted with prior to the commencement of and during activities.

13-1.2.2 Cumulative Impacts

In addition to the proposed raising of the walls of TSF 2 and TSF 2 Extension project, Tharisa Mine are also proposing to operate two additional WRDs (i.e., West Above Ground (OG) WRD and East OG WRD) (Figure 49). The potential noise impacts due to the proposed WRDs was assessed in August 2022 (von Gruenewaldt, 2022). As these projects may coincide with the TSF 2 and TSF 2 Extension activities, cumulative noise

impacts were assessed for all proposed project activities (hereafter referred to as cumulative project operations).

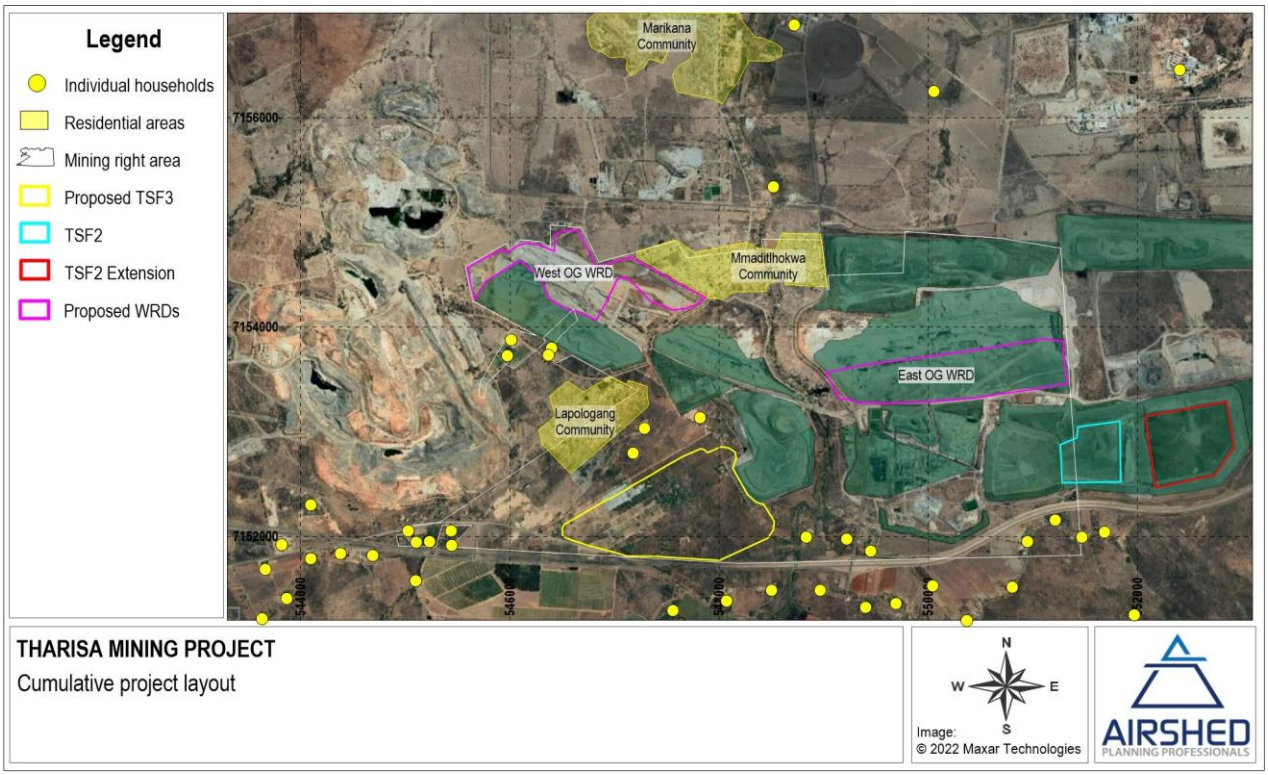

Figure 49: Layout of cumulative project operations

According to SANS 10103 (2008), the predicted increase in noise levels from the current baseline due to proposed project operations is expected to result in community reaction from the Mmaditlhokwa community.

13-1.3 Visual/ Aesthetic

The proposed raising of the walls of TSF 2 and TSF 2 Extension project occurs in a landscape rated primarily low in visual resource value. The project will not cause major changes to the existing mixed character of the landscape. In addition, due to the location of the proposed activities amongst existing and approved mine infrastructure, the visual absorption capacity of the landscape is high i.e. the existing and future landscape's ability to absorb physical changes caused by the project without transforming its visual character.

Visual impacts during the construction phase are not anticipated to be of significance, as the TSFs are located within a viewshed of existing mining activities and infrastructure. Activities associated with the proposed raising of the walls of TSF 2 and TSF 2 Extension project will be visible to varying degrees and from varying distances around the project site but always within a viewing envelope that contains other mining activities.

The TSFs to be lifted exist and will cause a minor loss and alteration to the baseline's key features and characteristics (i.e. existing and approved infrastructure). The pre-development landscape and views will be slightly affected, but in a minor way, through the introduction of elements considered characteristic when set within the attributes of the receiving landscape. Low visual and sense of place impacts would result.

13-1.3.1 Discussion, Significance Rating and Mitigation Measures

The impact on the visual environment during the construction phase is assessed to have a very low intensity and would occur over the short-term. The unmitigated impact would be localised and not extend beyond the assessed impact of the proposed raising of the walls of TSF 2 and TSF 2 Extension project.

POTENTIAL IMPACT: VISUAL IMPACT

Significance rating of impacts (positive or negative):	**Extent: Site - 1** **Intensity: Very low - 1** **Duration: Short term- 1** **Probability: Possible/ probable- 2** **Without mitigation = E+ I + D + P= 1+1+1+2= 5** **Low (Negative) = 5** **With mitigation** **Low (Negative)**
Significance rating of impacts after mitigation:	**The significance of this impact is regarded as low with and without mitigation measures.**
Risk of the impact and mitigation not being implemented	**Visual impacts from construction activities.**
Proposed mitigation:	• **Construction camp must be established in appropriate locations prior to the commencement of construction activities. The camp must be maintained in an orderly and tidy condition.** • **No littering at the site.** • **Sufficient containers must be made available to handle the amount of litter, wastes, rubbish, debris and builders' wastes generated on site. These containers must be emptied frequently to avoid rodents, insects or any other organisms accumulating on the site and becoming a health hazard to adjacent properties.** • **No waste is to remain at the construction site for more than two (2) weeks.** • **Waste must be separated into recyclable and non-recyclable waste, and shall be separated as follows:** ➢ **Hazardous waste – including (but not limited to) old oil and paint;** ➢ **General waste - including (but not limited to) construction rubble, reusable construction material.** ➢ **Recyclable waste shall preferably be deposited in separate bins. The contractor is advised that "Collect-a-Can" collect tins, including paint and chemical tins, and "Consol" collect glass for recycling.** • **Any illegal dumping of waste will not be tolerated. This action will result in a fine and if required further legal action will be taken. This aspect must be closely monitored and reported on.** • **Proof of legal dumping must be produced on request.** • **Bins must be clearly marked for ease of management. All refuse bins must have a lid secured so that animals cannot gain access.** • **Subcontractors must contain a clause to the effect that the disposal of all construction-generated refuse/ waste to an officially approved waste disposal site is the responsibility of the subcontractor in question and that the subcontractors are bound to the management activities stipulated in this EMPr.** • **Proof of this undertaking must be issued to the Environmental Control Officer (ECO). All solid and chemical wastes that are generated must be removed and disposed of at a licensed waste disposal site. The contractor is to provide proof of such to the ECO.** • **Chemical containers and packaging brought onto the site must be removed for disposal at a suitable site.** • **Good housekeeping to reduce dust from the mine, TSFs and in all working areas and access/haul roads associated with the project to an absolute minimum.**

13-1.3.2 Cumulative Impacts

The proposed project would have a low cumulative effect with respect to approved and existing mining activities.

13-1.4 Groundwater Systems and Surface Water

The inappropriate storage, management, and handling of waste, fuel, lubricants, and hazardous chemicals (e.g. paints, and solvents) during the construction period, could result in potentially negative impacts on soil and groundwater quality. Poorly managed construction vehicle maintenance procedures, and wash bays too, may impact negatively on groundwater quality. Contamination of this nature, associated with the construction

phase of a project of this type, would typically be hydrocarbon based (i.e. petrol, diesel, and oil leaks and spillages to bare soil surfaces).

Contaminants from spillages, or inadequate storage, may enter the soil, and subsequently the groundwater environment, through infiltration. Hydrocarbon spills are expected to be adsorbed to the soil, and thus are not expected to migrate significantly, and can thus generally be cleaned up by removal of the affected soil.

Large earthmoving vehicles will be on site during construction and staff must be made aware of the dangers involved with working near these large machines. Health and Safety procedures must be adhered to.

The construction of the decanting systems on TSF 2 Phase 2 (TSF 2 Extension) will be undertaken by third party contractors while the mine will complete the construction of the embankments. It is expected these activities will be undertaken concurrently. A thorough traffic management plan should be developed to coordinate the interactions of construction vehicles and personnel from various construction teams.

The dust generated by the works is to be monitored and if required dust suppression measures must be implemented.

13-1.4.1 Discussion, Significance Rating and Mitigation Measures

The following activities have the potential to result in contamination to groundwater systems and surface runoff:

- Contamination to ground- and surface water systems from oil, grease, and diesel spillages from construction vehicles.
- Storage of chemicals and building materials during construction of waste facilities.

POTENTIAL IMPACT:	CONTAMINATION TO GROUND- AND SURFACE WATER SYSTEMS
Significance rating of impacts (positive or negative):	Extent: Footprint/ site – 1
	Intensity: Medium – 3
	Duration: Medium Term - 3
	Probability: Highly probable/ possible – 4
	Without mitigation = E+ I + D + P= 1+3+3+4= 11 Medium to High (Negative) = 11
	With mitigation Negligible
Significance rating of impacts after mitigation:	The significance of this impact is regarded as Medium to High without mitigation measures. If the foreseen impacts are effectively mitigated to reduce the likelihood of groundwater and surface runoff contamination, the significance will be reduced to negligible.
Risk of the impact and mitigation not being implemented	Contamination to groundwater systems and surface runoff.
Proposed mitigation:	• Road compaction. • Vehicles must be checked for oil leaks and all maintenance must take place at a designated site with spillage sumps. • Spill-sorb or a similar product to be kept on site and used to clean up hydrocarbon spills in the event that they should occur. • All employees must be trained in cleaning up of spillage. • Polluted soil and used spill materials must be disposed of at a licenced facility. • All hazardous substances must be stored within a bunded area.

POTENTIAL IMPACT:	CONTAMINATION TO GROUNDWATER SYSTEMS
Significance rating of impacts (positive or negative):	Extent: Footprint/ site – 1
	Intensity: Medium – 3
	Duration: Medium Term - 3

	Probability: Highly probable/ possible – 4
	Without mitigation = E+ I + D + P= 1+3+3+4= 11 **Medium to High (Negative) = 11**
	With mitigation **Negligible**
Significance rating of impacts after mitigation:	**The significance of this impact is regarded as Medium to High without mitigation measures. If the foreseen impacts are effectively mitigated to reduce the likelihood of groundwater and surface runoff contamination, the significance will be reduced to negligible.**
Risk of the impact and mitigation not being implemented	**Contamination to groundwater systems.**
Proposed mitigation:	• **Implement best practise principals for storing hazardous substances and keep spill kits near working areas.** • **All hazardous substances must be stored within a bunded area.**

13-1.4.2 Cumulative Impact

The mine is situated in a developed mining region, with several mines situated downstream and agricultural activities upstream of the proposed development area. Based on the long-term hydrochemical analysis, the only constituent of concern is nitrate (ACS, 2022). Several factors contribute to higher concentrations of nitrate in groundwater including mining activities such as blasting as well as upstream agricultural and farming activities such as fertilisers, animal waste and plant decay which often contain high concentrations of nitrate.

13-2 OPERATIONAL PHASE IMPACTS

The operational phase of the proposed raising of the walls of TSF 2 and TSF 2 Extension project and associated infrastructure will be associated with the on-going mining operations at the mine, from the end of the construction period, up until the closure and decommissioning of the TSFs. The operational lifespan of TSF 2 and TSF 2 Extension will be 4.85 months and 5.44 months, respectively.

The operational phase of the project life cycle includes, *inter alia*, the following activities:

- Deposition of tailings; and
- Maintenance of the facility and related infrastructure (piping etc.).

All of the aforementioned operational activities have the potential to impact on one, or more, environmental parameters, as evaluated and described in the following sections.

13-2.1 Air Quality

The significance of air quality impacts due to the current operational activities are High without mitigation in place and Medium to High with mitigation measures (Table 55). The reason why impacts are Medium to High even with mitigation is because of exceedances of the NAAQSs at the Mmaditlhokwa Community and to the north-east of the mining rights boundary.

Table 55: Significance rating for air quality impacts

POTENTIAL IMPACT:	AIR QUALITY IMPACTS
Significance rating of impacts (positive or negative):	**Extent: Regional - 3**
	Intensity: High - 5
	Duration: Long term - 4
	Probability: Highly probable/ possible - 4
	Without mitigation = E+ I + D + P= 3+5+4+4= 16 **High (Negative) = 16**
	With mitigation **Medium - High (Negative)**

Significance rating of impacts after mitigation:	**The significance of air quality impacts due to the current operational activities are High without mitigation in place and Medium to High with mitigation measures.**
Risk of the impact and mitigation not being implemented	**Impacts on human health and the environment.**
Proposed mitigation:	• **Wind erosion is a complex process, including three different phases of particle entrainment, transport and deposition. It is primarily influenced by atmospheric conditions (e.g. wind, precipitation and temperature), soil properties (e.g. soil texture, composition and aggregation), land-surface characteristics (e.g. topography, moisture, aerodynamic roughness length, vegetation and non-erodible elements) and land-use practice (e.g. farming, grazing and mining) (Shao, 2008).** • **For wind erosion to occur, the wind speed needs to exceed a certain threshold, called the friction velocity. This relates to gravity and the inter-particle cohesion that resists removal (Shao, 2008). A threshold friction velocity (u*) for the TSFs was estimated at 7 m/s, with wind speeds exceeding 7 m/s occurring for 3.3% of the time. If this is the case, the potential for wind-blown dust from the existing TSFs is low. The hourly wind data does however not provide information on wind gusts, which could be twice as high as the hourly average wind speed (Goliger, et al., 2009). Since the dispersion model cannot account for sub-hourly wind speeds, the impacts from the Future Project (TSF3; TSF 2 and TSF 2 extension) are likely underestimated and therefore necessitates mitigation measures to be applied to the existing and Future Project TSFs.** • **As indicated, any binding properties would reduce the potential for wind erosion. One of the most effective measures of minimising wind erosion emissions from TSFs is re-vegetation. The control efficiency of vegetation is given as 40% for non-sustaining vegetation and 90% for re-vegetation. Secondary rehabilitation would up the control efficiency to 60% for non-sustaining vegetation (NPI, 2012).**

13-2.1.1 Cumulative Impacts

The significance rating is as assessed in Section 13-1.1.2.

13-2.2 Noise Impacts

The simulated noise impacts on nearby NSRs for project operations is low. Based on the significance methodology, the significance rating comes out medium for unmitigated and mitigated operations (Table 56). This is due to the long-term noise impacts that would continue for the life of operations and not the level of noise at NSRs. Noise impacts will cease when operations stop.

13-2.2.1 Discussion, Significance Rating and Mitigation Measures

Table 56: Significance rating for potential noise impacts

POTENTIAL IMPACT:	NOISE IMPACTS ON NSRS
Significance rating of impacts (positive or negative):	**Extent: Footprint/ site – 1**
	Intensity: Low - 2
	Duration: Long term - 4
	Probability: Probable/ possible - 2
	Without mitigation = E+ I + D + P= 1+2+4+2 = 9 **Medium (Negative) = 9**
	With mitigation **Medium (Negative)**
Significance rating of impacts after mitigation:	**The significance of construction phase noise impacts on nearby NSRs is considered medium with and without mitigation measures.**
Risk of the impact and mitigation not being implemented	**Increased noise levels.**
Proposed mitigation:	• **Train operational staff on noise control plan during health & safety briefings.** • **Regular inspection and maintenance of all equipment.** • **A noise complaints register must be kept.**

	• **If complaints are received, noise sampling should be undertaken at the NSRs and source of noise should be investigated.**

13-2.2.2 Cumulative Impacts

The significance rating is as assessed in Section 13-1.2.2.

13-2.3 Visual/ Aesthetic

Operational activities include tailings material being transferred to the TSF sites and light security instillations and lights associated with the movement of vehicles at night.

13-2.3.1 Discussion, Significance Rating and Mitigation Measures

The impact on the visual environment during the operational phase is assessed to have a very low intensity and would occur over the short-term. The unmitigated impact would be localised and not extend beyond the assessed impact of approved or existing TSF facilities and would not affect neighbours, resulting in a low significance (i.e. low consequence with minimal mitigation required).

POTENTIAL IMPACT: VISUAL IMPACT	
Significance rating of impacts (positive or negative):	**Extent: Site - 1**
	Intensity: Very low - 1
	Duration: Short term- 1
	Probability: Possible/ probable- 2
	Without mitigation = E+ I + D + P= 1+1+1+2= 5 Low (Negative) = 5
	With mitigation Low (Negative)
Significance rating of impacts after mitigation:	**The significance of this impact is regarded as low with and without mitigation measures.**
Risk of the impact and mitigation not being implemented	**Visual impacts from the operation of the proposed raised TSF 2 and TSF 2 Extension.**
Proposed mitigation:	• **Continuous and ongoing rehabilitation of the rising side walls with grasses and other vegetation as per the approved rehabilitation plan.** • **Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the TSFs, i.e. lights (spotlights) are pointed away from sensitive viewing areas specifically south and east of the sites.** • **Avoid high pole top security lighting along the site's periphery and use only lights activated on illegal entry to the site.** • **Minimise the number of light fixtures to the bare minimum, including security lighting.**

13-2.3.2 Cumulative Impacts

The significance rating is as assessed in Section 13-1.3.2.

13-2.4 Groundwater Systems and Surface Water Pollution

Impact on groundwater during the operational phase, from general maintenance activities and management of general waste produced by personnel, is anticipated to be negligible. The most potentially significant impact would be expected from seepage through TSF 2 and TSF 2 Extension turf, or a failure of the turf resulting in infiltration to groundwater.

13-2.4.1 Discussion, Significance Rating and Mitigation Measures

The risks associated with the operation of the facilities are as follows:

- The uncontrolled release of seepage.
- The supernatant water originating from the hydraulic deposition process will form a pool around the decant towers.
- Surface water runoff from facilities to Sterkstroom and Elandsdriftspruit tributary.
- Nitrate mass migration from planned new facilities downstream along preferential groundwater pathways.

The following are concerns related to operating the decant system:

- During rainfall periods, the planks of the catwalks used to access the tower could become slick, increasing the risk that operators could slip and fall into the pond. Emergency measures (e.g. life preservers, ropes, etc.) should be available to allow team members to aid those who have fallen off the catwalk. It is suggested that sufficient signage, warning people of the dangers, be provided.
- The planks of the catwalks will decay over time. These planks should be maintained to prevent any injuries due to a lack of firm footing and to maintain access to the decant towers at all times.
- It is plausible that the flow of water entering the decant system can be such that extracting individuals who have fallen into the decant system will either be extremely difficult or impossible, leading to the possible loss of life from drowning. A cage or grid should be placed over the penstock rings after the necessary number of rings have been added or removed to prevent individuals from slipping and falling into the inlet.

POTENTIAL IMPACT:	CONTAMINATION TO BASEFLOW AND GROUNDWATER SYSTEMS
Significance rating of impacts (positive or negative):	Extent: Site - 1
	Intensity: Medium – 3
	Duration: Long Term - 4
	Probability: Probable/ possible – 2
	Without mitigation = E+ I + D + P= 1+3+4+2= 10 Medium (Negative) =10
	With mitigation Low (Negative)
Significance rating of impacts after mitigation:	The significance of this impact is regarded as medium without mitigation measures. If the foreseen impacts are effectively mitigated to reduce the likelihood of baseflow and groundwater systems contamination, the significance will be low.
Risk of the impact and mitigation not being implemented	Contamination to baseflow and groundwater systems.
Proposed mitigation:	• A tertiary drainage which is a tributary of the Elandsdrifspruit Stream to the east, could receive runoff from the TSF 2 Extension. Current toe paddocks and solution trench installed does mitigate migration towards the east. A groundwater monitoring borehole should be developed adjacent to this drainage to verify whether there is any shallow seepage to this drainage. If seepage is detected, a combination of a deep cut off drain, seepage capturing wells and bioremediation should be developed. • The Sterkstroom Stream is located beyond the local TSFs catchments. Existing storm water containment structures would contain runoff to the Sterkstroom Stream.

POTENTIAL IMPACT:	CONTAMINATION TO GROUNDWATER AND SURFACE WATER (STERKSTROOM & ELANDSDRIFTSPRUIT TRIBUTARY) SOURCES
Significance rating of impacts (positive or negative):	Extent: Regional - 3
	Intensity: Medium – 3
	Duration: Medium Term - 3
	Probability: Highly probable/ possible – 4
	Without mitigation = E+ I + D + P= 3+3+3+4= 13 Medium to High (Negative) =13
	With mitigation Low (Negative)

Significance rating of impacts after mitigation:	**The significance of this impact is regarded as Medium to High without mitigation measures. If the foreseen impacts are effectively mitigated to reduce the likelihood of groundwater and surface water contamination, the significance will be low.**
Risk of the impact and mitigation not being implemented	**Contamination to groundwater and surface water (Sterkstroom and Elandsdriftspruit tributary) sources.**
Proposed mitigation:	• **Seepage from the TSFs is effectively captured by the East Pit and associated mine dewatering.** • **Water quality monitoring and seepage capturing from toe trenches and boreholes.** • **Natural decay of nitrates due to de-nitrification (conservative half-life calculated during previous assessments) will also limit impacts.**

13-2.4.2 Cumulative Impact

Cumulative impact as a result of nitrate mass migration from existing facilities (TSF 2, TSF Extension, and West WRD1) towards the Sterkstroom and Elandsdriftspruit tributary, and along preferential groundwater pathways towards boreholes north and northwest, exists.

In order to mitigate the cumulative impacts, the following measures should be implemented:

- Seepage from the TSFs is effectively captured by the East Pit and associated mine dewatering.
- Water quality monitoring and seepage capturing from toe trenches and boreholes.
- Ensure proper environmental management principles are followed, and no additional water supply boreholes are added within the plume area. West and East open pits dewatering cone acts as a sink and ensures mass migration towards open pits.
- Natural decay of nitrates due to de-nitrification (conservative half-life calculated during previous assessments) will also limit impacts.

13-2.5 Freshwater Ecology

It should be noted that TSF 2 and TSF 2 Extension already exist, therefore, only operational phase is applicable for the self-raising wall of the TSF 2 and TSF 2 Extension. The operational phase of the project has four identified potential impact to the watercourse. These impacts were rated as Low pre-mitigation and post-mitigation. These were all lowered provided the Stormwater Management Plan (SWMP) is updated to accommodate the increased capacity and height and accommodate all proposed activities.

13-2.5.1 Discussion, Significance Rating and Mitigation Measures

The various anticipated impacts for the different aspects and activities associated with the proposed project are detailed below.

Flow Dynamics	Increased surface run-off and erosion and erosion from the TSFs	Habitat destruction
		Removal of fertile soil for riparian vegetation
		Bank instability
	Downstream sedimentation	Covering of habitat
		Downstream siltation
Water quality	Failing of stormwater infrastructure	Increased litter and refuse within the watercourse
		Input of salts and metals
		Soil and water contamination
Anthropogenic disturbance	Establishment of alien plants on disturbed areas	Degradation of watercourse flora and fauna through the spread of alien and invasive species

POTENTIAL IMPACT:	**INCREASED SURFACE RUN-OFF AND EROSION FROM THE TSFS**
Significance rating of impacts (positive or negative):	**Extent: Site - 1**
	Intensity: Very Low – 1
	Duration: Short Term - 1
	Probability: Probable/ possible – 2
	Without mitigation = E+ I + D + P= 1+1+1+2= 5

	Low (Negative) = 5
	With mitigation **Low (Negative)**
Significance rating of impacts after mitigation:	**The significance of this impact is regarded as low with and without mitigation measures.**
Risk of the impact and mitigation not being implemented	**Increased surface run-off and erosion from the TSFs, downstream sedimentation, failing stormwater infrastructure, establishment of alien plants on disturbed areas.**
Proposed mitigation:	• **Access to the site must be from the existing point of entry along the provincial roads;** • **It is imperative that a budget be allocated for the planned rehabilitation efforts and likewise that it be approved by the relevant authorities.** • **Stay within the proposed areas and avoid extending earthmoving activities outside of these areas.** • **Water leaving the site should do so via appropriately engineered stormwater structures that serve to spread and dissipate flows to prevent the erosion of downstream watercourses.** • **Where possible, existing access routes and walking paths must be made use of, and new routes limited.** • **The contractors used for the New TSF 3 should have spill kits available prior to construction to ensure that any fuel, oil or hazardous substance spills are cleaned-up and discarded correctly.** • **All material used are to be restricted to within the existing facility.** • **All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping".** • **Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems.** • **Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.**

13-2.5.2 Cumulative Impact

A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged. Large scale cumulative impacts were attributed to general land use in the study area wherein open cast mining, agricultural and urban developments were cumulatively impacting on the ecological condition of the waterbody. The results in the Macroinvertebrate Response Assessment Index (MIRAI) in the Sterkstroom indicate a largely modified (Class D) ecological condition. Flow and habitat modification were determined to be the primary drivers of the modified macroinvertebrate community. Several expected taxa which are sensitive to flow and water quality changes were noted to be absent.

13-3 CLOSURE, REHABILITATION AND POST CLOSURE IMPACTS

The risks associated with the TSFs during closure and post-closure are not as extreme as those during the construction and operation. However, for closure, some design work is required to design the stormwater management system and to mitigate against soil erosion, as this can result in extensive damage downstream if not controlled.

Key risks to closure are:

- The time taken to clad the top surface area is dependent on the rate of consolidation of the residue. This may result in a lengthy closure period.
- It will be difficult to predict the long-term effectiveness of the re-vegetation of side slopes and crest or the TSFs.

The rehabilitation, closure and aftercare plan are based on the assumption that the objective of the process is to rehabilitate, as far as possible, the area disturbed during the establishment and operation phases of the project.

Because of the visibility of the TSFs from the N4 highway to the south and south-east of the site, the rehabilitation of the southern and eastern raised embankments of the TSFs is to be undertaken as soon as the construction of the respective section of the embankment is complete.

The rehabilitation involves the placement of a 500 mm soil layer over the downstream face of the waste rock embankment. The soil is sourced from stockpiles created during the removal of material beneath the footprint of the facility during construction. This material contains plant seeds that will germinate and vegetate the side slopes. The rehabilitation of the remainder of the side slopes should be undertaken as soon as possible during the construction and early operational phase. The advantages of rehabilitating the embankments during operation are:

- The cost incurred is absorbed as operating costs.
- Reduced environmental impact due to the separation of rainfall run-off from mine waste.
- Assist in dust suppression.
- Improve the overall visual impact of the TSFs.

At the cessation of operation of the TSFs, the focus will be to cover and vegetate the top surface of the facilities, the decommissioning facilities associated with the TSFs and the construction of stormwater control measures if required, such as an overflow spillway. Specific activities that will be carried out will include:

- The dismantling and removal of pumps, piping and valves associated with the deposition of tailings material and the decanting of supernatant water.
- Rehabilitation of any remaining unrehabilitated downstream slopes.
- Sealing/closing off the penstock tower intakes.
- The top surface of the facility should be shaped such that a low area will be created in the centre of the facility. The area will function as a collection point for rainfall and be developed into a wetland. This approach will be substituted with the creation of compartments along the entire beach profile. The compartment will offer localised storage, preventing the formation of a large waterbody on the surface of the facility after closure. The increased surface area of the accumulated water will increase the rate of evaporation as opposed to that of a single runoff collection point and will function as an effective means of removing water from the facility as the annual evaporation exceeds that of the annual rainfall depths. The compartments will be constructed using tailings material from the beach area with adequate storage to contain the 1 in 10 000 year 24-hour storm event.
- The final cover to the top surface of the TSFs will be constructed by importing topsoil from the topsoil stockpiles and covering the top surfaces with a minimum depth of topsoil of 0.3m.
- Minor earthworks.

Upon completion of the closure and rehabilitation measures, an aftercare programme is to be implemented to ensure that the closure measures are performed adequately and that no further closure liabilities arise. The aftercare period is normally not less than 5 years, however, may extend into decades depending on the physical and chemical characteristics of the mine residue material and TSFs design. In the case of a platinum residue, a minimum period of 5 years of aftercare has been proposed. The typical aftercare activities for the TSFs include the following:

- Monitoring of the closure measures to ascertain whether they are performing adequately, failing which some remediation work would be required e.g. successful establishment of top surface vegetation, erosion control etc.
- Monitoring the drop in the phreatic surface within each paddock and the quality and quantity of seepage water exiting from the toe drains.
- Surface and groundwater quality will be monitored regularly for a period to be agreed upon with the relevant authorities.
- Remediation of the seepage water collected in the sump, if required.
- Repairing areas that have degraded since closure.

- Monitoring of the closure measures to ascertain whether they are performing adequately, failing which some remediation work would be required e.g. successful establishment of top surface vegetation, erosion control etc.

13-3.1 Air Quality

The likely activities to result in dust impacts during closure will be similar to construction. For decommissioning and rehabilitation, the most likely sources contributing to impacts are:

- Infrastructure removal/ demolition;
- Topsoil recovered from stockpiles for rehabilitation and revegetation of surroundings; and
- Vehicle entrainment on unpaved road surfaces during rehabilitation – once that is done, vehicle activity associated with the operations should cease.

13-3.1.1 Discussion, Significance Rating and Mitigation Measures

Dust impacts during closure will be similar to construction, resulting in a medium significance before the implementation of mitigations measures, and low with mitigation measures in place. Mitigation measures as prescribed during the construction phase must be implemented.

Table 57: Significance rating for air quality impacts

POTENTIAL IMPACT:	AIR QUALITY IMPACTS
Significance rating of impacts (positive or negative):	Extent: Footprint/ Site - 1
	Intensity: Low - 2
	Duration: Short term few months - 2
	Probability: Possible/ probable - 2
	Without mitigation = E+ I + D + P= 1+2+2+2= 7 Medium (Negative) = 7
	With mitigation Medium (Negative)
Significance rating of impacts after mitigation:	The likely activities to result in dust impacts during decommissioning and rehabilitation will be similar to construction, resulting in a Medium significance with and without mitigation measures.
Risk of the impact and mitigation not being implemented	Impacts on human health and the environment.
Proposed mitigation:	• Air quality impacts during operation would be reduced through basic control measures such as limiting the speed of haul trucks; limit unnecessary travelling of vehicles on unpaved roads; and to apply water sprays on regularly travelled, unpaved sections. • When haul trucks need to use public roads, the vehicles need to be cleaned of all mud and the material transported must be covered to minimise windblown dust. • The access roads to the processing plants needs to be kept clean to minimise carry-through of mud on to public roads.

13-3.1.2 Cumulative Impacts

The significance rating is as assessed in Section 13-1.1.2.

13-3.2 Noise Impacts

The removal/ demolition and transportation of infrastructure material will generate noise during the closure and rehabilitation phase:

13-3.2.1 Discussion, Significance Rating and Mitigation Measures

The significance of closure and decommissioning phase noise impacts on nearby NSRs is considered Medium to High without mitigation and medium with mitigation measures (Table 58).

Table 58: Significance rating for potential noise impacts

POTENTIAL IMPACT:	NOISE IMPACTS ON NSRS
Significance rating of impacts (positive or negative):	Extent: Local Area - 2
	Intensity: Medium - 3
	Duration: Short term few months - 2
	Probability: Highly probable/ possible - 4
	Without mitigation = E+ I + D + P= 2+3+2+4= 11 Medium – High (Negative) = 11
	With mitigation Medium (Negative)
Significance rating of impacts after mitigation:	The significance of closure and decommissioning phase noise impacts on nearby NSRs is considered Medium to High without mitigation and medium with mitigation measures.
Risk of the impact and mitigation not being implemented	Increased noise levels.
Proposed mitigation:	• Routine monitoring of ambient noise and to comply with the relevant estimated background noise levels. • Closure staff need to be trained on noise control plan during health & safety briefings. • Low noise' equipment, or methods of work is to be selected. • Avoid clustering of mobile plant near receptors and enforce rest periods for unavoidable maximum noise events. • Investigate use of alternatives to audible reversing alarms (such as broadband noise emitting models) or configure to maximise forward movements of mobile plant. • Regular inspection and maintenance of all equipment is to be established. • Avoid unnecessary equipment idling. • Where possible, limit activities to daytime working hours (6am – 6pm). • Establish community engagement and ensure all affected persons have been consulted with prior to the commencement of and during activities.

13-3.2.2 Cumulative Impacts

The significance rating is as assessed in Section 13-1.2.2.

13-3.3 Visual/ Aesthetic

Decommissioning and closure activities include the rehabilitation of the TSFs, specifically the side walls.

13-3.3.1 Discussion, Significance Rating and Mitigation Measures

The impact on the visual environment during this phase is assessed to have a very low intensity and would occur over the short-term. The unmitigated impact would be localised and not extend beyond the assessed impact of the TSFs and would not affect neighbours resulting in a low significance (i.e. low consequence with minimal mitigation required). Mitigation measures cannot significantly reduce the already predicted low visual impact of the proposed raised TSF 2 and TSF 2 Extension, however, mitigation, including good housekeeping, should be rigorously applied and maintained throughout the life of the mine and during closure to ensure the long-term reduction of potential residual impacts and feasibility of rehabilitation efforts.

POTENTIAL IMPACT: VISUAL IMPACT	
Significance rating of impacts (positive or negative):	Extent: Site - 1
	Intensity: Very low - 1
	Duration: Short term- 1
	Probability: Possible/ probable- 2
	Without mitigation = E+ I + D + P= 1+1+1+2= 5 Low (Negative) = 5
	With mitigation Low (Negative)
Significance rating of impacts after mitigation:	The significance of this impact is regarded as low with and without mitigation measures.

Risk of the impact and mitigation not being implemented	**Visual impacts from the closure of the proposed raised TSF 2 and TSF 2 Extension.**
Proposed mitigation:	• **Mitigation measures as prescribed during the construction phase must be implemented.**

13-3.3.2 Cumulative Impacts

The significance rating is as assessed in Section 13-1.3.2.

13-3.4 Groundwater and Surface Water Contamination

The risks associated with the TSFs during closure and post-closure are not as extreme as those during construction and operation. However, for closure, some design work is required to accommodate the stormwater management system and to mitigate against soil erosion, as this can result in extensive damage downstream, if not controlled.

Key risks to closure are:

- The time taken to clad the top surface area is dependent on the rate of consolidation of the residue. This may result in a lengthy closure period.
- It will be difficult to predict the long-term effectiveness of the re-vegetation of side slopes and crest or the TSFs.
- There is potential for nitrate mass transport and seepage from the proposed raised TSF 2 and TSF 2 Extension on downstream receptors along preferential groundwater pathways.

13-3.4.1 Discussion, Significance Rating and Mitigation Measures

During the post-operational phase, nitrate would decay below SANS 241 within 5 - 10 years post facility closure. The pit rewatering and seepage water quality should be a useful water resource for agricultural and/or domestic supply in the post-closure phase. The TSFs and partially backfilled open pits could be used to store and supply water to increase the water supply yield of the Sterkstroom River Catchment. This could leave a long-term future sustainable legacy with specific reference to management of potential climate change impacts.

POTENTIAL IMPACT: CONTAMINATION TO GROUNDWATER AND SURFACE WATER (STERKSTROOM AND ELANDSDRIFTSPRUIT TRIBUTARY) SYSTEMS	
Significance rating of impacts (positive or negative):	**Extent: Local Area - 2**
	Intensity: Medium - 3
	Duration: Medium Term - 3
	Probability: Highly probable/ possible - 4
	Without mitigation = E+ I + D + P= 2+3+3+4= 12 **Medium to High = 12**
	With mitigation **Negligible**
Significance rating of impacts after mitigation:	**The significance of this impact is regarded as Medium to High without mitigation measures. If the foreseen impacts are effectively mitigated to reduce the likelihood of ground and surface water contamination, the significance will be negligible.**
Risk of the impact and mitigation not being implemented	**Groundwater and surface water contamination.**
Proposed mitigation:	• **The backfilled East Pit and future decanting (>50-year post-closure) would form a permanent sink to capture seepage from the TSFs.** • **Rehabilitation of facilities (capping and vegetation) to limit rainfall recharge.** • **Water quality monitoring to verify nitrate decay for 5 years post-operational.** • **Natural decay of nitrates due to de-nitrification (conservative half-life calculated during previous assessments) will also limit impacts from 2-5 years post-closure.**

	• **Seepage water quality should be useful for use as a water resource for agricultural and/or domestic supply in the post-closure phase. The TSFs and partially backfilled open pits could be used to store and supply water to increase the water supply yield of the Sterkstroom River Catchment where the East Pit decant would take place.**

13-3.4.2 Cumulative Impacts

The significance rating is as assessed in Section 13-2.4.2.

13-3.5 Freshwater Ecology

13-3.5.1 Discussion, Significance Rating and Mitigation Measures

The various anticipated impacts for the different aspects and activities associated with the proposed project are detailed below.

Final landscaping and shaping	Operation of equipment and machinery
	Removal of waste materials
	Final contouring
	Replanting of removed vegetation

POTENTIAL IMPACT:	**FINAL LANDSCAPING AND SHAPING**
Significance rating of impacts (positive or negative):	**Extent: Site - 1**
	Intensity: Very Low – 1
	Duration: Short Term - 1
	Probability: Probable/ possible – 2
	Without mitigation = E+ I + D + P= 1+1+1+2= 5 Low (Negative) =5
	With mitigation Low (Negative)
Significance rating of impacts after mitigation:	**The significance of this impact is regarded as low with and without mitigation measures.**
Risk of the impact and mitigation not being implemented	**Failure in landscaping and shaping.**
Proposed mitigation:	• **Access to the site must be from the existing point of entry along the provincial roads;** • **It is imperative that a budget be allocated for the planned rehabilitation efforts and likewise that it be approved by the relevant authorities.** • **Stay within the proposed areas and avoid extending earthmoving activities outside of these areas.** • **Water leaving the site should do so via appropriately engineered stormwater structures that serve to spread and dissipate flows to prevent the erosion of downstream watercourses.** • **Where possible, existing access routes and walking paths must be made use of, and new routes limited.** • **All material used are to be restricted to within the existing facility.** • **All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping".** • **Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems.** • **Landscape and rehabilitate all disturbed areas.** • **Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.**

13-3.5.2 Cumulative Impact

The significance rating is as assessed in Section 13-2.5.2.

SECTION 14: POSSIBLE MITIGATION MEASURES THAT COULD BE APPLIED AND THE LEVEL OF RISK

A list of the potential impacts identified by MC (SECTION 13:) and/or raised by I&APs, as well as the possible management and mitigation measures, is provided in Table 22. The level of residual risk after management or mitigation, associated with the proposed project, is also estimated. There are no issues raised by the I&APs or alternatives at the moment.

SECTION 15: MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED

Refer to Section 5-1.2.

SECTION 16: STATEMENT MOTIVATION THE PREFERRED SITE

Refer to Section 5-1.2.

SECTION 17: FULL DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY, ASSESS AND RANK THE IMPACTS AND RISKS THE ACTIVITY WILL IMPOSE ON THE PREFERRED SITE (IN RESPECT OF THE FINAL SITE ALYOUT) THROUGH THE LIFE OF THE ACTIVITY

17-1 DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY IMPACTS

Biophysical and socio-economic impacts associated with the proposed project were identified through site visits undertaken by MC and specialists, specialist studies and input from I&APs during the PPP.

17-2 DESCRIPTION OF THE PROCESS UNDERTAKEN TO ASSESS AND RANK THE IMPACTS AND RISKS

A description of the assessment methodology used to assess the severity of identified impacts (including the nature of impacts and the degree to which impacts may cause irreplaceable loss of resources), the extent of the impacts, the duration and reversibility of impacts, the probability of the impact occurring, and the degree to which the impacts can be mitigated.

A description of the methodology, which complies with Regulation 31(2) (l) of the NEMA, which has been utilised in the rating of significance of potential environmental and social impacts of the proposed raising of the walls of TSF 2 and TSF 2 Extension project is provided in SECTION 9:.

The assessment methodology was used to assess the extent, intensity, duration and the probability of the impacts. The assessment methodology also provided with the determination of significance with and without mitigation measures.

17-3 DESCRIPTION OF THE IMPACTS AND RISKS IDENTIFIED DURING THE ENVIRONMENTAL ASSESSMENT PROCESS

A description of the environmental impacts and risks identified during the EIA is included in SECTION 13: above.

17-4 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

The assessment of the significance of potential impacts, including the extent to which impacts can be avoided or mitigated, is included in SECTION 13: above.

Table 59: Assessment of each identified potentially significant impact and risk

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance if mitigated
CONSTRUCTION PHASE						
• Establishment of contractor laydown area (s), and project service facilities. • Site preparation (levelling, compaction, drainage, layout, etc.) and establishment of civil structures for TSF 2 and TSF 2 Extension. • Geomembrane installation. • Installation of tailings and water conveyance infrastructure (pipelines, pumps, etc., and their related civil, mechanical, and electrical works). • Commissioning. • Transport and general construction activities. • Levelling of area. • Wind erosion from open areas. • Materials handling.	• Change in ambient concentrations.	Air quality	Construction	**Medium (Negative)**	• Air quality impacts during construction would be reduced through basic control measures such as limiting the speed of haul trucks; limit unnecessary travelling of vehicles on unpaved roads; and to apply water sprays on regularly travelled, unpaved sections. • When haul trucks need to use public roads, the vehicles need to be cleaned of all mud and the material transported must be covered to minimise windblown dust. • The access roads to the processing plants needs to be kept clean to minimise carry-through of mud on to public roads.	**Medium (Negative)**
• Earthmoving equipment at the footprint area. • Hauling of material to and from the specific area. • Building activities during construction.	• Increase in ambient noise level.	Noise	Construction	**Medium to High (Negative)**	• Routine monitoring of ambient noise and to comply with the relevant estimated background noise levels. • Construction staff need to be trained on noise control plan during health & safety briefings. • Low noise equipment or methods of work is to be selected. • Avoid clustering of mobile plant near receptors and enforce rest periods for unavoidable maximum noise events. • Investigate use of alternatives to audible reversing alarms (such as broadband noise emitting models) or configure to maximise forward movements of mobile plant. • Regular inspection and maintenance of all equipment is to be established. • Avoid unnecessary equipment idling. • Where possible, limit activities to daytime working hours (6am – 6pm). • Establish community engagement and ensure all affected persons have been consulted with prior to the commencement of and during activities.	**Medium (Negative)**
• Establishment of contractor laydown area (s), and project service facilities. • Site preparation (levelling, compaction, drainage, layout, etc.) and establishment of civil structures for TSF 2 and TSF 2 Extension. • Geomembrane installation. • Installation of tailings and water conveyance infrastructure (pipelines, pumps, etc., and their related civil, mechanical, and electrical works). • Commissioning.	• Change in landscape and related visual aspects.	Visual	Construction	**Low (Negative)**	• Construction camp must be established in appropriate locations prior to the commencement of construction activities. The camp must be maintained in an orderly and tidy condition. • No littering at the site. • Sufficient containers must be made available to handle the amount of litter, wastes, rubbish, debris and builders' wastes generated on site. These containers must be emptied frequently to avoid rodents, insects or any other organisms accumulating on the site and becoming a health hazard to adjacent properties. • No waste is to remain at the construction site for more than two (2) weeks. • Waste must be separated into recyclable and non-recyclable waste, and shall be separated as follows: ➢ Hazardous waste – including (but not limited to) old oil and paint; ➢ General waste - including (but not limited to) construction rubble, reusable construction material. ➢ Recyclable waste shall preferably be deposited in separate bins. The contractor is advised that "Collect-a-Can" collect tins, including paint and chemical tins, and "Consol" collect glass for recycling. • Any illegal dumping of waste will not be tolerated. This action will result in a fine and if required further legal action will be taken. This aspect must be closely monitored and reported on. • Proof of legal dumping must be produced on request. • Bins must be clearly marked for ease of management. All refuse bins must have a lid secured so that animals cannot gain access. • Subcontractors must contain a clause to the effect that the disposal of all construction-generated refuse/ waste to an officially approved waste disposal site is the responsibility of the subcontractor in question and that the subcontractors are bound to the management activities stipulated in this EMPr. • Proof of this undertaking must be issued to the ECO. All solid and chemical wastes that	**Low (Negative)**

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance if mitigated
					are generated must be removed and disposed of at a licensed waste disposal site. The contractor is to provide proof of such to the ECO. • Chemical containers and packaging brought onto the site must be removed for disposal at a suitable site. • Good housekeeping to reduce dust from the mine, TSFs and in all working areas and access/haul roads associated with the project to an absolute minimum.	
	• Contamination to ground- and surface water systems from oil, grease, and diesel spillages from construction vehicles.	Groundwater Systems and Surface Water	Construction	**Medium to High (Negative)**	• Road compaction. • Vehicles must be checked for oil leaks and all maintenance must take place at a designated site with spillage sumps. • Spill-sorb or a similar product to be kept on site and used to clean up hydrocarbon spills in the event that they should occur. • All employees must be trained in cleaning up of spillage. • Polluted soil and used spill materials must be disposed of at a licenced facility. • All hazardous substances must be stored within a bunded area.	**Negligible**
	• Storage of chemicals and building materials during construction of waste facility.	Groundwater Systems	Construction	**Medium to High (Negative)**	• Implement best practise principals for storing hazardous substances and keep spill kits near working areas. • All hazardous substances must be stored within a bunded area.	**Negligible**
OPERATIONAL PHASE						
• Deposition of tailings. • Maintenance of the facility and related infrastructure (piping etc.).	• Change in ambient concentrations.	Air quality	Operational	**High (Negative)**	• Wind erosion is a complex process, including three different phases of particle entrainment, transport and deposition. It is primarily influenced by atmospheric conditions (e.g. wind, precipitation and temperature), soil properties (e.g. soil texture, composition and aggregation), land-surface characteristics (e.g. topography, moisture, aerodynamic roughness length, vegetation and non-erodible elements) and land-use practice (e.g. farming, grazing and mining) (Shao, 2008). • For wind erosion to occur, the wind speed needs to exceed a certain threshold, called the friction velocity. This relates to gravity and the inter-particle cohesion that resists removal (Shao, 2008). A threshold friction velocity (u*) for the TSFs was estimated at 7 m/s, with wind speeds exceeding 7 m/s occurring for 3.3% of the time. If this is the case, the potential for wind-blown dust from the existing TSFs is low. The hourly wind data does however not provide information on wind gusts, which could be twice as high as the hourly average wind speed (Goliger, et al., 2009). Since the dispersion model cannot account for sub-hourly wind speeds, the impacts from the Future Project (TSF3; TSF 2 and TSF 2 extension) are likely underestimated and therefore necessitates mitigation measures to be applied to the existing and Future Project TSFs. • As indicated, any binding properties would reduce the potential for wind erosion. One of the most effective measures of minimising wind erosion emissions from TSFs is re-vegetation. The control efficiency of vegetation is given as 40% for non-sustaining vegetation and 90% for re-vegetation. Secondary rehabilitation would up the control efficiency to 60% for non-sustaining vegetation (NPI, 2012).	**Medium to High (Negative)**
	• Increase in ambient noise level.	Noise	Operational	**Medium (Negative)**	• Train operational staff on noise control plan during health & safety briefings. • Regular inspection and maintenance of all equipment. • A noise complaints register must be kept. • If complaints are received, noise sampling should be undertaken at the NSRs and source of noise should be investigated.	**Medium (Negative)**
	• Change in landscape and related visual aspects.	Visual	Operational	**Low (Negative)**	• Continuous and ongoing rehabilitation of the rising side walls with grasses and other vegetation as per the approved rehabilitation plan. • Install light fixtures that provide precisely directed illumination to reduce light “spillage” beyond the immediate surrounds of the TSFs, i.e. lights (spotlights) are pointed away from sensitive viewing areas specifically south and east of the sites. • Avoid high pole top security lighting along the site's periphery and use only lights activated on illegal entry to the site. • Minimise the number of light fixtures to the bare minimum, including security lighting.	**Low (Negative)**
	• Contamination to baseflow and groundwater systems.	Baseflow and groundwater systems	Operational	**Medium (Negative)**	• A tertiary drainage which is a tributary of the Elandsdrifspruit Stream to the east, could receive runoff from the TSF 2 Extension. Current toe paddocks and solution trench installed does mitigate migration towards the east. A groundwater monitoring borehole should be developed adjacent to this drainage to verify whether there is any shallow seepage to this drainage. If seepage is detected, a combination of a deep cut off drain, seepage capturing wells and bioremediation should be developed. • The Sterkstroom Stream is located beyond the local TSFs catchments. Existing storm	**Low (Negative)**

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance if mitigated
					water containment structures would contain runoff to the Sterkstroom Stream.	
	• Contamination to ground- and surface water sources.	Ground- and surface water sources	Operational	**Medium to High (Negative)**	• Seepage from the TSFs is effectively captured by the East Pit and associated mine dewatering. • Water quality monitoring and seepage capturing from toe trenches and boreholes. • Natural decay of nitrates due to de-nitrification (conservative half-life calculated during previous assessments) will also limit impacts.	**Low (Negative)**
	• Increased surface run-off and erosion from the TSFs. • Downstream sedimentation. • Failing stormwater infrastructure. • Establishment of alien plants on disturbed areas.	Freshwater Systems	Operational	**Low (Negative)**	• Access to the site must be from the existing point of entry along the provincial roads; • It is imperative that a budget be allocated for the planned rehabilitation efforts and likewise that it be approved by the relevant authorities. • Stay within the proposed areas and avoid extending earthmoving activities outside of these areas. • Water leaving the site should do so via appropriately engineered stormwater structures that serve to spread and dissipate flows to prevent the erosion of downstream watercourses. • Where possible, existing access routes and walking paths must be made use of, and new routes limited. • The contractors used for the New TSF 3 should have spill kits available prior to construction to ensure that any fuel, oil or hazardous substance spills are cleaned-up and discarded correctly. • All material used are to be restricted to within the existing facility. • All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping". • Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems. • Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.	**Low (Negative)**
CLOSURE, REHABILITATION AND POST CLOSURE PHASE						
• Infrastructure removal/ demolition. • Topsoil recovered from stockpiles for rehabilitation and revegetation of surroundings. • Vehicle entrainment on unpaved road surfaces during rehabilitation – once that is done, vehicle activity associated with the operations should cease.	• Change in ambient concentrations.	Air quality	Closure, rehabilitation and post closure	**Medium (Negative)**	• Air quality impacts during operation would be reduced through basic control measures such as limiting the speed of haul trucks; limit unnecessary travelling of vehicles on unpaved roads; and to apply water sprays on regularly travelled, unpaved sections. • When haul trucks need to use public roads, the vehicles need to be cleaned of all mud and the material transported must be covered to minimise windblown dust. • The access roads to the processing plants needs to be kept clean to minimise carry-through of mud on to public roads.	**Medium (Negative)**
	• Increase in ambient noise level.	Noise	Closure, rehabilitation and post closure	**Medium to High (Negative)**	• Routine monitoring of ambient noise and to comply with the relevant estimated background noise levels. • Closure staff need to be trained on noise control plan during health & safety briefings. • Low noise' equipment, or methods of work is to be selected. • Avoid clustering of mobile plant near receptors and enforce rest periods for unavoidable maximum noise events. • Investigate use of alternatives to audible reversing alarms (such as broadband noise emitting models) or configure to maximise forward movements of mobile plant. • Regular inspection and maintenance of all equipment is to be established. • Avoid unnecessary equipment idling. • Where possible, limit activities to daytime working hours (6am – 6pm). • Establish community engagement and ensure all affected persons have been consulted with prior to the commencement of and during activities.	**Medium (Negative)**
	• Change in landscape and related visual aspects.	Visual	Closure, rehabilitation and post closure	**Low (Negative)**	• Continuous and ongoing rehabilitation of the rising side walls with grasses and other vegetation as per the approved rehabilitation plan. • Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the TSFs, i.e. lights (spotlights) are pointed away from sensitive viewing areas specifically south and east of the sites. • Avoid high pole top security lighting along the site's periphery and use only lights activated on illegal entry to the site. • Minimise the number of light fixtures to the bare minimum, including security lighting.	**Low (Negative)**

Activity	Potential Impact	Aspects Affected	Phase	Significance	Mitigation Type	Significance if mitigated
	• Contamination to ground- and surface water systems.	Groundwater and Surface Water Systems	Closure, rehabilitation and post closure	**Medium to High (Negative)**	• The backfilled East Pit and future decanting (>50-year post-closure) would form a permanent sink to capture seepage from the TSFs. • Rehabilitation of facilities (capping and vegetation) to limit rainfall recharge. • Water quality monitoring to verify nitrate decay for 5 years post-operational. • Natural decay of nitrates due to de-nitrification (conservative half-life calculated during previous assessments) will also limit impacts from 2-5 years post-closure. • Seepage water quality should be useful for use as a water resource for agricultural and/or domestic supply in the post-closure phase. The TSFs and partially backfilled open pits could be used to store and supply water to increase the water supply yield of the Sterkstroom River Catchment where the East Pit decant would take place.	**Negligible**
	• Final landscaping and shaping.	Freshwater Systems	Closure, rehabilitation and post closure	**Low (Negative)**	• Access to the site must be from the existing point of entry along the provincial roads; • It is imperative that a budget be allocated for the planned rehabilitation efforts and likewise that it be approved by the relevant authorities. • Stay within the proposed areas and avoid extending earthmoving activities outside of these areas. • Water leaving the site should do so via appropriately engineered stormwater structures that serve to spread and dissipate flows to prevent the erosion of downstream watercourses. • Where possible, existing access routes and walking paths must be made use of, and new routes limited. • All material used are to be restricted to within the existing facility. • All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good “housekeeping”. • Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems. • Landscape and rehabilitate all disturbed areas. • Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.	**Low (Negative)**

SECTION 18: SUMMARY OF THE FINDINGS AND RECOMMENDATIONS OF ANY SPECIALIST REPORTS

Summary and recommendations from specialist studies that informed the impact assessment are summarised in Table 60 below. The complete specialist reports have been attached in Appendix 7 of this BAR and EMPr Report.

Table 60: Summary of specialist reports

List of studies undertaken	Findings and Recommendations	Specialist recommendations that have been included in the EIA report (mark with an x where applicable)	Reference to applicable section of the report where specialist recommendations have been included
Air Quality Impact Assessment Study.	• To ensure that mitigation is effective, it is recommended that the dustfall monitoring network at the mine be maintained and the monthly dustfall results used as indicators to tract the effectiveness of the applied mitigation measures. • Due to the potential for non-compliance of both current and future operations at Tharisa Mine, it is recommended that PM_{10} sampling be conducted at Mmaditlhokwa Community.	X	Section 7-8 Section 13-1.1 Section 13-2.1 Section 13-3.1
Noise Impact Assessment	• The noise impacts due to the TSF 2 and TSF 2 Extension project only are predicted to be within calculated background levels and International Finance Corporation (IFC) guidelines at the closest residential dwellings to the project site. Since no fatal flaws were identified, and since the noise levels are predicted to be low at all noise sensitive receptors within the study area, it is recommended that the project should be authorised.	X	Section 7-9 Section 13-1.2 Section 13-2.2 Section 13-3.2
Visual Impact Assessment	• Impacts assessed to have a LOW significance would occur in the operation phase, be short-term, and cause a minor loss of landscape and visual resources. • The unmitigated impact of the proposed amendment activities would be localised and will not extending beyond the assessed impact for the existing TSF 2 and TSF 2 Extension. There will be no additional impact affecting the mine's neighbours. • The author believes that the project would cause an insignificant change to the visual baseline (approved and existing infrastructure) and sensitive receptor locations. The project should be approved provided that the mitigation/management measures are effectively implemented and managed in the long-term.	X	Section 7-10 Section 13-1.3 Section 13-2.3 Section 13-3.3
Geohydrological Investigations	• No additional basal seepage barrier systems are required to manage or mitigate groundwater seepage impacts. • A geophysical survey should be done towards the east of TSF 2 to detect subsurface flow zones and groundwater monitoring boreholes should be developed adjacent to this drainage to verify whether there is any shallow seepage. If seepage is detected, a combination of a deep cut off drains, seepage capturing wells and bioremediation should be developed. • The upstream and downstream monitoring network needs to be reviewed, as additional downstream monitoring locations (both surface water and groundwater) are required. • A parameter optimisation study must be conducted to only analyse for the Critical Control Parameters (CCP) on the water monitoring and feedback. • The water monitoring protocol should be updated focusing on the constituents which exceeded from the geochemical lab results for continued verification of no exceedances, and TSF 2 and TSF 2 Extension receptors, as part of the EMPr. • Monitoring data should be archived on a digital database that should serve as a future reference. Monitoring reports should be done on a quarterly (summary) and annual (detailed) basis. Management and mitigation measures should be adapted based on the monitoring results to effectively mitigate the impacts. • A hydrocensus should be conducted on an annual basis to evaluate the status of the potential surface water and groundwater receptors surrounding the proposed facility. • The numerical model should be updated and recalibrated initially once a year as new data becomes available.	X	Section 7-5 Section 13-1.4 Section 13-2.4 Section 13-3.4

Soil, Land Capability and Land use/ Agricultural Potential Assessment	• At present most of the soils immediately adjacent to the existing TSFs to be expanded require rehabilitation since the natural soil characteristics have been altered such that agricultural potential of these soils has been reduced. This impact is both from two aspects:
	  o The physical structure of the soil and the material that comprises the soil matrix; and
	  o The chemical characteristics of the soil with specific mention of salinisation and the introduction of high concentrations of nitrate to the soil while loss of organic carbon is likely.
	• Overall, the increase in the TSF height is not anticipated to contribute to the loss of land capability directly, however increased soil erosion and subsequent sediment runoff during high rainfall events is known to occur can be anticipated to continue in perpetuity unless the TSFs are appropriately capped at closure.
	• Similarly, seepage from the TSF is deemed likely to impact on soil chemistry and fertility in perpetuity unless the TSF is capped.
	• A baseline TSF inundation risk analysis should be considered to ascertain the potential loss of agricultural resources in the area should the TSFs to be expanded collapse.
	• Overall, the proposed project is regarded as being of low impact significance after mitigation measures have been implemented due to the inherent soil constraints of the area and the severe disturbance of the majority of the soils on site. Mitigation measures as outlined in the report should be implemented during all phases of development to ensure the impact significance and quantum of risk to the agricultural resources remains within the acceptable levels.
		X	Section 7-7

Freshwater Ecology.	• The anticipated impacts for the proposed project were rated as Low due to the proposed TSF footprints being located outside the delineated 100m riparian buffer area and within a disturbed area. • The operational phase of the project has four identified potential impact to the watercourse. These impacts were rated as Low pre-mitigation and post-mitigation. These were all lowered provided the Stormwater Management Plan (SWMP) is updated to accommodate the increased capacity and height and accommodate all proposed activities. • Additionally, it is important to note that the applicant is proposing to amend the existing EA, WML and EMPr and as such these areas were previously designated and approved for development. It is the opinion of the specialist that the proposed amendment activities will not contribute to a larger impact on the freshwater biodiversity as the initial approved activities, should the provided prescribed mitigation measures and recommendations (with emphasis to update the current SWMP to accommodate all proposed activities) are implemented, it is the opinion of the specialist that the proposed activities can be carefully considered.	X	Section 7-6 Section 13-2.5.1 Section 13-3.5.1
Terrestrial Biodiversity Compliance Statement	• The Transformed and Disturbed bushveld habitat associated with the project area is classified as having a sensitivity rating of 'Very Low' and 'Low' respectively and are likely to face minimal further impacts from any development activities. • Additionally, it is important to note that the applicant is proposing to amend the existing EA, WML and EMPr and as such these areas were previously designated and approved for development. It is the opinion of the specialist that the proposed amendment activities will not contribute to a larger impact on the terrestrial biodiversity as the initial approved activities, should the recommendations made within this report as well as the prescribed mitigation measures	X	Section 7-6

List of studies undertaken	Findings and Recommendations	Specialist recommendations that have been included in the EIA report (mark with an x where applicable)	Reference to applicable section of the report where specialist recommendations have been included
	be adhered to.		
HIA screener and Exemption of Palaeontological Impact Assessment.	• The area proposed for development has been previously surveyed for heritage resources and as such, it is very unlikely that the proposed development will impact negatively on any significant archaeological heritage resources. No further assessment of impact to archaeological heritage is recommended.	X	Section 7-11
Geochemistry study and Waste Assessment.	• Although the predicted leachate quality from the Tharisa waste storage facilities is expected for mine effluent, results of the source term assessment should not be evaluated in isolation but together with numerical or reactive groundwater modelling risk assessment. • The complete source, pathway and receptor should be considered in evaluating the overall potential risks to groundwater.	X	Section 3-4.2

SECTION 19: ENVIRONMENTAL IMPACT STATEMENT

It is the opinion of the EAP that although the proposed TSF 2 and TSF 2 Extension may cause adverse environmental impacts, provided that the proposed mitigation measures are implemented effectively and in line with the EMPr, these will be outweighed by the long-term positive impacts. Based on the findings of the Impact Assessment, the EAP sees no reason why the amended EA and WML should not be granted for the proposed project to proceed, as the impacts which have been identified can be mitigated through the implementation of the identified management measures. Additionally, the proposed TSF 2 and TSF 2 Extension are unlikely to result in the generation of any significant cumulative impacts when managed in accordance with the management measures specified in the EMPr.

Should the proposed project not be implemented, the positive impacts such as expected revenue, economic development, employment creation, skills development, poverty alleviation and the continued upliftment of the surrounding communities would not be realised. Additionally, it would be impossible to discard the tailings, and therefore the mine would have to cease its operation, as there would be limited waste storage area when the current operational (TSF 2 Extension) reaches its end of life.

19-1 SUMMARY OF THE KEY FINDINGS OF THE ENVIRONMENTAL IMPACT ASSESSMENT

This section provides a summary of the findings of identified and assessed potential impacts on the receiving environment in both the significance unmitigated and mitigated scenarios. A summary of the potential impacts (Table 61 and SECTION 13:), associated with the preferred alternative (Section 5-1). The table also provides an indication of the contribution of potential impacts, associated with the proposed project.

Table 61: Summary of potential project-related impacts

Potential Impact	Aspects Affected	Significance	Significance if mitigated
CONSTRUCTION PHASE			
• Change in ambient concentrations.	Air quality	**Medium (Negative)**	**Medium (Negative)**
• Increase in ambient noise level.	Noise	**Medium to High (Negative)**	**Medium (Negative)**
• Change in landscape and related visual aspects.	Visual	**Low (Negative)**	**Low (Negative)**
• Contamination to ground- and surface water systems from oil, grease, and diesel spillages from construction vehicles.	Groundwater Systems and Surface Water	**Medium to High (Negative)**	**Negligible**
• Storage of chemicals and building materials during construction of waste facility.	Groundwater Systems	**Medium to High (Negative)**	**Negligible**
OPERATIONAL PHASE			
• Change in ambient concentrations.	Air quality	**High (Negative)**	**Medium to High (Negative)**
• Increase in ambient noise level.	Noise	**Medium (Negative)**	**Medium (Negative)**
• Change in landscape and related visual aspects.	Visual	**Low (Negative)**	**Low (Negative)**
• Contamination to baseflow and groundwater systems.	Baseflow and groundwater systems	**Medium (Negative)**	**Low (Negative)**
• Contamination to ground- and surface water sources.	Ground- and surface water sources	**Medium to High (Negative)**	**Low (Negative)**
• Increased surface run-off and erosion from the TSFs. • Downstream sedimentation. • Failing stormwater infrastructure. • Establishment of alien plants on	Freshwater Systems	**Low (Negative)**	**Low (Negative)**

disturbed areas.			
CLOSURE, REHABILITATION AND POST CLOSURE PHASE			
• Change in ambient concentrations.	Air quality	**Medium (Negative)**	**Medium (Negative)**
• Increase in ambient noise level.	Noise	**Medium to High (Negative)**	**Medium (Negative)**
• Change in landscape and related visual aspects.	Visual	**Low (Negative)**	**Low (Negative)**
• Contamination to ground- and surface water systems.	Groundwater and Surface Water Systems	**Medium to High (Negative)**	**Negligible**
• Final landscaping and shaping.	Freshwater Systems	**Low (Negative)**	**Low (Negative)**

19-2 FINAL SITE MAP

The final preferred site layout plan is included in Appendix 1, Figure 5 and Figure 14.

19-3 SUMMARY OF THE POSITIVE AND NEGATIVE IMPLICATIONS AND RISKS OF THE PROPOSED ACTIVITY AND IDENTIFIED ALTERNATIVES

A summary of the positive and negative impacts is presented Table 61.

SECTION 20: PROPOSED IMPACT MANAGEMENT OBJECTIVES AND THE IMPACT MANAGEMENT OUTCOMES FOR INCLUSION IN THE EMPR

The key objectives of the EMPr are to set out the management and monitoring measures required to minimise any potentially adverse environmental impact; to enhance the environmental benefits of the project; and to ensure that responsibilities and appropriate resources are efficiently allocated to implement the plan.

The aspects which are considered to be of most importance to the development, including the respective management objectives and outcomes for the impacts associated with these aspects are provided in Table 62.

Table 62: Management Objectives and Outcomes

Aspect	Management objective	Outcome
Soil	• To rehabilitate disturbed areas in line with the management plans. • To accommodate the present land uses of communal grazing and/or wilderness. • Manage suitable onsite soil resources for rehabilitation activities. • Prevent the contamination of soil resources. • Managed response to the clean-up of accidental spillages and leaks.	• Rehabilitation that supports post-closure land uses. • Soil resources protected from contamination. • Accidental leaks and spillages responded to rapidly and all contamination remediated in accordance with legal requirements.
Surface Water	• To prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow and to prevent pollution of surface water resources.	• Ensure surface water quality remains within acceptable limits for both domestic and agricultural purposes. • Ensure that the reduction of the volume of runoff into the downstream catchment is limited to what is necessary and that natural drainage patterns are re-established as part of rehabilitation in order to prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow.
Air	• Control and minimise particulate and dust emissions. • To prevent air pollution health impacts.	• Ensure that any pollutants emitted as a result of the project remain within acceptable limits as per relevant standards so as to prevent health related impacts. • Air emissions from the development are managed in accordance with legal requirements.
Noise	• To prevent public exposure to disturbing noise.	• Ensure that any noise generated as a result of the project remains within acceptable limits (as set out in the specialist report) to avoid the disturbance of third parties. • Good stakeholder relations with community members and authorities.
Biodiversity	• Protection of biodiversity.	• No flora and fauna species damaged nor destroyed during project activities.
Heritage	• Protection of heritage resources.	• No heritage resources damaged nor destroyed during project activities.
Visual	• To limit negative visual impacts.	• Limit negative visual views.
Groundwater	• To prevent pollution of groundwater resources and related harm to water users and to prevent losses to third party water users. • Managed response to the clean-up of accidental spillages and leaks. • Monitor groundwater to ensure that any changes in groundwater quality and quantity are identified and investigated.	• Good stakeholder relations with community members. • Accidental leaks and spillages responded to rapidly and all contamination remediated in accordance with legal requirements. • To ensure that groundwater continues to be available to current users.
Traffic	• To prevent mine-related road disturbance.	• Ensure the mine's use of public roads is done in a responsible manner.

SECTION 21: FINAL PROPOSED ALTERNATIVES

No additional alternatives to those identified and assessed through the impact assessment process are proposed for the proposed project.

SECTION 22: ASPECTS FOR INCLUSION AS CONDITIONS OF AUTHORISATION

Specific conditions proposed by the specialists are as follows:

List of studies undertaken	Specific conditions proposed by the specialists
Freshwater Ecology.	• Mitigation measures and recommendations (with emphasis to update the current SWMP to accommodate all proposed activities) must be implemented.
Air Quality Impact Assessment Study.	• To ensure that mitigation is effective, it is recommended that the dustfall monitoring network at the mine be maintained and the monthly dustfall results used as indicators to tract the effectiveness of the applied mitigation measures. • Due to the potential for non-compliance of both current and future operations at Tharisa Mine, it is recommended that PM_{10} sampling be conducted at Mmaditlhokwa Community.
Geohydrological Investigations	• A geophysical survey should be done towards the east of TSF 2 to detect subsurface flow zones. • Groundwater monitoring boreholes should be developed adjacent to the drainage to verify whether there is any shallow seepage. If seepage is detected, a combination of a deep cut off drains, seepage capturing wells and bioremediation should be developed. • The upstream and downstream monitoring network needs to be reviewed, as additional downstream monitoring locations (both surface water and groundwater) are required. • A parameter optimisation study must be conducted to only analyse for the CCP on the water monitoring and feedback. • The water monitoring protocol should be updated focusing on the constituents which exceeded from the geochemical lab results for continued verification of no exceedances, and TSF 2 and TSF 2 Extension receptors, as part of the EMPr. • Monitoring data should be archived on a digital database that should serve as a future reference. • Monitoring reports should be done on a quarterly (summary) and annual (detailed) basis. • Management and mitigation measures should be adapted based on the monitoring results to effectively mitigate the impacts. • A hydrocensus should be conducted on an annual basis to evaluate the status of the potential surface water and groundwater receptors surrounding the proposed facility. • The numerical model should be updated and recalibrated initially once a year as new data becomes available.
Geochemistry study and Waste Assessment.	• Results of the source term assessment should be evaluated with numerical or reactive groundwater modelling risk assessment.

SECTION 23: DESCRIPTION OF ANY ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

It is assumed that the information provided by the specialists from the various assessments is accurate. The gaps and/or limitations in the specialist studies are detailed below:

23-1 SOIL, LANDUSE AND LAND CAPABILITY ASSESSMENT

For the purpose of this assessment, the following assumptions are applicable:

- The soil survey conducted as part of the land capability assessment was confined within the study area outline. However consideration of the immediately adjacent areas was given.
- The satellite imagery as used in the maps presented in the report does not depict the current on-site conditions, however the soil and land capability classification are based on the current existing conditions ground-truthed by the soil specialist in September 2022.
- The soil chemical analysis was not conducted as part of the assessment due to the existing baseline chemical data and also because the soil chemical status is regarded a limitation agriculture as it can be ameliorated.
- Since soils occur in a continuum with infinite variances, it is often problematic to classify any given soils as one form, or another. for this reason, the classifications presented in this report are based on the "best fit" to the soil classification system of South Africa.

23-2 FRESH WATER RESOURCE REPORT

The following aspects were considered limitations during the study:

- It is assumed all information received from the client is relevant and correct.
- No baseline biomonitoring data/report(s) were available at the time of this report completion. Therefore, the results are solely based on a short time spent on site.
- No water quality analysis, macroinvertebrate and fish assessment were completed for this assessment due to no site access and short time spent on site. Therefore, this study is based on desktop data.
- The extent of the riparian zone was delineated at a desktop level following the on-site survey.
- The data (water quality, Macroinvertebrate community) was obtained from surveys previously conducted by The Biodiversity Company (TBC) during the 2020 and 2021 at Sterk Upper and Sterk Lower sites was used to determine the current PES of the Sterkstroom River.
- As Tharisa Mine is already operating, the assessed construction phase applies only to the proposed TSFs.

23-3 AIR QUALITY IMPACT ASSESSMENT

The main assumptions, exclusions and limitations are summarised below:

- Meteorological data: no onsite meteorological data was available and simulated. WRF data for the study site was obtained for the period January 2019 – December 2021.
- Tharisa Mine has a dustfall network in place and conducts passive sampling campaigns to determine background SO_2 and NO_2 concentrations. Data available for inclusion in the study was limited to the period January to March 2021 and January to March 2022.
- Operational hours for the mine were assumed to be 24-hours a day, 7-days per week.
- Emissions:
    - *The quantification of sources of emission was for project activities only, including current and proposed future Tharisa Mine operations. Background sources were not included.*
    - *Information required for the calculation of emissions from fugitive dust sources for the current and project operations were provided in the form of volume/ tonnages of topsoil, waste, and reef for a 12-month period covering October 2021 – September 2022.*

- *Throughputs were provided for current activities only.*
- *Only routine emissions were estimated and modelled. This was done for the provided operational hours.*
- *Gaseous emissions from vehicle exhaust and other auxiliary equipment were quantified but not modelled as the impacts from these sources are usually localised and unlikely to exceed health screening limits outside the project area. This is confirmed by the measured SO_2 and NO_2 concentrations. The main pollutant of concern from the operations at the study site is particulate matter and hence formed the focus of the study.*
- *The Particle Size Distribution (PSD) for waste rock, tailings and surface road material was based on analysis of composite samples taken by Airshed personnel during the site visit on 22 April 2022. PSD for RoM and product stockpiles were assumed to be similar to waste.*

- Impact assessment:
  - *Impacts due to two operational phases (baseline and project) were assessed quantitatively, whilst the closure and decommissioning phases were assessed qualitatively due to the limited information available. Since it is an operational mine, construction activities will coincide with the current mining operations and were therefore not assessed.*
  - *The impact assessment was limited to airborne particulate [including Total suspended particulates (TSP), PM_{10} and Particulate Matter with an aerodynamic diameter less than or equal to 2.5 µm ($PM_{2.5}$)].*
  - *There will always be some degree of uncertainty in any geophysical model, but it is desirable to structure the model in such a way to minimise the total error. A model represents the most likely outcome of an ensemble of experimental results. The total uncertainty can be thought of as the sum of three components: the uncertainty due to errors in the model physics; the uncertainty due to data errors; and the uncertainty due to stochastic processes (turbulence) in the atmosphere. Nevertheless, dispersion modelling is generally accepted as a necessary and valuable tool in air quality management and typically provides a conservative prediction of emission concentrations.*
  - *Potential health impacts from the metal content in the inhalable dust was based on the previous Air Quality Impact Assessment conducted for the additional WRDs at Tharisa Mine (Liebenberg-Enslin, Petzer, Bornman and Moletsane, 2022).*

23-4 NOISE IMPACT ASSESSMENT

The following limitations and assumptions should be noted:

- The mitigating effect of buildings and infrastructure acting as acoustic barriers were not taken into account providing a conservative assessment of the noise impacts off-site.
- The quantification of sources of noise was limited to the operational phase of the project. Construction and closure phase activities were assessed qualitatively. Noise impacts will cease post-closure.
- The pumps were assumed to operate 24 hours per day, 7 days per week. The lighting plants were assumed to operate during night-time only.
- Although other existing sources of noise within the area were identified, such sources were not quantified but were taken into account during the surveys undertaken.
- Blast vibration and noise did not form part of the scope of work of this assessment.
- Cumulative noise impacts were assessed with the proposed East WRD and West WRD at the Tharisa Mine. The environmental noise impact assessment for these sources (East WRD and West WRD) was completed in August 2022 as part of another project proposed for the mine.
- The environmental noise assessment focussed on the evaluation of impacts for humans. It is important to note that the applicability of environmental noise assessments to wildlife is limited as it is not possible simply to infer the impacts of anthropogenic noise on wildlife from the human literature. This is because the hearing ranges and sensitivities of non-human animals can be very different from those of humans. Noise studies on humans understandably use methodologies that tailors the quantification of anthropogenic noise to our hearing capabilities: for example, the use of microphones limited to the human hearing range (20 Hz – 20 kHz) and the implementation of frequency filters effectively mimicking human auditory sensitivity (A-weighting). As such, noise measurements may only cover

part of the relevant acoustic range for other species. Moreover, species differences in behaviour, physiology, and ecology, in addition to hearing capabilities and perception, mean that extrapolations from human studies can provide only a limited understanding of the potential impact of anthropogenic noise on wildlife.

23-5 TERRESTRIAL BIODIVERSITY COMPLIANT STATEMENT

The following limitations and assumptions should be noted:

- The floral assessment was confined to the study area and does not include the neighbouring and adjacent properties. The entire study area and immediate surroundings were, however, included in the desktop analysis.

23-6 VISUAL IMPACT ASSESSMENT

The following assumptions limitations have been made in the study:

- The description of project components is limited to what has been supplied to the author by MC.
- The basic simulations are indicative and used only to illustrate the location, scale and bulk of the proposed project.
- The worst-case scenario, i.e. when the TSFs are at their final designed height, was modelled.
- No alternative sites have been proposed as the proposed activities will occur on an existing approved footprint and existing TSFs.
- Site photos were taken during extreme haze conditions (not atypical for the study area) and may not reflect the character of the area as experienced through all seasons/ daylight conditions. However, due to the disturbed nature of the study area, this is not a major concern when assessing potential visual impacts.

23-7 GEO CHEMISTRY STUDY AND WASTE ASSESSMENT

Predicting water qualities from an evaporation and settling setting, requires some assumptions and has limitations. The statistician George Box said: all models are wrong, but some models are useful (Box, 1976).

This statement captures the essential truth that all model's approximate reality in that they reduce complex systems to a limited number of significant processes. How "useful" a model is depending on how closely the selected processes approximate reality. Predicting the water qualities of complex systems demands assumptions. Even a rigorous sampling and analysis programme cannot precisely determine the physical and geochemical characteristics of the system. Nor can they precisely indicate how these characteristics may change over time.

Table 63 summarises the key limitations of the input data and the hydrogeochemical model used for the assessment.

Table 63: Tharisa composite waste rock and tailings minerology

No.	Limitation	Description
1	Predicting field scale water quality from lab scale test results is an approximation.	Leaching of salts and metals at the field scale is variable in time and controlled by factors not fully applied at the lab scale. Amongst others, these factors include temperature, evaporation, nature of the leaching solution, the solution to solid ratio, solution-solid contact time and particle size of the solid. The modelled quality of water due to interaction with tailings or waste is an informed estimate.
2	The geochemical database is relevant to the system being modelled.	Hydrogeochemical modelling uses the inherently uncertain laboratory results and water qualities as inputs. These are processed using thermodynamic data determined in the laboratory on ideal materials and solutions. The laboratory determined constants may not be directly applicable to the materials, solutions, and chemical context of the waste material. The llnl.dat database was used for the model.
3	The modelling assumes thermodynamic equilibrium in the model system.	In the field, all chemical components are subject to kinetic variation and the system might, at best, be in a state of quasi equilibrium. This may suggest that attempts to simulate or predict the state of these complex systems have questionable value.

No.	Limitation	Description
		However, geochemical evaluations of natural and mine waters over the last few decades have shown that the equilibrium assumption is a powerful tool that in many circumstances produces results that accurately describe the general chemistry of such waters.
4	Adsorption surface.	Metal cations can sorb to charged surfaces. There is no data to quantify either these surfaces, or their effect on water quality. Cation sorption linked to the amount of ferrihydrite precipitating was not modelled.

Considering the uncertainties outlined above, the available information is sufficient to provide the preliminary estimated sediments seepage quality presented in the report. However, even though the report presents deterministic concentration values, these should be viewed as first-order approximations (a first-order approximation is an estimated value of a quantity, often preliminary to more precise determination. Mathematically, it is a linear approximation of a polynomial function). As such, the predicted concentrations in the report indicate the likely order of magnitude concentrations.

SECTION 24: REASONED OPINION AS TO WHETER THE PROPOSED ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED

24-1 REASON WHY THE ACTIVITY SHOULD BE AUTHORISED OR NOT

The activity must be authorised considering the following reasons:

The current facilities are nearing their full capacity, hence the need for raising the walls of TSF 2 and TSF 2 Extension. If the application for amendment is not granted for TSF 2 and TSF 2 Extension, the following negative environmental impacts may occur if the authorisation is not granted:

- The tailings material being hydraulically pumped from the mine's processing plants to TSF 2 Extension for storage will soon reach FSL.
- Excessive disposal of tailings can result in a health and safety risk due to height and dust generation.
- Decrease in the mine's production when the mine runs out of tailings disposal space.
- Reduction in economic growth [job losses, decline in Goss Domestic Product (GDP) and loss of income].

Additionally, based on the findings of the specialists' studies and the outcome of the impact assessment, MC is of the opinion that an amended EA, WML and EMPr for the proposed raising of the walls of TSF 2 and TSF 2 Extension project must be granted, provided that the prescribed mitigation measures will be implemented, and that the conditions of the amended EA and WML will be complied with, in all phases of the lifted TSFs.

24-2 CONDITIONS THAT MUST BE INCLUDED IN THE AUTHORISATION

24-2.1 Specific conditions to be included into the compilation and approval of EMPr

The conditions to be included into the amended EA and WML are discussed under SECTION 22: of this report.

24-2.2 Rehabilitation requirements

The rehabilitation, closure and aftercare plan are based on the assumption that the objective of the process is to rehabilitate, as far as possible, the area disturbed during the establishment and operation phases of the project.

24-2.2.1 Closure Activities before and during operations

Because of the visibility of the TSFs from the N4 highway to the south and south-east of the site, the rehabilitation of the southern and eastern raised embankments of the TSFs is to be undertaken as soon as the construction of the respective section of the embankment is complete.

The rehabilitation involves the placement of a 500 mm soil layer over the downstream face of the waste rock embankment. The soil is sourced from stockpiles created during the removal of material beneath the footprint of the facility during construction. This material contains plant seeds that will germinate and vegetate the side slopes. The rehabilitation of the remainder of the side slopes should be undertaken as soon as possible during the construction and early operational phase. The advantages of rehabilitating the embankments during operation are:

- The cost incurred is absorbed as operating costs.
- Reduced environmental impact due to the separation of rainfall run-off from mine waste.
- Assist in dust suppression.
- Improve the overall visual impact of the TSFs.

24-2.2.2 Closure Activities at cessation of operations.

At the cessation of operation of the TSFs, the focus will be to cover and vegetate the top surface of the facilities, the decommissioning facilities associated with the TSFs and the construction of stormwater control measures if required, such as an overflow spillway. Specific activities that will be carried out will include:

- The dismantling and removal of pumps, piping and valves associated with the deposition of tailings material and the decanting of supernatant water.
- Rehabilitation of any remaining unrehabilitated downstream slopes.
- Sealing/closing off the penstock tower intakes.
- The top surface of the facility should be shaped such that a low area will be created in the centre of the facility. The area will function as a collection point for rainfall and be developed into a wetland. This approach will be substituted with the creation of compartments along the entire beach profile. The compartment will offer localised storage, preventing the formation of a large waterbody on the surface of the facility after closure. The increased surface area of the accumulated water will increase the rate of evaporation as opposed to that of a single runoff collection point and will function as an effective means of removing water from the facility as the annual evaporation exceeds that of the annual rainfall depths. The compartments will be constructed using tailings material from the beach area with adequate storage to contain the 1 in 10 000 year 24-hour storm event.
- The final cover to the top surface of the TSFs will be constructed by importing topsoil from the topsoil stockpiles and covering the top surfaces with a minimum depth of topsoil of 0.3m.
- Minor earthworks.

24-2.2.3 Aftercare and Maintenance Requirements

Upon completion of the closure and rehabilitation measures, an aftercare programme is to be implemented to ensure that the closure measures are performed adequately and that no further closure liabilities arise. The aftercare period is normally not less than 5 years, however, may extend into decades depending on the physical and chemical characteristics of the mine residue material and TSFs design. In the case of a platinum residue, a minimum period of 5 years of aftercare has been proposed. The typical aftercare activities for the TSFs include the following:

- Monitoring of the closure measures to ascertain whether they are performing adequately, failing which some remediation work would be required e.g. successful establishment of top surface vegetation, erosion control etc.
- Monitoring the drop in the phreatic surface within each paddock and the quality and quantity of seepage water exiting from the toe drains.
- Surface and groundwater quality will be monitored regularly for a period to be agreed upon with the relevant authorities.
- Remediation of the seepage water collected in the sump, if required.
- Repairing areas that have degraded since closure.
- Monitoring of the closure measures to ascertain whether they are performing adequately, failing which some remediation work would be required e.g. successful establishment of top surface vegetation, erosion control etc.

SECTION 25: PERIOD FOR WHICH THE ENVIRONMENTAL AUTHORISATION IS REQUIRED

It is expected that the current active TSF 2 Extension will reach its FSL by December 2025 based on the current tailings production. It is envisaged that the amended EA and WML would have been granted by then. Subsequent to the issuance of all approvals, construction activities will then commence. The amended EA and WML is required for a period of 10 years.

SECTION 26: FINANCIAL PROVISIONS

The amount that is required to both manage and rehabilitate the environment in respect of rehabilitation, for the proposed raising of the walls of TSF 2 and TSF 2 Extension project **is R37 282 455,50 (including VAT)**. Refer to Table 65 below.

26-1 EXPLAIN HOW THE AFORESAID AMOUNT WAS DERIVED

The calculations of the financial provisions associated with the proposed raising of the walls of TSF 2 and TSF 2 Extension project have been completed in accordance with the Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided published by the DMRE, dated January 2005.

Following are the steps as detailed in the guidelines:

- Step 1: Determine the primary mineral and saleable mineral by-products.
- Step 2: Determine the risk class of the mine.
- Step 3: Determine the area sensitivity in which the mine is located.
- Step 4.1: Determine the level of information available for calculating the financial liability.
- Step 4.2: Determine the closure components associated with the mine.
- Step 4.3: Determine the unit rates for the associated closure components.
- Step 4.4: Determine and apply various weighting factors (site specific).
- Step 4.5: Identify the areas of disturbance.
- Step 4.6: Identify any specialist studies required.
- Step 4.7: Calculate the closure liability using the DMR template provided.

The unit (Master) rates for each closure component are taken from the DMRE guideline (and inflated by the Consumer Price Index (CPI) to account for escalation since January 2005) and a Multiplication Factor applied depending on the Risk Ranking and the Environmental Sensitivity.

The average annual percentage change in the CPI as provided by Statistics South Africa is presented in Table 64.

Table 64: CPI as provided by Statistics South Africa

January to December						
2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
3.4 %	4.7 %	7.1 %	11.5 %	7.1 %	4.3 %	5.0 %
2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
5.6 %	5.7 %	6.1 %	4.6 %	6.4 %	5.3 %	4.7 %
2019	**2020**	**2021**	**2022**	**2023**	**2024**	
4.1 %	3.3 %	4.5 %	6.9%	6.0%	4.4%	

26-2 CONFIRM THAT THIS AMOUNT CAN BE PROVIDED FOR FROM OPERATING EXPENDITURE

The amount will be provided from the operating expenditure.

Table 65: Calculation of Closure Liability

CALCULATION OF THE QUANTUM OVER THE NEXT 10 YEARS

Applicant: Tharisa Minerals (Pty) Ltd

Ref No.: NW30/5/1/2/3/2/1/ (358) EM

Date: 04-Jul-25

EAP: Manyabe Consultancy (Pty) Ltd

No.	Description	Unit	A Quantity	B Master Rate	C Multiplication factor	D Weighting factor 1	E=A*B*C*D Amount (Rands)
1	Dismantling of processing plant and related structures (including overland conveyors and powerlines)	m3	0	23,19	1	1	R0,00
2(A)	Demolition of steel buildings and structures	m2	0	322,96	1	1	R0,00
2(B)	Demolition of reinforced concrete buildings and structures	m2	0	475,94	1	1	R0,00
3	Rehabilitation of access roads	m2	0	57,79	1	1	R0,00
4(A)	Demolition and rehabilitation of electrified railway lines	m	0	560,93	1	1	R0,00
4(A)	Demolition and rehabilitation of non-electrified railway lines	m	0	305,96	1	1	R0,00
5	Demolition of housing and/or administration facilities	m2	0	645,92	1	1	R0,00
6	Opencast rehabilitation including final voids and ramps	ha	0	328737,80	0,04	1	R0,00
7	Sealing of shafts adits and inclines	m3	0	173,38	1	1	R0,00
8(A)	Rehabilitation of overburden and spoils	ha	160,00	225 731,02	0,52	1	R18 780 821,12
8(B)	Rehabilitation of processing waste deposits and evaporation ponds (non-polluting potential)	ha	0	281143,91	1	1	R0,00
8(C)	Rehabilitation of processing waste deposits and evaporation ponds (polluting potential)	ha	0	816575,18	0,66	1	R0,00
9	Rehabilitation of subsided areas	ha	0	189 015,74	1	1	R0,00
10	General surface rehabilitation	ha	0	178817,05	1	1	R0,00
11	River diversions	ha	0	178 817,05	1	1	R0,00
12	Fencing	m	0	203,97	1	1	R0,00
13	Water management	ha	160,00	67 991,27	0,25	1	R2 719 650,88
14	2 to 3 years of maintenance and aftercare	ha	160,00	23 796,95	1	1	R3 807 511,23
15(A)	Specialist study	Sum	0	0	1	1	R0,00
15(B)	Specialist study	Sum	0	0	1	1	R0,00
					Sub Total 1		R25 307 983,23
Weighting factor 2		0,05				5% of Sub Total 1	R1 265 399,16
						(Subtotal 1 plus Weighting Factor 2 value) Subtotal 2	R26 573 382,39
Preliminary and General (P&G)		0,12				12% of Sub Total 2	R3 188 805,89
						(Preliminary and General + Sub Total 2) Subtotal 3	R29 762 188,28
Contingencies		0,1				10% of Sub Total 2	R2 657 338,24
TOTAL (Excl. VAT)						(Contingency + Sub Total 3) Subtotal 4	R32 419 526,52
VAT (15%)		0,15				15% of Sub Total 4	R4 862 928,98
					Grand Total		R37 282 455,50

SECTION 27: SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

27-1 IMPACTS ON THE SOCIO-ECONOMIC CONDITIONS OF ANY DIRECTLY AFFECTED PERSON

The results of the specialists' studies and impact assessment, and evaluation have been provided for in SECTION 13: above.

27-2 IMPACT ON ANY NATIONAL ESTATE REFERRED TO IN SECTION 3(2) OF THE NHRA

A HIA screener and Palaeontological Assessment exemption letter has been compiled for the proposed raising of the walls of TSF 2 and TSF 2 Extension project. The letter has been attached in Appendix 7. A summary of the findings is provided in SECTION 18:

There are no archaeological or paleontological resources identified on the proposed raising of the walls of TSF 2 and TSF 2 Extension project area.

SECTION 28: OTHER MATTERS REQUIRED IN TERMS OF SECTIONS 24(4)(A) AND (B) OF THE ACT

Not Applicable.

PART B: ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

SECTION 29: FINAL ENVIRONMENTAL MANAGEMENT PROGRAMME

29-1 DETAILS OF THE EAP

It is hereby confirmed that the requirements for the provision of the details and expertise of the EAP are already included in PART A, Section 1-2.

29-2 DESCRIPTION OF THE ASPECT OF THE ACTIVITY

It is hereby confirmed that the requirement to describe the aspects of the activity is already included in PART A, SECTION 2:.

29-3 COMPOSITE MAP

Refer to Appendix 1.

29-4 DESCRIPTION OF IMPACTS MANAGEMENT OBJECTIVES INCLUDING MANAGEMENT STATEMENT

29-4.1 Closure and Rehabilitation

A closure and rehabilitation plan will be developed prior to decommissioning and closure for submission to the DMRE for approval.

29-4.1.1 Principles of Rehabilitation

The following principles will be followed during all phases of the rehabilitation process:

- Define and agree upon end-goals for the rehabilitation process, such as land-use, rehabilitation objectives, areas to be rehabilitated, etc.;
- Prevent and continually manage the propagation and establishment of alien and invasive species;
- As far as is practical, implement concurrent rehabilitation in order to limit degradation of soil biota;
- Limit the footprint area of the disturbing activity in order to minimise environmental damage;
- Rehabilitation earthworks should aim to reshape the disturbed areas to represent the area prior to disturbance and to present a safe, functional and sustainable environment;
- Visual impacts of rehabilitated areas must be minimised by recreating natural landforms and ensuring that reshaped areas are visually suited to surrounding landscapes;
- Natural landforms such as drainage lines, undulating areas and ridges, which have been damaged during activities, must be restored;
- Implement erosion control measures to prevent the loss of topsoil;
- Rip and aerate all compacted soils in order to facilitate plant establishment and growth;
- Re-vegetate all disturbed areas with suitable vegetation cover and methods;
- After completion of activities, ensure that the site is safe for use by the intended land users and remove all activity equipment; and
- Implement a monitoring plan to determine the efficacy of the rehabilitation exercise (this should be a long-term monitoring program).

29-4.2 Determination of closure objective

The rural nature of the mine, and the aridity of the area, limits the range of potentially feasible end land-use alternatives available to Tharisa at the end of life of the mine. The overall environmental objectives of mine closure are as follows:

- To restore the pre-development topography to the greatest extent that is practical and feasible at closure.
- To restore the site biodiversity and ecological system functioning to as close as practically possible to pre-development conditions.
- To ensure that the site is made safe.
- To ensure that final site shaping allows for free drainage of rainwater and the prevention of erosion.
- To ensure that the pollution generating potential of residue deposits and residue stockpiles is addressed through appropriate capping and closure thereof, where applicable.
- To ensure that significant entrainment of particulate matter is prevented through adequate land cover and shaping where necessary.

29-4.3 The process for managing any environmental damage, pollution pumping and treatment of extraneous water or ecological degradation as result of undertaking a listed activity

The management actions outlined in SECTION 30: and 0 have been identified in order to manage and reduce impacts associated with the proposed project in order to prevent unnecessary damage to the environment.

29-4.4 Potential risk of Acid Mine drainage

Two (2) tailings samples from the mine were subjected to comprehensive geochemical investigation and waste assessment to predict the leachate quality from the waste storage facilities on site and if they pose any risk to surface or groundwater resources. The laboratory results (LCT and SPLP) are based on first flush static tests that often give conservative (elevated) concentrations whereas the modelled source terms are calibrated to long term water quality monitoring data that is subject to field scale conditions and are regarded as more accurate indicators of site leachate quality.

The X-Ray Diffraction (XRD) analysis confirmed the dominant minerals for all waste materials at Tharisa Mine to be Enstatite and Plagioclase, with minor Muscovite, Augite and Quartz present. The SPLP results for Tharisa waste materials returned only SANS 241: Operational and Aesthetic exceedances for Al and Fe, respectively.

According to NEMWA GNR. 635 and 636 guidelines, all the waste rock and tailings samples can be classified as equivalent to a Type 4 waste using a risk-based approach and will be required to be incorporated into a storage facility with a Class D barrier.

The geochemical source terms modelled for the Tharisa tailings materials predicted the following CoCs for possible risk to water resources due to:

- Exceedance of DWAF livestock TWQG nitrate levels for all the waste streams

However, nitrate is not sourced from the mined geochemistry but originates from operational blasting and decays with time. Based on the kinetics of the bacteria-controlled nitrate reduction, the half-life of nitrate is estimated to be between 500 – 1350 days (Eppinger and Walraevens, 1998) and proven to be between 108-162 days based on long-term site monitoring data.

The increase in the modelled pH levels relative to the SPLP input values is due to the dominant mineral Enstatite, which tends to uptake 2 H^+ ions in exchange for Mg^{2+} on the mineral surface, which ultimately results in an increase in modelled leachate pH (Oelkers & Schott, 2001).

29-4.5 Steps taken to investigate, assess, and evaluate the impacts of Acid Mine Drainage

SLR field agent visited the site on 26 January 2022 to collect tailing samples for geochemical analysis (Figure 50). A fresh tailings sample (THTSF-01) was collected from the inlet pipe depositing Vulcan plant slurry and a dried sample (THTSF-02) was collected from the surface of TSF 2 (TSF 2 Extension), representing a mixture of semi-weathered Vulcan and Genesis tailings. All the samples were then transported to Waterlab geochemistry laboratory, accompanied by chain of custody documentation for comprehensive analysis. The findings of the geochemical report are summarised in the sections below. The report is attached in Appendix B of Appendix 9.

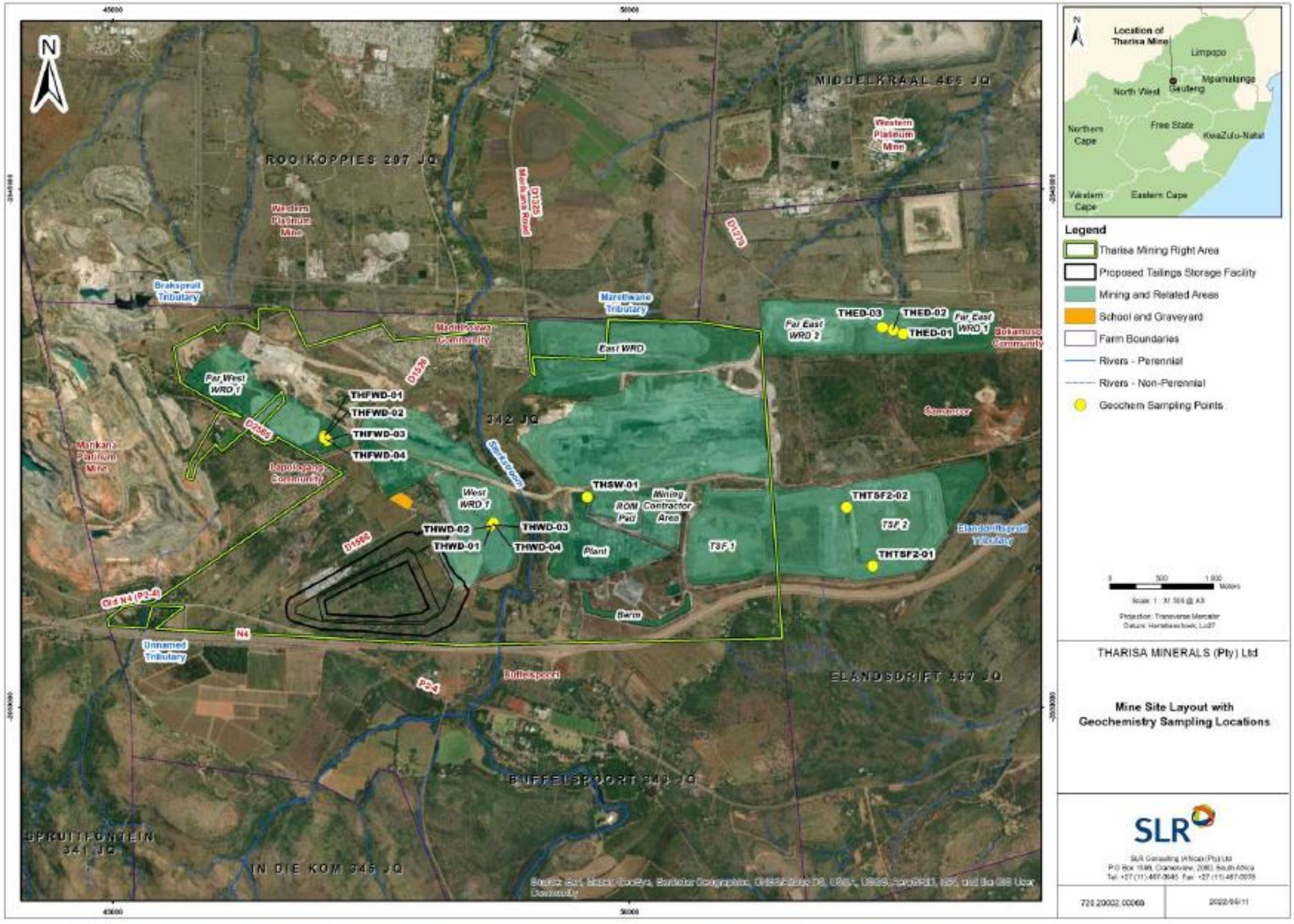

Figure 50: Geochemical sampling locations at Tharisa Mine

29-4.5.1 Minerology: X-Ray diffraction

Minerals are the building blocks of rocks. Mine drainage quality is generally a function of mineral dissolution (or precipitation) during interaction of rocks with water. XRD analysis identifies the main crystalline mineral phases in each sample. XRD is conducted on whole rock samples that have been crushed and ground to a powder. The powdered sample is placed on a flat holder, which faces the X-ray beam. The X-rays are diffracted by the crystal planes in the minerals, with diffraction peaks at characteristic angles. The phases are identified by comparing the locations and intensities of the diffraction peak with the peaks of mineral reference standards (Price, 2009). Limitations of XRD are that it is not easy to identify non-crystalline minerals, and minerals present in low concentrations may not be detected.

The mineralogy of Tharisa Mine waste materials is listed in Table 66 below.

Table 66: Tharisa composite waste rock and tailings minerology

Mineral Name	Formulas	Composition (%)				
		East Dump	West Dump	Far West Dump	THTSF 2	THTSF 2 Extension
Quartz	SiO_2	1.3	1.9	0.2	1.0	1.3
Plagioclase	$(Na,Ca)(Si,Al)_4O_8$	61.4	74.3	58.3	47.2	35.5
Augite	$Ca(Fe,Mg)Si_2O_6$	3.4	5.3	5.4	2.6	1.9
Enstatite	$MgSiO_3$	29.9	17.7	35.0	45.6	48.8
Talc	$Mg_3(Si2O5)_2(OH)_2$	1.5	0	0	2.6	5.3
Muscovite	$KAl_2((OH)_2 Al Si_3 O_{10})$	2.46	0	0	0	0
Actinolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)$	0.1	0.5	0	0	1.1
Rutile	TiO_2	0	0.2	0	0	2.8
Chlorite	$(Mg,Fe)_5Al(AlSi_3O_{10})(OH)_8$	0	0	1.1	0.9	3.4

29-4.5.2 Synthetic Precipitation Leaching Procedure

The SPLP is a quick and inexpensive method to determine:

- The mobility/ leachability of low volatility organic and inorganic analytes in liquids, soils, and wastes.
- The measure of desorption of contaminants from soil (rather than adsorption).
- The possibility of leaching metals into ground and surface waters.
- A site-specific impact to groundwater soil remediation standard.

Since the test uses custom pH levels to simulate rainfall in a particular geographic region, this test is often recommended over other methods when predicting leachate quality and risk to ground water.

Many factors can affect the leaching potential of organic constituents: pH, redox conditions, liquid-to-solid ratio, solubility, partitioning, presence of organic carbon, and non-aqueous phase extraction. Therefore, SPLP concentrations are used as input concentrations to Geochemical models to simulate realistic field conditions and produce more accurate source terms.

As part of this assessment, the SPLP and modelled source terms were subject to preliminary screening to identify potential CoCs by comparing the results to the following relevant water quality and effluent standards:

- SANS 241 Drinking Water (SANS 241:2015).
- DWS livestock target water quality guidelines (DWAF TWQG).

Use of drinking water guidelines does not suggest that leachates and drainage from mine activities will be used for drinking purposes. Use of these guidelines is purely intended as a preliminary indicator of potential environmental risk.

The SPLP concentrations for the tailings samples returned no CoCs except for a marginal exceedance of SANS 241: Operational for Al (THTSF 2 – fresh Vulcan tailings). Refer to Table 67.

29-4.5.3 Total and Leachate Concentrations

The waste assessment according to TLC for the waste samples is presented Table 14 and Table 15. A summary of the waste type classification and barrier requirements is presented in Table 16 and Table 17.

Based on the results, the tailings samples are classified as a Type 3 criteria in terms of TLC. Waste Classification and Assessment was undertaken as detailed in Section 3-4.2.

Table 67:Tharisa Mine composite waste rock and tailings SPLP results

Analytes	Ag	Al*	As	Au	B	Ba	Be	Bi	Ca*	Cd	Ce	Co	Cr (total)	Cs	Cu	Dy	Er	Eu	Fe*	Ga
Unit	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*
1. DWAF TWQG		**5**	**1**		**5**				**1000**	**10**		**1**			**5**				**10**	
2. IFC: Mining effluent			**0.1**							**0.05**					**0.3**				**2.0**	
3. SANS 241: Operational		**0.3**																		
4. SANS 241: Aesthetic																			**0.3**	
5. SANS 241: Acute Health																				
6. SANS 241: Chronic Health			**0.01**		**2.4**	**0.7**				**0.003**		**0.5**	**0.05**		**2.0**				**2.0**	
Comp 1 East Dump	<0.010	0,553	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0,185	<0.010
Comp 2 West Dump	<0.010	0,673	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	4	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0,153	<0.010
Far West Dump	<0.010	0,257	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<1	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0,323	<0.010
THTSF2-01	<0.010	0,508	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	7	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0,119	<0.010
THTSF2-02	<0.010	0,169	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	4	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0,135	<0.010

Analytes	Gd	Ge	Hf	Hg	Ho	In	Ir	K*	La	Li	Lu	Mg*	Mn*	Mo	Na*	Nb	Nd	Ni	Os	P
Unit	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*
1. DWAF TWQG				**1.0**								**500**	**10**	**0.01**	**2000**			**1**		
2. IFC: Mining effluent				**0.002**														**0.5**		
3. SANS 241: Operational																				
4. SANS 241: Aesthetic													**0.1**		**200**					
5. SANS 241: Acute Health																				
6. SANS 241: Chronic Health				**0.006**									**0.4**					**0.07**		
Comp 1 East Dump	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	1,439	<0.010	<0.010	<0.010	1	0,025	<0.010	<1	<0.010	<0.010	<0.010	<0.010	0,016
Comp 2 West Dump	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	1,842	<0.010	<0.010	<0.010	<1	0,025	<0.010	<1	<0.010	<0.010	<0.010	<0.010	0,037
Far West Dump	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0,138	<0.010	<0.010	<0.010	<1	0,025	<0.010	<1	<0.010	<0.010	<0.010	<0.010	0,012
THTSF2-01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	1,305	<0.010	<0.010	<0.010	2	0,025	<0.010	4	<0.010	<0.010	<0.010	<0.010	0,017
THTSF2-02	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	1,282	<0.010	<0.010	<0.010	2	0,025	<0.010	<1	<0.010	<0.010	<0.010	<0.010	<0.010

Analytes	Pb	Pd	Pr	Pt	Rb	Rh	Ru	Sb	Sc	Se	Si*	Sm	Sn	Sr	Ta	Tb	Te	Th	Ti	Tl
Unit	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*
1. DWAF TWQG	**0.5**									**50**										
2. IFC: Mining effluent	**0.2**																			
3. SANS 241: Operational																				
4. SANS 241: Aesthetic																				
5. SANS 241: Acute Health																				
6. SANS 241: Chronic Health	**0.01**							**0.02**		**0.04**										
Comp 1 East Dump	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	2,41	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Comp 2 West Dump	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	2,241	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Far West Dump	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	4,161	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
THTSF2-01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	3,172	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
THTSF2-02	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	1,561	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010

Analytes	Tm	U	V	W	Y	Yb	Zn	Zr	pH	EC	TDS	Tot Alk	Cl	SO4	NO3	NO2	F	Free NH3	Ortho-P	
Unit	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*		*mS/m*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	*mg/l*	
1. DWAF TWQG			**1**				**20**				**3000**		**3000**	**1000**	**100**	**10**	**6**			
2. IFC: Mining effluent							**0.5**		**9**											
3. SANS 241: Operational									**5 - 9.7**											
4. SANS 241: Aesthetic							**5**			**170**	**1200**		**300**	**250**				**1.5**		
5. SANS 241: Acute Health														**500**	**11**	**0.9**				
6. SANS 241: Chronic Health		**0.03**	**0.2**														**1.5**			
Comp 1 East Dump	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8,1	4,2	50	20	<2	<2	0,1	<0.05	0,2	<0.1	<0.1	
Comp 2 West Dump	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0,21265	<0.010	8,1	4,3	64	16	<2	<2	0,3	<0.05	0,2	0,1	<0.1	
Far West Dump	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	6,7	1,8	38	8	<2	<2	<0.1	<0.05	0,2	<0.1	<0.1	
THTSF2-01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	8,4	7,8	88	24	<2	5	0,3	0,2	0,2	0,2	<0.1	
THTSF2-02	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	7,7	4,5	52	20	<2	<2	<0.1	<0.05	0,2	<0.1	<0.1	

29-4.6 Engineering of mine design solutions to be implemented to avoid or remedy Acid Mine Drainage

The proposed raising of the walls of TSF 2 and TSF 2 Extension project designs are discussed in Section 2-3.

29-4.7 Measures that will be put in place to remedy any residual or cumulative impact that may result from Acid Mine Drainage

A baseline TSF inundation risk analysis should be considered to ascertain the potential loss of agricultural resources in the area should the TSFs collapse.

the design of the existing facilities was accepted as a class-D liner due to the nature of the tailings material and the presence of a thick “black turf” layer beneath the footprint of the facilities. The black turf is known for its low permeability, which ranges from 1E-9 m/sec to 4.7E-10 m/sec while maintaining a high plasticity index ranging between 32 and 72.

A cut-to-fill SWD was constructed for TSF1 and TSF 2, to divert clean water run-off from the upstream catchment of the TSF complex, preventing interaction with the TSF footprint, as shown in Figure 16 above.

29-4.8 Volumes and rates of water use required for the mining, trenching or bulk sampling operation

A water balance analysis was undertaken by Epoch. The findings have been documented in the Engineering Design Report which has been attached in Appendix 9. The TSF design employs a deterministic water balance model that aims to calculate the relative inflows and outflows of the various sources of water associated with TSFs, as shown in Figure 51.

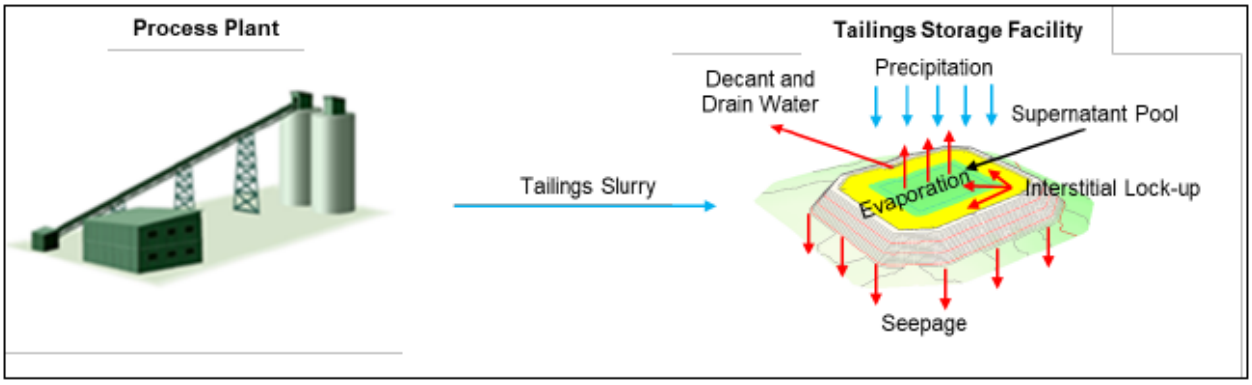

Figure 51: Typical Inflows and Outflows of a TSF

Inflows consist of the following:

- Precipitation run-off originating from the wet and dry beach area as well as the pool area; and
- Slurry water originating from the deposition of tailings.

Outflows comprise the following:

- Seepage;
- Lock-up;
- Evaporation; and
- Decant water.

The analysis is based on daily rainfall records to ascertain the maximum, minimum and average volume of water estimated to be available for return/discharge from the TSF as well as the expected minimum and maximum pool volumes.

Three scenarios were modelled during the analysis, namely, the driest yearly rainfall, average yearly rainfall, and the wettest year on record. Months with a complete rainfall record nearest to that of the respective month's average rainfall intensity were extracted from the 83 years of daily rainfall records obtained from the Buffelspoort II Agricultural Weather Station (No. 0511855 A9), to create the average daily rainfall dataset used in the analysis. This dataset was applied to each simulated year of operation of the facility, taking cognisance of the changes to catchment properties as tailings deposition progresses. The minimum, average and maximum returns based on this simulation were extracted for each month and used to create an envelope of expected returns per month over the operational life of the facility. In addition, the 1 in 10 000-year storm event was introduced into the model and the results thereof assessed.

From Table 68, it is evident that variation in rainfall events experienced at the site has a significant impact on the expected returns for the TSF complex. During normal operations, the average daily return volume could be as low as 52% during dry rainfall periods. During high rainfall periods (wet year simulation) the average daily return could increase to 68%.

Table 68: Available plant returns during normal operating conditions

Description	Unit	Scenario		
		Dry Year	Average Year	Wet Year
Total operating days	Days	429		
Average Return to plant	m^3/day	4524	5152	5846
	%	52%	60%	68%
Max Return to plant	m^3/day	11864	11976	18181
	%	100%	100%	100%
Min Return to plant	m^3/day	47	47	47
	%	0%	0%	0%

the average yearly expected return is equal to 61 % of the slurry water requirements. During the wet season, an estimated daily average of 69% can be returned whereas, during the dry season, the average daily return could equal 54 % of the slurry water requirements.

29-4.9 Has the water use licence been applied for?

A WULA process is being undertaken, for Section 21 (g): "*disposing of waste in a manner which may detrimentally impact on a water resource*" i.e., raising of the walls of TSF 2 and TSF 2 Extension, as the activity is listed as a water use under Section 21 of the NWA.

29-4.10 Impact to be mitigated in their respective phases

Table 69: Measures to rehabilitate the environment affected by the undertaking of any listed activity

Activities	Phase	Size and Scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
CONSTRUCTION PHASE					
• Establishment of contractor laydown area (s), and project service facilities. • Site preparation (levelling, compaction, drainage, layout, etc.) and establishment of civil structures for TSF 2 and TSF 2 Extension. • Geomembrane installation. • Installation of tailings and water conveyance infrastructure (pipelines, pumps, etc., and their related civil, mechanical, and electrical works). • Commissioning.	• Construction	• Construction Footprint	• Mitigation in accordance with the recommendations by SAHRA, as required in terms of the NHRA, Section 38(4)c(i); 38(4)c(ii) and 38(4) e. • Chance Find Protocol must be implemented.	• Recommendations by SAHRA. • Chance Find Protocol.	Site Establishment, and throughout the construction phase, on a daily basis.
			• Site demarcation. • Use of existing roads and walking paths. • Use of hydrocarbon Spill Management Plan. • Use of an emergency spill kit and drip trays or any form of oil absorbent material. • Fire management plan.	• NEMBA. • Fire Management Plan.	Site Establishment, and throughout the construction phase, on a daily basis.
			• Information and prohibitory signs. • Appointment of the ECO. • Environmental induction. • Speed limits enforcement. • Long-term water monitoring programmes. • Use of environmentally friendly dust suppressant products. • Fire management plan.	• NEMBA. • Surface water monitoring programmes.	Throughout the construction phase, on a daily basis.
			• Dust-reducing mitigation. • Use of environmentally friendly dust suppressant products. • Speed limits enforcement. • Long-term dust monitoring programme. • Rehabilitation plan.	• Dust monitoring programme. • Control through design and operational controls.	Throughout the construction phase, on a daily basis.
			• Waste management, collection, storage and removal. • Signs and protocols enforcement. • Provision of ablution facilities. • Method statements. • Monitoring for leaks and failures.	• Signs and protocols. • Method statements. • Monitoring Programmes.	Site Establishment, and throughout the construction phase, on a daily basis.
			• Environmental Awareness Training. • Action plans for spills, leaks and other impacts to the adjacent natural areas.	• Environmental Awareness Training. • Action Plans.	Site Establishment, and throughout the construction phase, on a daily basis.
• Transport and general construction activities. • Levelling of area. • Wind erosion from open areas. • Materials handling.	• Construction	• Construction Footprint and surrounding areas.	• Basic control measures e.g. limiting the speed of haul trucks; limiting unnecessary travelling of vehicles on unpaved roads; and to application of water sprays.	• Traffic Signs. • Traffic By-Laws. • National Road Traffic Act, 1996 (Act No. 93 of 1996).	Site Establishment, and throughout the construction phase, on a daily basis.
• Earthmoving equipment at the footprint area. • Hauling of material to and from the specific area. • Building activities during construction.	• Construction	• Construction Footprint and surrounding areas.	• Routine monitoring of ambient noise levels. • Training in noise control plan during health & safety briefings. • Noise equipment or methods of work selection. • Regular inspection and maintenance of all equipment. • Community engagement.	• SANS Environmental Noise Standards. • IFC Performance Standards. • Ambient noise levels monitoring. • Noise control plan. • National Road Traffic Act, 1996 (Act No. 93 of 1996)	Site Establishment, and throughout the construction phase, on a daily basis.
• Establishment of contractor laydown area (s), and project service facilities. • Site preparation (levelling, compaction, drainage, layout, etc.) and establishment of civil structures for TSF 2 and TSF 2 Extension. • Geomembrane installation. • Installation of tailings and water conveyance infrastructure (pipelines, pumps, etc., and their related civil, mechanical, and electrical works). • Commissioning.	• Construction	• Construction Footprint and surrounding areas.	• Rehabilitation Plan. • Construction camp demarcation. • Waste management, collection, storage and removal. • Signs and protocols enforcement. • Provision of ablution facilities.	• Signs and protocols. • Rehabilitation Plan.	Site Establishment, and throughout the construction phase, on a daily basis.
	• Construction	• Construction Footprint	• Revegetation. • Temporary erosion control measures. • Use of environmentally friendly dust suppressant products. • Footprint demarcation. • Soil Compaction Management. • Soil Contamination Management. • TSF risk inundation analysis. • TSF liner requirements. • Spill prevention and emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan. • Demarcation of “No Go Areas. • Close supervision and monitoring.	• Erosion control measures. • TSF risk inundation analysis. • Emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan.	Site Establishment, and throughout the construction phase, on a daily basis.

Activities	Phase	Size and Scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
			• Stockpile Management. • A short-term fertilizer program.		
	• Construction	• Construction Footprint	• Vehicles regular checks for oil leaks. • hydrocarbon spills clean ups and training. • Waste handling. • Best practise principals for hazardous substances storage. • Hazardous substances storage.	• MPRDA and NEMA principles. • Water management measures in compliance with NWA and IWUL. • NWA. • NEMA.	Throughout the construction phase, on a daily basis.
	• Construction	• Construction Footprint and surrounding areas.	• Access Control. • Footprint demarcation. • Engineered stormwater management structures. • Use of spill kits and environmental induction • Landscape and Rehabilitation Plan.	• Landscape and Rehabilitation Plan. • NEMBA.	Throughout the construction phase, on a daily basis.
	• Construction	• Construction Footprint and surrounding areas.	• Strict times for machinery and materials transportation.	• Traffic Signs. • Traffic By-Laws. • National Road Traffic Act, 1996 (Act No. 93 of 1996).	Site Establishment, and throughout the construction phase, on a daily basis.
OPERATIONAL PHASE					
• Deposition of tailings. • Maintenance of the facility and related infrastructure (piping etc.).	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Dustfall monitoring.	• NEMAQA.	Throughout the operational phase, on a daily basis.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Information and prohibitory signs. • Speed limits enforcement. • Long-term biomonitoring and surface water monitoring programmes. • Use of environmentally friendly dust suppressant products.	• NEMBA. • Biomonitoring monitoring programmes.	Throughout the operational phase, on a daily basis.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Alien Invasive Plant management plan.	• NEMBA. • Biomonitoring monitoring programmes. • Alien Invasive Plant management plan.	Throughout the operational phase, on a daily basis.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Dust-reducing mitigation. • Use of environmentally friendly dust suppressant products. • Speed limits enforcement. • Long-term dust monitoring programme. • Rehabilitation plan.	• Dust monitoring programme. • Control through design and operational controls.	Throughout the operational phase, on a daily basis.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Waste management, collection, storage and removal. • Signs and protocols enforcement. • Provision of ablution facilities. • Method statements. • Monitoring for leaks and failures.	• Signs and protocols. • Method statements. • Monitoring Programmes.	Throughout the operational phase, on a daily basis.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Environmental Awareness Training. • Action plans for spills, leaks and other impacts to the adjacent natural areas.	• Environmental Awareness Training. • Action Plans.	Throughout the operational phase, on a daily basis.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Control through the monitoring of socioeconomic conditions.	• SLP • Mining Charter • MPRDA • IFC Performance Standards • Mine Health and Safety Act, 1996 (Act No. 29 of 1996)	Throughout the operational phase, on a monthly basis.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Continuous and ongoing rehabilitation as per the rehabilitation plan.	• Rehabilitation plan	Throughout the operational phase, on a daily basis.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Revegetation. • Erosion control measures. • Use of environmentally friendly dust suppressant products. • Soil Compaction Management. • Soil Contamination Management. • Spill prevention and emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan. • Close supervision and monitoring. • Stockpile Management. • A short-term fertilizer program.	• Erosion control measures. • TSF risk inundation analysis. • Emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan.	Throughout the operational phase, on a daily basis.

Activities	Phase	Size and Scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Intense competent operational management. • Perimeter fence inspection daily. • Slope stability analysis. • Phreatic surface level monitoring. • Assessment of the functionality of the drainage system. • A geophysical survey should be done towards the east of TSF 2 to detect subsurface flow zones. • Groundwater monitoring boreholes should be developed adjacent to this drainage to verify whether there is any shallow seepage. If seepage is detected, a combination of a deep cut off drains, seepage capturing wells and bioremediation should be developed. • The upstream and downstream monitoring network needs to be reviewed, as additional downstream monitoring locations (both surface water and groundwater) are required. • Parameter optimisation study to analyse CCP. • Water monitoring protocol update. • Annual and quarterly monitoring. • Annual hydrocensus. • Annual numerical model updated and recalibration.	• Perimeter fence inspection programme. • Slope stability analysis programme. • Phreatic surface level monitoring programme. • Drainage system assessment programme. • Geophysical survey. • Groundwater monitoring. • Parameter optimisation study. • Water monitoring protocol. • Annual and quarterly monitoring programme. • Annual hydrocensus programme. • Annual numerical model.	Throughout the operational phase, at frequencies determined by the various programmes and approvals.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Freeboard monitoring. • Daily TSF inspections. • Slope stability analysis. • A geophysical survey should be done towards the east of TSF 2 to detect subsurface flow zones. • Groundwater monitoring boreholes should be developed adjacent to this drainage to verify whether there is any shallow seepage. If seepage is detected, a combination of a deep cut off drains, seepage capturing wells and bioremediation should be developed. • The upstream and downstream monitoring network needs to be reviewed, as additional downstream monitoring locations (both surface water and groundwater) are required. • Parameter optimisation study to analyse CCP. • Water monitoring protocol update. • Annual and quarterly monitoring. • Annual hydrocensus. • Annual numerical model updated and recalibration.	• Freeboard monitoring programme. • TSF inspections programme. • Slope stability analysis programme. • Geophysical survey. • Groundwater monitoring. • Parameter optimisation study. • Water monitoring protocol. • Annual and quarterly monitoring programme. • Annual hydrocensus programme. • Annual numerical model.	Throughout the operational phase, at frequencies determined by the various programmes and approvals.
CLOSURE, REHABILITATION AND POST CLOSURE PHASE					
• Infrastructure removal/ demolition. • Topsoil recovered from stockpiles for rehabilitation and revegetation of surroundings. • Vehicle entrainment on unpaved road surfaces during rehabilitation – once that is done, vehicle activity associated with the operations should cease.	• Closure, rehabilitation and post closure	• TSF 2 and TSF 2 Extension footprint.	• Revegetation.	• NEMBA. • Biomonitoring monitoring programmes.	During Rehabilitation and Post Closure Monitoring, at frequencies determined by the various programmes and approvals.
	• Closure, rehabilitation and post closure	• TSF 2 and TSF 2 Extension footprint and surrounding areas.	• Routine monitoring of ambient noise levels. • Training in noise control plan during health & safety briefings. • Noise equipment or methods of work selection. • Regular inspection and maintenance of all equipment. • Community engagement.	• Traffic Signs. • Traffic By-Laws. • National Road Traffic Act, 1996 (Act No. 93 of 1996).	During Closure, rehabilitation and Post Closure Monitoring, at frequencies determined by the various programmes and approvals.
	• Closure, rehabilitation and post closure	• TSF 2 and TSF 2 Extension footprint and surrounding areas.	• Control through the monitoring of socioeconomic conditions.	• SANS Environmental Noise Standards. • IFC Performance Standards. • Ambient noise levels monitoring. • Noise control plan. • National Road Traffic Act, 1996 (Act No. 93 of 1996)	During Closure, rehabilitation and Post Closure Monitoring, at frequencies determined by the various programmes and approvals.
	• Closure, rehabilitation and post closure	• TSF 2 and TSF 2 Extension footprint and surrounding areas.	• Rehabilitation Plan. • Waste management, collection, storage and removal. • Signs and protocols enforcement. • Provision of ablution facilities.	• SLP • Mining Charter • MPRDA • IFC Performance Standards • Mine Health and Safety Act, 1996 (Act No. 29 of 1996)	During Closure, and Rehabilitation.
	• Closure,	• TSF 2 and TSF 2	• Revegetation.	• Signs and protocols.	During Closure, and Rehabilitation.

Activities	Phase	Size and Scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	rehabilitation and post closure	Extension footprint.	• Temporary erosion control measures. • Use of environmentally friendly dust suppressant products. • Footprint demarcation. • Soil Compaction Management. • Soil Contamination Management. • TSF risk inundation analysis. • Appropriately cap the TSFs. • Spill prevention and emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan. • Demarcation of "No Go Areas. • Close supervision and monitoring. • Stockpile Management. • A short-term fertilizer program.	• Rehabilitation Plan.	
	• Closure, rehabilitation and post closure	• TSF 2 and TSF 2 Extension footprint.	• The backfilled East Pit to form a permanent sink to capture seepage from the TSFs. • Rehabilitation Plan. • Water quality monitoring. • Rehabilitation Plan in accordance with the EMPr and closure plan.	• Rehabilitation Plan. • Water quality monitoring programme. • Control through design and operational controls.	During Closure, rehabilitation and Post Closure Monitoring, at frequencies determined by the various programmes and approvals.

SECTION 30: IMPACT MANAGEMENT OUTCOMES

Table 70: Impact Management Outcome

Activities	Phase	Size and Scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation	Standard to be achieved/ Objectives
CONSTRUCTION PHASE						
• Establishment of contractor laydown area (s), and project service facilities. • Site preparation (levelling, compaction, drainage, layout, etc.) and establishment of civil structures for TSF 2 and TSF 2 Extension. • Geomembrane installation. • Installation of tailings and water conveyance infrastructure (pipelines, pumps, etc., and their related civil, mechanical, and electrical works). • Commissioning.	• Construction	• Construction Footprint	• Mitigation in accordance with the recommendations by SAHRA, as required in terms of the NHRA, Section 38(4)c(i); 38(4)c(ii) and 38(4) e. • Chance Find Protocol must be implemented.	• Recommendations by SAHRA. • Chance Find Protocol.	Site Establishment, and throughout the construction phase, on a daily basis.	• To minimise disturbance of heritage and paleontological resources.
			• Site demarcation. • Use of existing roads and walking paths. • Use of hydrocarbon Spill Management Plan. • Use of an emergency spill kit and drip trays or any form of oil absorbent material. • Fire management plan.	• National Environmental Management: Biodiversity Act, 20024 (Act No. 10 of 2004) (NEMBA). • Fire Management Plan.	Site Establishment, and throughout the construction phase, on a daily basis.	• To prevent the loss and fragmentation of vegetation communities. • To ensure safe movement of faunal species. • To prevent the direct and indirect loss and disturbance of floral and faunal species and communities.
			• Information and prohibitory signs. • Appointment of the ECO. • Environmental induction. • Speed limits enforcement. • Long-term water monitoring programmes. • Use of environmentally friendly dust suppressant products. • Fire management plan.	• NEMBA. • Surface water monitoring programmes.	Throughout the construction phase, on a daily basis.	• To ensure safe movement of faunal species. • To prevent the direct and indirect loss and disturbance of floral and faunal species and communities.
			• Dust-reducing mitigation. • Use of environmentally friendly dust suppressant products. • Speed limits enforcement. • Long-term dust monitoring programme. • Rehabilitation plan.	• Dust monitoring programme. • Control through design and operational controls.	Throughout the construction phase, on a daily basis.	• To reduce dustfall and prevent erosion.
			• Waste management, collection, storage and removal. • Signs and protocols enforcement. • Provision of ablution facilities. • Method statements.	• Signs and protocols. • Method statements. • Monitoring Programmes.	Site Establishment, and throughout the construction phase, on a daily basis.	• To ensure proper waste management, collection, storage and removal. • To prevent and monitor leaks/spillages into the

Activities	Phase	Size and Scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation	Standard to be achieved/ Objectives
			• Monitoring for leaks and failures.			environment.
			• Environmental Awareness Training. • Action plans for spills, leaks and other impacts to the adjacent natural areas.	• Environmental Awareness Training. • Action Plans.	Site Establishment, and throughout the construction phase, on a daily basis.	• To ensure compliance with the Environmental Awareness Training.
• Transport and general construction activities. • Levelling of area. • Wind erosion from open areas. • Materials handling.	• Construction	• Construction Footprint and surrounding areas.	• Basic control measures e.g. limiting the speed of haul trucks; limiting unnecessary travelling of vehicles on unpaved roads; and to application of water sprays.	• Traffic Signs. • Traffic By-Laws. • National Road Traffic Act, 1996 (Act No. 93 of 1996).	Site Establishment, and throughout the construction phase, on a daily basis.	• To ensure that the basic control measures are correctly implemented.
• Earthmoving equipment at the footprint area. • Hauling of material to and from the specific area. • Building activities during construction.	• Construction	• Construction Footprint and surrounding areas.	• Routine monitoring of ambient noise levels. • Training in noise control plan during health & safety briefings. • Noise equipment or methods of work selection. • Regular inspection and maintenance of all equipment. • Community engagement.	• SANS Environmental Noise Standards. • IFC Performance Standards. • Ambient noise levels monitoring. • Noise control plan. • National Road Traffic Act, 1996 (Act No. 93 of 1996)	Site Establishment, and throughout the construction phase, on a daily basis.	• To reduce noise disturbance to the surrounding communities
• Establishment of contractor laydown area (s), and project service facilities. • Site preparation (levelling, compaction, drainage, layout, etc.) and establishment of civil structures for TSF 2 and TSF 2 Extension. • Geomembrane installation. • Installation of tailings and water conveyance infrastructure (pipelines, pumps, etc., and their related civil, mechanical, and electrical works). • Commissioning.	• Construction	• Construction Footprint and surrounding areas.	• Rehabilitation Plan. • Construction camp demarcation. • Waste management, collection, storage and removal. • Signs and protocols enforcement. • Provision of ablution facilities.	• Signs and protocols. • Rehabilitation Plan.	Site Establishment, and throughout the construction phase, on a daily basis.	• To limit negative visual impacts.
	• Construction	• Construction Footprint	• Revegetation. • Temporary erosion control measures. • Use of environmentally friendly dust suppressant products. • Footprint demarcation. • Soil Compaction Management. • Soil Contamination Management. • TSF risk inundation analysis. • TSF liner requirements. • Spill prevention and emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan. • Demarcation of “No Go Areas. • Close supervision and monitoring. • Stockpile Management. • A short-term fertilizer program.	• Erosion control measures. • TSF risk inundation analysis. • Emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan.	Site Establishment, and throughout the construction phase, on a daily basis.	• To prevent the loss of soil resources and land capability due to contamination.
	• Construction	• Construction Footprint	• Vehicles regular checks for oil leaks. • hydrocarbon spills clean ups and training. • Waste handling. • Best practise principals for hazardous substances storage. • Hazardous substances storage.	• MPRDA and NEMA principles. • Water management measures in compliance with NWA and IWUL. • NWA. • NEMA.	Throughout the construction phase, on a daily basis.	• To prevent contamination to ground- and surface water systems. • To ensure proper storage of chemicals and building materials. • To prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow and to prevent pollution of surface water resources.
	• Construction	• Construction Footprint and surrounding areas.	• Access Control. • Footprint demarcation. • Engineered stormwater management structures. • Use of spill kits and environmental induction • Landscape and Rehabilitation Plan.	• Landscape and Rehabilitation Plan. • NEMBA.	Throughout the construction phase, on a daily basis.	• To prevent the unacceptable disturbance and loss of aquatic biodiversity. • To prevent loss of ecosystem functionality.
	• Construction	• Construction Footprint and surrounding areas.	• Strict times for machinery and materials transportation.	• Traffic Signs. • Traffic By-Laws. • National Road Traffic Act, 1996 (Act No. 93 of 1996).	Site Establishment, and throughout the construction phase, on a daily basis.	• To prevent traffic congestion.
OPERATIONAL PHASE						

Activities	Phase	Size and Scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation	Standard to be achieved/ Objectives
• Deposition of tailings. • Maintenance of the facility and related infrastructure (piping etc.).	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Dustfall monitoring.	• NEMAQA.	Throughout the operational phase, on a daily basis.	• To reduce dustfall and prevent erosion.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Information and prohibitory signs. • Speed limits enforcement. • Long-term biomonitoring and surface water monitoring programmes. • Use of environmentally friendly dust suppressant products.	• NEMBA. • Biomonitoring monitoring programmes.	Throughout the operational phase, on a daily basis.	• To ensure safe movement of faunal species. • To prevent the direct and indirect loss and disturbance of floral and faunal species and communities.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Alien Invasive Plant management plan.	• NEMBA. • Biomonitoring monitoring programmes. • Alien Invasive Plant management plan.	Throughout the operational phase, on a daily basis.	• To prevent Alien Vegetation and Fauna encroachment.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Dust-reducing mitigation. • Use of environmentally friendly dust suppressant products. • Speed limits enforcement. • Long-term dust monitoring programme. • Rehabilitation plan.	• Dust monitoring programme. • Control through design and operational controls.	Throughout the operational phase, on a daily basis.	• To reduce dustfall and prevent erosion.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Waste management, collection, storage and removal. • Signs and protocols enforcement. • Provision of ablution facilities. • Method statements. • Monitoring for leaks and failures.	• Signs and protocols. • Method statements. • Monitoring Programmes.	Throughout the operational phase, on a daily basis.	• To ensure proper waste management, collection, storage and removal. • To prevent and monitor leaks/spillages into the environment.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Environmental Awareness Training. • Action plans for spills, leaks and other impacts to the adjacent natural areas.	• Environmental Awareness Training. • Action Plans.	Throughout the operational phase, on a daily basis.	• To ensure compliance with the Environmental Awareness Training.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Control through the monitoring of socioeconomic conditions.	• SLP • Mining Charter • MPRDA • IFC Performance Standards • Mine Health and Safety Act, 1996 (Act No. 29 of 1996)	Throughout the operational phase, on a monthly basis.	• To enhance the positive economic impacts to the local economy.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Continuous and ongoing rehabilitation as per the rehabilitation plan.	• Rehabilitation plan	Throughout the operational phase, on a daily basis.	• To limit negative visual impacts.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Revegetation. • Erosion control measures. • Use of environmentally friendly dust suppressant products. • Soil Compaction Management. • Soil Contamination Management. • Spill prevention and emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan. • Close supervision and monitoring. • Stockpile Management. • A short-term fertilizer program.	• Erosion control measures. • TSF risk inundation analysis. • Emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan.	Throughout the operational phase, on a daily basis.	• To prevent the loss of soil resources and land capability due to contamination.
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Intense competent operational management. • Perimeter fence inspection daily. • Slope stability analysis. • Phreatic surface level monitoring. • Assessment of the functionality of the drainage system. • A geophysical survey should be done towards the east of TSF 2 to detect subsurface flow zones. • Groundwater monitoring boreholes should be developed adjacent to this drainage to verify whether there is any	• Perimeter fence inspection programme. • Slope stability analysis programme. • Phreatic surface level monitoring programme. • Drainage system assessment programme. • Geophysical survey. • Groundwater monitoring.	Throughout the operational phase, at frequencies determined by the various programmes and approvals.	• To prevent contamination to ground- and surface water systems. • To ensure proper storage of chemicals and building materials. • To prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow and to prevent pollution of surface water resources.

Activities	Phase	Size and Scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation	Standard to be achieved/ Objectives
			shallow seepage. If seepage is detected, a combination of a deep cut off drains, seepage capturing wells and bioremediation should be developed. • The upstream and downstream monitoring network needs to be reviewed, as additional downstream monitoring locations (both surface water and groundwater) are required. • Parameter optimisation study to analyse CCP. • Water monitoring protocol update. • Annual and quarterly monitoring. • Annual hydrocensus. • Annual numerical model updated and recalibration.	• Parameter optimisation study. • Water monitoring protocol. • Annual and quarterly monitoring programme. • Annual hydrocensus programme. • Annual numerical model.		
	• Operational	• TSF 2 and TSF 2 Extension footprint.	• Freeboard monitoring. • Daily TSF inspections. • Slope stability analysis. • A geophysical survey should be done towards the east of TSF 2 to detect subsurface flow zones. • Groundwater monitoring boreholes should be developed adjacent to this drainage to verify whether there is any shallow seepage. If seepage is detected, a combination of a deep cut off drains, seepage capturing wells and bioremediation should be developed. • The upstream and downstream monitoring network needs to be reviewed, as additional downstream monitoring locations (both surface water and groundwater) are required. • Parameter optimisation study to analyse CCP. • Water monitoring protocol update. • Annual and quarterly monitoring. • Annual hydrocensus. • Annual numerical model updated and recalibration.	• Freeboard monitoring programme. • TSF inspections programme. • Slope stability analysis programme. • Geophysical survey. • Groundwater monitoring. • Parameter optimisation study. • Water monitoring protocol. • Annual and quarterly monitoring programme. • Annual hydrocensus programme. • Annual numerical model.	Throughout the operational phase, at frequencies determined by the various programmes and approvals.	• To prevent the unacceptable disturbance and loss of aquatic biodiversity. • To prevent loss of ecosystem functionality.
CLOSURE, REHABILITATION AND POST CLOSURE PHASE						
• Infrastructure removal/ demolition. • Topsoil recovered from stockpiles for rehabilitation and revegetation of surroundings. • Vehicle entrainment on unpaved road surfaces during rehabilitation – once that is done, vehicle activity associated with the operations should cease.	• Closure, rehabilitation and post closure	• TSF 2 and TSF 2 Extension footprint.	• Revegetation.	• NEMBA. • Biomonitoring monitoring programmes.	During Rehabilitation and Post Closure Monitoring, at frequencies determined by the various programmes and approvals.	• To prevent Alien Vegetation and Fauna encroachment.
	• Closure, rehabilitation and post closure	• TSF 2 and TSF 2 Extension footprint and surrounding areas.	• Routine monitoring of ambient noise levels. • Training in noise control plan during health & safety briefings. • Noise equipment or methods of work selection. • Regular inspection and maintenance of all equipment. • Community engagement.	• Traffic Signs. • Traffic By-Laws. • National Road Traffic Act, 1996 (Act No. 93 of 1996).	During Closure, rehabilitation and Post Closure Monitoring, at frequencies determined by the various programmes and approvals.	• To reduce noise disturbance to the surrounding communities.
	• Closure, rehabilitation and post closure	• TSF 2 and TSF 2 Extension footprint and surrounding areas.	• Control through the monitoring of socioeconomic conditions.	• SANS Environmental Noise Standards. • IFC Performance Standards. • Ambient noise levels monitoring. • Noise control plan. • National Road Traffic Act, 1996 (Act No. 93 of 1996).	During Closure, rehabilitation and Post Closure Monitoring, at frequencies determined by the various programmes and approvals.	• To enhance the positive economic impacts to the local economy.
	• Closure, rehabilitation and post closure	• TSF 2 and TSF 2 Extension footprint and surrounding areas.	• Rehabilitation Plan. • Waste management, collection, storage and removal. • Signs and protocols enforcement. • Provision of ablution facilities.	• SLP. • Mining Charter. • MPRDA. • IFC Performance Standards. • Mine Health and Safety Act, 1996 (Act No. 29 of 1996).	During Closure, and Rehabilitation.	• To limit negative visual impacts.
	• Closure, rehabilitation and post	• TSF 2 and TSF 2 Extension footprint.	• Revegetation. • Temporary erosion control measures. • Use of environmentally friendly dust suppressant	• Signs and protocols. • Rehabilitation Plan.	During Closure, and Rehabilitation.	• To prevent the loss of soil resources and land capability due to contamination.

Activities	Phase	Size and Scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation	Standard to be achieved/ Objectives
	closure		products. • Footprint demarcation. • Soil Compaction Management. • Soil Contamination Management. • TSF risk inundation analysis. • Appropriately cap the TSFs. • Spill prevention and emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan. • Demarcation of "No Go Areas. • Close supervision and monitoring. • Stockpile Management. • A short-term fertilizer program.			
	• Closure, rehabilitation and post closure	• TSF 2 and TSF 2 Extension footprint.	• The backfilled East Pit to form a permanent sink to capture seepage from the TSFs. • Rehabilitation Plan. • Water quality monitoring. • Rehabilitation Plan in accordance with the EMPr and closure plan.	• Rehabilitation Plan. • Water quality monitoring programme. • Control through design and operational controls.	During Closure, rehabilitation and Post Closure Monitoring, at frequencies determined by the various programmes and approvals.	• To prevent contamination to ground- and surface water systems. • To ensure proper storage of chemicals and building materials. • To prevent unacceptable alteration of drainage patterns and related reduction of downstream surface water flow and to prevent pollution of surface water resources.

SECTION 31: IMPACT MANAGEMENT ACTIONS

Table 71: Impact Management Actions

Activity	Potential Impact	Mitigation Type	Time period for implementation	Compliance with standards
CONSTRUCTION PHASE				
• Establishment of contractor laydown area (s), and project service facilities. • Site preparation (levelling, compaction, drainage, layout, etc.) and establishment of civil structures for TSF 2 and TSF 2 Extension. • Geomembrane installation.	• Disturbance of heritage and paleontological resources	• Mitigation in accordance with the recommendations by SAHRA, as required in terms of the NHRA, Section 38(4)c(i); 38(4)c(ii) and 38(4) e. • Chance Find Protocol must be implemented.	• Site Establishment, and throughout the construction phase, on a daily basis.	• Recommendations by SAHRA. • Chance Find Protocol.
• Installation of tailings and water conveyance infrastructure (pipelines, pumps, etc., and their related civil, mechanical, and electrical works). • Commissioning.	• The loss and fragmentation of vegetation communities. • The safe movement of faunal species. • The direct and indirect loss and disturbance of floral and faunal species and communities.	• Site demarcation. • Use of existing roads and walking paths. • Use of hydrocarbon Spill Management Plan. • Use of an emergency spill kit and drip trays or any form of oil absorbent material. • Fire management plan.	• Site Establishment, and throughout the construction phase, on a daily basis.	• NEMBA. • Fire Management Plan.
	• The safe movement of faunal species. • The direct and indirect loss and disturbance of faunal species and communities.	• Information and prohibitory signs. • Appointment of the ECO. • Environmental induction. • Speed limits enforcement. • Long-term water monitoring programmes. • Use of environmentally friendly dust suppressant products. • Fire management plan.	• Throughout the construction phase, on a daily basis.	• NEMBA. • Species relocation plan. • Biomonitoring and surface water monitoring programmes.
	• Dustfall and Erosion.	• Dust-reducing mitigation. • Use of environmentally friendly dust suppressant products. • Speed limits enforcement. • Long-term dust monitoring programme. • Rehabilitation plan.	• Throughout the construction phase, on a daily basis.	• Dust monitoring programme. • Control through design and operational controls.
	• Waste generation and dumping. • Leaks/spillages into the	• Waste management, collection, storage and removal. • Signs and protocols enforcement.	• Site Establishment, and throughout the construction phase, on a daily basis.	• Signs and protocols. • Method statements.

Activity	Potential Impact	Mitigation Type	Time period for implementation	Compliance with standards
	environment.	• Provision of ablution facilities. • Method statements. • Monitoring for leaks and failures.		• Monitoring Programmes.
	• Compliance with the training.	• Environmental Awareness Training. • Action plans for spills, leaks and other impacts to the adjacent natural areas.	• Site Establishment, and throughout the construction phase, on a daily basis.	• Environmental Awareness Training. • Action Plans.
• Transport and general construction activities. • Levelling of area. • Wind erosion from open areas. • Materials handling.	• Change in ambient concentrations	• Basic control measures e.g. limiting the speed of haul trucks; limiting unnecessary travelling of vehicles on unpaved roads; and to application of water sprays.	• Site Establishment, and throughout the construction phase, on a daily basis.	• Traffic Signs. • Traffic By-Laws. • National Road Traffic Act, 1996 (Act No. 93 of 1996).
• Earthmoving equipment at the footprint area. • Hauling of material to and from the specific area. • Building activities during construction.	• Increase in ambient noise level	• Routine monitoring of ambient noise levels. • Training in noise control plan during health & safety briefings. • Noise equipment or methods of work selection. • Regular inspection and maintenance of all equipment. • Community engagement.	• Site Establishment, and throughout the construction phase, on a daily basis.	• SANS Environmental Noise Standards. • IFC Performance Standards. • Ambient noise levels monitoring. • Noise control plan. • National Road Traffic Act, 1996 (Act No. 93 of 1996)
• Establishment of contractor laydown area (s), and project service facilities. • Site preparation (levelling, compaction, drainage, layout, etc.) and establishment of civil structures for TSF 2 and TSF 2 Extension. • Geomembrane installation. • Installation of tailings and water conveyance infrastructure (pipelines, pumps, etc., and their related civil, mechanical, and electrical works). • Commissioning.	• Economic Impacts	• Rehabilitation Plan. • Construction camp demarcation. • Waste management, collection, storage and removal. • Signs and protocols enforcement. • Provision of ablution facilities.	• Site Establishment.	• SLP • Mining Charter • MPRDA • IFC Performance Standards • Mine Health and Safety Act, 1996 (Act No. 29 of 1996)
	• Change in landscape and related visual aspects	• Rehabilitation Plan. • Construction camp demarcation. • Waste management, collection, storage and removal. • Signs and protocols enforcement. • Provision of ablution facilities.	• Site Establishment, and throughout the construction phase, on a daily basis.	• Signs and protocols. • Rehabilitation Plan.
	• Loss of soil resources and land capability due to contamination	• Revegetation. • Temporary erosion control measures. • Use of environmentally friendly dust suppressant products. • Footprint demarcation. • Soil Compaction Management. • Soil Contamination Management. • TSF risk inundation analysis. • TSF liner requirements. • Spill prevention and emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan. • Demarcation of “No Go Areas. • Close supervision and monitoring. • Stockpile Management. • A short-term fertilizer program.	• Site Establishment, and throughout the construction phase, on a daily basis.	• Erosion control measures. • TSF risk inundation analysis. • TSF liner requirements. • Emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan.
	• Contamination to ground- and surface water systems from oil, grease, and diesel spillages from construction vehicles. • Storage of chemicals and building materials during construction of waste facility.	• Vehicles regular checks for oil leaks. • hydrocarbon spills clean ups and training. • Waste handling. • Best practise principals for hazardous substances storage. • Hazardous substances storage.	• Throughout the construction phase, on a daily basis.	• MPRDA and NEMA principles. • Water management measures in compliance with NWA and IWUL. • NWA. • NEMA.
	• Erosion and sedimentation. • The altered hydrology. • Sedimentation of the resources. • Impaired water and habitat quality.	• Access Control. • Footprint demarcation. • Engineered stormwater management structures. • Use of spill kits and environmental induction • Landscape and Rehabilitation Plan.	• Throughout the construction phase, on a daily basis.	• Landscape and Rehabilitation Plan. • NEMBA.
	• Increased traffic which could result in traffic congestion.	• Strict times for machinery and materials transportation.	• Site Establishment, and throughout the construction phase, on a daily basis.	• Traffic Signs. • Traffic By-Laws. • National Road Traffic Act, 1996 (Act No. 93 of 1996).

Activity	Potential Impact	Mitigation Type	Time period for implementation	Compliance with standards
OPERATIONAL PHASE				
• Deposition of tailings. • Maintenance of the facility and related infrastructure (piping etc.).	• Dustfall and Erosion.	• Dust-reducing mitigation. • Use of environmentally friendly dust suppressant products. • Speed limits enforcement. • Long-term dust monitoring programme. • Rehabilitation plan.	• Throughout the operational phase, on a daily basis.	• Dust monitoring programme. • Control through design and operational controls.
	• Waste generation and dumping. • Leaks/spillages into the environment.	• Waste management, collection, storage and removal. • Signs and protocols enforcement. • Provision of ablution facilities. • Method statements. • Monitoring for leaks and failures.	• Throughout the operational phase, on a daily basis.	• Signs and protocols. • Method statements. • Monitoring Programmes.
	• Compliance with the training.	• Environmental Awareness Training. • Action plans for spills, leaks and other impacts to the adjacent natural areas.	• Throughout the operational phase, on a daily basis.	• Environmental Awareness Training. • Action Plans.
• Deposition of tailings. • Maintenance of the facility and related infrastructure (piping etc.).	• Change in ambient concentrations	• Not Applicable	• Not Applicable	• Not Applicable
	• Increase in ambient noise level	• Not Applicable	• Not Applicable	• Not Applicable
	• Economic Impacts	• Control through the monitoring of socioeconomic conditions.	• Throughout the operational phase, on a monthly basis.	• SLP • Mining Charter • MPRDA • IFC Performance Standards • Mine Health and Safety Act, 1996 (Act No. 29 of 1996)
	• Change in landscape and related visual aspects	• Continuous and ongoing rehabilitation as per the rehabilitation plan.	• Throughout the operational phase, on a daily basis.	• Rehabilitation plan
	• Loss of soil resources and land capability due to contamination	• Revegetation. • Erosion control measures. • Use of environmentally friendly dust suppressant products. • Soil Compaction Management. • Soil Contamination Management. • Spill prevention and emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan. • Close supervision and monitoring. • Stockpile Management. • A short-term fertilizer program.	• Throughout the operational phase, on a daily basis.	• Erosion control measures. • TSF risk inundation analysis. • TSF liner requirements. • Emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan.
	• Contamination to ground- and surface water systems from oil, grease, and diesel spillages from construction vehicles. • Storage of chemicals and building materials during construction of waste facility.	• Intense competent operational management. • Perimeter fence inspection daily. • Slope stability analysis. • Phreatic surface level monitoring. • Assessment of the functionality of the drainage system. • A geophysical survey should be done towards the east of TSF 2 to detect subsurface flow zones. • Groundwater monitoring boreholes should be developed adjacent to this drainage to verify whether there is any shallow seepage. If seepage is detected, a combination of a deep cut off drains, seepage capturing wells and bioremediation should be developed. • The upstream and downstream monitoring network needs to be reviewed, as additional downstream monitoring locations (both surface water and groundwater) are required. • Parameter optimisation study to analyse CCP. • Water monitoring protocol update.	• Throughout the operational phase, at frequencies determined by the various programmes and approvals.	• Perimeter fence inspection programme. • Slope stability analysis programme. • Phreatic surface level monitoring programme. • Drainage system assessment programme • Geophysical survey. • Groundwater monitoring. • Parameter optimisation study. • Water monitoring protocol. • Annual and quarterly monitoring programme. • Annual hydrocensus programme. • Annual numerical model.

Activity	Potential Impact	Mitigation Type	Time period for implementation	Compliance with standards
		• Annual and quarterly monitoring. • Annual hydrocensus. • Annual numerical model updated and recalibration.		
	• Increased surface run-off and erosion from TSF 2 and TSF 2 Extension. • Downstream sedimentation. • Failing stormwater infrastructure. • Establishment of alien plants on disturbed areas.	• Freeboard monitoring. • Daily TSF inspections. • Slope stability analysis. • A geophysical survey should be done towards the east of TSF 2 to detect subsurface flow zones. • Groundwater monitoring boreholes should be developed adjacent to this drainage to verify whether there is any shallow seepage. If seepage is detected, a combination of a deep cut off drains, seepage capturing wells and bioremediation should be developed. • The upstream and downstream monitoring network needs to be reviewed, as additional downstream monitoring locations (both surface water and groundwater) are required. • Parameter optimisation study to analyse CCP. • Water monitoring protocol update. • Annual and quarterly monitoring. • Annual hydrocensus. • Annual numerical model updated and recalibration.	• Throughout the operational phase, at frequencies determined by the various programmes and approvals.	• Freeboard monitoring programme. • TSF inspections programme. • Slope stability analysis programme. • Geophysical survey. • Groundwater monitoring. • Parameter optimisation study. • Water monitoring protocol. • Annual and quarterly monitoring programme. • Annual hydrocensus programme. • Annual numerical model.
CLOSURE, REHABILITATION AND POST CLOSURE PHASE				
• Infrastructure removal/ demolition. • Topsoil recovered from stockpiles for rehabilitation and revegetation of surroundings. • Vehicle entrainment on unpaved road surfaces during rehabilitation – once that is done, vehicle activity associated with the operations should cease.	• Encroachment of alien vegetation.	• Revegetation.	• During Rehabilitation and Post Closure Monitoring, at frequencies determined by the various programmes and approvals.	• NEMBA. • Biomonitoring monitoring programmes.
	• Increase in ambient noise level	• Routine monitoring of ambient noise levels. • Training in noise control plan during health & safety briefings. • Noise equipment or methods of work selection. • Regular inspection and maintenance of all equipment. • Community engagement.	• During Closure, rehabilitation and Post Closure Monitoring, at frequencies determined by the various programmes and approvals.	• SANS Environmental Noise Standards. • IFC Performance Standards. • Ambient noise levels monitoring. • Noise control plan. • National Road Traffic Act, 1996 (Act No. 93 of 1996)
	• Economic Impacts	• Control through the monitoring of socioeconomic conditions.	• During Closure, and Rehabilitation.	• SLP • Mining Charter • MPRDA • IFC Performance Standards • Mine Health and Safety Act, 1996 (Act No. 29 of 1996)
	• Change in landscape and related visual aspects	• Rehabilitation Plan. • Waste management, collection, storage and removal. • Signs and protocols enforcement. • Provision of ablution facilities.	• During Closure, and Rehabilitation.	• Signs and protocols. • Rehabilitation Plan.
	• Exposed to erosion, dust emission, and potential soil contamination.	• Revegetation. • Temporary erosion control measures. • Use of environmentally friendly dust suppressant products. • Footprint demarcation. • Soil Compaction Management. • Soil Contamination Management. • TSF risk inundation analysis. • Appropriately cap the TSFs. • Spill prevention and emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan. • Demarcation of “No Go Areas. • Close supervision and monitoring.	• During Closure, and Rehabilitation.	• Erosion control measures. • TSF risk inundation analysis. • TSF liner requirements. • Emergency spill response plan. • Fire prevention plans. • Emergency response contingency plan.

Activity	Potential Impact	Mitigation Type	Time period for implementation	Compliance with standards
		• Stockpile Management. • A short-term fertilizer program.		
	• Contamination to ground- and surface water systems. • Storage of chemicals. • Contamination via baseflow.	• The backfilled East Pit to form a permanent sink to capture seepage from the TSFs. • Rehabilitation Plan. • Water quality monitoring. • Rehabilitation Plan in accordance with the EMPr and closure plan.	• During Closure, rehabilitation and Post Closure Monitoring, at frequencies determined by the various programmes and approvals.	• Rehabilitation Plan. • Water quality monitoring programme. • Control through design and operational controls.

SECTION 32: FINANCIAL PROVISION DETERMINATION OF THE AMOUNT OF FINANCIAL PROVISION

32-1 DESCRIBE THE CLOSURE OBJECTIVES AND THE EXTENT TO WHICH THEY HAVE BEEN ALIGNED TO THE BASELINE ENVIRONMENT DESCRIBED UNDER REGULATION 22 (2) (D) AS DESCRIBED IN 2.4 HEREIN

Refer to Section 29-4 above.

32-2 CONFIRM SPECIFICALLY THAT THE ENVIRONMENTAL OBJECTIVES IN RELATION TO CLOSURE HAVE BEEN CONSULTED WITH LANDOWNER AND INTERESTED AND AFFECTED PARTIES

The proposed raising of the walls of TSF 2 and TSF 2 Extension project falls within a mining area. The mine is owned by Tharisa.

32-3 PROVIDE A REHABILITATION PLAN THAT DESCRIBES AND SHOWS THE SCALE AND AERIAL EXTENT OF THE MAIN MINING ACTIVITIES, INCLUDING THE ANTICIPATED MINING AREA AT THE TIME OF CLOSURE

Refer to Section 29-4 above.

32-4 EXPLAIN WHY IT CAN BE CONFIRMED THAT THE REHABILITATION PLAN IS COMPATIBLE WITH THE CLOSURE OBJECTIVES

Refer to Section 29-4 above.

32-5 CALCULATE AND STATE THE QUANTUM OF THE FINANCIAL PROVISION REQUIRED TO MANAGE AND REHABILITATE THE ENVIRONMENT IN ACCORDANCE WITH THE APPLICABLE GUIDELINE

Refer to SECTION 26: above.

32-6 CONFIRM THAT THE FINANCIAL PROVISION WILL BE PROVIDED AS DETERMINED

Refer to SECTION 26: above.

SECTION 33: MECHANISM FOR MONITORING COMPLIANCE AND PERFORMANCE ASSESSMENT AGAINST THE EMPR

33-1 MONITORING OF IMPACT MANAGEMENT ACTIONS

Tharisa will ensure that the monitoring programmes comprise the following:

- A formal procedure.
- Appropriately calibrated equipment.
- Where sample require analysis, they will be preserved according to laboratory specifications.
- An accredited, independent, commercial laboratory will undertake sample analyses.
- Parameters to be monitored will be identified in consultation with a specialist in the field and/or the relevant authority.
- If necessary, following the initial monitoring results, certain parameters may be removed from the monitoring programme in consultation with a specialist and/ or the relevant authority.
- Monitoring data will be stored in a structured database.
- Data will be interpreted and reports on trends in the data will be compiled by an appropriately qualified person on a quarterly basis.
- Both the data and the reports will be kept on record for the LoM.

EMPr Performance Assessment will be undertaken as per the NEMA EIA Regulations, 2014 as amended through GNR. 326, Regulation 34, which makes provision for auditing of compliance with EA, EMPr and Closure Plan.

The scope of the performance assessment will be to determine the level of compliance which Tharisa maintains in terms of the EMPr commitments; at the TSFs.

The objectives of the audit performance assessment will be to verify and determine the level of compliance/ continued conformity that Tharisa maintains with the EMPr commitments as well as commenting on the overall suitability of the EMPr.

33-2 MONITORING AND REPORTING FREQUENCY

Monitoring will be done as required depending on the aspect to be monitored. An ECO will monitor compliance with this EMPr and the amended EA. During construction, the reporting to the CA will be done monthly. During operation, the reporting to the CA will be done annually or as and when required by the CA.

33-3 RESPONSIBLE PERSONS

In order for the EA and generic conditions to be successfully implemented, all the role players involved in the project need to co-operate. Role players must clearly understand their roles and responsibilities in the project. They must also be professional, form respectful and transparent relationships, and maintain open lines of communication.

33-3.1 Department of Mineral Resources and Energy

DMRE will play a lead role in the implementation of environmental policies, legislation and regulations. Their role will be to ensure that the construction activities are implemented in a sustainable manner, in compliance with the relevant environmental legislation. DMRE is responsible for issuing the amended EA and WML for the project and any revisions and amendments thereto.

33-3.2 Tharisa Minerals

The overall responsibility for ensuring compliance lies with Tharisa. Tharisa will ultimately remain responsible for ensuring that implementation of the amended EA, WML and EMPr conditions comply with the relevant legislation, and that the proposed raising of the walls of TSF 2 and TSF 2 Extension project is implemented according to the requirements of the issued amended EA, WML and the EMPr.

Inter alia, Tharisa must ensure the following:

- Sufficient resources (time, financial, labour, equipment, etc.) are available to the other role players (e.g. the ECO), and contractor, to efficiently perform their tasks in terms of the amended EA, WML and EMPr. Tharisa will be held responsible for restoring the environment in the event of negligence leading to damage to the environment.
- Tharisa must ensure that the amended EA, WML and EMPr is included in the contractor's documentation so that he/ she is bound to the conditions of the amended EA, WML and EMPr.
- Tharisa must be familiar with the conditions of the amended EA, WML and EMPr and must ensure implementation of the measures.
- Monitor the site activities on a daily basis for compliance.
- Conduct internal audits of the construction site against the amended EA, WML and EMPr.
- Confine the construction site to the demarcated area.
- Rectify transgressions through the implementation of corrective action.

33-3.3 Consulting Engineers

Consulting Engineers will be contracted by Tharisa to fulfil the role of Principal Agents who will oversee all construction related activities on behalf of Tharisa. Consulting Engineers will be responsible and accountable for ensuring that all parties involved in the implementation of the standing amended EA, WML and EMPr are compliant. The Consulting Engineers will therefore be responsible for overall management of the project and amended EA, WML and EMPr implementation.

The Consulting Engineers will also have the ability to issue site instructions and, in some instances, variation orders to the contractor. The Consulting Engineers will ensure that there is always a representative on site [(Resident Engineer (RE)] who fulfils their duties.

33-3.4 Engineer's Environmental Representative

The Engineer's Environmental Representative (EER) will be employed by the Engineer and will be responsible for overseeing the daily implementation of the amended EA, WML and EMPr for the duration of the project. The EER must have a clear understanding of the project as well as all the environmental matters pertaining to the project and should have good knowledge on the applicable environmental legislation and processes.

Responsibilities of the EER include:

- To advise and provide recommendations on all environmental and related issues based on the requirements of the amended EA, WML and EMPr.
- To record and forward complaints received from the public to the RE and Employer.
- Resolve conflict.
- Keep detailed and accurate records of the amended EA, WML and EMPr related activities on site.
- Report to the ECO on the monitoring of environmental issues.

33-3.5 Contractor

The contractor will be responsible for the overall execution of the activities during construction phase, including the implementation and compliance with recommendations and conditions of the amended EA, WML and EMPr. The Contractor must make sure that he/she clearly understands the environmental matters pertaining to the project.

The Contractor will also be responsible for the implementation of corrective actions issued by the ECO and Tharisa within a reasonable or agreed period of time.

They will be responsible for the appointment of a Contractor's Environmental Representative (CER) who will be responsible for monitoring all the contractors' activities on site for compliance with the issued amended EA, WML and EMPr.

The responsibilities of the contractor include but not limited to the following:

- The Contractor acts as the applicant's agent on site and is bound to the amended EA, WML and EMPr conditions through his/her contract with the developer.
- The Contractor, including subcontractors, is responsible for ensuring that he/she adheres to all the conditions of the amended EA, WML and EMPr.
- The Contractor must thoroughly familiarise him/ herself with the amended EA, WML and EMPr requirements before establishing the site. The Contractor must request for clarification on any aspect of the amended EA, WML and EMPr, should they be unclear.
- The Contractor must ensure that he/ she has provided sufficient budget for complying with all conditions of the amended EA, WML and EMPr.
- The Contractor must comply with all orders (whether verbal or written) given by the ECO, project manager or site engineer in terms of the amended EA, WML and EMPr.
- A representative of each sub-contractor must be provided with a copy of the amended EA, WML and EMPr for signing the Environmental Code of Conduct to give assurance that they understand the conditions of the amended EA, WML and EMPr and that they undertake to comply with conditions therein.

33-3.6 Contractor's Environmental Representative

The CER will be part of the Contractor's staff and will be responsible for all activities related to the day-to-day on-site implementation of the amended EA, WML and EMPr and compliance with the environmental specifications, and for the compilation of regular (monthly) Monitoring reports. The CER must liaise with the Engineer on all environmental and related issues when necessary and ensure that any complaints received from the public are properly recorded and dealt with. The Contractor must ensure that all his employees, visitors and sub-contractors receive Environmental Awareness Training as specified.

The CER must:

- Be well versed in environmental matters.
- Understand the relevant environmental legislation and processes.
- Understand the hierarchy of environmental compliance reporting, and the implications of non-compliance,
- Be able to resolve conflicts and make recommendations (to the Contractor) in terms of the requirements of the amended EA, WML and EMPr.
- Keep accurate and detailed records of all amended EA, WML and EMPr-related activities on site.

The CER should arrange the presentation of environmental awareness training courses to all site staff, Contractors and Sub-contractors, and monitor the environmental awareness training for all new site personnel employed by the Contractor. Furthermore, the CER should advise on the rectification of any pollution, contamination or damage to the project site, rights of way and adjacent land.

33-3.7 Environmental Control Officer

Tharisa or the Consulting Engineers must appoint an ECO who will be responsible for the following:

- Conduct monthly site inspections to be able to report on compliance to relevant environmental legislation and respond to any environmental issues;
- Report compliance and non-compliance issues to Tharisa;
- Advise the Contractor on environmental issues within the defined work areas;
- Review access and incidents records that may pertain to the environment and reconcile the entries with the observations made during site inspection, monitoring and auditing;
- Recommend corrective action when required for aspects of noncompliance with the issued amended EA, WML and EMPr; and
- Take immediate action on site where clearly defined and agreed “no-go” areas are violated or in danger of being violated and to inform Tharisa of the occurrence immediately and to take action.

33-4 TIME PERIOD FOR IMPLEMENTING IMPACT MANAGEMENT ACTIONS

The impact management actions must be implemented throughout the life of the proposed raising of the walls of TSF 2 and TSF 2 Extension project, from planning to post closure phases.

33-5 MECHANISM FOR MONITORING COMPLIANCE

Table 72: Impact Management Monitoring

Source Activity	Impacts Requiring Monitoring Programmes	Functional Requirements for Monitoring	Roles and Responsibility	Monitoring and Reporting Frequency and Time Periods for Implementing Impacts Management Actions
Construction, Operational and Closure Related Activities.	Elevated dust fallout levels Elevated PM_{10} and $PM_{2.5}$ emission	• The dustfall monitoring network at the mine must be maintained and the monthly dustfall results used as indicators to tract the effectiveness of the applied mitigation measures. • PM_{10} sampling must be conducted at Mmaditlhokwa Community.	ECO and Tharisa Environmental Specialist	• Monthly, Quarterly and Annual monitoring must be undertaken. • The impacts management actions must be implemented until the Closure Phase.
Construction, Operational and Closure Related Activities.	Noise levels	• Keep a complaint register for community members to make remarks on noise levels if not well managed. • Inspect the service record and functioning of equipment, machinery, trucks and other vehicles operating on site. • Noise monitoring will be undertaken as per SANS 10103:2008, the Code of Practice for the Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and Speech Communication.	ECO and Tharisa Environmental Specialist	• Annual monitoring must be undertaken. • The impacts management actions must be implemented until the Closure Phase.
Construction, Operational and Closure Related Activities.	Visual Impacts	• Site Inspections	ECO and Tharisa Environmental Specialist	• Monitoring or reporting of adherence to the proposed management measures should be conducted by Tharisa's Environmental Specialist, on a monthly basis (during operation and closure), and by the ECO, on a monthly basis during construction.
Construction, Operational and Closure Related Activities.	Water Quality	• Surface water sampling	ECO and Tharisa Environmental Specialist	• The monitoring network needs to be reviewed, as additional upstream and downstream monitoring locations (both surface water and groundwater) are required. Monitoring reports must be compiled on a quarterly (summary) and annual (detailed) basis. • A hydrocensus should be conducted on an annual basis to evaluate the status of the potential surface water and groundwater receptors surrounding the facilities. • The numerical model should be updated and recalibrated initially once a year as new data becomes available. • The impacts management actions must be implemented until the Closure Phase.
Construction, Operational, Closure and Post Closure Related Activities.	Water quality and availability	• Groundwater water sampling	ECO and Tharisa Environmental Specialist	• The monitoring network needs to be reviewed, as additional upstream and downstream monitoring locations (both surface water and groundwater) are required. Monitoring reports must be compiled on a quarterly (summary) and annual (detailed) basis. • A hydrocensus should be conducted on an annual basis to evaluate the status of the potential surface water and groundwater receptors surrounding the facilities. • The numerical model should be updated and recalibrated initially once a year as new data becomes available. • The impacts management actions must be implemented until the Closure Phase.

SECTION 34: INDICATE THE FREQUENCY OF THE SUBMISSION OF THE PERFORMANCE ASSESSMENT REPORT

Monitoring will be done as required depending on the aspect to be monitored. An ECO will monitor compliance with this EMPr and the amended EA and WML. During construction, the reporting to the CA will be done monthly. During operation, the reporting to the CA will be done annually or as and when required by the CA. Refer to Section 33-2.

SECTION 35: ENVIRONMENTAL AWARENESS PLAN

35-1 MANNER IN WHICH THE APPLICANT INTENDS TO INFORM HIS OR HER EMPLOYEES OF ANY ENVIRONMENTAL RISK WHICH MAY RESULT FROM THEIR WORK

Contractors should ensure that its employees and any third party who carries out all or part of the Contractor's obligations are adequately trained with regard to the implementation of the EMPr, as well as regarding environmental legal requirements and obligations.

An ECO may be contracted to provide training and to ensure that records of all training interventions are kept in accordance with the record keeping and documentation control requirements as set out in this EMPr.

The environmental training should, as a minimum, include the following:

- Environmental legal requirements and obligations.
- The importance of conformance with all environmental policies.
- The environmental impacts, actual or potential, of their work activities.
- The environmental benefits of improved personal performance.
- Their roles and responsibilities in achieving conformance with the environmental policy and procedures, including emergency preparedness and response requirements.
- The potential consequences of departure from specified operating procedures.
- The mitigation measures required to be implemented when carrying out their work activities.
- Details regarding floral/faunal species of special concern and protected species, and the procedures to be followed should these be encountered during the construction of main access roads, approach roads or construction camps.
- The importance of not littering.
- The importance of using supplied toilet facilities.
- The need to use water sparingly.
- Details of and encouragement to minimise the production of waste and re-use, recover and recycle waste where possible.

The CER will be responsible for ensuring that everyone on site is given an environmental awareness induction which outlines the requirements of the EMPr as a management tool to protect the environment.

In addition to the above Tharisa will:

- Conduct refresher training/ presentations on environmental issues for mine employees (permanent and contractors) at regular intervals.
- Promote environmental awareness using relevant environmental topic posters displayed at strategic locations on the mine. These topics will be changed monthly and will be reviewed annually by the environmental specialist to ensure relevance.
- Participate and organise events which promote environmental awareness, some of which will be tied to national initiatives e.g., National arbor week, world environment day and national water week.

35-2 MANNER IN WHICH RISKS WILL BE DEALT WITH IN ORDER TO AVOID POLLUTION OR THE DEGRADATION OF THE ENVIRONMENT

35-2.1 Environmental Emergency Plan

Tharisa must compile and maintain environmental emergency procedures to ensure that there will be an appropriate response to unexpected or accidental actions or incidents that will cause environmental impacts,

throughout all phases of the proposed raising of the walls of TSF 2 and TSF 2 Extension project. Such activities may include, *inter alia*:

- Accidental discharges of polluting substances to water and land.
- Accidental exposure of employees to hazardous substances.
- Accidental fires.
- Accidental spillage of hazardous substances.
- Accidental toxic emissions into the air.
- Specific environmental and ecosystem effects from accidental releases or incidents.

These plans should include:

- Emergency organisation and responsibilities, accountability and liability.
- A list of key personnel and contact details.
- Details of emergency services available (e.g. the fire department, spill clean-up services, etc.).
- Internal and external communication plans, including prescribed reporting procedures where required by legislation.
- Actions to be taken in the event of different types of emergencies.
- Incident recording, progress reporting and remediation measures required to be implemented.
- Information on hazardous materials, including the potential impact associated with each, and measures to be taken in the event of accidental release.
- Training plans, testing exercises and schedules for effectiveness.

During construction, the construction camp area must be monitored for oil and fuel spills and such spills must be cleaned and remediated to the satisfaction of the ECO. Cleaning and remediation must be done with products that are in line with best environmental practice i.e. Sunsorb. The Contractor must be in possession of an emergency spill kit that must be complete and available at all times on site. The Contractor must ensure that senior and other relevant members of the workforce are trained in dealing with spills by using emergency spill kits.

The following must apply:

- All contaminated soil/ yard stone must be removed and disposed of as hazardous waste at a registered facility or placed in containers to be taken to one central point where bioremediation can be done.
- A specialist Contractor must be used for the bioremediation of contaminated soil where the required remediation material and expertise is not available on site. All spills of hazardous substances must be reported to the CER or ECO. The Contractor must comply with the regulations of the OHSA.
- The Contractor must keep the necessary materials and equipment to deal with spills/ fire in the vicinity of the site and in an easily accessible place, should they occur.
- The Contractor must set up a procedure for dealing with spills/ fire, which will include notifying the ECO and/or Applicant, the relevant authorities prior to commencing with construction. These procedures must be developed with consultation and approval of the appointed CER and ECO as applicable.
- A record must be kept of all spills and the corrective action taken.

35-2.1.1 Safety and emergency procedures, risk management and training

- The application of the OHSA and regulations must be ensured. This includes the distribution and use of protective clothing and equipment to at least include safety shoes, overalls, gloves, dust masks, and where appropriate ear muffs and eye/ face protection shields.
- Handout and use of safety and protective equipment must be recorded. Staff who fails to use the protective equipment provided by site staff must not be allowed to work on site.

- The Contractor's Safety Officer is to present emergency procedures during the mandatory Health and Safety Induction presented to all new site staff.
- Emergency procedures for fire, adverse conditions due to inclement weather, spillages, stoppage of operations due to refusal to work by employees, etc. must be included in the emergency procedures.
- All relevant firefighting equipment should be kept on site.
- The Site Manager must be assigned as the Safety Officer for the facility and the Site Manager must assign a person as deputy to act when appropriate.
- The Contractor must after occupation of the construction site ensure that appropriate Safety, Health and Environmental (SHE) signs (symbolic safety signs) are displayed on site.
- The Contractor's employees must comply with all SHE signage posted at various locations.

The following requirements would be the minimum for the safety program:

- Orientation of new employees including safety training and emergency contingency planning.
- Accident reporting procedures for notification to the Employer and thereafter appropriate agencies.
- Thorough investigation and documentation of all accidents to ascertain the cause and future methods of preventing recurrence.
- Mandatory first aid instruction for all staff members.
- Regularly scheduled safety meetings.
- Fire prevention and firefighting instruction.
- Routine inspection and testing procedure for all safety and emergency equipment and protective devices, and routine walk through inspections conducted by the Operator through all areas to identify and correct potential unsafe conditions.
- Posting of safety bulletins and posters required by regulatory agencies and other materials concerning accident prevention and hazardous conditions.
- The Contractor must abide by all local, provincial, and national safety requirements.
- The Contractor must provide for a first aid station and emergency medical response for injured staff.
- All plant/equipment failure must be repaired or replaced by the Contractor without any undue delay or adverse effect to the operation of the site.
- This includes all mechanical equipment and tools, safety and warning systems.
- The Operator will ensure that all equipment is maintained in a safe operating condition.

35-2.1.2 Accident and incident control and reporting

- All accidents must be recorded irrespective of the severity or seriousness of injuries and damage. Data about the accident must be provided within 24 hours after occurrence.
- Appropriate recording documents must be available on site and a person must be designated as the SHE Officer.
- Appropriate authorities and law enforcement officers must be included in investigations into accidents.
- Steps to avoid recurrence of similar accidents must be identified and implemented. The steps must be recorded and monitored.
- Incidents must be recorded in an incident register noting the time, date and place where the incident occurred, who and what was involved, and a detailed description of the incident must be included in the report.
- Actions taken to address the occurrence of the incident, as well as the avoidance of recurrence of the incident must be recorded.

35-2.1.3 Chemical fuel spill

- The site must have a supply of absorbent material readily available to absorb any emergency hydrocarbon (fuel / oil) spills, and where possible be designed to encapsulate minor hydrocarbon

spillage. The quantity of such materials must be able to absorb/ deal with a minimum of 200 ℓ of hydrocarbon liquid spill.

- The source of the spill must be isolated, and the spillage contained.
- The area should be cordoned off and secured.
- Treatment and remediation of spill areas must be undertaken to the satisfaction of the Contractor and the ECO.
- Material stockpiles and equipment are to be kept outside of potential flood zones after heavy rains.

35-2.1.4 Emergency Contact Details

This EMPr has made provisions for some of the Emergency Numbers within the Rustenburg and Madibeng Local Municipalities:

Rustenburg Local Municipality	
Police:	+2714 572 3100/ 43
Ambulance:	+2714 597 6612
Fire Service:	+2714 590 3333/ 3444/ 3232
Nearest Hospital: Peglerae Hospital (Casualties):	+2714 597 2823
Rustenburg Local Municipality:	+2714 590 3111

Madibeng Local Municipality	
Police:	+2712 381 6000
Ambulance (Netcare):	+2782911
Fire Service:	+2712 250 2222
Nearest Hospital (Brits District Hospital):	+2712 381 7000
Madibeng Local Municipality Offices:	+2712 318 9100

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SECTION 36: SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

No specific information has been requested by the DMRE on the proposed project.

SECTION 37: THE CORRECTNESS OF THE INFORMATION PROVIDED IN THE REPORTS

I **Mpho Manyabe**, the EAP responsible for compiling this report, undertake that:

- The information provided in this report is correct, and that the level agreement with I&APs and stakeholders has been correctly recorded and reported herein.
- Comments and inputs from stakeholders and I&APs have been included and correctly recorded in this report.
- Inputs and recommendations from the specialist reports have been included where relevant.
- Any information provided to I&APs and any responses to comments or inputs made is correct or was correct at that time

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SECTION 38: UNDERTAKING

The EAP herewith confirms:

a) the correctness of the information provided in the reports **YES**

b) the inclusion of comments and inputs from stakeholders and I&APs; **YES**

Comments from stakeholders have been incorporated into this Final BAR and EMPr Report (Appendix F of Appendix 3).

c) the inclusion of inputs and recommendations from the specialist reports where relevant; and **YES**

d) that the information provided by the EAP to I&APs and any responses by the EAP to comments or inputs made by I&APs are correctly reflected herein. **YES**

Comments from stakeholders have been incorporated into this Final BAR and EMPr Report (Appendix F of Appendix 3).

I, _____, ID Number: _____, in my professional capacity as an EAP, hereby declare under oath, in accordance with Regulation 16 (1)(b)(iv) of the EIA 2014 Regulations (as amended) GNR. 982 of 04 December 2014 as amended by GNR.326 of 7 April 2017, that the content of the BAR and EMPr Report and the associated information submitted in support of this application, and within my knowledge, is true and correct. **YES**

SIGNED AT _____ ON THIS _____ DAY OF _____ 2025

_____
MANYABE CONSULTANCY (PTY) LTD

HERETO SWORN BEFORE ME AT _____ ON THIS _____ DAY OF _____ 2025

_____
COMMISSIONER OF OATHS

-END-

SECTION 39: STATEMENT OF MC'S INDEPENDENCE

- I act as the independent EAP in this application for the proposed **raising of the walls of TSF 2 and TSF 2 Extension project** at Tharisa Mine.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting EIAs, including knowledge of the relevant Acts, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations and all other applicable legislation, policies and guidelines.
- Undertake to disclose to the applicant and the CA all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the CA; and the objectivity of any report, plan or document to be prepared by myself for submission to the CA.
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to I&APs and the public at large and that participation by I&APs is facilitated in such a manner that all I&APs, state department and CA will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application.
- I will ensure that the comments of all I&APs are considered and recorded in reports that are submitted to the CA in respect of the application, provided that comments that are made by I&APs in respect of a final report that will be submitted to the CA may be attached to the report without further amendment to the report.
- I will keep a register of all I&APs that participated in a PPP; and all the particulars furnished by me in this form are true and correct.
- I will perform all other obligations as expected from an EAP in terms of the Regulations.

Signature of the EAP

Date: 04 July 2025

EAP Company: Manyabe Consultancy (Pty) Ltd

SECTION 40: CONCLUSION

This report serves to detail the outcome of impact assessment requirements for the proposed **TSF 2 and TSF 2 Extension project**. Various alternatives have been identified and were carried through for investigation in this BA process. The Draft BAR and EMPr Report was subjected to PPP for review by all identified I&APs.

The following activities will take place as part of the ongoing BA process:

- All comments received during the review of the Draft BAR and EMPr Report have been incorporated into this Final BAR and EMPr Report for submission to the DMRE for approval.
- The DMRE will then decide on the submission. The decision will then be communicated to all stakeholders.

The BA process associated with the proposed TSF 2 and TSF 2 Extension was undertaken in terms of the relevant EIA requirements. The BA process is underpinned by PPP with in-depth consultation undertaken through various forms of engagement.

Tharisa Mine is an existing operational mine, and therefore, mine personnel are presently managing impacts in line with the existing environmental management requirements. The impacts assessed in this Final BAR and EMPr Report for the proposed TSF 2 and TSF 2 Extension are of a similar nature to the impacts presently being managed in the operation of the mine's infrastructure.

It is the opinion of the EAP that although the proposed TSF 2 and TSF 2 Extension may cause adverse environmental impacts, provided that the proposed mitigation measures are implemented effectively and in line with the EMPr, these will be outweighed by the long-term positive impacts. Based on the findings of the Impact Assessment, the EAP sees no reason why the amended EA and WML should not be granted for the proposed project to proceed, as the impacts which have been identified can be mitigated through the implementation of the identified management measures. Additionally, the proposed TSF 2 and TSF 2 Extension are unlikely to result in the generation of any significant cumulative impacts when managed in accordance with the management measures specified in the EMPr.

Should the proposed project not be implemented, the positive impacts such as expected revenue, economic development, employment creation, skills development, poverty alleviation and the continued upliftment of the surrounding communities would not be realised. Additionally, it would be impossible to discard the tailings, and therefore the mine would have to cease its operation, as there would be limited waste storage area when the current operational (TSF 2 Extension) reaches its end of life.

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APPENDICES

APPENDIX 1: LOCALITY MAP, MASTER PLAN; LAYOUT PLAN AND OTHER SITE MAPS

APPENDIX 2: AUTHORITY CORRESPONDENCE

APPENDIX 3: PUBLIC PARTICIPATION PROCESS DOCUMENTATION

APPENDIX 4: EAP DETAILS (CV, QUALIFICATIONS AND REGISTRATION BODIES CERTIFICATES)

APPENDIX 5: EXISTING APPROVALS

APPENDIX 6: SCREENING REPORT

APPENDIX 7: SPECIALISTS STUDIES REPORTS

APPENDIX 8: INTEGRATED WATER AND WASTE MANAGEMENT PLAN

APPENDIX 9: ENGINEERING DESIGN REPORT