DRAFT ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT (EIA/EMPR) FOR THE PROPOSED REZONING OF PROPERTIES, OPENCAST & UNDERGROUND MINING, WASTE ROCK DUMP EXPANSION, NEW TAILINGS STORAGE FACILITY AND THE OVERALL CONSOLIDATION OF THE ENVIRONMENTAL MANAGEMENT PROGRAMMES AT LANNEX SECTION LP 30/5/1/2/2/191 MR AND LP 30/5/1/2/2/213 MR

for

Samancor Chrome Limited
Eastern Chrome Mines

Located on:
Portions 0(RE) and 1 of the Farms Annex Grootboom 335 KT, and Grootboom 336 KT
Fetakgomo Tubatse Local Municipality
Limpopo Province

Public Participation Comments to be send to:

Gudani Environmental and Social Scientists (Pty) Ltd.
P.O. Box 714, Fauna park, Polokwane, 0787.
Tel: 015 291 3620 / 5669. Fax 086 235 9820.
Email: itumeleng@gudaniconsulting.co.za
For attention: Itumeleng Senamela

Ref: LANNEX OPENCAST AND ASSOCIATED INFRASTRUCTURE
COMMETING PERIOD: 11 MAY 2021- 11 JUNE 2021

Report Compiled by:

Prescali Environmental Consultants (Pty) Ltd

P.O. Box 2544
Montana Park
0159
Tel: 012 543 3808
Fax 086 621 0294
E-mail: info@prescali.co.za

Title:

Draft EIAR/EMPR for the proposed rezoning of properties, opencast & underground mining, waste rock dump expansion, tailings storage facility and the overall consolidation of the Environmental Management Programmes at Lannex Section LP 30/5/1/2/2/191MR and LP 30/5/1/2/2/213 MR located on Portions (RE), 1 of the Farms Annex Grootboom 335 KT and Portions 0, 1, 2, 3, 4 of farm Grootboom 336 KT Fetakgomo Tubatse Local Municipality, Limpopo Province.

Client:

Samancor Chrome Limited
Eastern Chrome Mines
PO Box 3
Steelpoort
1133

Telephone No:	013 230 7027
Fax No.:	013 230 7082

Report no:

Samancor/ECM/Lannex/EIAR/EMPR/2021/v0

Document prepared by:

Prescali Environmental Consultants (Pty) Ltd
P.O. Box 2544
Montana Park
0159

Telephone No:	012 - 543 3808
Fax No:	086 - 621 0294

DOCUMENT CONTROL

	Name	**Signature**	**Date**
Compiled:	*Gregory Netshilindi (Cand.Nat.Sci)*		29 March 2021
Checked:	Elaine van der Linde (*Pri. Sci. Nat*)		3 April 2021
Authorized:	Dr Petro Erasmus (*Pri. Sci. Nat*)		23 April 2021

Applicant Approval

I, ______________________________________, duly authorised by Samancor Chrome Ltd, Eastern Chrome Mines, hereby confirm that the report has been reviewed and approved for distribution (Public Participation Process).

_________________________________   ____________________

Signature   Date

REVISION AND AMENDMENTS

Description of Revision / Amendment	**No**	**Date**
Lannex Section Scoping Report (Draft)	0	22 July 2020
Lannex Section Scoping Report (Final)	1	10 October 2020
Lannex Section Environmental Impact Assessment and Environmental Management Programme Report (EIAR and EMPR)	0	23 April 2021

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

DRAFT EIA AND EMPR REPORT FOR PUBLIC REVIEW

PROPOSED REZONING OF PROPERTIES, OPENCAST, UNDERGROUND, WASTE ROCK DUMP EXPANSION, NEW TAILINGS STORAGE FACILITY AND THE OVERALL CONSOLIDATION OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME AT LANNEX SECTION REFERENCE NUMBER: LP 30/5/1/2/2/191 MR AND LP 30/5/1/2/2/213 MR

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: Samancor Chrome Limited – Eastern Chrome Mines
TEL NO: +27 13 230 7027
FAX NO: +27 13 230 7082
POSTAL ADDRESS: P.O Box 3, Steelpoort, 1133
PHYSICAL ADDRESS: Portions 0(RE) and 1 of Farm Annex Grootboom 335 KT and Portions 0, 1, 2, 3, 4 of farm Grootboom 336 KT
FILE REFERENCE NUMBER SAMRAD: **LP 30/5/1/2/2/191 MR AND LP 30/5/1/2/2/213 MR**

IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act No. 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 No. 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 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.

OBJECTIVE OF THE SCOPING PROCESS

1) The objective of the scoping process is to, through a consultative process—
   (a) identify the relevant policies and legislation relevant to the activity;
   (b) motivate the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
   (c) identify and confirm the preferred activity and technology alternative through an impact and risk assessment and ranking process;
   (d) identify and confirm the preferred site, through a detailed site selection process, which includes an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified alternatives focusing on the geographical, physical, biological, social, economic, and cultural aspects of the environment;
   (e) identify the key issues to be addressed in the assessment phase;
   (f) agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required as well as the extent of further consultation to be undertaken to determine the impacts and risks the activity will impose on the preferred site through the life of the activity, including the nature, significance, consequence, extent, duration and probability of the impacts to inform the location of the development footprint within the preferred site; and

identify suitable measures to avoid, manage, or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

Table of Contents

List of Tables

Table of Figures

List of Appendices

PART A: SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1. *CONTACT PERSON AND CORRESPONDENCE ADDRESS*

1.1. DETAILS

1.1.1 DETAILS OF THE EAP

Name of The Practitioner: Prescali Environmental Consultants. The report was compiled by Gregory Netshilindi *(Cand.Nat. Sci)(EAPASA)*.

- Tel No.: 012 543 3808
- Fax No. :086 621 0294
- e-mail address: info@prescali.co.za

1.1.2 EXPERTISE OF THE EAP

1.1.2.1. The qualifications of the EAP (with evidence)

Mr Gregory Netshilindi has qualifications in Environmental & Geographical Sciences and Geological Sciences. He is a Cand.Nat.Sci. (SACNASP), Natural Professional Scientist for geological sciences and has registered as an Environmental Assessment Practitioner with EAPASA. His qualifications are provided in Appendix 1.

Reviewers:

- Ms. E. van der Linde has qualifications in Geology, Engineering Geology and Environmental Management and experience in Water and Environmental Management. She is registered as an Environmental Assessment Practitioner (with EAPASA) as well as Natural Professional Scientist (with SACNASP). Her qualifications are provided in Appendix 1
- Dr. P. Erasmus has qualifications in Zoology and Biochemistry and further studied in Zoology and Marine pollution. She is registered as an Environmental Assessment Practitioner (with EAPASA) as well as Natural Professional Scientist (with SACNASP) for Ecological and Environmental Sciences. Her qualifications are provided in Appendix 1.

1.1.2.2. Summary of the EAP's past experience (In carrying out the Environmental Impact Assessment Procedure)

- Mr G. Netshilindi has 5 years applicable experience (a short resume with a list of projects is attached in Appendix 1) and has been employed by:
  - Minmet Services (Pty) Ltd;
  - Tshikovha Green and Climate Change Advocates (Pty) Ltd; and
  - Prescali Environmental Consultants (Pty) Ltd.

1.1.2.3. Reviewers:

- Ms. E. van der Linde has 20 years of applicable experience (a short resume with a list of projects is attached in Appendix 1)
- Dr. P. Erasmus has 15 years of applicable experience (a short resume with a list of projects is attached in Appendix 1).

2. *DESCRIPTION OF THE PROPERTY*

2.1. SITE LOCATION

Table 2-1: Property description and surveyor codes

Farm Name:	Portions (RE), RE (1), and RE(2) of Farm Annex Grootboom 335 KT and Portions 0, 1, 2, 3, 4 of farm Grootboom 336 KT

Application area (Ha)	3438,56 Ha	
Magisterial district:	Fetakgomo Tubatse Local Municipality, Sekhukhune Magisterial District	
Distance and direction from nearest town	4.3 km north-east to Steelpoort, though Tubatse village is 0 km from the extended opencast area	
Cadastral Codes	21 Digit surveyor codes	Areal extent
	T0KT00000000033500000	1442,63
	T0KT00000000033500001	
	T0KT00000000033500002	
	T0KT00000000033600000	1995.93
	T0KT00000000033600001	
	T0KT00000000033600002	
	T0KT00000000033600003	
	T0KT00000000033600004	

2.2. Locality Map (show nearest town, scale not smaller than 1:250 000)

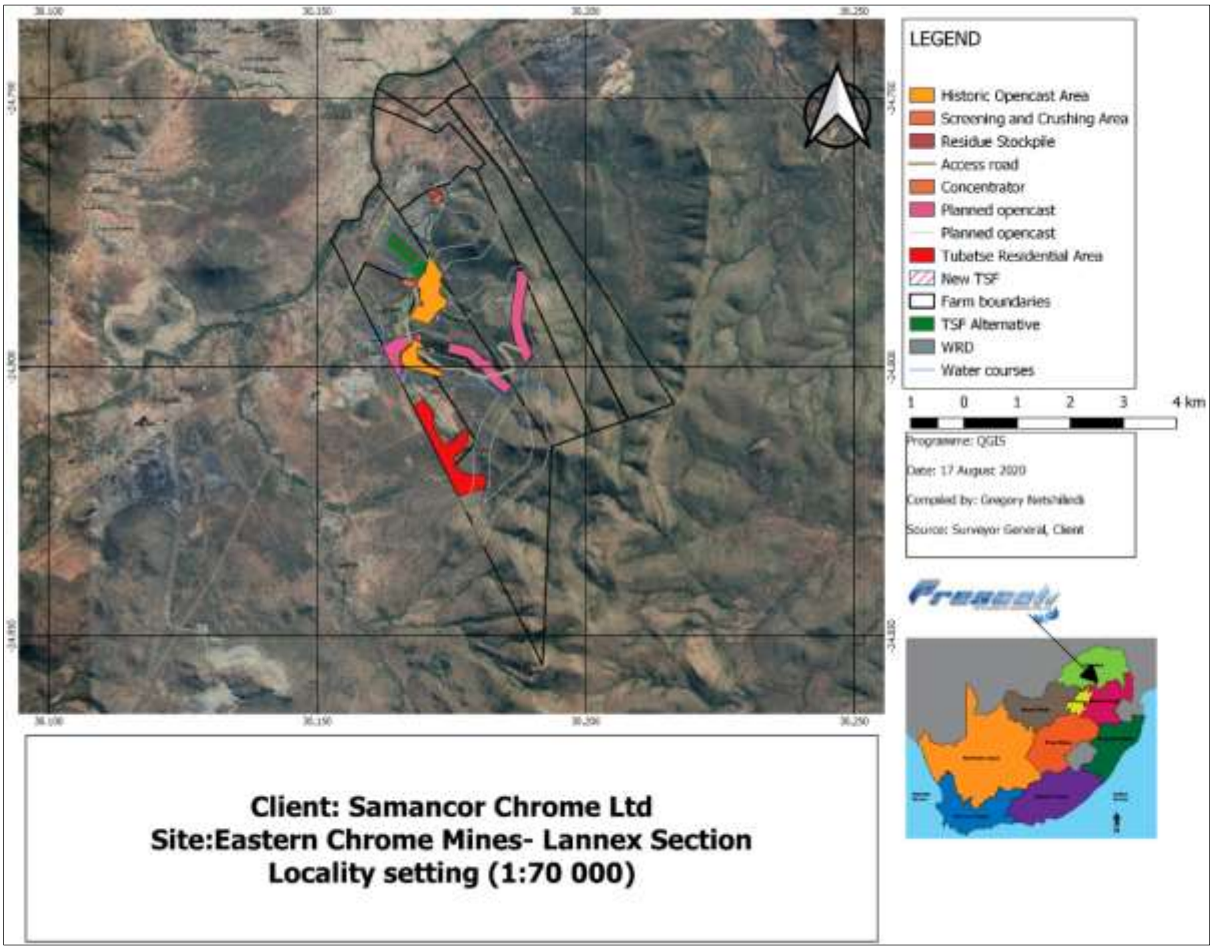

Figure 2-1: ECM Lannex Section Locality Map (1:70 000)

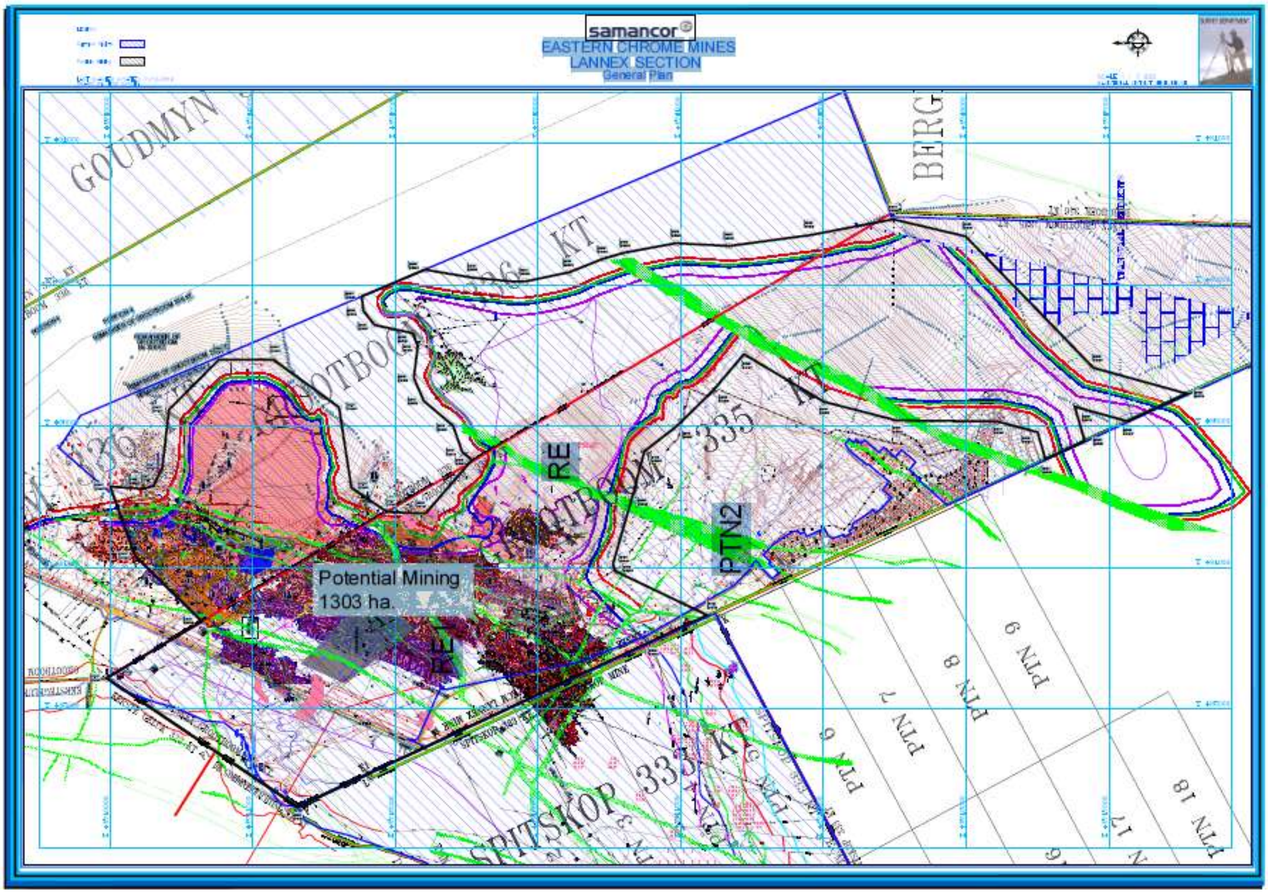

Figure 2-2: Lannex Section Mining Area

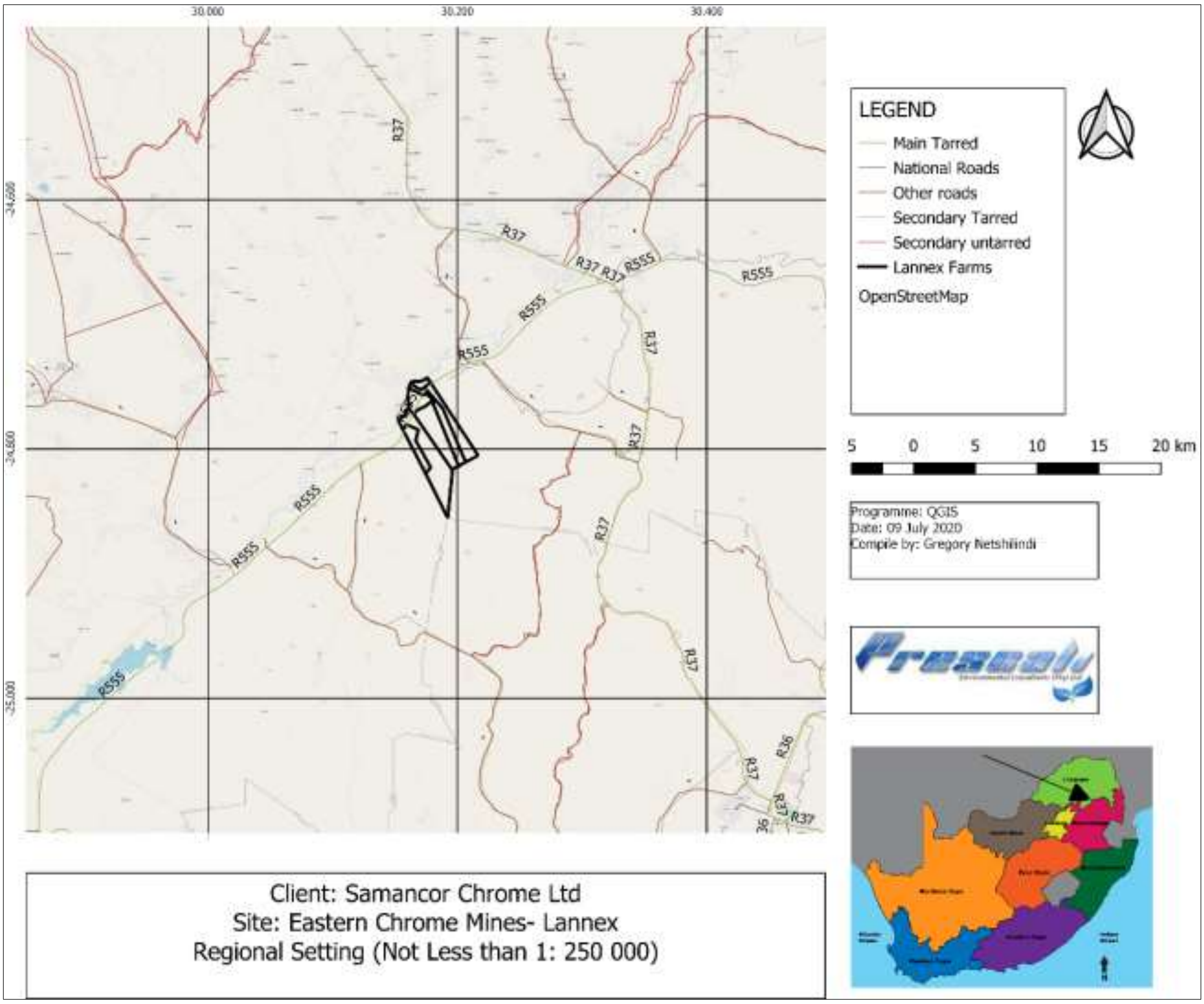

Figure 2-3: ECM Lannex Section Regional Locality Map (1:250 000)

3. DESCRIPTION OF THE SCOPE OF THE PROPOSED OVERALL ACTIVITY

3.1. LISTED AND SPECIFIED ACTIVITIES

Provide a plan drawn to a scale acceptable to the competent authority but not less than 1: 10 000 that shows the location, and area (hectares) of all the aforesaid main and listed activities, and infrastructure to be placed on site and attach as Appendix 4.

Table 3-1: Listed and Specified Activities to be authorized

NAME OF ACTIVITY	AERIAL EXTENT OF THE ACTIVITY	LISTED ACTIVITY	APPLICABLE LISTING NOTICE	WASTE MANAGEMENT AUTHORIZATION
(E.g. For prospecting – drill site, site camp, ablution facility, accommodation, equipment storage, sample storage, site office, access route)	Ha or m^2	(Mark with an X where applicable or affected)	GNR LN1: 983 / LN2 984 / LN =3: 985 (as amended 07 April 2017)	(Indicate whether an authorization is required in terms of the Waste Management Act). (Mark with an X)
Storm water management infrastructure will be developed around the opencast (phased approach) and the TSF area, these will not be pipelines but open culverts which may exceed the 0.36 m diameter or the 120l/s peak throughput. Lannex Slurry pumping capacity is approximately 180 m^3/h and the pipeline is a160 mm diameter line.	TSF: (2 320 m x 4m) 9 280 m^2 Opencast: (17 000 m x 4 m) 68 000 m^2	X	Develop LN1: #9	
Tailings and return water pipeline will be expanded from the existing TSF to the new TSF. These will be longer than 1 km and will exceed 0.36 m diameter or 120 l/s. As far as possible the pipelines will be located next to internal roads. Lannex Slurry pumping capacity is approximately 180 m^3/h and the pipeline is 160 mm diameter line.	1001 m x 2 pipelines	X	Expand: LN1: #46	
A retaining dam will be located upstream of the proposed opencast sections and may exceed 100 m^2, in addition the proposed opencast sections will cross several watercourses which will result in changes to more than 100 m^2 physical footprint of watercourses. Most of the area is either an ecological support area or CBA. It is not expected that the dam will have a wall height greater than 5 meters.	Opencast areas intercept rivers: 13 477 m, 269 540 m^2 Potential retention dams: 41 000 m^2 (combined footprint areas)	X	LN3: #14	
It is anticipated that 5 retention dams be constructed within watercourses at the opencast section may have a capacity of more than 50 000 m^3	Potential retention dams: 41 000 m^2 (combined footprint areas)	X	Develop: LN1: #12	

The proposed opencast will require additional diesel storage as well as other dangerous goods e.g. Oils to be stored. Combined with the existing capacities already in use at Lannex the 500 m^3 will be exceeded.	3 x 80 m^3 for each of the 3 active opencast pits is anticipated	X	Develop: LN2: #4	
The opencast activities in the impacted watercourses will result in the removal and infilling of material in excess of 10 m^3.	Opencast areas intercept rivers: 13 477 m, 269 540 m^2 Potential retention dams: 41 000 m^2 (combined footprint areas)	X	LN1: #19	
Various access roads will be developed around the TSF as well as access roads to the opencast areas and a temporary access road to Tubatse Village. These roads will be wider than 8 meters but less than 13.5. Some of the roads are existing informal internal roads and will be upgraded (widened by more than 4 meters and lengthened by more than 1 km). Most of the Opencast area is classified as ecological support or CBA areas. The road development will be a phased approach.	Road expansion: 10 ha (total footprint area) New road: (7 596 m x 13.4) 101 787 m^2 WRD Road Diversion: (1 191 m) 5 958 m^2 Tubatse Road diversion (Lannex portion only): 160 m x 13.4 m) 2 144 m^2	X	Expand: LN1: #56 Expansion: LN3: 18	
The TSF, WRD expansion and opencast areas will require vegetation clearance that will exceed 20 Ha area in an ecological support / CBA area.	Opencast: 528 ha Contractor's camp: 10 ha TSF and Storm water: 22.05 ha Potential retention dams: 41 000 m^2 WRD expansion: 10 ha	X	LN2: #15 LN3: #12	
Should any protected plant species require relocation as a result of the proposed opencast activities a permit will be applied for in terms of the NEMBA.	1 ha (assumption)	X	LN1: #30	
The new storm water dam at the TSF will require a water use licence.	1 ha (assumption)	X	Development: LN2: #6	
Phased activities that will take place as per the opencast mining in terms of stormwater development, overburden dumps and backfilling and road development. LN1:24(i), 30, 34, LN2: 5, 7, 8(ii), 11, 13, 16, 27(i) or (ii).	Opencast: 528 ha Road expansion: 10 ha (total footprint area) New road: (7 596 m x 13.4)	X	LN1: #67	

	101 787 m^2			
Phased activities that will take place as per the opencast mining in terms of stormwater development, overburden dumps and backfilling and road development. Excluded: LN3: 7, 8, 11, 13, 20, 21, 24.	Opencast: 528 ha Road expansion: 10 ha (total footprint area) New road: (7 596 m x 13.4) 101 787 m^2	X	LN3: #26	
The application is for an amended mining right as a result of the proposed opencast and associated minerals being applied for.	1 995.93 ha	X	LN2: #17	
Development of a new residue deposit (Tailing storage facility), expansion of the waste rock dump and new residue stockpile.	TSF: 23 ha Residue stockpile: 1 ha TSF expansion area: 10 ha	X		X

3.2. DESCRIPTION OF THE ACTIVITIES TO BE UNDERTAKEN

(Describe Methodology or technology to be employed, including the type of commodity to be mined and for a linear activity, a description of the route of the activity)

3.2.1 BACKGROUND

Lannex Mine wishes to amend and consolidate its existing Environmental Management Programme (EMPr) by including additional infrastructures. Table 3-2 lists the existing operation scope and the proposed additional scope.

Table 3-2: Lannex Current\Existing and Proposed Scope\Extent Activities

Current\existing Operation scope	Project Proposed Scope\Extent
The existing mining activities at Portions 0 (RE) and 1 of Farm Annex Grootboom 335 KT; and Farm Grootboom 336 KT: • Underground (operational); • Opencast (historical). Lannex Mine is an operational mine and has the following existing activities and infrastructures: • Internal haul roads, culverts and bridges; • Topsoil, Product and ROM stockpiles; • Overburden stockpiles; • Offices, parking bays, workshops, change house, storehouses and warehouses; • Diesel/fuel storage facilities; • Trackless workshop; • Metallurgical plants with conveyors; • Water supply network, storm water network, pollution control dams, raw water dam, effluent dam, septic tanks and water treatment works; • Tailings storage facility (Not enough capacity); • Waste rock dump (Not enough capacity); • Explosive magazine bay with destruction facilities; • Security entrances and gates; • Electrical substation and power lines; • Underground adits.	The extent of proposed mining activities at Portions 0 (RE) and 1 of Farm Annex Grootboom 335 KT; and Farm Grootboom 336 KT covers: • Continuation of underground workings; • Continuation and expansion/extension of historical opencast workings. The extent of proposed mining area triggers the following activities and additional infrastructures: • Rezoning of properties; • Tailings storage facility; • Water supply network, storm water network, pollution control dams, raw water dam, effluent dam, septic tanks and water treatment works; • RoM crushing and screening plant; • Product storage area; • Waste rock dump expansion area; • Access road to opencast areas; • Road diversion around opencast area.

3.2.2 PROPOSED INFRASTRUCTURE/ACTIVITIES

3.2.2.1. Rezoning of properties to Mining

Applicable areas of the properties will be rezoned from residential to mining to ensure compliance with the Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013) (SPLUMA).

3.2.2.2. Residue deposit area and Crushing and Screening Plant

A new crushing and screening plant will be constructed on the old TSF footprint area which will also cater for a new residue stockpile area.

3.2.2.3. New tailing storage facility with associated infrastructure

The existing operational Tailings Storage Facility (TSF) has reached capacity and a new TSF is needed. This will include stormwater management infrastructures and water pipelines in addition to slurry pipelines. There is an existing road to the proposed area however a maintenance road around the TSF and stormwater infrastructure is required.

The target monthly production rate is at 40,500 tpm with an in-situ density of 1.78 t/m^3.

The height vs storage volume was modelled, and the new TSF will have a total capacity of 2,355,400 m^3 at a height of 37 m vertical height (from lowest point to the crest). The new TSF will therefore have a calculated life for 7.5 years based on the median deposition rate and a long term annual rate of rise should be less than 4 m/year, with a peak of 5-6 m/year at the starter wall top and end of TSF. This peak deposition can be tolerated for short periods under stringent monitoring for cyclone deposition method.

The lowest elevation for the TSF is 785 mamsl and the starter wall height is calculated to be 10 m high.

The site selected for the new TSF is situated south of the plant and the existing waste rock dump (WRD). The availability of area for a new TSF is very limited due to the extensive mining, flood lines and the relatively steep slopes in certain areas. Steep slopesare not an ideal area, specifically when the basin of the TSF is also lined.

The general description of the new TSF is being a chrome tailings facility built by utilising the upstream wall building technique. Slurry is separated into a coarse (underflow) and finer (overflow) fraction through hydro-cyclones and deposited onto the TSF footprint which will consist of a coarse (underflow) outer perimeter (minimum 50 m wide) to allow for structural support and containing the central portion which will be filled with the finer overflow material i.e. the slurry zone. The facility is lined with a network of sub-surface and cut-off drains to control and mitigate the phreatic zone and allow for minimal to zero hydraulic pressure exerted on the barrier system. The supernatant pool that forms during deposition on top of the TSF is drawn down to the RWD with a penstock intake system.

The following associated infrastructure will be constructed to support the new TSF:

a) <u>Intake structure and pool development</u>

Water from the supernatant pool on the TSF would be decanted through a vertical intake penstock and then flow through a concrete-encased HDPE outfall pipeline along the bottom of the TSF to the lowest point, into a dissipating structure, silt trap and then into the RWD. Temporary intakes will be installed along the outfall pipeline to be operated as the pool migratesfrom the western high-wall towards the central position within the TSF (final concrete intake structure). The temporary intakes will be sealed as they become redundant with only the final concrete intake remaining operational.

The intake penstock is raised (from the concrete base) by placing precast penstock rings as required. The final intake would consist of two 510 mm diameter intake structures, with the one intake being the operational intake and the other being the breather pipe during normal operations. The safe limit of raising with penstock rings is of a vertical height of 20 m based on historical performance. A structural assessment and sealing of these intakes would then be required, an elevated penstockis then to be designed and installed timeously for continued operations.

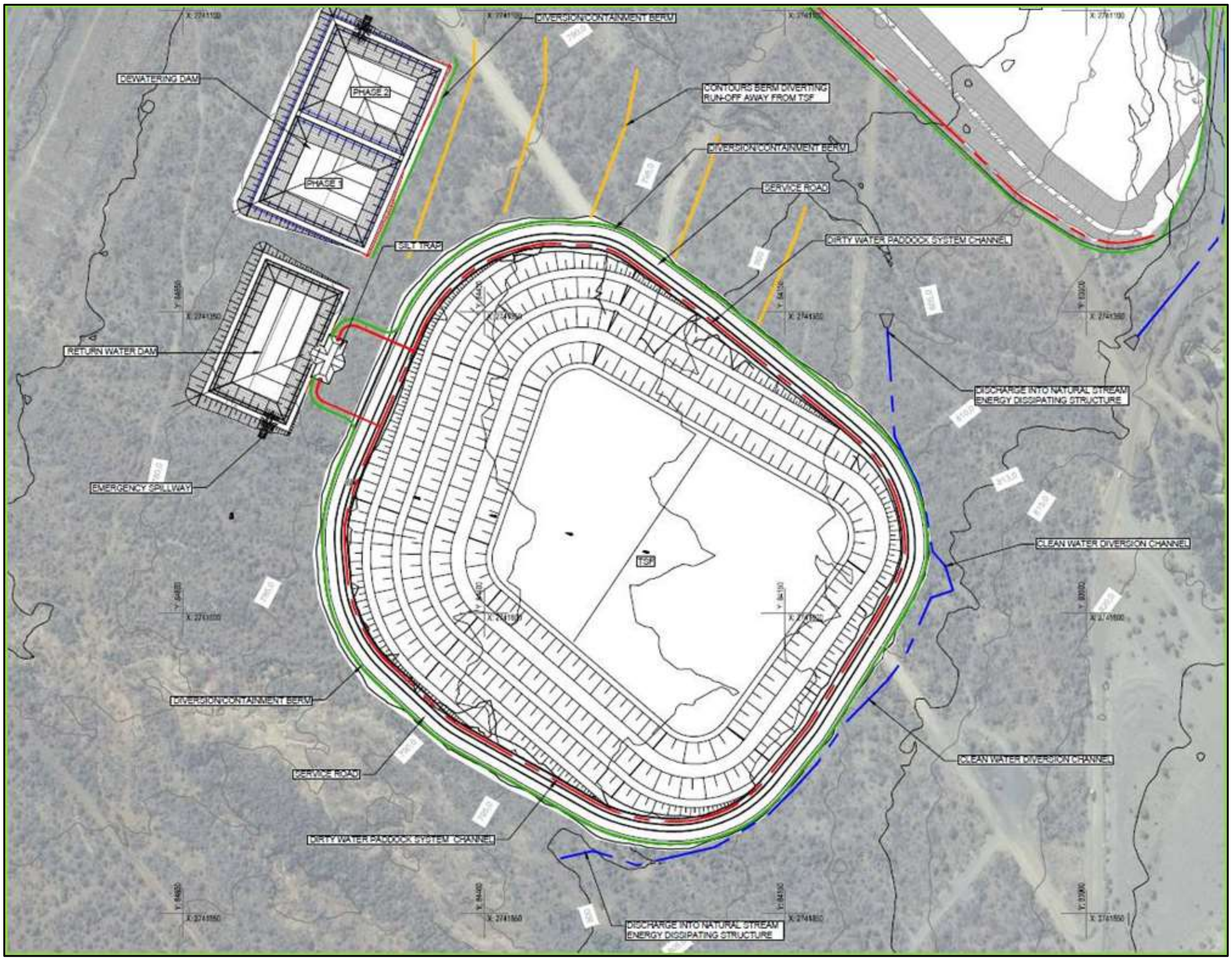

Figure 3-1: Layout of the new TSF and associated supporting infrastructure.

The intake penstocks and outfall pipeline must be able to decant the water from a calculated 1:100 year storm event plus24 hours of free water, emanating from the placed tailings within 72 hours.

Based on the calculated loads, operatibilty, flow requirements and access for inspection the outfall pipeline is calculated and adjusted to be a 355 mm HDPE concrete-encased pipeline.

The supernatant pool will concentrate at the lowest area, as free water from the deposition becomes available. Initially the pool would be located against the western wall of the new TSF and then gradually migrate towards the centroid of the TSF as the CDF grows vertically. The two figures below show the expected initial position and then following the yellow arrow,migrate to its final position.

A permanent penstock intake structure will be located at the centre of the TSF and three temporary intakes will be located along the penstock outfall line and used to decant the excess water and the focus will be to keep the volume as minimal as possible. The design challenge is to keep the pool deep enough for limited ponding to take place and induce a level of segregation of the tailings slurry with a relatively flat beach slope which is expected to be at approximately 1 – 2%. This is to be addressed through the operational procedure and by maintaining the penstock rings height at the intakes.

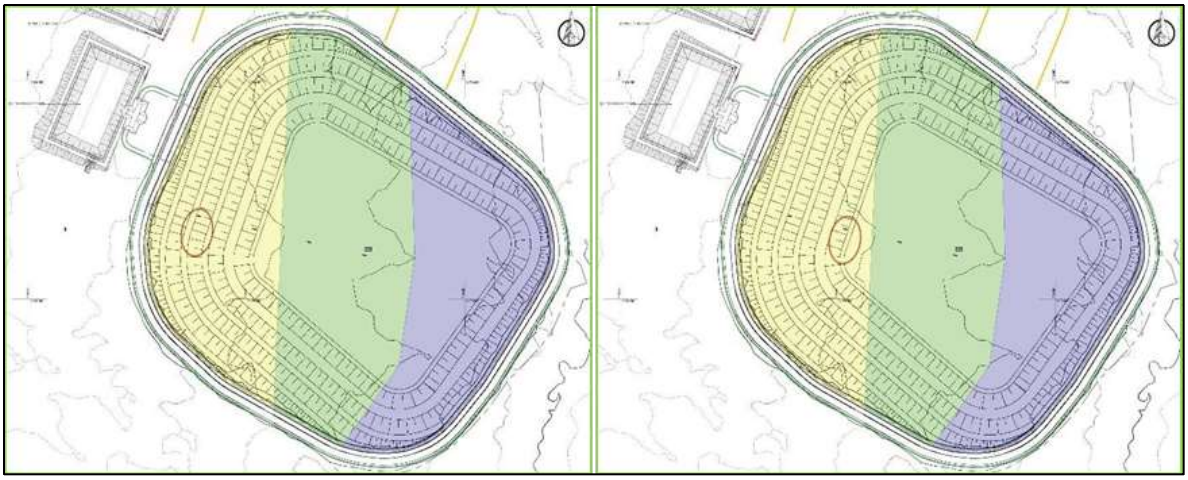

Figure 3-2: Pool migration- stage 1 and 2

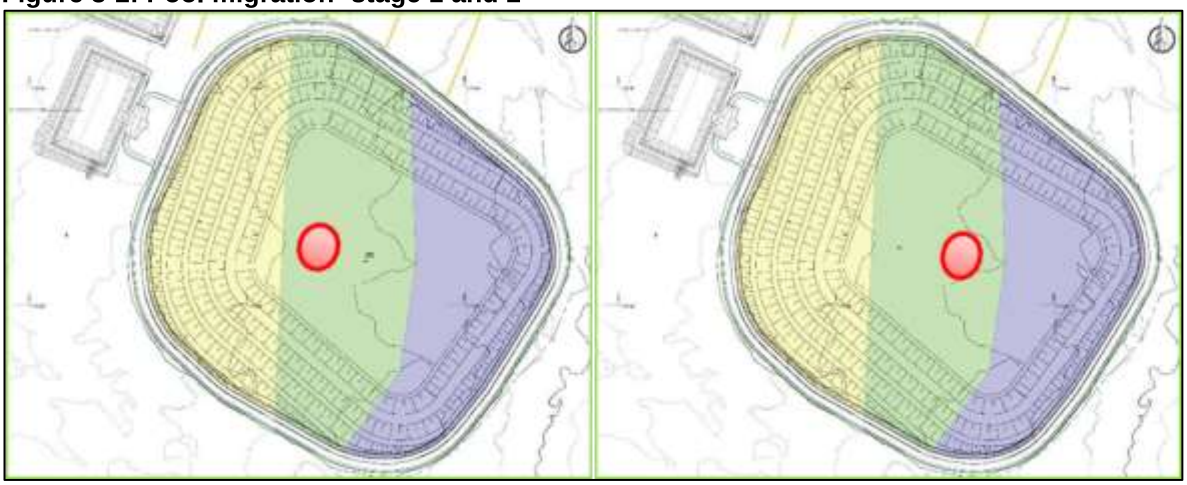

Figure 3-3: Pool migration- stage 3 and final stage

b) Dirty Water channels

A combination paddock and dirty water channel system surrounding the TSF are included in the design. The channels will be concrete lined and are sized for a skid steer to access the channel by means of ramps spaced at 100 m intervals to clean.

c) Silt Trap

The secondary pollutant that will be generated from dirty water areas is sediment (suspended solids). The delineated dirty areas include the entire TSF and service road. The entire area has a high potential to generate silt that over time will reduce the capacity of the Pollution Control Dams (PCDs). Therefore, a silt trap is included downstream of the dirty water catchment with an outlet into the PCD.

In order to allow suspended solids to settle out of solution, sufficient retention time allowed for in the silt traps. The required settling time, and subsequent sediment pond volume, was determined using Stoke's law for settlement. The silt traps capable to function optimally at 1:10 year, but will be able to function up to a peak flow of up to 1:50 year.

After the suspended solids have settled out of solution, the clear top water (supernatant) will be discharged to the PCD by means of the overflow. The emergency overflows will be designed to accommodate the 1:100 flood event into the PCDs.

The silt trap will be cleaned after each storm event with a skid steer or TLB. Therefore, the silt trap has a textured concrete access ramp at 1:6 with a sediment drying pad adjacent to the ramp.

d) Pollution Control Dam Facility

The supernatant from the silt-trap will be discharged into the RWD.

All water pumped from the pits will be released Dewatering Dam (DWD). The Dewatering Dam consists of 2 cells to allow for phased development as required by mining operations. The Dewatering dam will have a capacity of 39 750 m^3 while the Return Water Dam will have a capacity of 20 250 m^3.

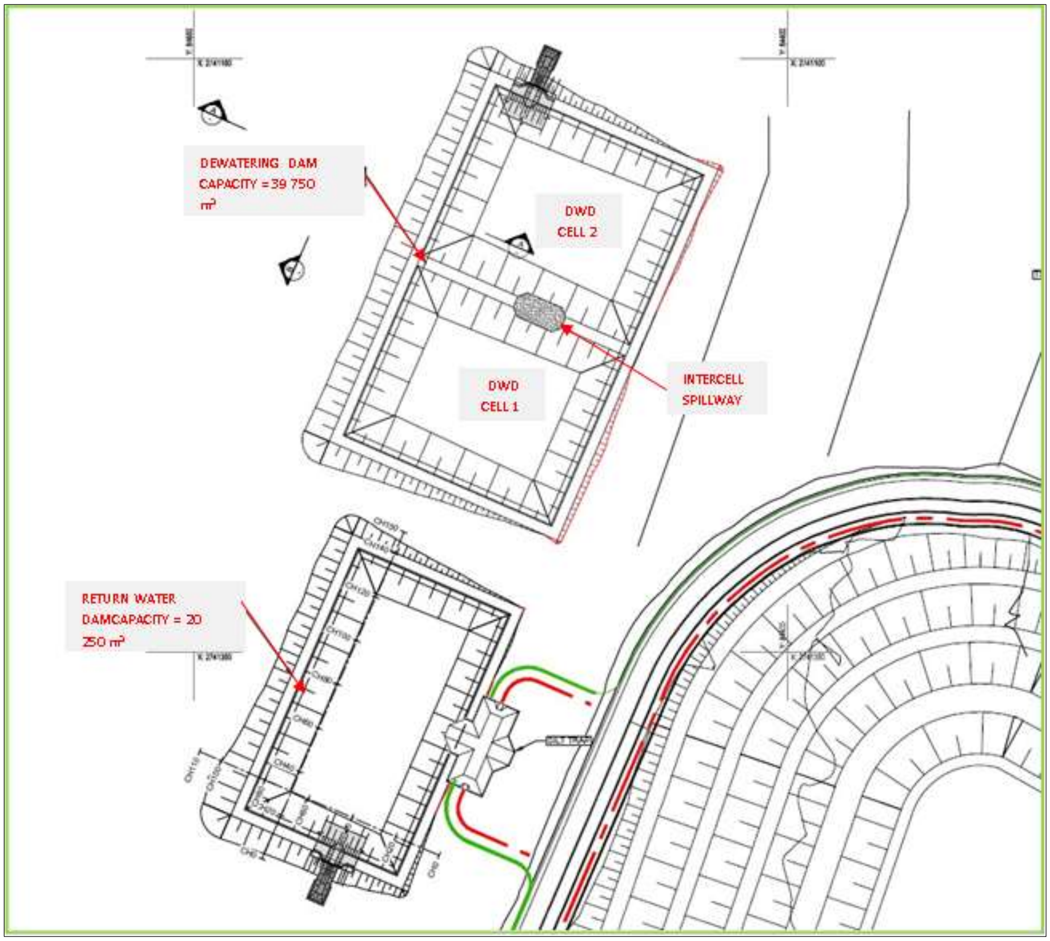

Figure 3-4: Pollution Control Dam Facility at TSF

In order to prevent seepage and groundwater contamination, all the PCDs are provided with a Class-C barrier system. The PCDs also include a minimum freeboard of 800 mm from the lowest point along the non-overspill crest and have a reinforced concrete emergency spillway capable of safely passing a 1:100-year storm event. Considering SANCOLD 2011, the 800 mm freeboard is more than adequate for the designed PCDs and the 800 mm falls within the prescribed dry freeboard.

In the case of DWD the two cells are constructed directly next to each other, an inter-cell spillway is included in the design.

Both Dams also include a minimum freeboard of 800 mm and a reinforced concrete emergency spillway capable of safely passing a 1:100 year event through it

Table 3-3: New TSF information

Name	PCD
Type of Dam	Lined Earth Fill Embankments.
Lining	Class C Barrier (Alternative presented in Barriers System Design)
Crest width	5 m
Crest length	RWD: 425 m DWD Cell 1: 360 m DWD Cell 2: 360 m
Capacity	RWD: 20 250 m^3 DWD Cell 1: 19 873 m^3 DWD Cell 2: 19 873 m^3 DWD Total: 39 755 m^3
Spillway type	Trapezoidal Broad Crested Weir.
Spillway Size	RWD: 2.0 m wide (1:100 year peak) with 800 mm freeboard DWD: 2.0 m wide (1:100 year peak) with 800 mm freeboard, but not required as it will only be impoundment dam with only inflow being pumped dewatering.
Purpose	Stormwater Management Pollution Control and Buffer Dams.
Safety Risk Category	Inferred to be a dam without a safety risk but to be categorised by Dam Safety Office of the Department of Water Affairs.
Safety Risk Size	N/A

3.2.2.4. Expansion of the Waste Rock Dump (WRD)

The WRD extension will be operated in a similar manner as the previous facilities, but slope management will be introduced to ensure that slopes are constructed as designed and not merely end-tipped at a slope exceeding the angle of repose.

The general description of the WRD extension is being a waste rock dump for rock generated in a chrome beneficiation plant. Waste rock is loaded on ADTs and transported to the WRD and dumped on site. Then a bulldozer spread the material out in layers. The facility is lined with a Class D barrier system. The entire footprint will be shaped to be free draining with slopes ranging from max 16% to min 2%, draining into lined conveyance channels, through a silt trap towards the existing RWD.

The following supporting infrastructure will be built for the Waste Rock Dump:

a) Fencing

The entire site is fenced, and access controlled. The WRD existing fence will be relocated to enclose the extended footprint, with access only via the access road to the east.

b) Access roadway and discard distribution network

An access roadway along the western perimeter of the existing WRD footprint connects to the service roads north and south of the WRD. The access roadway will have three access points that will lead to the constructed ramps for access to the various step-in levels up the slope of the WRD. The main access will be from the northern side (closest to the plant area) and the south.

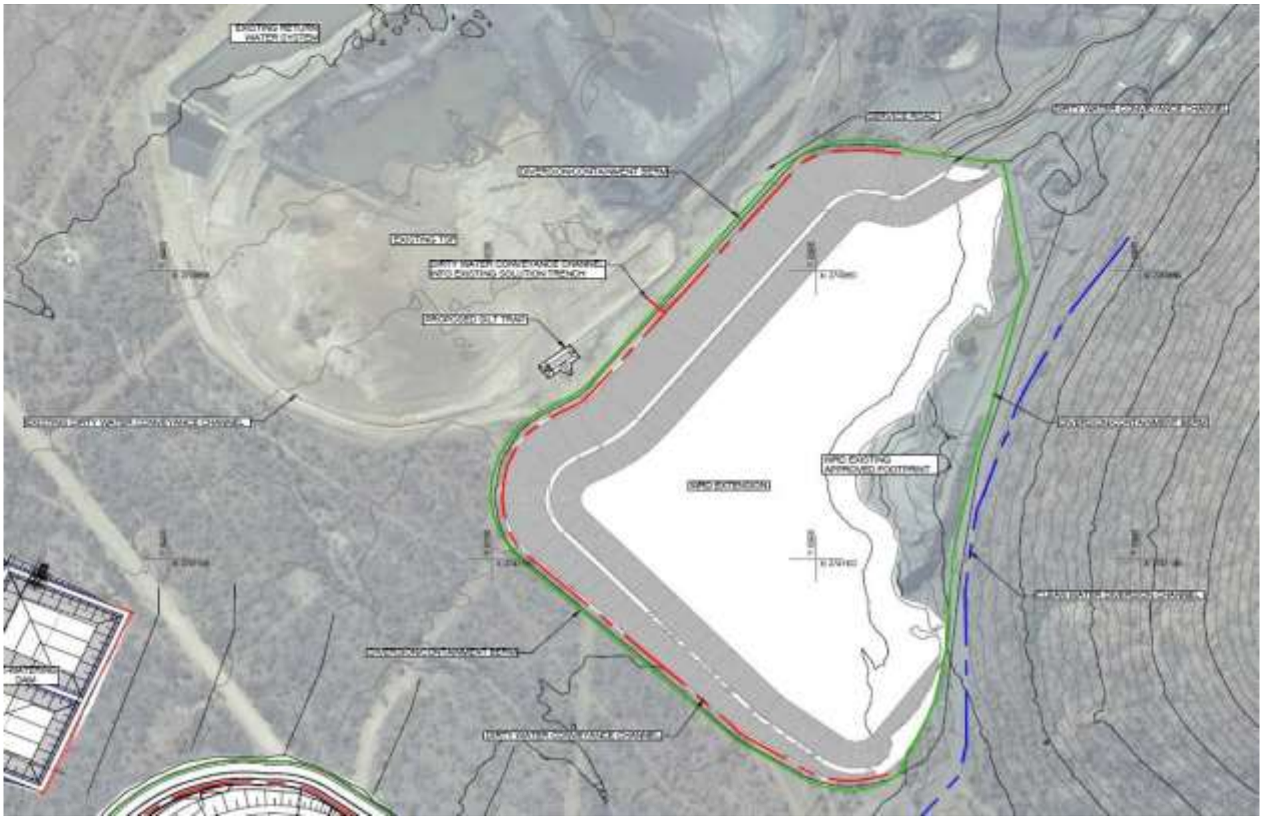

Figure 3-5: Waste Rock Dump Expansion area

Figure 3-6: WRD Area of influence

c) Deposition wall and building

The WRD will be constructed by a combination of end-tipping and push-tipping from bottom-up due to the inclined topography and the required terracing.

This method will entail the construction of terraced from the bottom up. This deposition method has primarily been selected because of the current WRD constructed and operated on the site.

d) Base preparation

The basin is to be cleared and grubbed, the top 1000 mm layer of soil is to be removed and stockpiled as topsoil in the designated areas. The basin is then to be compacted and prepared prior to placement of waste rock

e) Dirty water channel

The dirty water channel surrounding the WRD is included in the design. The channels will be concrete lined with a containment berm downstream of the channels to ensure the required 500 mm freeboard for the system.

f) Silt trap

The secondary pollutant that will be generated from dirty water areas is sediment (Suspended Solids). The delineated dirty areas include the existing and extended WRD and service road. The entire area has a high potential to generate silt that over time will reduce the capacity of the existing RWD. Therefore, a silt trap is included downstream of the dirty water catchment with an outlet into the PCD.

In order to allow suspended solids to settle out of solution, sufficient retention time allowed for in the silt traps. The required settling time, and subsequent sediment pond volume, was determined using Stoke's law for settlement. The silt traps capable to function optimally at 1:10 year, but will be able to function up to a peak flow of up to 1:50 year.

After the suspended solids have settled out of solution, the clear top water (supernatant) will be discharged to the existing RWD by means of the overflow. The emergency overflows will be designed to accommodate the 1:100 flood event into the existing RWD.

The silt trap will be cleaned after each storm event with a skid steer or TLB. Therefore, the silt trap has a textured concrete access ramp at 1:6 with a sediment drying pad adjacent to the ramp.

3.2.2.5. Opencast Mining Area

Three opencasts will be mined during the proposed development and will have an aerial extent of 528 Ha. Opencast mining involves the stripping of usable soil and soft over burden material using a fleet of diesel trucks and shovels. Thereafter hard over burden is blasted to break the rock, which is removed as waste. The waste rock is returned directly to the mined out portions of the pit where possible, or if necessary, held in a waste rock dump until available mined out pit space is available to receive such material.

Once the hard overburden has been removed, the exposed chromite ore is blasted and hauled to a run of mine (ROM) tip by truck.

3.2.2.6. Underground Mining

The underground operation entails conventional room-and pillar mining, typically with low-angle adits connecting to a horizontal access level. Blasting within the underground workings relies on drilling with hand-held pneumatic jackleg units. The ore is mined either up-dip or breast in rooms approximately 16 m wide, with the roof supported by ore pillars and roof bolts. Scrapers haul chromite ore to ore passes that feed trains on the haulage level.

Ore is transferred from the ore trains to a conveyor in the hoisting adit. In certain areas of the mine mechanised mining takes place and involves 10 m wide panels that are established on breast and are divided by the panel pillars which are on average 10 m long and 5 m wide depending on the depth below surface. Drilling in these sections is done using a drill rig. Ore is cleaned (picked up) using load haul dumpers which transfer the ore to a strike conveyor belt that feeds onto the dip conveyor in the decline shaft. The decline consists of three parallel excavations, one for the conveyor belt, one for vehicles and the other for general access.

.

3.2.2.7. Consolidation of all approved EMPr`s into one document

Approval of environmental management programme dated October 1995 and stamped by the DMR dated 12/11/2006. Approval letter stamped by the DMR dated 1999. The amendment to the approved environmental management programme dated 2006. The amendment was to include Lannex North opencast activities. This application includes continuation with historical opencast mining activity approved in this EMP as it was temporarily ceased. The amendment to the approved environmental management programme dated 2013.

3.2.2.8. Access roads to opencast areas

Access roads will be constructed to access the proposed opencast areas. The proposed access roads will cover an area of approximately 10 Ha.

4. *POLICY AND LEGISLATIVE CONTEXT*

Table 4-1: Policy and Legislation

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	**REFERENCE WHERE APPLIED**
(a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process);	
The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) Section 2 of the Constitution states that: "*This Constitution is the supreme law of the Republic; law or conduct inconsistent with it is invalid, and the obligations imposed by it must be fulfilled*." Section 24 of the CA, states that *everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:* • *prevent pollution and ecological degradation;* • *promote conservation; and* • *secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*. Section 24 guarantees the protection of the environment through reasonable legislative (and other measures) and such legislation is continuously in the process of being promulgated. Section 33(1) concerns administrative justice which includes the constitutional right to administrative action that is lawful, reasonable and procedurally fair.	The draft EIA/EMPR Report was accordingly prepared and considered within the constitutional framework set by Section 24 and 33 of the Constitution.
The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and the Environmental Assessment Regulations, 2014 (as amended) The overarching principle of the NEMA is sustainable development. It defines sustainability as meaning *the integration of social, economic and environmental factors into planning, implementation and decision making so as to ensure the development serves present and future generations*. Section 2 of NEMA provides for National Environmental Management Principles. These principles include: • Environmental management must place people and their needs at the forefront of its concern. • Development must be socially, environmentally and economically sustainable. • Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated. • Environmental justice must be pursued. • Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human wellbeing must be pursued. • Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.	An application for Environmental Authorisation in line with the provisions contained in GNR 982 (EIA Regulations 2014) was submitted to the Department of Mineral Resources: Limpopo Region (DMR), in terms of section 24 of the NEMA for consideration. The activities specified above in Table 3-1 was identified as being applicable to the proposed mining operations. Both the Draft Scoping Report and the Draft EIA & EMPR were distributed for public

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED
• The participation of all Interested and Affected Parties (I&APs) in environmental governance must be promoted. • Decisions must take into account the interests, needs and values of all I&APs. 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. • Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law. • 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 costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment. The EIA process to be undertaken in respect of the authorization process of the proposed mining operations is in compliance with the MPRDA, as well as the NEMA read with the Environmental Impact Assessment Regulations of 2014 (as amended). The proposed development involves 'listed activities', as identified in terms of the NEMA and in terms of section 24(1), the potential consequences for or impacts on the environment of listed activities must be considered, investigated, assessed and reported on to the Minster of Mineral Resources or to the relevant office of the Department responsible for mineral resources, except in respect of those activities that may commence without having to obtain an environmental authorisation in terms of the NEMA.	review for a period of 30 days as part of the environmental impact assessment process.
GNR 1147 (20 November 2015) of the NEMA - Financial Provisioning Regulations In accordance with the above legislation, the holder of a mining right must make the prescribed financial provision for the costs associated with the undertaking of the management, rehabilitation and remediation of the negative environmental impacts due to prospecting, exploration and mining activities and the latent or residual environmental impacts that may become known in future.	The Final Rehabilitation, Decommissioning and Mine Closure plan will be compiled in accordance with GNR 1147.
Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) Previously South African mineral rights were owned either by the State or the private sector. This dual ownership system represented an entry barrier to potential new investors. The current Government's objective is for all mineral rights to be vested in the State, with due regard to constitutional ownership rights and security of tenure. The MPRDA was passed in order to make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources, and to provide for matters connected therewith. The Preamble to the MPRDA inter alia affirms the State's obligation to: • protect the environment for the benefit of present and future generations; • ensure ecologically sustainable development of mineral and petroleum resources; and	The draft EIA/EMPR Report was compiled as per the guidelines and requirements of the DMR.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED
• promote economic and social development. The aforesaid preamble affirms the general right to an environment provided for in section 24 of the Constitution (as set out hereinabove). The objects of the MPRDA, as set out in section 2 thereof serve as a guide to the interpretation of the Act. The objects of the MPRDA are as follows: • recognise the internationally accepted right of the State to exercise sovereignty over all the mineral and petroleum resources within the Republic; • give effect to the principle of the State's custodianship of the nation's mineral and petroleum resources; • promote equitable access to the nation's mineral and petroleum resources to all the people of South Africa; • substantially and meaningfully expand opportunities for historically disadvantaged persons, including women, to enter the mineral and petroleum industries and to benefit from the exploitation of the nation's mineral and petroleum resources; • promote economic growth and mineral and petroleum resources development in the Republic; • promote employment and advance the social and economic welfare of all South Africans; • provide for security of tenure in respect of prospecting, exploration, mining and production operations; • give effect to section 24 of the Constitution by ensuring that the nation's mineral and petroleum resources are developed in an orderly and ecologically sustainable manner while promoting justifiable social and economic development; and • ensure that holders of mining and production rights contribute towards the socio-economic development of the areas in which they are operating. The national environmental management principles provided for in section 2 of the NEMA apply to all prospecting and mining operations and any matter relating to such operation. These principles apply throughout the Republic to the actions of all organs of state including inter alia the Department of Mineral Resources that may significantly affect the environment. Any prospecting or mining operation must be conducted in accordance with generally accepted principles of sustainable development by integrating social, economic and environmental factors into the planning and implementation of prospecting and mining projects in order to ensure that exploitation of mineral resources serves present and future generations. Section 38 of the MPRDA states that the holder of inter alia, a prospecting right, mining right or mining permit: • Must at all times give effect to the general objectives of integrated environmental management laid down in Chapter 5 of NEMA;	

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED

• Must consider, investigate, assess and communicate the impact of his or her prospecting or mining on the environment as contemplated in section 24(7) of NEMA;
• Must manage all environmental impacts –
  ○ In accordance with an environmental management plan or approved environmental management programme, where appropriate, and
  ○ As an integral part of the prospecting or mining operations, unless the Minister directs otherwise.
• Must as far as reasonably practicable, rehabilitate the environment affected by the prospecting or mining operations to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and
• Is responsible for any environmental damage, pollution or ecological degradation as a result of prospecting or mining operations and which may occur inside and outside the boundaries of the area to which such right, permit or permission relates.	

National Water Act, 1998 (Act No. 36 of 1998 (NWA) In terms of the NWA, the National Government, acting through the Minister of Water Affairs, is the public trustee of South Africa's water resources, and must ensure that water is protected, used, development, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all persons (section 3(1)). In terms of the NWA a person may only use water without a license under certain circumstances. All other use, provided that such use qualifies as a use listed in section 21 of the Act, require a water use license. A person may only use water without a license if such water use is permissible under Schedule 1 (generally domestic type use) if that water use constitutes a continuation of an existing lawful water use (water uses being undertaken prior to the commencement of the NWA, generally in terms of the Water Act of 1956), or if that water use is permissible in terms of a general authorisation issued under section 39 (general authorisations allow for the use of certain section 21 uses provided that the criteria and thresholds described in the general authorisation is met). Permissible water use furthermore includes water use authorised by a license issued in terms of the NWA. Section 21 of the NWA indicates that "water use" includes: • taking water from a water resource (section 21(a)); • storing water (section 21(b)); • impeding or diverting the flow of water in a water course (section 21(c)); • engaging in a stream flow reduction activity contemplated in section 36 (section 21(d)); • engaging in a controlled activity which has either been declared as such or is identified in section 37(1) (section 21(e));	Lannex Section already has a water use licence for the existing activities. A new water use licence will be applied for the Section 21 activities identified as a result of the construction of the new proposed activities.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED
• discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit (section 21(f)); • disposing of waste in a manner which may detrimentally impact on a water resource (section 21(g); • disposing in any manner of water which contains waste from, or which has heated in, any industrial or power generation process (section 21 (h)); • altering the bed, banks, course or characteristics of a water course (section 21(i)); • removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people (section 21(j)); and • using water for recreational purposes (section 21(k)). In addition to the above and in terms of section 26 of the NWA, Regulations on the Use of Water for Mining and Related Activities Aimed at the Protection of Water Resources were published in GN R. 704 of 4 June 1999 (GN R. 704). The aforesaid GN R. 704 provides for inter alia the capacity requirements of clean and dirty water systems (regulation 6), the protection of water resources by a person in control of a mine (regulation 7), security and addition measures (regulation 8) and temporary or permanent cessation of a mine or activity (regulation 9). According to GN R. 704 “no person in charge of a mine may carry on any underground or opencast mining, prospecting or any other operation or activity under or within the 1:50 year flood-line or within a horizontal distance of 100 metres from any watercourse or estuary, whichever is the greatest”. Insofar as the undertaking of section 21 water uses is concerned, it is anticipated that application for registration and water use licensing will be undertaken.	
National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) The NHRA established the South African Heritage Resources Agency (SAHRA) as well as Provincial Heritage Resources Agencies. In terms of the NHRA, no person may destroy, damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of any heritage site without a permit issued by the heritage resources authority responsible for the protection of such site. No person may damage, disfigure, alter, subdivide or in any other way develop any part of a protected area unless, at least 60 days prior to the initiation of such changes, he/she/it has consulted with the relevant heritage resources authority. Section 34 of the NHRA provides for the protection of immovable property by providing for a prohibition on altering or demolishing any structure or part of any structure, which is older than 60 years, without a permit issued by the relevant provincial heritage resources authority. Accordingly, should the proposed activities, prospecting or mining activities or the closure and rehabilitation of mined land involve the altering or demolishing of any structure or part of any structure, which is older than 60 years, a permit issued by the relevant provincial heritage resources authority is required. No person may, without a permit issued by the responsible heritage resources authority destroy, damage, excavate, alter,	An Archaeological and Palaeontological Impact Assessment has been conducted for the project.

<table>
<tr><th>APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT</th><th>REFERENCE WHERE APPLIED</th></tr>
<tr><td>deface or otherwise disturb any archaeological or palaeontological site or any meteorite; destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite; trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

No person may, without a permit issued by SAHRA or a provincial heritage resources authority destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves; destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or bring onto or use at the burial ground or grave referred to above any excavation equipment or any equipment which assists in the detection or recovery of metals.

Section 38 of the NHRA states that any person who intends to undertake developments categorised in Section 38 of the NHRA must at the very earliest stages of initiating such development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development. By way of example, the developments referred to in Section 38 of the NHRA include:
the construction of a road, wall, power-line, pipeline, canal or other similar form of linear development or barrier exceeding 300 metres in length;
the construction of a bridge or similar structure exceeding 50 metres in length;
any development or other activity which will change the character of a site as specified in the regulations;
any other category of development provided for in regulations by SAHRA or the provincial heritage resources authority.
However, the abovementioned provisions are subject to the exclusion that section 38 does not apply to a development as described in subsection (1) if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act No. 73 of 1989 (EIA) (now presumably the NEMA in view of the repeal of the listed activities under the ECA: Provided that the consenting authority must ensure that the evaluation fulfils the requirements of the relevant heritage resources authority in terms of subsection (3), and any comments and recommendations of the relevant heritage resources authority with regard to such development have been taken into account prior to the granting of the consent.</td><td></td></tr>
<tr><td>National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA)
The NEMBA aims to provide for the management and conservation of South Africa’s biodiversity within the framework of the NEMA; the protection of species and ecosystems that warrant national protection; the sustainable use of indigenous</td><td>A terrestrial biodiversity assessment has been conducted for the project.</td></tr>
</table>

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED
biological resources; the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources; the establishment and functions of a South African National Biodiversity Institute; and for matters connected therewith. The NEMBA provides for the publishing of various lists of species and ecosystems by the Minister of Environmental Affairs and Tourism (now the Minister of Water and Environmental Affairs) as well as by a Member of the Executive Council responsible for the conservation of biodiversity of a province in relation to which certain activities may not be undertaken without a permit. In terms of Section 57 of the NEMBA, no person may carry out any restricted activity involving any species which has been identified by the Minister as “critically endangered species”, “endangered species”, “vulnerable species” or “protected species” without a permit. The NEMBA defines “restricted activity” in relation to such identified species so as to include, but not limited to, “hunting, catching, capturing, killing, gathering, collecting, plucking, picking parts of, cutting, chopping off, uprooting, damaging, destroying, having in possession, exercising physical control over, moving or translocating”.\ The Minister has made regulations in terms of section 97 of the NEMBA with regards to Threatened and Protected Species which came into effect on 1 June 2007. Furthermore, the Minister published lists of critically endangered, endangered, vulnerable and protected species in terms of section 56(1) of the NEMBA.	
National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEMAQA) The NEMAQA came into power on the 24th of February 2005. Additionally, the amendment to the Minimum Emission Standards (GN R 893) also came into effect on the 12 June 2015. This Notice provides a list of activities that may cause atmospheric emissions which have or may have a significant detrimental effect on the environment as well as the minimum emission standards (“MES”) for these activities as contemplated in section 21 of NEMAQA. The effect of the commencement of the NEMAQA and the listed activities, listed in GN 964 is that an atmospheric emission licence (AEL) is now required for conducting these listed activities.	An air quality impact assessment has been conducted for the project.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEMWA) The NEMWA commenced on 1 July 2009 and as a result of its commencement the relevant provisions in the Environment Conservation Act No. 73 of 1989 (ECA) in respect of waste management, were repealed. The NEMWA sets out to reform the law regulating waste management and deals with waste management and control more comprehensively than was dealt with in the ECA. It also introduces new and distinct concepts never before canvassed within the realm of waste management in South Africa, such as the concept of contaminated land and extended producer responsibility. It also provides for more elaborate definitions to assist in the interpretation of the Act. Section 19 of the NEMWA provides for listed waste management activities and states in terms of section 19(1), the Minister may publish a list of waste management activities that have, or are likely to have a detrimental effect on the	The proposed activities (construction and reclamation) require a waste management licence (WML) as listed in GNR 921 of 29 November 2013 (Category B (11)).

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED
environment. Such a list was published in GNR 921 of 29 November 2013. In accordance with section 19(3), the Schedule to GNR 921 provides that a waste management licence is required for those activities listed therein prior to the commencement, undertaking or conducting of same. In addition, GNR 921 differentiates between Category A, B, and Category C waste management activities. Category A waste management activities are those which require the conducting of a basic assessment process as stipulated in the EIA Regulations, 2014 promulgated in terms of the NEMA as part of the waste management licence application and Category B waste management activities are those that require the conducting of a scoping and environmental impact assessment process stipulated in the EIA Regulations, 2014 as part of the waste management licence application. Category C waste management activities do not require a waste management licence, however a person who wished to commence, undertake or conduct a waste management activity listed under this category, must comply with the relevant requirements and standards, Section 20 of the NEMWA pertains to the consequences of listing waste management activities and states that no person my commence, undertake or conduct a waste management activity, except in accordance with the requirements or standards for that activity as determined by the Minister or in accordance with a waste management licence issued in respect of that activity, if a licence is required. In terms of the current statutory framework with regards to waste management, a waste management licence is required for those waste management activities identified in the Schedule to GNR 921. Certain of the waste management activities listed in the Schedule are governed by specific thresholds. Where any process or activity falls below or outside the thresholds stipulated, a waste management licence is not required.	
Limpopo Environmental Management Act, 2003 (Act No. 7 of 2003) (LEMA) The LEMA came into effect on 1 May 2004 and aims to consolidate and amend the environmental legislation of or assigned to the Province and to provide doe matters incidental thereto. The objectives of the Act are: a) to manage and protect the environment in the Province; b) to secure ecologically sustainable development and responsible use of natural resources in the Province; c) generally, to contribute to the progressive realisation of the fundamental rights contained in section 24 of the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) ; and d) to give effect to international agreements effecting environmental management which are binding on the Province.	The terrestrial biodiversity assessment as conducted by the specialist will include the requirements of this Act into their findings.
Integrated Development Plans and Environmental Management Frameworks	
Environmental Management Framework for the Olifants and Letaba Rivers Catchment Areas (OLEMF), December 2009 The purpose of this EMF is to develop a framework that will integrate policies and frameworks, and align different government mandates in a way that will streamline decision-making to improve cooperative governance and guide future development in an environmentally responsible manner. The objectives of the EMF are to:	A surface water and floodline impact assessment has been conducted for the project.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED
• encourage sustainable development; • establish development priorities; • identify strategic guidance and development management proposals; • identify the status quo, development pressures and trends in the area; • determine opportunities and constraints; • identify geographical areas in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA); • specify additional activities within identified geographical areas that will require EIA based on the environmental attributes of such areas; • specify currently listed activities that will be excluded from EIA within certain identified geographical areas based on the environmental attributes of such areas; and • develop a decision support system for development in the area to ensure that environmental attributes, issues and priorities are taken into account.	
Greater Sekhukhune District Municipality (DM) 2014/15 Final Integrated Development Programme (FIDP) Review: Greater Tubatse Local Municipality (LM) Draft IDP 2017 – 2018 Legislation was enacted to guide the establishment of and functions of metropolitan, district and local municipalities, including the promulgation of integrated development planning as a tool for development in district and local municipal IDP reports. Section 25 of the Municipal System Act, 2000 (Act No. 32 of 200) (MSA) requires that an IDP must be compatible with National and Provincial development plans and planning requirements. The above municipalities are characterised by similar developmental constraints highlighted in the Integrated Development Plans for the respective districts: • Large portions of the population reside in rural areas with limited access to opportunities for social and economic upliftment; • Due to its rural nature; the Tubatse Municipality is confronted with a high service delivery backlog. Majority of the settlements are far apart which; makes the provision and maintenance of services very costly. Some of these areas are too small to attain the economic threshold required to provide social facilities in a cost-effective manner. • There are extensive skills shortages in the areas and limited provision of human resource development programmes that would address the skills gap, specifically in the mining sector that is an important revenue generator for both local municipalities; • Existence of large infrastructure backlogs. Together with the identified agriculture and tourism potential, mining is delineated as a priority sector for both municipalities. District municipalities endorse and promote communication and partnerships in the mining industry. It is widely recognised	The proposed development fall under the jurisdiction of the Fetakgomo-Greater Tubatse Local Municipality which is located in the Greater Sekhukhune District Municipality. The need and desirability of the project is in line with the IDP`s of these municipalities.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED
that investment within the mining industry is paramount for the creation of social and economic upliftment within the municipalities.	

5. *NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES*

(Motivate the need and desirability of the proposed development including the need and desirability of the activity in the context of the preferred location).

5.1. NEED

The existing TSF at Lannex Section is reaching its design capacity thus the need for a new TSF has been identified. To ensure that Lannex Section has the required airspace available for deposition a new TSF is needed which complies with the requirements of GN704 of 4 June 1999 as well as GN R362 of 24 July 2015 (as amended). Without the needed airspace, basic processing of the run of mine (ROM) may need to be halted resulting in the loss of employment opportunities. In addition, as Lannex section re-treat tailings (through the appointed contractor Sylvania), the loss of airspace will result in the closing of the retreatment project increasing the loss of employment opportunities.

The Waste Rock Dump Footprint will be expanded to ensure that sufficient airspace is available for future deposition of the waste material in a safe manner.

The expansion of the opencast and continuation of the underground mining sections is needed to allow Samancor to mine the resource as allocated to them in their mining right for Lannex Sections. The expansions will extend the life of mine and ensure that employment opportunities are maintained.

5.2. DESIRABILITY

Limpopo has rich mineral resources, making mining a critical sector of the economy of the province, contributing 22% to its Growth Domestic Product (GDP). Unemployment in the region is high with an estimated 42% of the economically active population in the Fetakgomo-Greater Tubatse Local Municipality being unemployed.

Although there are several mines in the area, the proposed minerals mined remain unexploited. Expansion in this sector is important as it brings with it investment in infrastructure, results in creation of job sustenance and generates many other economic spin-offs. The lack of economic growth in the region warrants special attention and support to optimize the available opportunities. However, cognizance should be taken of the outflow of money from the mines in Greater Tubatse to other regions.

Fetakgomo-Greater Tubatse Local Municipality has significant mining in existence and manufacturing (ferrochrome smelters) sectors, but unemployment is still significantly above the provincial average. Information from different sources suggests that new mining developments could reduce unemployment from 73% (expanded unemployment rate definition) in 2001 to 44% in 2010 and 23% in 2015. Further reduction in the unemployment rate will depend on effective intervention by public sector institutions to facilitate economic sector diversification through competitive cluster value-chain development. This implies upstream development in the manufacturing and trade sector to provide essential items in the mining supply chain by local entrepreneurs. It also implies side-stream development in the form of construction and Urban renewal. This approach is consistent with the Limpopo Employment Growth and Development Plan (Fetakgomo Greater Tubatse Municipality , 2016).

The economy of the Sekhukhune District is a mixture of very negative features (such as the highest unemployment rate in Limpopo) and very positive opportunities (like the enormous mining potential within the area). The region is also characterised by a weak economic base, poor infrastructure, major service backlogs, dispersed human settlements and high poverty levels.

Southern Africa hosts about 90% of the world’s chromite reserves and resources and accounts for approximately 60% of global chrome ore production. South African output rose above 20Mt for the first time ever in 2018. Most chrome ores are mined as a primary product although, in South Africa, around 30% of chrome ore output in 2018 was derived as a by-product from UG2 tailings of platinum group metal (PGM) operations.

Over 90% of chromium consumption is attributable to metallurgical applications. Stainless steel alone represents more than 75% of consumption. Trends in stainless steel production are, therefore, the main determinant for the outlook of chromium demand. Ferrochrome is the intermediate chromium-iron alloy used in the steel industry. Most of the ferrochrome production is in the form of high-carbon ferrochrome and charge chrome, of which 80-90% is consumed directly in stainless steel. The balance of ferrochrome production is in the form of low- and medium-carbon ferrochrome used to trim the final chromium composition within specified Cr:C ratios of stainless and other steel products.

The chromium chemical and refined metal industry accounted for just over 3% of the total market in 2018. Prices for these niche products have followed different trends to metallurgical chrome ores and ferrochrome. China hosts by far the largest capacity of chromium chemicals production, although producers with less than 10 ktpy capacity were largely eliminated a decade ago because of more stringent environmental regulations. As environmental inspections have ramped up in China in recent years, further closures and suspensions have allowed Kazakhstan, Turkey, the USA and India to gain a combined market share of 45% in chromium chemicals in 2018, up from 30% a decade ago. Demand for chromium chemicals is estimated to have consumed just over 1.5 Mt of chrome ores in 2018 (Anon., 2019).

The extraordinary physical properties of the platinum group make its metals almost indispensable in a wide range of industrial applications. Auto catalysts, which account for more than 40% of the total demand for platinum, are the major demand sector for PGMs. Around 38% of the world's platinum finds its way into jewellery, and the electrical and electronics industry accounts for 50% of the annual palladium and ruthenium demands. Growth is associated with PGMs playing a role in fighting viral, bacterial and parasitic infections in the future and even being used as diagnostic tools. The use of clean and efficient fuel cells in the future, in which platinum catalysts are used to convert the chemical energy of a fuel into electrical energy, has for some time been sees as the next new major demand sector for platinum (Anon., 2008).

An expected increase in the demand for platinum and palladium is expected for the future due to stricter emissions legislation globally and a rise in the growth of vehicle production and sales. In addition, with global energy demand expected to grow by more than 60% by 2030, the security of energy supply has become a concern and has led to the diversification of energy sources. This has created new opportunities for PGMs in the development of fuel cell technology, which could lead to significant socio-economic development as it will result in job creation in terms of manufacturing, installation and maintenance, as well as skills development (Anon., 2012).

The benefits of the development of the Lannex Mine is apparent from the above, with the expected increase in demand for platinum-group metals (PGMs) on a global basis, especially for fuel cell technology, which not only provides an alternative clean and sustainable energy source but comes with a variety of socio-economic benefits. In addition to the global socio-economic benefits, the continuation of the Lannex Mine will also provide the local communities with various benefits relating mainly to job creation and sustainability of existing job and skills development. Unemployment in the region is high and mining is seen to hold major possibilities for the area.

Without the implementation of this project, the mentioned benefits would not be realised. The realization of the outcome the Mining Charter (2004), within the context of the MPRDA (2002), would therefore also not be reached and this has potentially significant negative impacts on national economic growth and social well-being. The Mining Charter's main objectives, which the Lannex expansion project will assist to reach, are:

- to promote equitable access to South Africa's Mineral Resources for all South Africans;
- to substantially and meaningfully expand opportunities for historically disadvantaged South Africans (HDSAs);

- to utilize the existing skills base for the empowerment of HDSAs (Refer to the Social and Labour Plan (SLP) as part of the Mining Right);
- to expand the skills base of HDSAs to serve the community; (Refer to the SLP conducted according to the MPRDA);
- to promote employment and advance the social and economic welfare of mining communities and areas supplying mining labour; (Refer to the SLP as part of the Mining Right); and
- to promote beneficiation of South Africa's mineral commodities beyond mining and processing, including the production of consumer products.

The proposed Lannex Mine is currently operational, therefore the sustenance and creation of new job opportunities and training in the local community as part of the continuation of the mining project will have a positive impact. Currently the need in the local community is significant and this will be reviewed as part of the overall assessment of the community needs.

As Samancor Chrome possesses South African in-house expertise, it has however decided to conduct all opencast operations using contractors. This includes the initial development, and opencast mining. The mine contractor will also be responsible for the maintenance of all haul roads and any other gravel roads within the mine area. Operating costs were developed from first principles on an owner-operated basis using a combination of industry norms and in-house data.

The current number of employment positions (excluding Shared Services) at Lannex Mine is 475. The mine employs no core contractor employees. Of the Lannex workforce, 417 employees (87.4%) are from the FTLM (local labour-sending area). The remaining 58 (12.2%) come from other local municipalities throughout the nine provinces, and South Africa's neighbouring countries. The Shared Services employees are also provided for: 264 (75%) of the 352 are from the FTLM.

ECM is using a scheme whereas community learners are recruited and placed on a skills development program on a quarterly basis. The program enable community learners to undergo institutional and/or workplace training and assessment. The aim of the program is to give the community learners the opportunity to obtain the necessary skills and knowledge as per operational requirement. At the end of the program the community learners receive a competency certificate which will in return promote job creation and reduce unemployment.

5.2.1 MOTIVATION FOR THE OVERALL PREFERRED SITE, ACTIVITIES AND TECHNOLOGY ALTERNATIVE

NB!! – This section is about the determination of the specific site layout and the location of infrastructure and activities on site, having taken into consideration the issues raised by interested and affected parties, and the consideration of alternatives to the initially proposed site layout.

The section below describes the site/location alternatives considered as part of the project. As indicated above, Lannex Mine is an existing mine, and has been subjected to previous environmental processes, which considered alternatives in the form of both development and land use alternatives prior to approval.

5.2.2 DETAILS OF THE PROPERTY ON WHICH OR LOCATION WHERE IT IS PROPOSED TO UNDERTAKE THE ACTIVITY

The property on which the proposed opencast and the associated infrastructure will be located are within the Mining Right Area (Figure 2-1) as outlined below:

- Annex Grootboom; and
- Grootboom.

The location of the underground mining area is:

- Annex Grootboom; and
- Grootboom.

Samancor is also the surface right holder for some of these properties and hold the Title Deeds as indicated below.

Table 5-1: Surface and chromite rights for Lannex mine as applicable to Samancor Chrome Ltd

Title deed number	Farm Number	Farm and portion	Hectares	Rights	Holder
T 11981/1993	335 KT	RE (0)	1137.5643	Surface rights Chromite and associated minerals	Samancor Chrome Ltd
T 75536/1993	335 KT	Portion 1	263.8943	Surface rights Chromite and associated minerals	Samancor Chrome Ltd
T 159656/2005	336 KT	Portion 0	434.5842	Chromite and associated minerals	Dolphin Whisper Trading 10 Pty Ltd
T 98215/2001	336 KT	Portion 1	736	Surface rights Chromite and associated minerals	Samancor Chrome Ltd
T 55771/2011	336 KT	Portion 2	103	Chromite and associated minerals	XTLS Inv 129 Pty Ltd
T 17669/1999	336 KT	Portion 3	258	Chromite and associated minerals	Tubatse African Agricultural Merging Farmers Communal Property Association
T 39213/2001	336 KT	Portion 4	466	Chromite and associated minerals	Ngululu Bulk Carriers Pty Ltd

The type of minerals mined are chrome (Cr_2O_3), and associated minerals: platinum, palladium, rhodium, ruthenium, iridium and osmium, gold, silver, copper, nickel and cobalt, which may be extracted from normal mining of Chromite in the Middle Group (MG) and Lower Group (LG) Reefs.

The land use of the proposed mining area, new TSF area, TSF reclamation, and access road is now considered to be predominantly for mining and mining related activities, therefore, there is no practical development alternative for the current Lannex Mine area. The proposed extension of the opencast of the current mining area has to be taken into consideration economic viability and practicality as well as the location of the resource to be mined.

5.2.3 Location Alternatives

Lannex is an existing mine with existing infrastructure that will be utilised during the proposed opencast and underground expansion. A site selection process was undertaken to consider the possible location of the proposed tailings storage facility, return water dam, plant area, TSF reclamation, and access road. However, the opencast and underground site was selected based on the availability of Chrome and other minerals that ECM is targeting to extract. Minerals can only be mined where identified and verified, therefore it was not practical to select any the mining site.

5.2.3.1. Rezoning

Applicable areas of the properties will be rezoned from residential to mining to ensure compliance with the Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013) (SPLUMA). Tubatse Residential area will be excluded from rezoning. There is no other area that has been investigated for rezoning within the mining property. The alternative will be to not rezone the properties and remain as it stands, this will result in less minable material which will shorten the life of mining activities at Lannex.

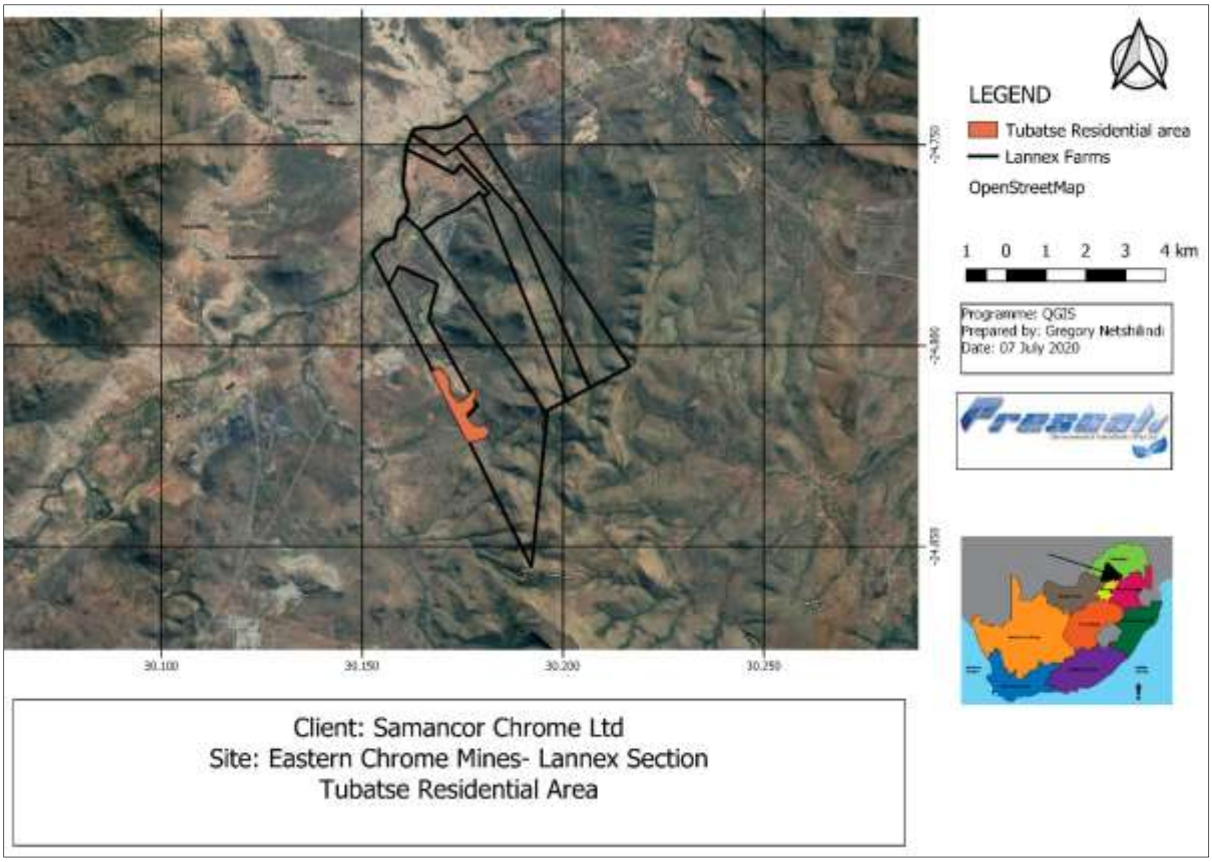

Figure 5-1: Tubatse Residential Area rezoning

5.2.3.2. <u>New crushing and screening plant and New product stockpile area</u>

The new crushing and screeing plant and product stockpile area's location was determined and located to be as close as possible to the existing infrastructure. Other locations that would be far from existing infrastrucuture would require more financial resources to transport materials from the underground and opencast location. The proposed area has already deteriorated by previous mining activities No other alternatives were considered.

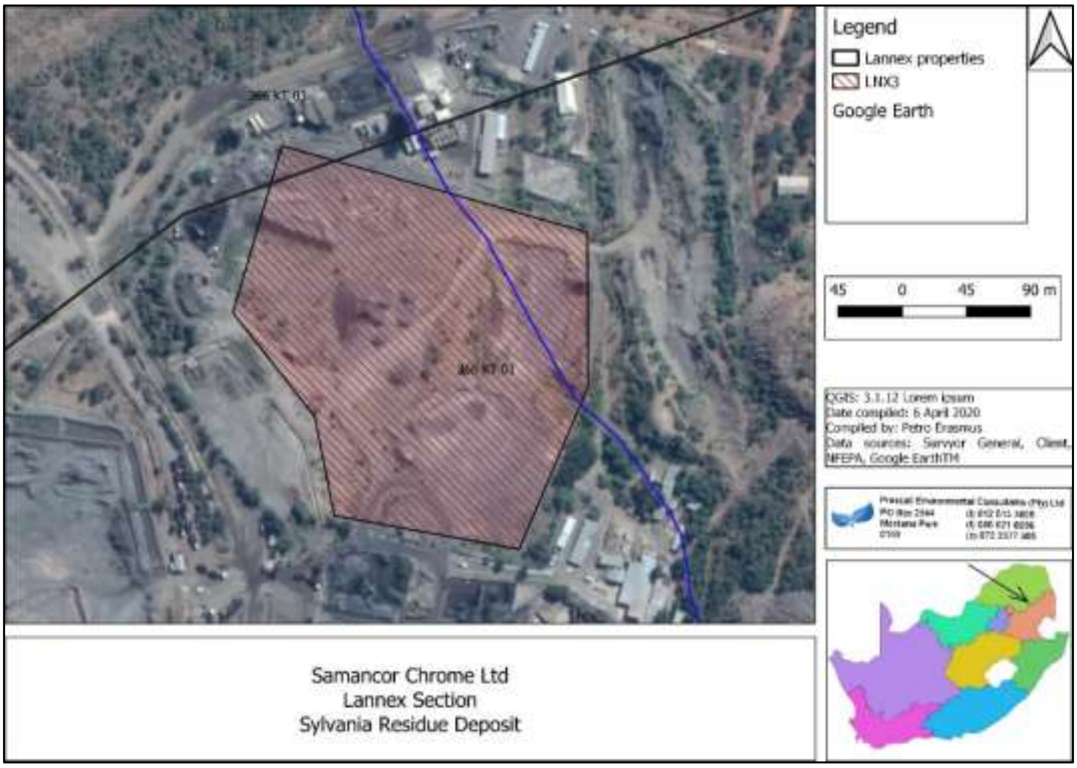

Figure 5-2: New crushing and screening plant area with new product stockpile

5.2.3.3. New TSF Area

A site alternative assessment for the proposed TSF is discussed below Table 5-2 and attached as Appendix 8. LNX 1 is the preferred alternative due to the following reasons:

This site is located parallel to the informal settlement and compared to wind flow might get spill over air impacts (e.g. dust). Vegetation seems to be natural though the potential for species of conservation concern (SCC) may be present. Anthropogenic impacts are already visible at this site (e.g. roads). The site is located on a Critical Biodiversity Area (CBA2) and National Protected Area Expansion Strategy (NPAES) area.

With a little bit of modification in terms of location this site can be located outside the regulated 100 m surface water buffer (Please note that the 1:100-year flood line needs to be determined and included in the final design and location). In addition, the watercourse to be crossed is an ephemeral stream that only flows during rainfall events. It is believed that a pipeline crossing this watercourse (if designed and maintained properly) would not impact on the watercourse in terms of water quality and quantity. This site is closer to the plant and existing TSF area than LNX2.

5.2.3.4. WRD expansion area

The proposed expansion area of the WRD was determined by the existing footprint area of the WRD and the expansion area is located next to the existing dump. No other alternatives were considered. Any other location alternative would have greater impact on the alternative area as the material dumped is classified as Type 3 waste as per the NEMWA Regulations and require appropriate lining systems to prevent any groundwater contamination. However the WRD is not a true type 3 waste as it is inert and the leachable concentration did not exceed the LCT0 limits.

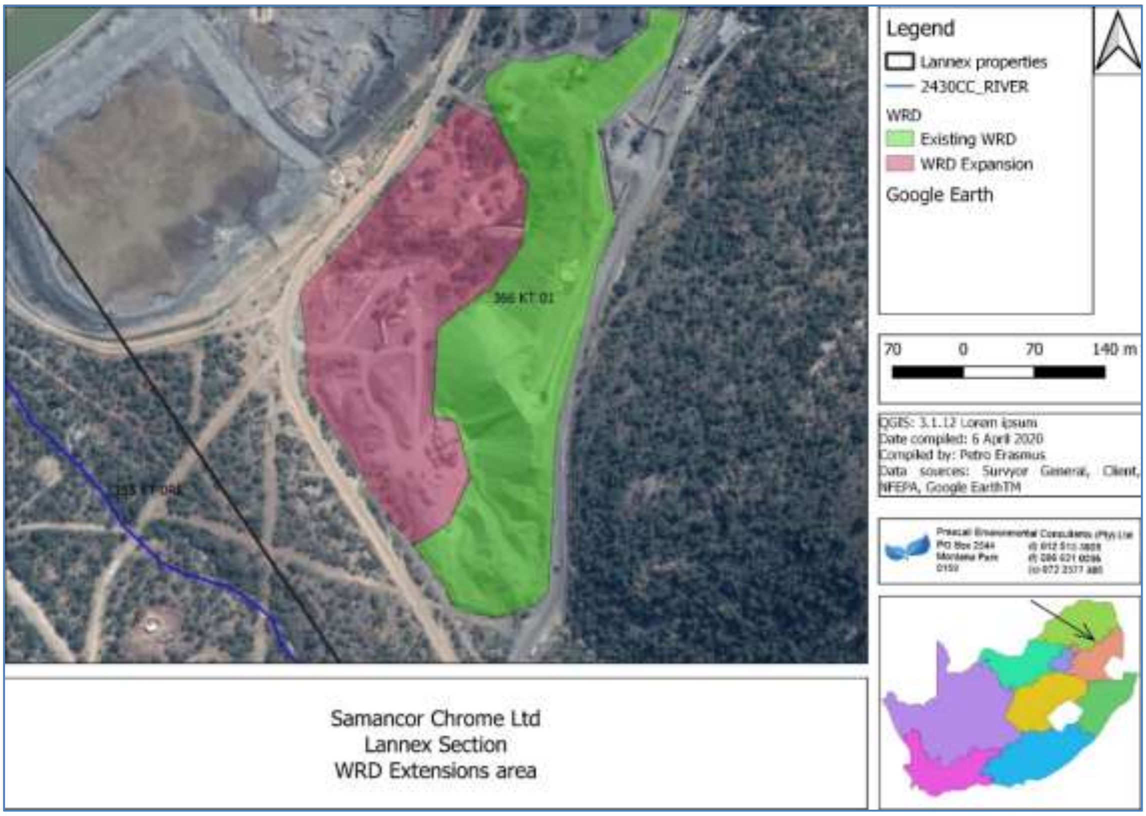

Figure 5-3: Lannex Section Waste Rock Dump Expansion Area

5.2.3.5. Access roads and road diversion

Three access roads have been considered for the opencast mining area as seen in Figure 5-4 based on distance, costs, available area, and terrain and topography.

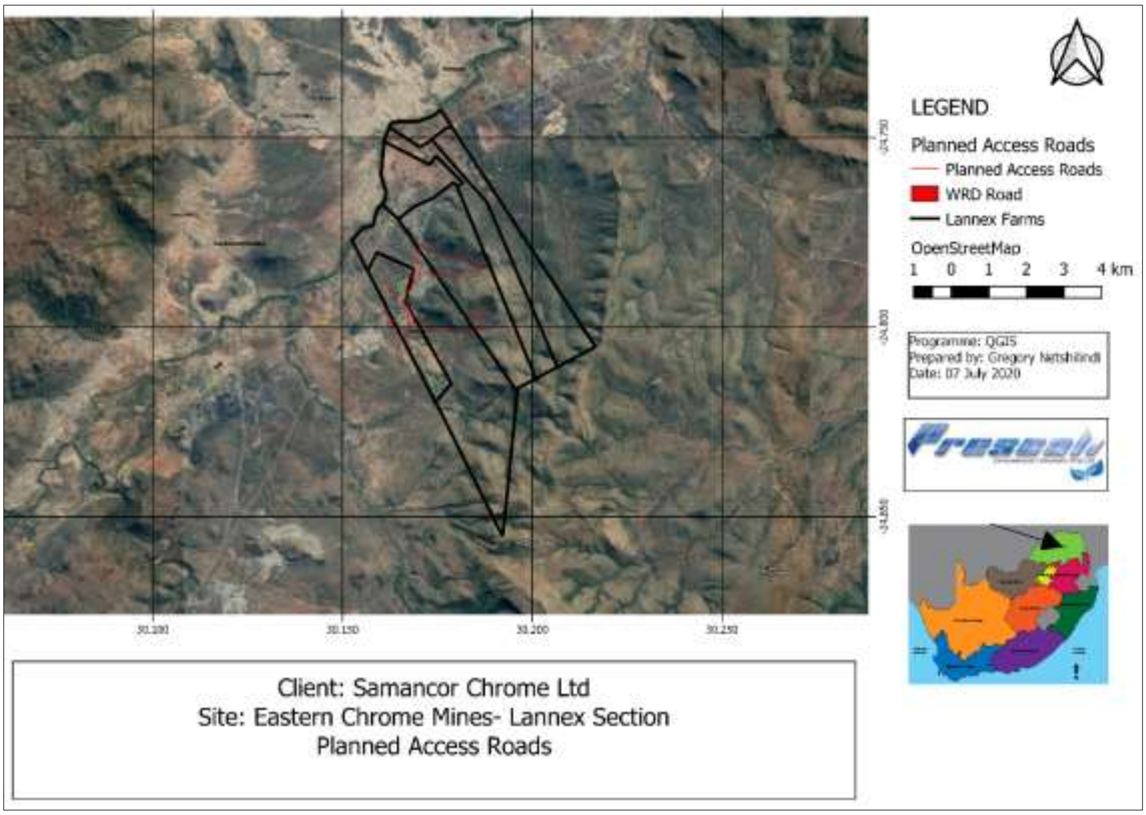

Figure 5-4: Proposed access roads.

Access road option 3 has been identified as the preferred road,this based on accessibility to all the proposed opencast areas. A temporary road diversion will be creaded around the Tubatse Village (Figure 5-6).

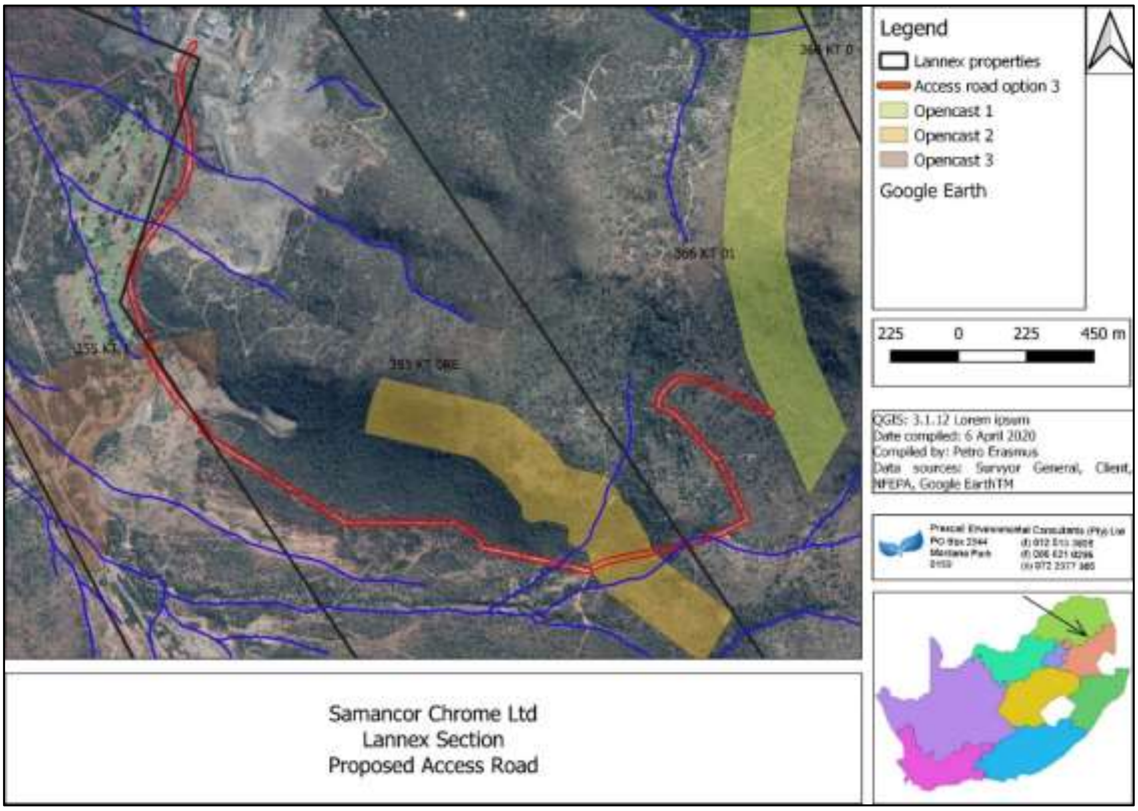

Figure 5-5: Lannex Section preferred access road

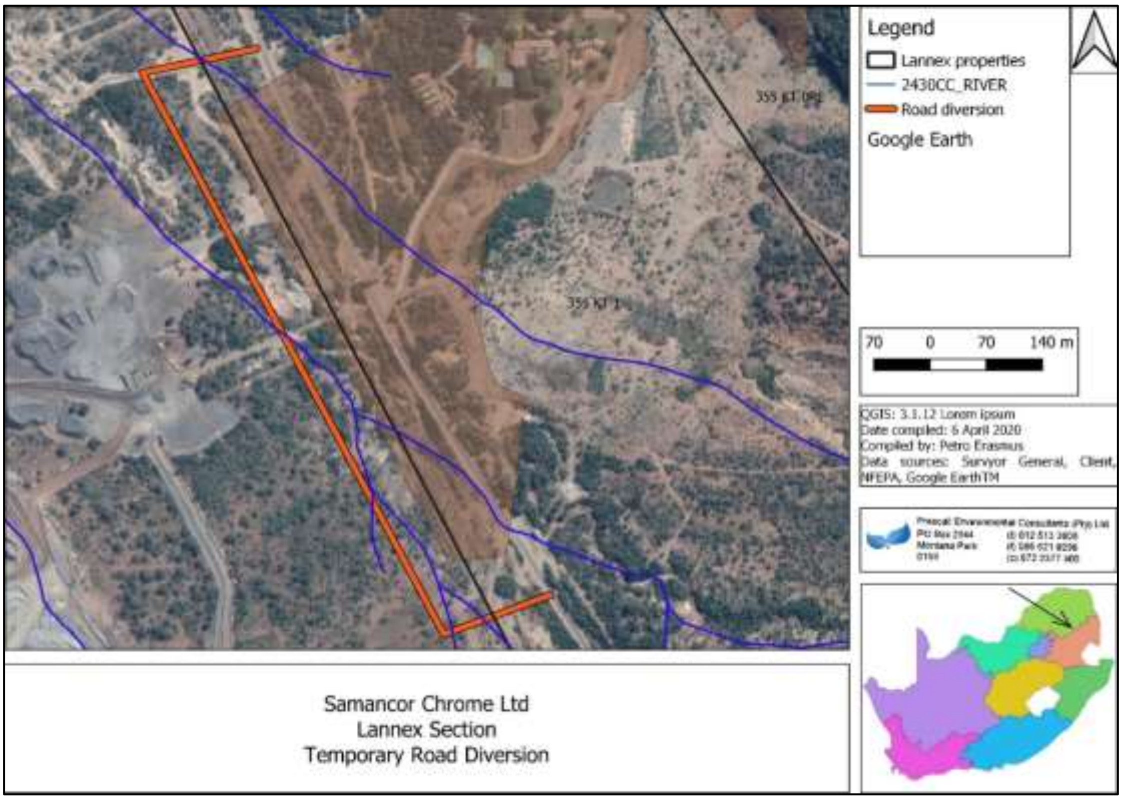

Figure 5-6: Lannex Section temporary road diversion

5.2.4 SITE ALTERNATIVES FOR THE PROPOSED INFRASTRUCTURE AND MINING AREA SUITABLE FOR OPENCAST AND UNDERGROUND OPERATION

The site selection report has identified the following location for the proposed infrastructure show in Figure 3-1, Figure 5-7 and Table 5-2.

Table 5-2: TSF site selection process.

TSF options	Comments	Average	Rating based on Average
LNX 1	This site is located parallel to the informal settlement and compared to wind flow might get spill over air impacts (e.g. dust). Vegetation seems to be natural though the potential for species of conservation concern (SCC) may be present. Anthropogenic impacts are already visible at this site (e.g. roads). The site is located on a Critical Biodiversity Area (CBA2) and National Protected Area Expansion Strategy (NPAES) area. With a little bit of modification in terms of location this site can be located outside the regulated 100 m surface water buffer . In addition, the watercourse to be crossed is an ephemeral stream that only flows during rainfall events. It is believed that a pipeline crossing this watercourse (if designed and maintained properly) would not impact on the watercourse in terms of water quality and quantity. This site is closer to the plant and existing TSF area than LNX2.	2	1
LNX 2	This site is located furthest from the settlement. Vegetation seems to be natural though the potential for Species of Concservational Concern (SCC) may be present. Anthropogenic impacts are already visible at this site (e.g. roads). The site is located on a CBA2, Ecological Support Areas (ESA1) and NPAES area. This site is located further from the plant area and the required pipeline will cross more ephemeral stream increasing the risk relating to potential spills. It is also smaller in size than the area available at LNX3.	2.7	3
LNX 3	This site is located in an already impacted (brown fields area) but close to an informal settlement and the natural surface water drainage has already been diverted around the site. *Concern*: it is possible that this area may not be sufficiently sized for the required tonnage to be disposed.	2.2	2
LNX 4	This site is located downwind from the settlement. Vegetation seems to be natural though the potential for SCC may be present. Anthropogenic impacts are already visible at this site. This site is the least preferred due to the following: 1) Close proximity to the Steelpoort River which is a perennial river. Any incidents from this site that could impact on a surface water resource will thus be more difficult to contain; 2) It crosses an existing water furrow; 3) The pipeline will have to cross the busy provincial road to Steelpoort. 4) Soils may not be suitable for stockpiling.	3.2	4

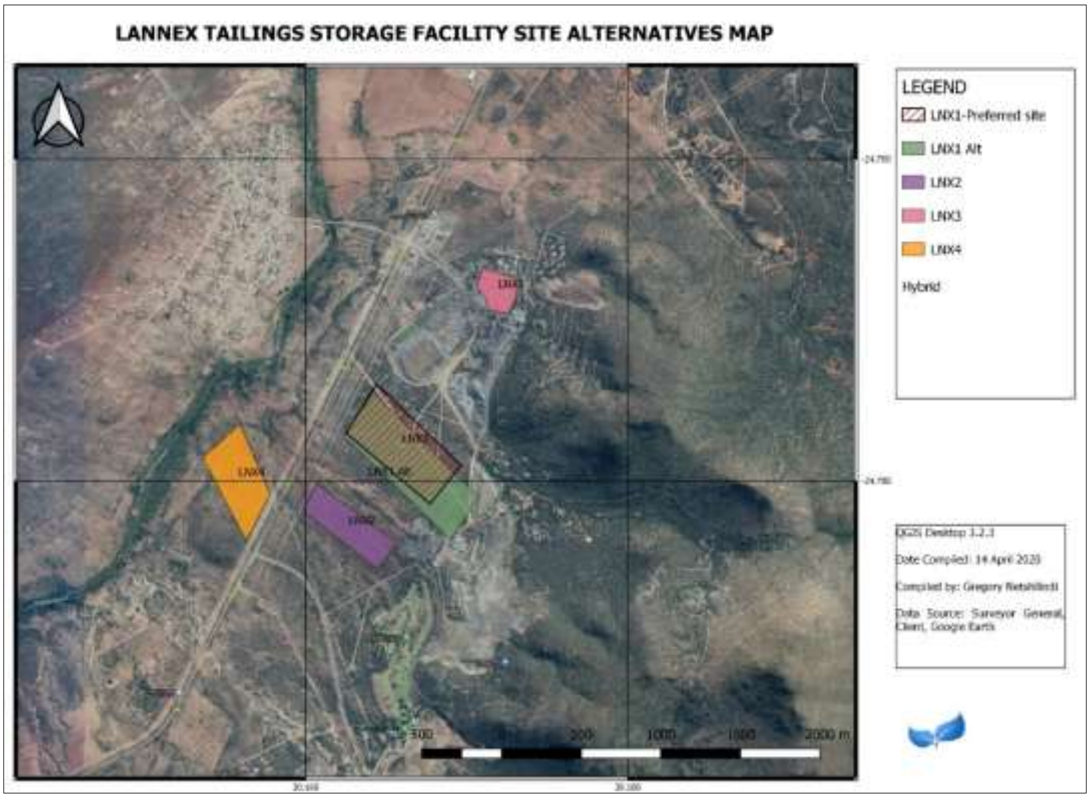

Figure 5-7: Lannex TSF Site selection options

5.2.5 The type of activity to be undertaken

Lannex section is an operational mining area and the construction of the proposed additional activities are required to allow continued processing of the ROM generated by the mining activities and the re-treatment of the tailings.

WRD depositing will continue as per the current method, no alternatives were investigated.

Due to the location and depth of the mineral resource, opencast mining is the only viable mining method in the areas as identified for the opencast mining. Similarly, underground mining will take place where most feasible.

The area is an existing mining area and the area zoned as residential is excluded from the area to be rezoned as mining.

5.2.6 Designs and Layout Alternatives

Please refer to Section 5.2.3 above where the site alternatives for the mining infrastructure in relation to the reserves are discussed.

The final design of the WRD, tailings storage facility and the supporting infrastructure will be prescribed by the site and will comply with the requirements of the Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits, 2015 as published in Government Notice R632 in Government Gazette 39020 dated 24 July 2015.

The design of the new Return water dam iscompliant with the Requirements of GN704.

All roads will be structurally sound.

5.2.7 THE TECHNOLOGY TO BE USED IN THE ACTIVITY

The technology to be used during the deposition of the mining, TSF and WRD will be outlined in the final design report which will comply with the requirements of the Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits, 2015 as published in Government Notice R632 in Government Gazette 39020 dated 24 July 2015.

Technology to be used during opencast and underground mining will not change from current technology as the mine has already acquired and adapted to the current mining technology. New and efficient mining technologies will be researched and may be implemented by the mine during the course of the life of mine.

5.2.8 THE OPERATIONAL ASPECTS OF THE ACTIVITY

Operational aspects of the deposition of the mining, TSF and WRD will be outlined in the design report which will comply with the requirements of the Regulations Regarding the Planning and Management of Residue Stockpiles and Residue Deposits, 2015 as published in Government Notice R632 in Government Gazette 39020 dated 24 July 2015.

5.2.9 THE OPTION OF NOT IMPLEMENTING THE ACTIVITY

The no-go option refers to the alternative of the proposed development not going ahead at all. This alternative will avoid potentially positive and negative impacts on the environmental condition of the area would remain which is the conditions of the current ECM- Lannex Mine without any deviations or expansions. Mining operations at Lannex would cease followed by retrechments and loss of income for over 1000 permanent employees at Lannex Mine. Socio-economic impacts of proceeding with the proposed expansion is discussed in various sections of the report including Section 10.5.4.5. No go althernative will also mean that the proposed rezoning process will not go ahead and the area zoned as residential area remains as is, this will mean less minable material and a reduced life of mine for Lannex Mine.

6. *DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED*

Describe the process undertaken to consult interested and affected parties including public meetings and one on one consultation. NB the affected parties must be specifically consulted regardless of whether or not they attended public meetings. (Information to be provided to affected parties must include sufficient detail of the intended operation to enable them to assess what impact the activities will have on them or on the use of their land.

Public Participation Process for the EIAR/EMPr will commence once the report is made available for public comment.

The section below describes all the public participation engagements that have taken place in the Scoping phase of the application. A comprehensive public participation feedback will be included in the final EIAR/EMPr report.

Due to the COVID-19 pandemic a Public Participation Plan was submitted to the DMRE, the plan will be adhered to and amended as regulations are gazetted. The following process was undertaken to facilitate the public participation process for the proposed project thus far.

Public participation is a continuous two-way communication process aimed at promoting full public understanding of the processes and mechanisms through which environmental problems and needs are investigated and solved by the responsible agency. It is aimed at keeping the public informed about the status and progress of the studies conducted and the implications of the project thereof as well as document all issues, comments and concerns voiced by the public and their preferences regarding resource use and alternative development or management strategies and any other information and assistance relative to the project decisions.

The Stakeholder Engagement Process as it is referred to by the Department of Environmental Affairs (DEA) is a *"…process leading to a joint effort by stakeholders, technical specialists, the authorities and the proponent who work together to produce better decisions than if they had acted independently"*. The process aims at improving *"…communication between stakeholders – including the proponent – in the interest of facilitating better decision-making and or sustainable development"*.

Sustainable development requires some level of trade-off between economic growth, social equity and ecological integrity. The stakeholder engagement process provides an opportunity for Interested and Affected Parties (I&APs) to participate in an informed bases and ensure their needs and requirements are considered and allows the decision-making authority to understand to what degree stakeholders are willing to accept and live with the trade-offs involved.

6.1. Approach to Stakeholder Engagement

Our approach to stakeholder engagement was based on the following principles outlined by the Department of Environmental Affairs:

- Undertake meaningful and timely participation of I&APs;
- Focus on important issues during the scoping and stakeholder engagement phases;
- Due consideration of alternatives (where applicable) were undertaken;
- Accountability for information used for decision-making should be provided;
- Encouragement of co-regulation, shared responsibility and a sense of ownership should be developed over the project lifecycle;
- Application of "due process" particularly with regard to public participation in environmental governance as provided for in the Constitution is essential; and
- The needs, interests and values of I&APs must be considered in the decision-making process.

6.1.1 Identification of Stakeholders (Interested and Affected Parties)

Stakeholder engagement varies given the technical nature of the activity, the geographical location, extent, duration, intensity and frequency of potential impacts associated with the proposed activity, as well as the capacity of the receptive community to participate in the project. The processes outlined below are specific to this study.

I&APs were identified through several mechanisms. These include:

- Networking with tribal authorities, non-governmental agencies, community-based organisations, local council representatives, and municipality;
- Advertising in the press, placement of community notices, and distribution of background information documents (discussed separately).

All I&AP identified were registered on the stakeholder database. The public participation consultant endeavoured to ensure that individuals / organisations from referrals and networking were notified of the project, in addition to efforts to notify and identify stakeholders at a geographical level.

6.2. Advertisement

The newspaper advert was placed on the newspaper informing members of the public and any other interested and affected parties (I&APs) about the Rezoning of Properties, Opencast and Underground Mining, Waste Rock Dump Expansion, New Tailings Storage Facility and the overall Consolidation of the Environmental Management Programmes underway and to comment on these proposed Lannex Section Projects.

In addition, site notices and background information documents (BID) were distributed to various stakeholders and I&APs within the project area. Distribution was done on the **12th August 2020.**

The purpose of a BID was to provide stakeholders with introductory information on the proposed expansion projects, the environmental impact assessment (EIA) and management programme (EMP) being undertaken and the stakeholder engagement process. The BID also provided stakeholders who are interested in the project with the opportunity to register as stakeholders by way of requesting and completing the registration sheet distributed with the BID. Information on the registration sheet has been used to register stakeholders on a database to receive all project-related information and invitations to meetings. The registration sheet included a section for comments and issues, which allows stakeholders an opportunity to provide the consultants with written comments and feedback.

6.3. Content on Advertisement and Site Notices

Advertisements and notices indicated the public participation process (PPP) being undertaken, the project description and explanation of the proposed EIA/EMP process for the expansion project and EMP, the nature and location of the proposed project, where further information on the project could be obtained and the manner in which representations in respect of the project can be made.

6.4. Placement of Advertisements and Site Notices

To inform the surrounding public, I&APs and immediately adjacent landowners to Portions 0 (RE) and 1 of Farm Annex Grootboom 335 KT; and Farm Grootboom 336 KT about the proposed Lannex Section Project, site notices were placed at various places and locations which are visible and accessible within farm homesteads on the **12th August 2020.** Site notices were placed at the following points/sites:

Table 6-1: A3 Site Notice Placement

Area	Strategic Places	Co-ordinate
Lannex Section Area 12/08/2020	Lannex Mine Samuel Tuck Shop General Dealer Peace Tuck Shop Steelpoort Taxi Rank	-24.76945; 30.17089 -24.76387; 30.15801 -24.76180; 30.15573 -24.75828; 30.15309 -24.73193; 30.20661

Figure 6-1: Site Notice Placement

6.5. CONSULTATION MEETINGS

The following Consultation meetings were held:

- Meeting with Magoshi were held on the 15th September 2020, from 10h00 to 11h30 at Winterveld Club.
- Meeting scheduled with Forums could not take place as all members of the community wanted to be in the meeting and the meeting could not take place due to Covid-19 pandemic and subsequent country-wide lockdown; the said public meeting could not take place. Subject to easing of the lockdown conditions and level the requisite public participation meeting will/may be undertaken at a later stage.
- To circumvent the requisite public participation meeting, site notices placement within Surrounding Farm Homestead was undertaken on the 1**2th August 2020** inviting comments and inputs from interested and affected parties.

Figure 6-2: Meeting with Traditional Authorities and Ward Councillors

6.6. AUTHORTY PARTICIPATION

Authorities' consultation was or will be undertaken during **August 2020– still to date** as part of the consultation process with interested and affected parties. The following authorities were (draft scoping report submitted for comments) and will be consulted:

a) Department of Agriculture, Forestry and Fishery (DAFF);
b) Limpopo Department of Economic Development, Environmental and Tourism (LDEDET);
c) Department of Water Affairs;
d) Fetakgomo-Greater Tubatse Local Municipality;
e) Department of Agriculture (DA);
f) National Department of Environmental Affairs (DEA); and
g) South African Heritage Resource Agency (SAHRA).

Salient points from the discussion included the following:

a) Summary of the process undertaken,
b) Alternatives,
c) Socio-economic impacts – including social and labour plan,
d) Poverty alleviation proposals and job creation for local people,
e) Air and water pollution,
f) Comments by the authorities prior to the final decision.

6.7. DOCUMENT REVIEW

The Scoping/EIA/EMP Reports was made available at public places for review prior to finalisation and submission to DEA/LDEDET/DWA/SAHRA/DAFF. Stakeholders on the database were notified of the availability of these reports via e-mail, fax and post. The reports will also be made available at the Local Municipality Offices, and Ward Committee's Offices.

6.8. SUMMARY OF ISSUES RAISED

(Complete the table summarising comments and issues raised, and reaction to those responses)

Table 6-2: Issues and Response – Traditional Authorities and Ward Councillors

Issue Raised –	Date	Commentator	Response
Stakeholder Management			
What will happen to the cattle grazing within the proposed area?	15/09/2020	Kgoputso Segokodi	We will engage with the community/ Moshate to identify a new alternative site. The proposed expansion projects fall within the existing mining right area.
You can proceed with the proposed project; kindly send us the presentation report.	15/09/2020	David Phurutsi	Comment noted and the presentations will be sent by email.
Do the proposed expansion projects fall within the exiting ECM mining footprint.	15/09/2020	Cllr Linky Mariri	All the new expansion projects fall within the existing ECM Mining Right area.
The public participation process must include all stakeholders.	15/09/2020	Rantho	The public participation process will include all stakeholders. However, due to Covid-19 ECM opted to start with the community leaders – Tribal Authorities and Ward Councillors.
ECM must take cognizance of any land claims on the affected project areas.	15/09/2020	David Phurutsi	Comment noted and follow-up will be done with the Land Claims Commissioner.

Table 6-3: Issues and Response – Water Affairs and DMRE Authorities

Issue Raised –	Date	Commentator	Response
Stakeholder Management			
All new water uses (currently existing but not in the existing WULs) triggers new application process in terms of Government Notice Regulation (GNR) 267 published on 24 March 2017	07 May 2019	Water Affairs Official	Noted
Public participation process as outlined in GNR 267 has to be followed and documents must be clear in terms of what the new application entails	07 May 2019		Noted
The minutes of these meeting and the pre-consultation meetings of 2015 will form part of the formal pre-consultations of the new applications	07 May 2019		Noted
Applications will be submitted on Electronic Water Use Licence Application and Authorisation System (EWULAAS)	07 May 2019		Noted
Correction of existing WUL conditions (errors), follows WUL amendment process	07 May 2019		Noted
The environmental authorization application for the two projects is still to be submitted to DMRE – scheduled for 31st August 2020.		Petro Erasmus	
Submission of the EA application can the submitted Scoping Report be acknowledged by the DMRE	27/08/2020	Mapula Sathekge	Noted
Record of decision from Department of Water Affairs will be required as part the EMP	27/08/2020		

amendment process and application. She will assist to forward a DWS Checklist which must be complied with.			
The submission of the EA Application to DMRE Prescali must compile a detailed activity plan which must be shared and sanctioned by Samancor ECM.	27/08/2020	Thabo Thobejane	Noted

7. *THE ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE DEVELOPMENT FOOTPRINT ALTERNATIVES.*

(The environmental attributed described must include socio- economic, social, heritage, cultural, geographical, physical and biological aspects)

This is not applicable as several alternatives is applicable and was discussed in details within Section 5.2.1 regarding the motivation for the overall preferred site, activities and technology. Full scale mining activities are described in the previous sections and the anticipated impacts and the current environmental situation is described below.

8. *TYPE OF ENVIRONMENT AFFECTED BY THE PROPOSED ACTIVITY*

(Its current geographical, physical, biological, socio- economic and cultural character).

The Lannex Mine is located on the farms of Annex Grootboom 335 KT and Grootboom 336 KT, approximately 10 km south-west of Steelpoort in Limpopo Province and is accessed directly from the R555. The area surrounding Lannex Mine is characterised by koppies and mountanious zones to an elevation of over 1 000 m. These elevated areas slope steeply down to flatter areas where mine infrastructure is located. Mining is conducted on flatter areas and up into the koppies.

8.1. CLIMATE

A typical description of the Lannex Mine is hot summers and cold dry winters. The climate of the area is however influenced by prevailing topography being the foothills of the mountain ranges adjacent to the mining area that creates microclimatic effects in the form of a hotter and drier climate. In general, the climate of Lannex area can be described as sub-arid, warm temperate with a summer rainfall, with over 70% of the annual rainfall occurring during the October to February period. The average minimum and maximum daily temperatures are 14.7 ºC and 31.3 ºC, when averaged over the years 2007-2012 (Table 8-1). The average daily temperature is 31.9 ºC. Average daily maximum temperatures may exceed 30 ºC from September to May. Average daily minimum temperatures of less than 10 ºC occur from June to August.

Table 8-1 : minimum and maximum temperatures

Month	Minimum (ºC)	Average (ºC)	Maximum (ºC)
January	19.2	27.0	36.6
February	18.2	27.3	37.6
March	16.7	25.9	34.9
April	12.3	22.2	31.3
May	8.6	20.1	33.5
June	6.2	16.5	25.99
July	5.2	15.97	26.1
August	8.7	19.1	29.4
September	10.8	23.1	33.6
October	16.2	24.9	34.2
November	16.7	25.9	41.2
December	18.2	26.1	34.0

The lowest rainfall per month is in June (0 mm) and the highest in January with an average of 100 mm to 118 mm per month. Rainfall during winter months is erratic (between 0 mm and 40 mm monthly) while evapotranspiration is never less than 80 mm per month. This implies that the area has a precipitation deficit and can therefore be classified as a dry area for agricultural purposes.

8.1.1 MESO-SCALE METEOROLOGY

The nature of the local climate will determine what will happen to the pollution when it is released into the atmosphere (Tyson & Preston-Whyte, 2000). Pollution levels fluctuate daily and hourly, in response to changes in atmospheric stability and variations in mixing depth. Similarly, atmospheric circulation patterns will have an effect on the rate of transport and dispersion of pollution.

The release of atmospheric pollutants into a large volume of air results in the dilution of those pollutants. This is best achieved during conditions of free convection and when the mixing layer is deep (unstable atmospheric conditions). These conditions occur most frequently in summer during the daytime. This dilution effect can however be inhibited under stable atmospheric conditions in the boundary layer (shallow mixing layer). Most surface pollution is thus trapped under a surface inversion.

Inversion occurs under conditions of stability when a layer of warm air is situated directly above a layer of cool air. This layer prevents a pollutant from diffusing freely upward, resulting in an increased pollutant concentration at or close to the earth's surface. Surface inversions develop under conditions of clear, calm and dry conditions and often occur at night and during winter (Tyson & Preston-Whyte, 2000). Radiative loss during the night results in the development of a cold layer of air close to the earth's surface. These surface inversions are however, usually destroyed as soon as the sun rises and warm the earth's surface. With the absence of surface inversions, the pollutants are able to diffuse freely upward; this upward motion may however be prevented by the presence of an elevated inversion (Tyson & Preston-Whyte, 2000).

Elevated inversions occur commonly in high pressure areas. Sinking air warms adiabatically to temperatures in excess of those in the mixed boundary layer. The interface between the upper, gently subsiding air is marked by an absolutely stable layer or an elevated subsidence inversion. This type of elevated inversions is most common over Southern Africa (Tyson & Preston-Whyte, 2000).

The climate and atmospheric dispersion potential of the interior of South Africa is determined by atmospheric conditions associated with the continental high-pressure cell located over the interior. The continental high pressure present over the region in the winter months results in fine conditions with little rainfall and light winds with a northerly flow. Elevated inversions are common in such high-pressure areas due to the subsidence of air. This reduces the mixing depth and suppresses the vertical dispersion of pollutants, causing increased pollutant concentrations (Tyson & Preston-Whyte, 2000).

Seasonal variations in the positions of the high-pressure cells have an effect on atmospheric conditions over the region. For most of the year the tropical easterlies cause an air flow with a north-easterly to north-westerly component. In the winter months the high-pressure cells move northward, displacing the tropical easterlies northward resulting in disruptions to the westerly circulation. The disruptions result in a succession of cold fronts over the area in winter with pronounced variations in wind direction, wind speeds, temperature, humidity, and surface pressure.

Airflow ahead of a cold front passing over the area has a strong north-north-westerly to north-easterly component, with stable and generally cloud-free conditions. Once the front has passed, the airflow is reflected as having a dominant southerly component (Tyson & Preston-Whyte, 2000).

Easterly and westerly wave disturbances cause a southerly wind flow and tend to hinder the persistence of inversions by destroying them or increasing their altitude, thereby facilitating the dilution and dispersion of pollutants. Pre-frontal conditions tend to reduce the mixing depth. The potential for the accumulation of pollutants during pre-frontal conditions is therefore enhanced over the plateau (Tyson & Preston-Whyte, 2000).

8.1.2 Precipitation and Evaporation

Lannex Mine is located on the B41J quaternary catchment. The Water Resources of South Africa 2012 (WR2012) database indicates a mean annual precipitation (MAP) of 591 mm/a for the B71E catchment and a MAP of 598 mm/a for the B41J catchment. The WR2012 data per quaternary catchment was compiled from a number of rainfall stations per quaternary catchment and reviewed to get a final patched rainfall dataset per rain zone (applicable to one or more quaternary catchments that are grouped based on similar rainfall micro climatic zones) that stretched from 1925 to 2010.

Rainfall and temperature data were obtained from the DWS site Buffelskloof @ Buffelskloof Dam (B4E003) was available from 1972/07/01 until 31/01/2015 at B4E003 is approximately 618 mm per year.

Table 8-2: Mean climatic rainfall conditions for the project area

Month	Average Monthly Rainfall (mm)	Mean Monthly Evaporation (mm)
January	118.8	193
February	88.5	164.3
March	59.2	156.9
April	44.5	122.8
May	11.8	101.5
June	5.4	80.5
July	2.2	87.6
August	3.9	122.7
September	16.7	161.8
October	46.9	191.8
November	93.6	184.6
December	124.6	193.4
Annual	617.2	1 760.9

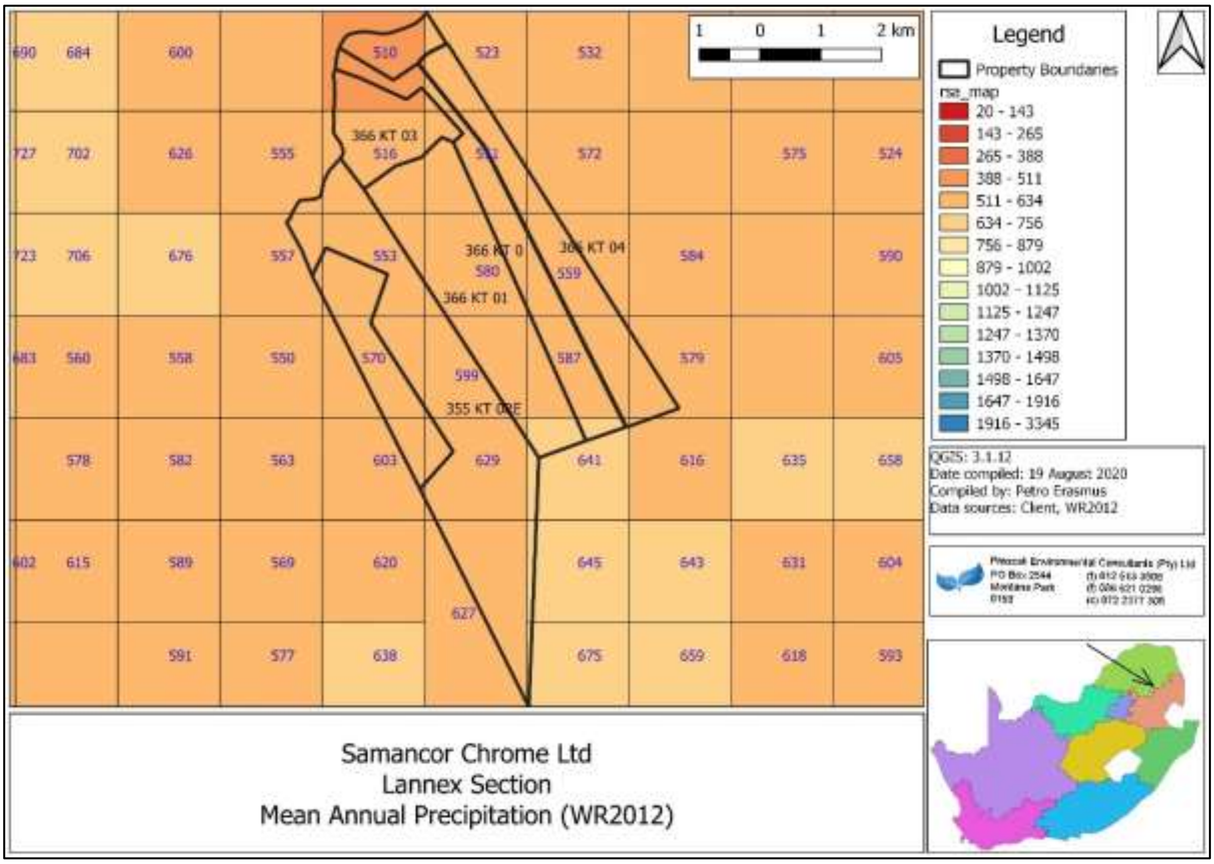

Figure 8-1: Mean Annual Precipitation (WR2012)

8.1.3 WIND

Airshed Planning Professions used a model to determine the wind direction and speed at the mine site.

Table 8-3: Summary of mean monthly wind directions from Lydenburg Station

Month	N	NE	E	SE	S	SW	W	NW
January	49	21	79	87	26	21	15	63
February	34	13	91	133	38	26	11	48
March	28	21	78	95	31	23	18	56
April	41	14	40	65	19	21	26	58
May	32	16	31	50	25	21	25	67
June	33	14	37	63	18	28	25	54

Month	N	NE	E	SE	S	SW	W	NW
July	32	23	45	55	14	22	17	77
August	57	20	55	56	15	20	28	102
September	64	30	66	78	11	17	23	105
October	86	40	79	56	14	18	29	109
November	75	34	59	68	15	11	25	109
December	69	24	60	79	19	17	14	79
Average	50	23	60	74	20	20	21	77

A period wind rose for the site is presented in Figure 8-3. Wind roses comprise of 16 spokes which represents the direction from which winds blew during the period. The colours reflect the different categories of wind speeds. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories.

Based on an evaluation of the meteorological data simulations run from a global NOAA Environmental Modeling System (NEMS) weather model at ~30 km resolution from 1985 to current of the project area.

Looking at Figure 8-2 below, the predominant wind direction is predicted to occur mainly from the north-east and east-north-east more than 1550 and 1200 hours per year, respectively, with wind speeds higher than 5 km/h. From Figure 8-3 at the site, calm conditions with wind speeds of 12 km/h or less, are predicted 5-19 days per month throughout the year. 12-19 km/h winds are predicted 8-16 days per month through the year. Wind speeds of more than 19 km/h are predicted to occur 2-10 days per year on average.

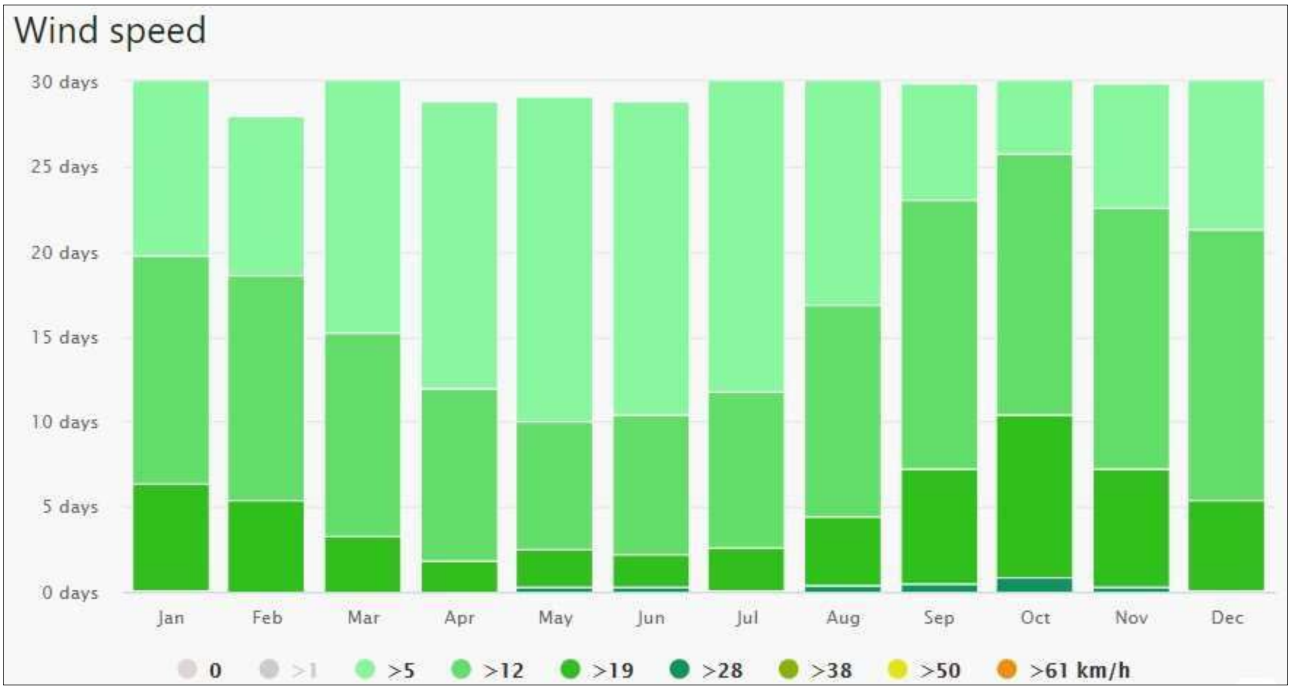

Figure 8-2: Wind class frequency distribution per month

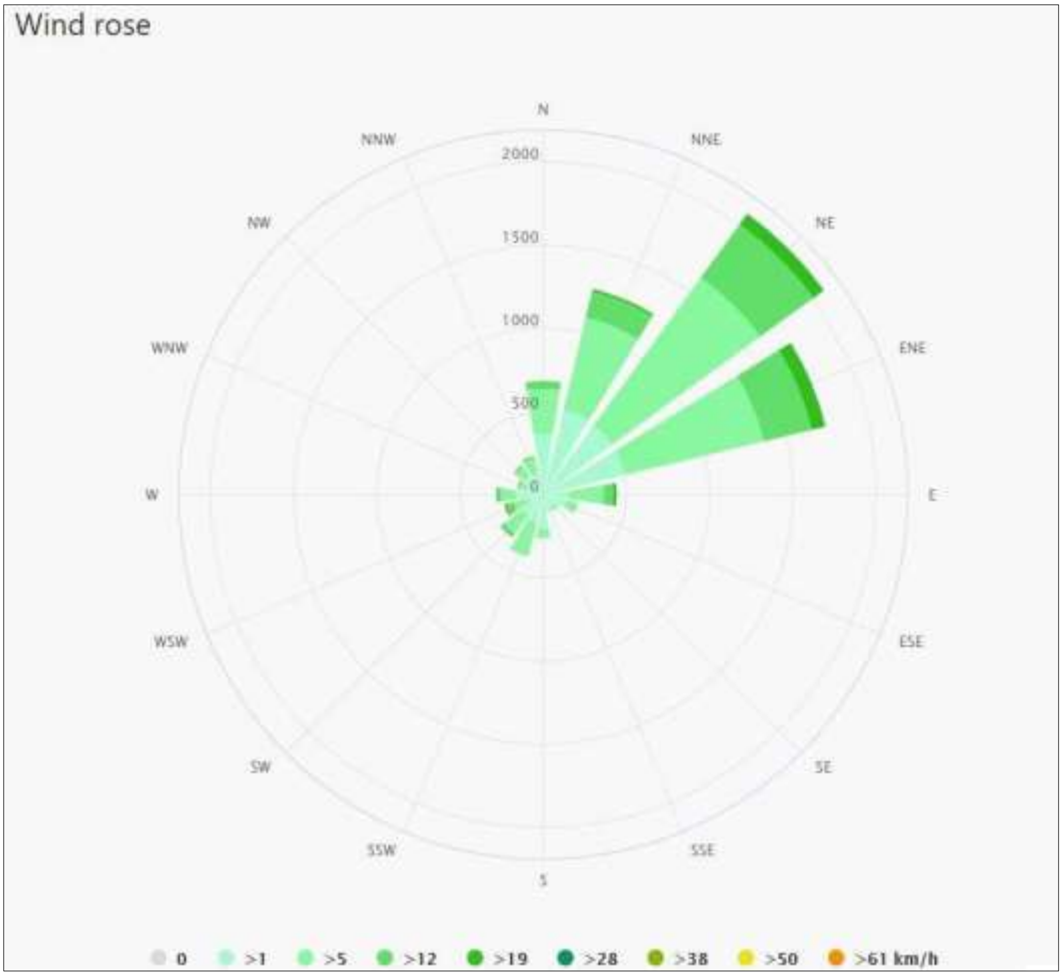

Figure 8-3: NEMS 30km simulation model wind rose for the Lannex Project area for the period 1985 to current

8.1.3.1. Atmospheric Stability

The tendency of the atmosphere to resist or enhance vertical motion and thus turbulence is termed atmospheric stability. Stability is related to both the change of temperature with height and wind speed. A neutral atmosphere neither enhances nor inhibits mechanical turbulence. An unstable atmosphere enhances turbulence, whereas a stable atmosphere inhibits mechanical turbulence. The turbulence of the atmosphere is the most important parameter affecting dilution of air pollution as the more unstable the atmosphere, the greater the dilution of air pollution.

Atmospheric stability is commonly categorised into six stability classes as per Table 8-4 below. The atmospheric boundary layer is usually unstable during the day due to turbulence caused by the sun's heating effect on the earth's surface. The depth of this mixing layer depends mainly on the amount of solar radiation, increasing in size gradually from sunrise to reach a maximum at about 5 - 6 hours after sunrise. The degree of thermal turbulence is increased on clear warm days with light winds. During the night-time a stable layer, with limited vertical mixing, exists. During windy and/or cloudy conditions, the atmosphere is normally neutral.

Table 8-4: Atmospheric stability classes

A	Very unstable	Calm wind, clear skies, hot climate condition
B	Moderately unstable	Clear skies daytime conditions
C	Unstable	Moderate wind, slightly overcast daytime conditions
D	Neutral	High winds or cloudy days and nights
E	Stable	Moderate wind, slightly overcast night-time conditions
F	Very stable	Low winds, clear skies, cold night-time conditions

A neutral atmospheric potential neither enhances nor inhibits mechanical turbulences. Unstable atmospheric condition enhances turbulence, whereas stable conditions inhibit mechanical turbulence.

8.2. TOPOGRAPHY

The topography of the area is characterised by rugged areas and steep gradients. The project area is situated along rugged hills within a number of rural settlements in the Steelpoort Valley. The terrain consists predominantly of mountainous areas with flatter parcels of developable land on the plateaus, terraces and areas adjacent to the rivers. The Topography of the site is highly variable and range between a maximum altitude of 1 440 and 770 meter above mean sea level.

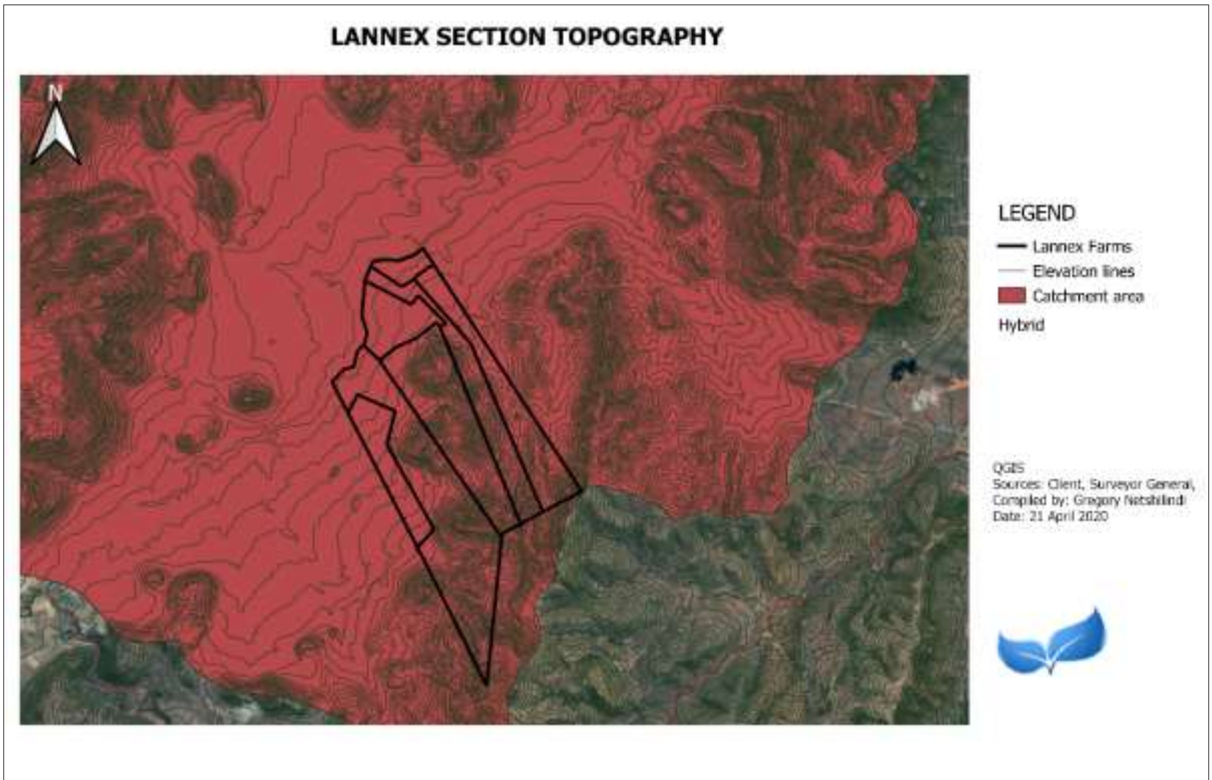

Figure 8-4: Topography of the Lannex Mining Right area

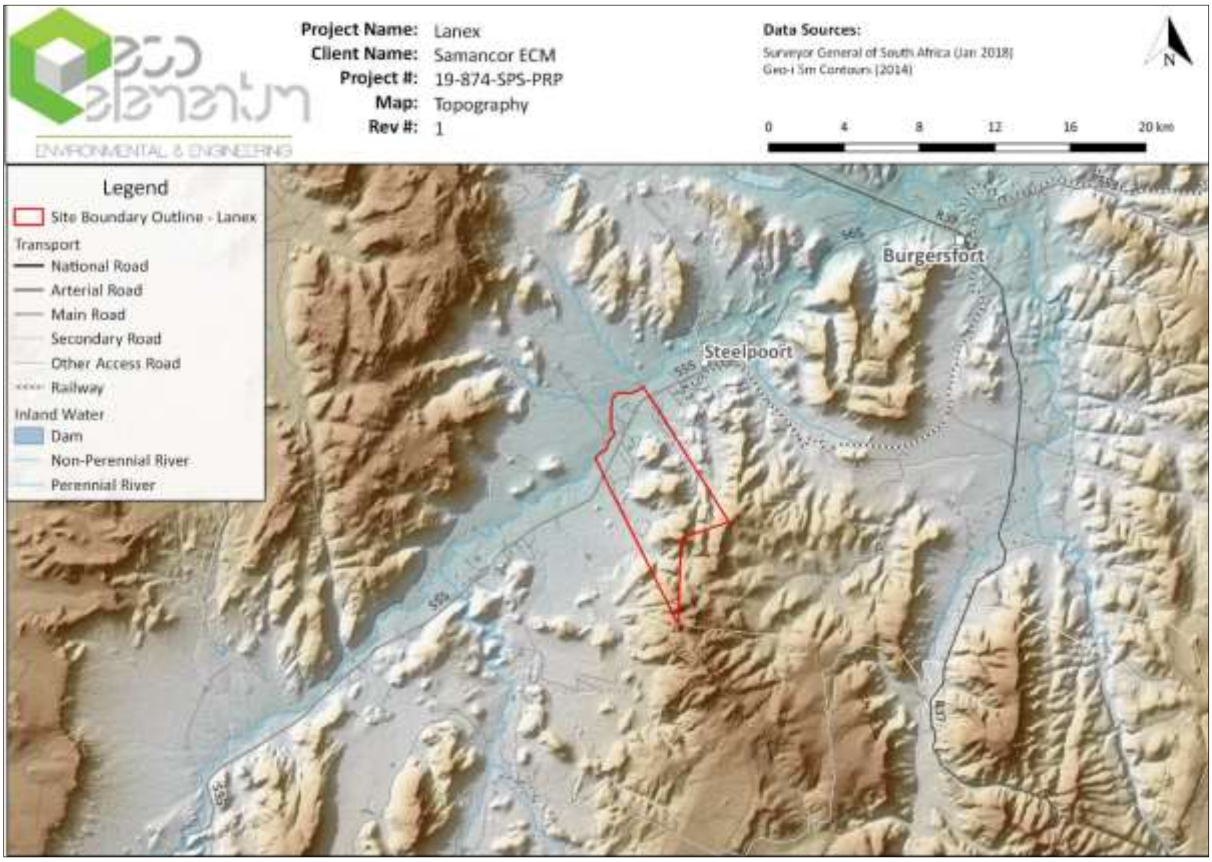

Figure 8-5: Regional Digital Elevation Model (DEM) of the entire Lannex Mining Right and surrounding areas

8.3. GEOLOGY

8.3.1 REGIONAL GEOLOGY

Approximately 98% of the world`s chrome-ore resources are found within gabbroic-layered intrusions of which the Bushveld Igneous Complex (BIC). The BIC is a world-renowned deposit that hosts PGEs, chromite, vanadium and titanium mineralisation. Situated within the north-central Kaapvaal Craton, this massive Proterozoic intrusive body, or, more likely, a series of interconnected intrusive, has a surface area of approximately 66 000 km^2 and consists of a mafic-ultramafic succession of layered and massive rocks known as the Rustenburg Layered Suite (RLS), a penecontemporaneous series of granitic rocks, termed the Lebowa Granite Suite and felsic extrusive rocks of the Rooiberg Group. For the majority of the area of the BIC, the Transvaal Supergroup forms the floor. ECM transgresses in the northern limb into the Archaean granites.

The ECM deposits occur in the BIC, which was emplaced into the Kaapvaal Craton between 1 700 and 2 100 million years ago. The lower mafic layered intrusion, the Rustenburg Layered Suite consists stratigraphically of a Marginal Zone, a Lower Zone, a Critical Zone and an Upper Zone (Figure 8-7).

The magmatic layering of the ultramafic-mafic rocks is remarkably consistent and can be traced over several hundreds of kilometres of strike. The layering may be correlated throughout most of the BIC. The dip of the igneous layering is generally shallow and towards the centre of the BIC. It is generally accepted that, rather than being a single body, BIC comprises several overlapping lopolith-shaped intrusions. The similarity of geology across large areas within each of the three limbs, particularly the sequence of igneous layering that includes both the Merensky Reef and the UG2, is probably indicative of simultaneous differentiation and replenishment of a basaltic magma under essentially identical conditions.

The ECM falls within the eastern limb of the BIC. Granites and related felsic volcanics occur in the central area between these limbs. Post BIC sedimentary successions of the Waterberg Group and

Karoo Supergroup, as well as more recent alluvial deposits of Holocene age, cover large parts of the BIC.

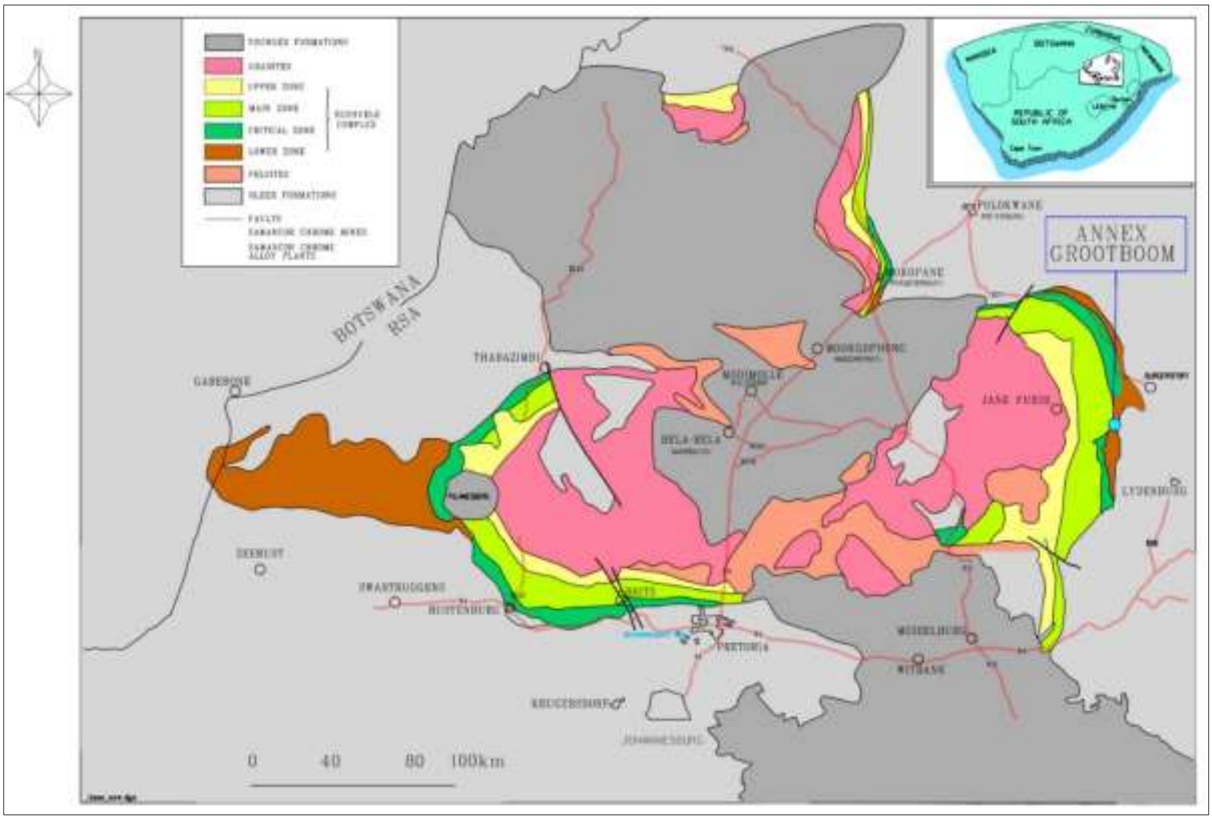

Figure 8-6: Location of Lannex Mine in Relation to the Eastern Limb of the Bushveld Complex

Chromitite layers occur throughout the Critical Zone are in turn divided into Lower-Middle- Upper Groups. At ECM, Chromite ore is being produced from the Lower Group (LG), particularly the LG6 and sometimes also the LG6A chromitite seams at Steelpoort Section, and the Middle Group chromitites (MG), particularly the MG1 chromitite seam at the Lannex and Tweefontein Sections.

The BIC stratigraphy is divided into five major units (from deepest to shallowest):

The Marginal Zone comprises a heterogeneous succession of generally unlayered basic rocks dominated by norites. These rocks contain quartz and hornblende believed to be a result of contamination of the basic magmas by the enclosing host rocks. The Marginal Zone ranges in thickness from several metres to several hundred metres, and field exposures of this zone are generally poor.

The Lower Zone ("LZ") is dominated by ultramafic rocks. The most complete exposure is in the north- eastern part of the eastern limb of the BIC. In this area, the LZ occurs as a series of dunite-harzburgite cyclically layered units. The unit varies in thickness, having a trough-like geometry with the thinnest succession developed over structural highs in the basin floor.

The Critical Zone ("CZ") is particularly remarkable for containing the largest Resources of chromium and PGEs in the world. The CZ is subdivided into the Lower Critical Zone ("LCZ") and the Upper Critical Zone ("UCZ") and is made up of cyclic units consisting of chromitite, pyroxenite, norite and anorthosite. Cycles in the LCZ are entirely ultramafic in character and are dominated by pyroxenite with interlayered harzburgite and chromitite layers. The UCZ represents a mixed mafic-ultramafic cyclic unit comprising layered pyroxenites, norites, anorthosites and chromitites. The base of the UCZ is marked by the appearance of cumulus plagioclase. The igneous layering within the CZ is remarkably uniform over much of the BIC and occurs on a variety of scales, with individual layers traceable for tens to hundreds of kilometres, and may also be locally regular to highly irregular in aspect. Chromitite layers occur throughout the CZ, usually at the base of crystallization cycles. The chromitite layers have been classified into lower, middle and upper groups, with the lower group occurring in the pyroxenitic LCZ, the upper group in the anorthositic UCZ and the middle group straddling the boundary between lower and upper divisions. The layers are identified according to their location within the layered succession, with numbers commencing from the bottom up.

The lowermost group is known as the LG1 (Lower Group 1), followed by LG2, LG3 to LG7. This sequence progresses upwards from the MG1 (Middle Group 1) through to the MG4 and, finally, to the UG1 (Upper Group 1), UG2, and UG3. The thickness of these chromitite layers ranges from several millimetres to several meters. The chromitite layers may comprise multiple layers of chromitite separated by intercalated silicate rocks. The thickest chromitite layers, specifically the LG6 and MG1, are mined for their chromite content. All of the chromitite layers in the BIC contain anomalous concentrations of PGEs, with a general increase in PGE content upward in the sequence, with the UG2 currently one of two reefs of commercial interest for its PGE content. The other main PGE layer, the Merensky Reef, occurs above the UG chromitites, close to the top of the UCZ. The distance between the UG2 and the Merensky Reef is variable across the BIC and in the eastern limb it can attain stratigraphic distance of between 170 m and 400 m. The top of the CZ is characterised by the Giant Mottled Anorthosite, a robust anorthosite.

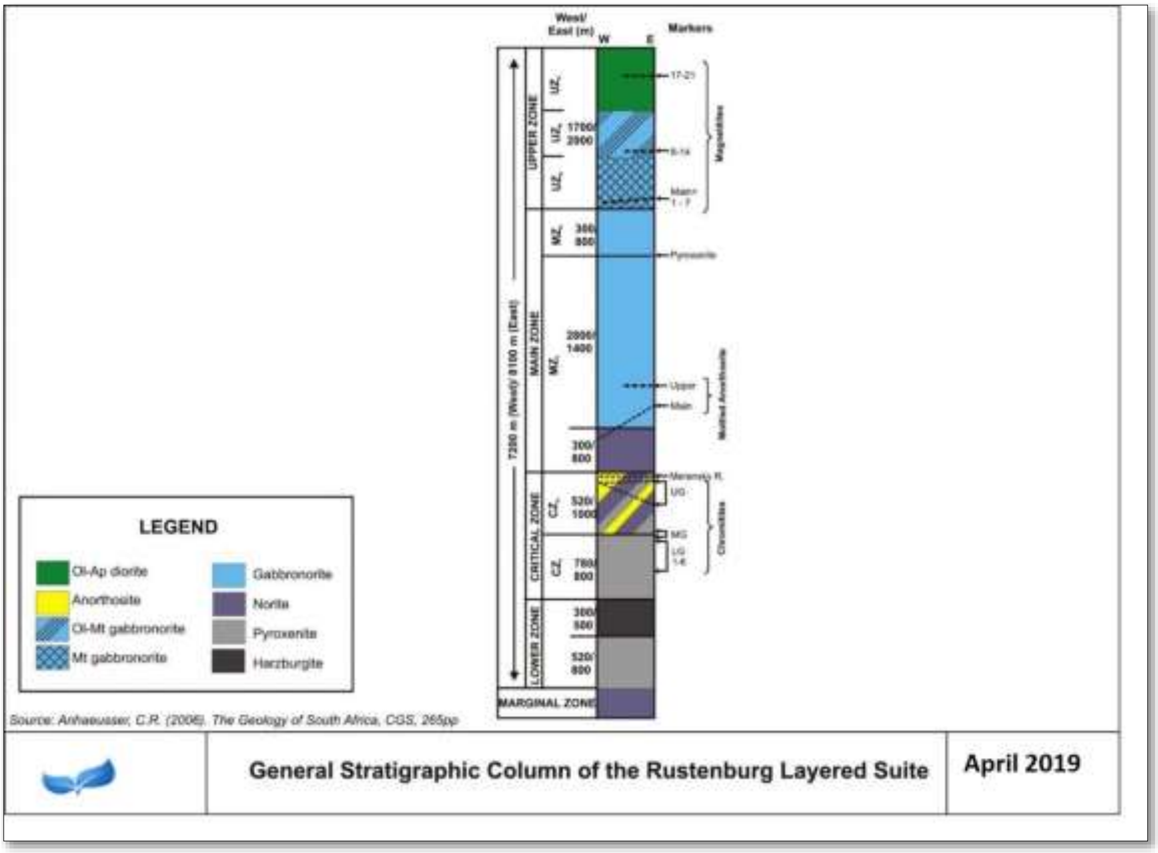

Figure 8-7: Generalized Stratigraphy of the Rustenburg Layered Suite

The Main Zone ("MZ") is the thickest unit within the RLS. In general, approximately half the RLS stratigraphic interval is occupied by this zone. The MZ consists of gabbro-norites with some anorthosite and pyroxenite layering. The Pyroxenite Marker is located approximately in the top third of the Zone. Layering is not as well-developed as in the CZ and LZ. The Upper Zone ("UZ") is dominated by gabbros. However, layered anorthosite and magnetite sequences are also present. There is no chilled contact with the roof rocks, which comprise rhyolites and granophyres. The base of the UZ is typically taken as the first appearance of cumulus magnetite above the Pyroxenite

Marker. The extent and regional geology (with the relative location of the ECM) of the eastern limb of the BIC is illustrated in Figure 8-6**.**

The Chromitite layers vary in thickness from 2 cm to 2 m and dip towards the centre of the saucer-like structure of the Bushveld Complex. These chromitite layers are remarkably uniform and have been traced for distances of more than 100 km in strike.

Dip Angles are typically between 10 degrees, but vary between 8 and 14 degrees, depending on the area being mined. Local variations beyond these angles do occur, however, due to the rolls in the strata, potholes and large faults. Dip angles at Lannex, situated close to the large Steelpoort Fault, are for instance much steeper. The general dip direction is E-W.

The rock types encountered include anorthosite, norite, pyroxenite and chromitite. The rock type that surrounds the presently mined chromitite seams is pyroxenite. This typically a very massive rock type, with no typical bedding planes, except for specific layering normally caused by other chromitite layers or stringers and parting planes.

8.3.1.1. Lannex Section Geological Setting

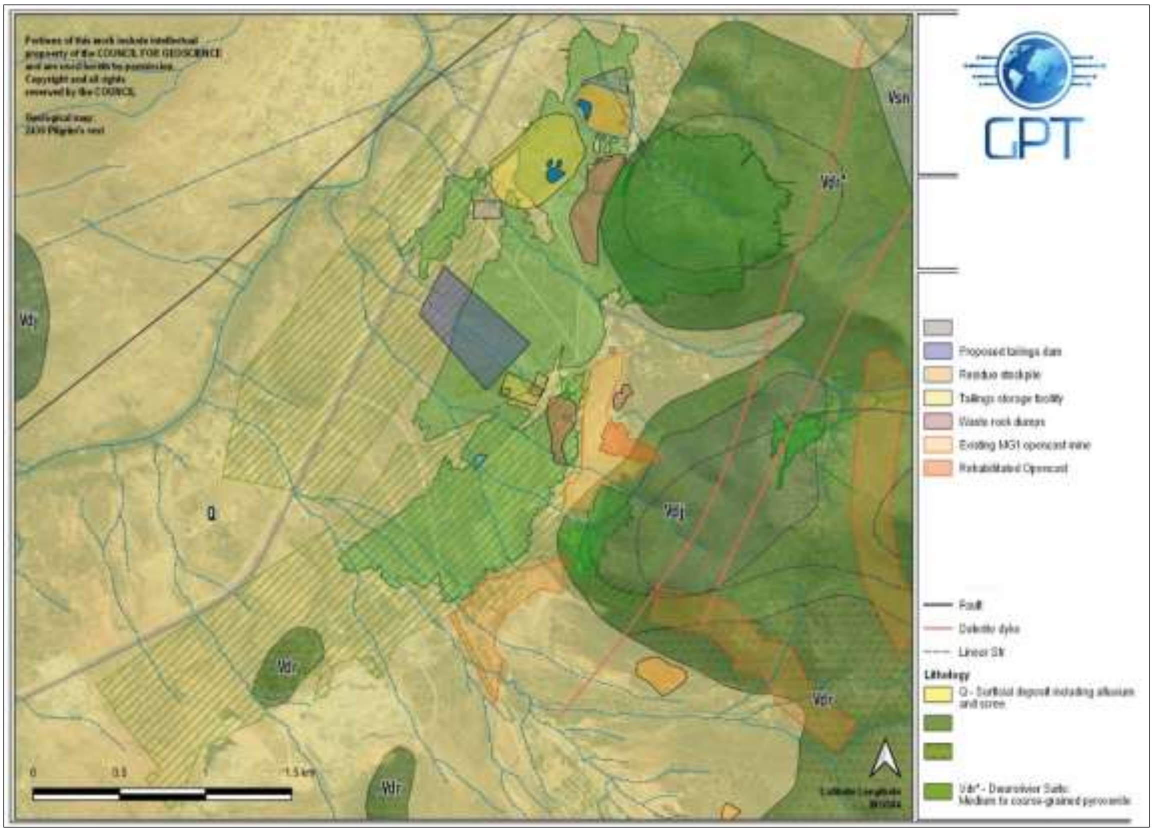

Figure 8-8: Site Specific Geology of Lannex Section (Appendix 5.5: Geohydrological Impact Assessment)

The stratigraphy of Lannex Mine is similar to that at Tweefontein Section. In the underground only the MG1 has been mined at Lannex Mine. The opencast extracts the MG1 and MG2.

The Middle Group rocks consist of pyroxenite, norite, anorthosite and chromitite layers. Of particular significance is the MG1 chromitite seam, which is being mined at the Lannex and Tweefontein Mines. Small-scale mining of the MG2 has been carried out in the past.

The MG2 consist of three distinct chromitite layers called A, B, and C at the top. The chromitite layers of the MG2 package are separated by pyroxenite partings and disseminated chromitite layers.

As shown in Figure 8-9 below, the MG1 chromitite seam is separated from the MG2 chromitite layer above by a pyroxenite parting. An anorthosite layer separates the MG2 and MG3 seams.

8.3.1.2. Seams mined in the Lannex Section

Seams mined: The MG1 chromitite seam has been mined extensively at the Lannex section for approximately 1650 m along strike. The MG2 is poorly developed over the area, and is only mined in the open castable areas where possible.

Depth: Current mining at the Lannex Mine, and mining planned are at depth ranging from 30 m to 180 m below surface.

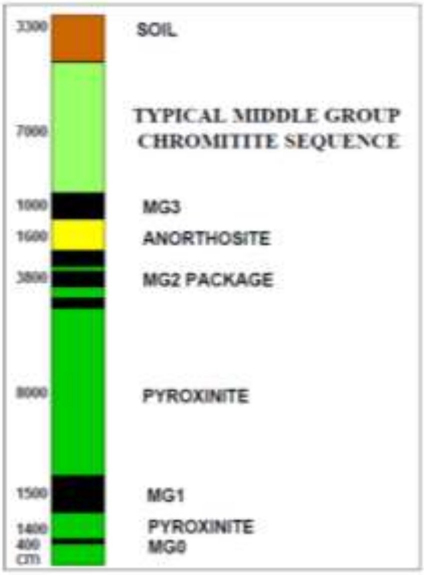

Figure 8-9: Lannex Section chromitite layers

8.3.1.3. Associated Minerals

The associated minerals that can be economically extracted from the current risings from the Chrome Ore in the current risings mined from the above seams, presently occur in the following rations at the Grootboom mine:

Table 8-5: Associated minerals

Associated Mineral	% of split of current risings from the chrome ore mined
Platinum	58%
Rhodium	16.5%
Palladium	25.5%
Gold	0%

8.3.1.4. Major Geological features

Faults: The Lannex Mine is situated on a horst type structure. The Winze fault, which has a 40 m down-throw in the westerly direction, forms the current western boundary of Lannex Section. The mechanised extension will exploit the resources below the Winze fault. The annex-Grootboom Fault (striking north-west) has a 20 m throw and is situated in the north eastern part of the orebody.

Joints: The major joint set in areas being mined at present is sub-parallel to the Winze Fault, which strikes approximately north to north east.

8.4. AGRICULTURAL, SOIL AND LAND TYPE AND LAND CAPABILITY

An agricultural, soil and land capability assessment was conducted by Eco Soil in 2020 (See Appendix

5.6).

A soil classification and identification of agricultural potential was done during the field survey and supplemented with desktop information on 4 sites consisting of 26.1 ha, 13.2 ha, 5.4 and 16.4 ha respectively for Lannex 1, 2, 3 and 4. Additional observations points were made at the two Historic opencast sites, as well as selected, accessible points on the complete opencast area. A total of forty-seven observation points were made on the sites (Figure 8-10). Eight soil samples were taken at specifically selected positions to evaluate the soil chemical properties of the soils. The samples were sent to the Nvirotek Lab at Ifafi, Hartbeespoort for analysis for an agricultural assessment of pH, P, K, Ca, Mg, and Na.

The investigation of the soils during the field trip involved the collation of the following soil information using the *Taxonomic Soil Classification for South Africa* (Soil Classification working group, 1991). A hand augur of the Thompson type, as well as observations at open cuttings was used for identifying the soil types.

Geology, properties of the soil types, soil depth, clay content, estimated profile available water content (PAWC), soil restrictions and strengths, as well as soil potential were determined from the land type information (Land Type Survey Staff. 1972 – 2006).

Google EarthTM and digital images were used to identify areas presently used for agricultural activities. It includes: forestry, commercial and subsistence farming.

Applying the combined information obtained from the field trip and desktop information it was possible to characterize soils based on the limitations of the soils' physical characteristics and site constraints. The data was then used to obtain the land capability and agricultural potential of the soils.

From the gathered information the soils in this study area could be classed in the four land capability classes, namely:

- Soils of intermediate suitability for arable agriculture,
- Soils not suitable for arable agriculture, but suitable for forestry or grazing,
- Soils of poor suitability for arable agriculture,
- Soils with no dominant class (Classes 7 and 8).

A new system for classification of land capability was published in the Government Gazette, 20 March 2020 (p 30) and describes procedures for classing of the agricultural potential of the soil. In the case of this report the land capability of the Lannex area was classed following the procedures in Government Gazette, 20 March 2020 (p 30). However, there are as yet (2020) no specific guidelines or protocols for the categorisation of the classes for a workable template to evaluate the site.

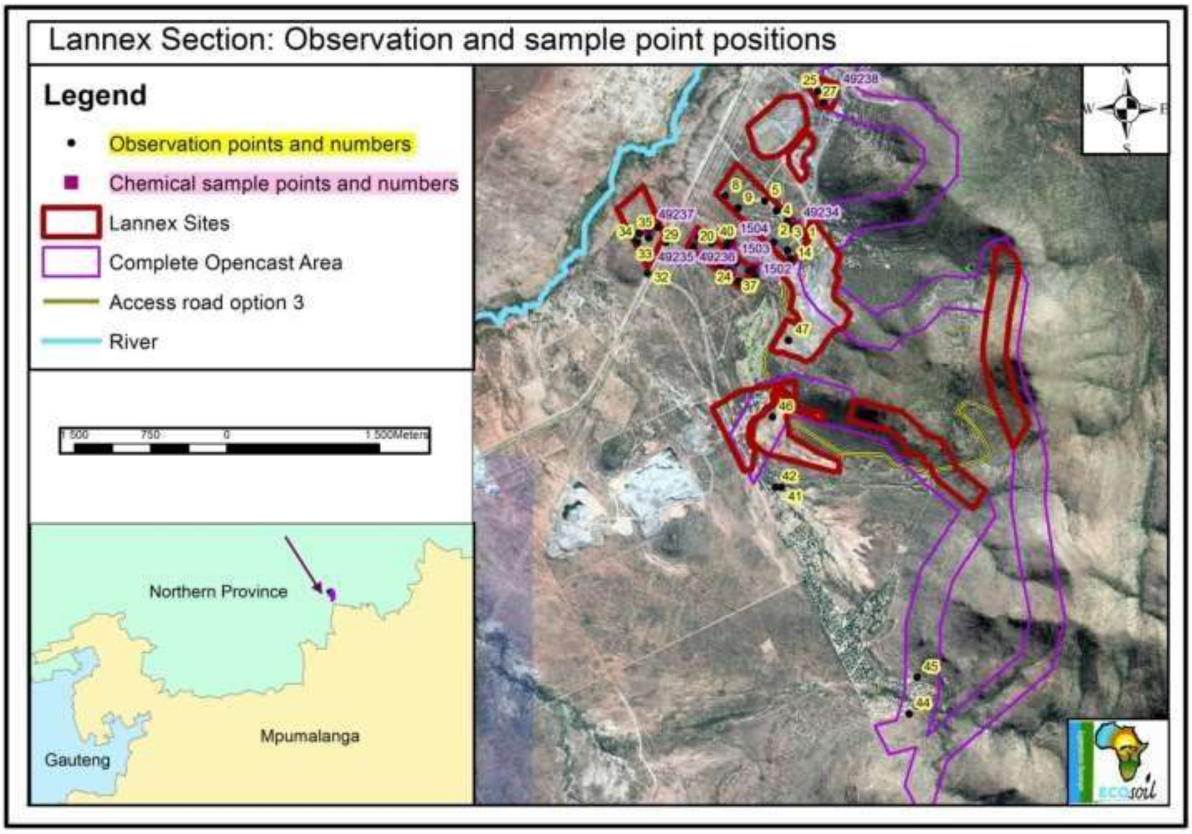

Figure 8-10: Position of the observation and sample points made on the sites at Lannex

8.4.1 Soils

Soils vary significantly in physical composition over the different areas. They are strongly influenced by the underlying parent material (geology) from which they were derived and the origin of the parent material (in-situ versus colluvium/alluvium derived), as well as by their position in the landscape (catena). In the area of Lannex Section the soils are derived from quaternary windblown deposits and residues of the weathering of underlying materials.

8.4.1.1. Soil forms

The land type information (Land Type Survey Staff. 1972 – 2006) indicates that the soils in the western parts of the Lannex Section are red-yellow or red apedal, freely drained soils with a high base status, and generally deeper than 300 mm. The site visit however indicates that the soils are not as specified by the land type information (Landtype Ae27), mainly because the information is collected on a broad scale. Landtype Ae27 covers 17947 ha and only give the main soil type found in the area and other soil forms may be present additional to the information given by the landtype survey staff.

The soil forms found on the Lannex sites are Augrabies, Glenrosa, Mispah, Oakleaf and Witbank:

- **Augrabies-Au** (Orthic A / neocarbonate B / unspecified: The B-horizon has nonhomogeneous colours and its aggregation is weaker than moderately structured. This soil form has undergone pedogenesis and contains Ca or Ca-Mg carbonate in the soil matrix of the B-horizon. It reflects specific climatic (usually arid to semi-arid regions) and topographic environments in which the leaching potential is limited. The parent material is rich in divalent base cations.
- **Glenrosa-Gs** (Orthic A / lithocutanic B): The Glenrosa is generally a shallow soil and the underlying material in this case is lithocutanic, which is a tonguing soil/saprolite transition. The tongues penetrate the saprolite and are therefore not continuous. It gradually changes to fractured rock and then to hard rock.
- **Mispah-Ms** (Orthic A / hard rock): The Mispah is generally a shallow soil and the underlying material in this case is a continuous hard layer of rock. It cannot be cut with a spade when wet.

- **Oakleaf-Oa** (Orthic A / neocutanic B / unspecified material): The B-horizon has nonhomogeneous colours. Its aggregation is weaker than moderately structured, developed from unconsolidated material and is non-calcareous. The sub-soil shows no signs of wetness. The underlying material is unspecified (but should be specified by the surveyor).
- **Witbank-Wb** (Orthic A / Man made soil deposit): The Witbank soil form is man-made materials with or without rock fragments or man-made materials. The soils have not undergone pedogenesis and do not have recognizable diagnostic soil horizons.

The soils in the area are characterized by mainly shallow, massive or weak structured soils with low base status. LNX sites 1 and 2 are heavily disturbed with many roads, paths and footpaths. Severe topsoil loss is visible on all the sites and subjected to erosion and overgrazing. Several rock outcrops and a few dongas are present on Lannex 1 (Photo 1 to 4). In the eastern part of the site the Witbank soil form is dominant, although the Mispah and Glenrosa forms are also present. Lannex 2 is also disturbed and the soil forms on this site are Glenrosa and Mispah. (Photos 1 to 4). These forms represent shallow soils and have no or low agricultural crop potential. Site Lannex 3 is heavily disturbed due to the existence of an old tailings dam. There is no top or sub soil present on this site and the soil type can therefore be described as Witbank soil form. Lannex 3 is almost bare from vegetation, which causes top soil sheet erosion. The Mispah and Glenrosa soil forms cover almost the entire Lannex 4 site (Photo 5 and 6). These soil forms represent soils with a shallow top soil on rock or weathered rock respectively.

The terrain on the opencast expansion (OC) sites 1 and 2 is very steep and mountainous.

- The Mispah and Glenrosa soil forms cover almost the entire OC area.
- The quality of the terrain on opencast site 3 is similar to that of Lannex 2 and 4. The dominant soil types are classified as Witbank.
- The Mispah and Glenrosa soil forms also occur on the central and western boundary of the site.

Only very few observation could be made on the planned opencast areas 1 and 2, as well as on the complete opencast areas due to inaccessibility. Desktop landtype information was therefore used to evaluate the soil and soil potential of this area (

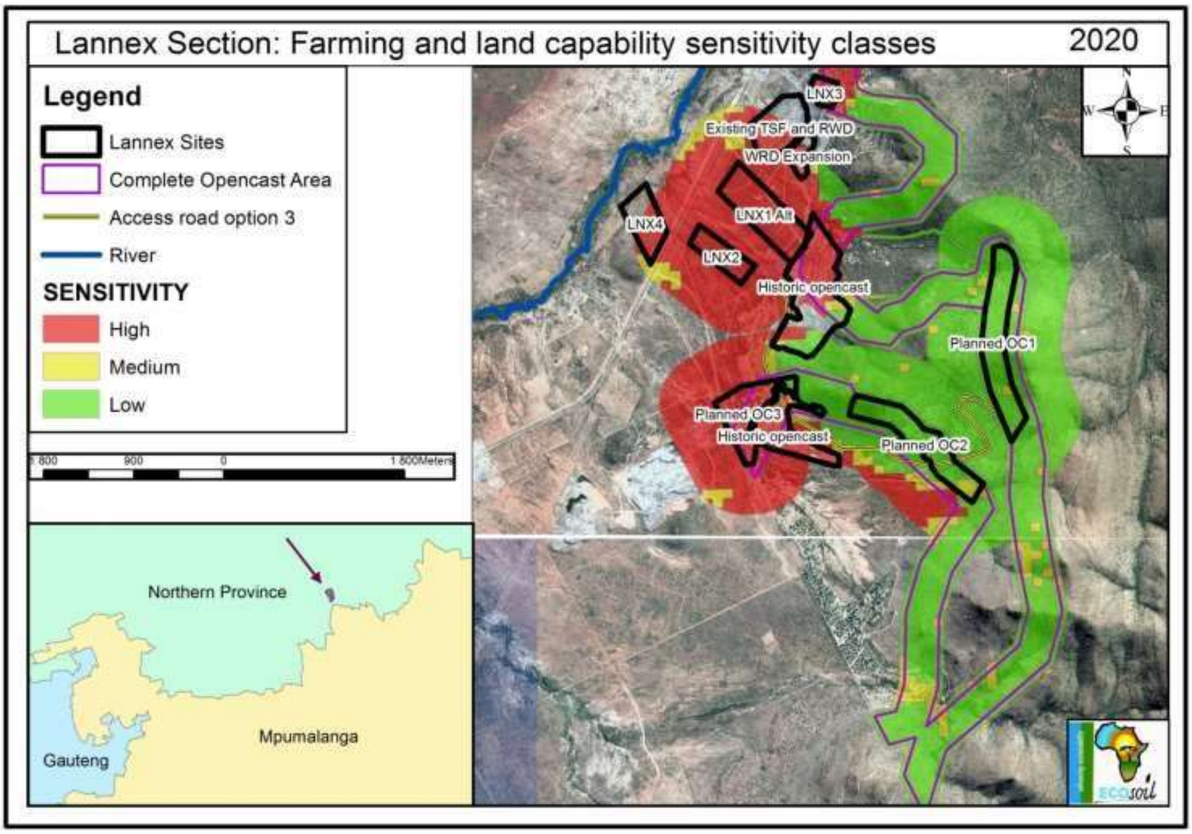

Figure 8-11: Land types information on the soils at Lannex). The land type information indicates the entire opencast area as "miscellaneous land classes, rocky areas with miscellaneous soils". It is therefore very difficult to evaluate the soil properties of this site, but generally the soils in such areas are patchy and only small, if any, parts may have soils of agricultural value. Slope restrictions are usually an additional limitation for crop cultivation.

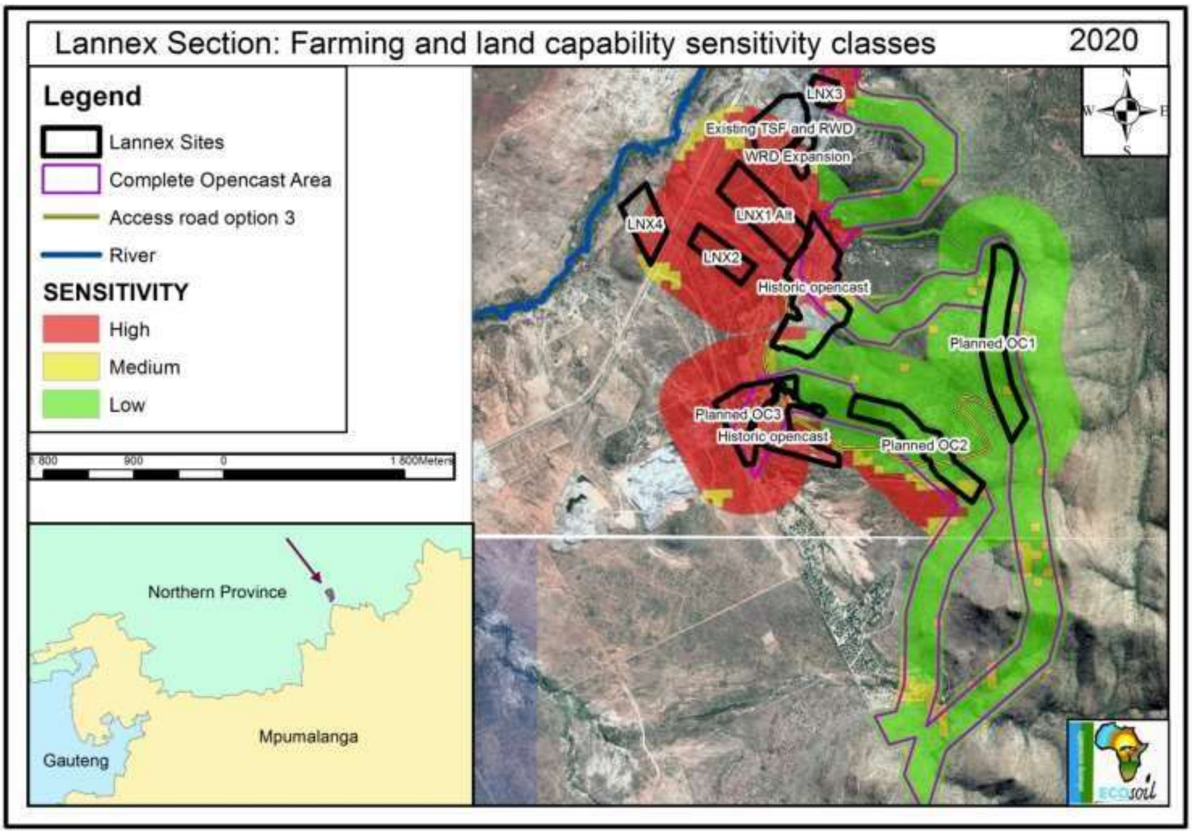

Figure 8-11: Land types information on the soils at Lannex

8.4.1.2. Soil depth

Soil depth has a dominant influence on soil potential. Shallow soils indicate soils with a low arable crop potential, while deep soils are a good indication of high potential. It is not recommended that arable crops and especially trees be cultivated on soils shallower than 500 mm. Some vegetable can be produced on shallow soils, but success is mostly limited to small areas and farmer's competency and availability of water. The variation in soil depth indicates that there will be a variation in yield potential, although the soils have a very low agricultural potential. The soils at all sites at Lannex are generally not deeper than 300 mm (Appendix 5.6) and the deepest observed soil profiles were 600 mm and 700 mm respectively at the Lannex Village and in the Tubatse stream.

8.4.1.3. Clay content

The soils of the Lannex sites have clay contents of approximately 18 to 20% in the top soil and in the sub soil (Appendix 5.6). However, a large amount (60 to 80%) of the soil volume consists of material larger than 2.0 mm (gravel and rock) in the top 30 cm of the soil, which has a serious limitation on the water holding capacity and resulting soil potential.

8.4.1.4. Soil chemical properties

According to the soil analysis indicated in Table 8-6 there are no specific problems regarding the use for agricultural purposes. Although the values of phosphorus and potassium are low it could be rectified for dryland agricultural use. The Magnesium content in sample ref 1504 is extremely high. The S contents are slightly elevated. No specific pollution or problems has been identified.

Table 8-6: Soil Chemical properties at Lannex sites

LAB No	Ref	Description	pH	P Bray1	K	Na	Ca	Mg	S AmAc	EXCH ACID	Ca%	Mg%	K%	Na%	ACID SAT	.Ca:Mg	(Ca+Mg)/K	Na:K	S-VALUE	T-VALUE	Dens.	C WB	SOM
			KCl	mg/kg (AmAc)						cmol(+)/kg			%					1.5-4.5	10.0-20.0		cmol(+)/kg	g/ml	%
G23-28782	049234	Top soil	7.03	2	41	60	3223	1160	16.45	0	62	36.58	0.41	1.01	0	1.69	241.45	2.47	25.99	25.99	1.22	1.17	2.02
G23-28783	049235	Top soil	5.76	2	68	28	2027	898	16.86	0	57	41.37	0.98	0.67	0	1.38	100.56	0.69	17.78	17.78	1.28	0.64	1.1
G23-28784	049236	Top soil	6.38	1	54	11	1045	345	9.29	0	63.4	34.34	1.68	0.57	0	1.85	58.02	0.34	8.24	8.24	1.66	0.72	1.23
G23-28785	049237	Top soil	6.83	4	128	8	1754	507	9.29	0	66	31.28	2.47	0.25	0	2.11	39.43	0.1	13.29	13.29	1.46	0.74	1.27
G23-28786	049238	Top soil	7.41	2	50	69	3480	1218	17.04	0	62.6	35.9	0.46	1.09	0	1.74	213.07	2.35	27.82	27.82	1.21	0.72	1.24
G24-12182	1502	Top soil	7.35	2	106	99	2255	1980	18.72	0	40	57.53	0.96	1.53	0	0.69	101.22	1.59	28.21	28.21	1.01		
G24-12183	1503	Top soil	6.43	2	56	27	2444	906	11.08	0	61.4	37.29	0.72	0.6	0	1.65	136.11	0.82	19.91	19.91	1.13		
G24-12184	1504	Top soil	7.29	3	102	84	908	2660	33.14	0	16.8	80.84	0.97	1.36	0	0.21	100.66	1.4	26.98	26.98	0.79		

8.4.2 LAND CAPABILITY

The main variables determining the soil's agricultural potential include the effective depth (<300 mm), clay content (18 - 20%), rainfall (between 500 and 675 mm) and slope. The soil forms are mainly Mispah, Glenrosa and Witbank, which represents very shallow soils or already disturbed soils (Witbank). The soils of all sites of the Lannex Section are not suitable for dryland arable agriculture from an agricultural viewpoint. Because of the high risk for erosion the soils should always be covered with vegetation and it should be regarded as a high priority for any development and/or disturbance Appendix 5.6.

8.4.2.1. Klingebiel & Montgomery classification

The soils at Lannex are therefore grouped as between Class Vll to Vlll according to the Klingebiel & Montgomery (1961) classification.

Lannex area has poor suitability with no dominant class as a result of:

- Bush encroachment,
- Erosion consisting of sheet (very poor vegetation coverage), rill and donga types,
- Dumped waste, scrap metal, bricks and other forms of waste at Lannex 1,
- Actual rock dumps and a rock dump deposit site (Lannex 1),
- It is therefore not possible to give an actual agricultural potential class because of combination of abovementioned factors and is classed as a "no dominant" class. As a result of the complexity of the area the land capability can be justified as: **Class VII and VIII**
- Land in Class VII has very severe limitations that makes it unsuited to cultivation and that restrict its use largely to grazing, woodland or wildlife.
- Restrictions are more severe than those for Class VI because of one or more continuing limitations that cannot be corrected, such as:
  - Very steep slopes.
  - Erosion.
  - Shallow soil.
  - Stones.
  - Low water-holding capacity.
- Land in Class VIII cannot be expected to return significant on-site benefits from management for crops, grasses or trees, although benefits from wildlife use, watershed protection or recreation may be possible.
- Badlands, rock outcrop, sandy beaches, river wash, mine tailings and other nearly barren lands are included in Class VIII.
- Physical conditions are such that it is impractical to apply such pasture or range improvements as seeding, liming and fertilizing.
- Depending on soil characteristics and climate, land in Class VII may be well or poorly suited to woodland.

8.5. TERRESTRIAL BIODIVERSITY

A terrestrial biodiversity assessment was conducted by Red kite Environmental Solution in August 2020, See Appendix 5.1. A desktop assessment and a field survey were conducted and the following baseline information was collected.

8.5.1 DESKTOP ASSESSMENT

A baseline assessment was conducted to establish whether any potentially sensitive species/receptors might occur on site. The South African National Biodiversity Institute's (SANBI)[1] online biodiversity tool and the Virtual Museum and Animal Demography Unit (ADU) were used to query species lists for the 2430CC quarter degree grid cell. This was supplemented by researching all available books and peer reviewed websites.

[1] https://www.sanbi.org/biodiversity/

The importance of a baseline study is to provide a reference condition to determine the current state of the environment and to draw comparisons between the potential of the area and current degradation from surrounding land uses.

Aerial photographs and satellite imagery were used to delineate potential sensitive habitat types and these areas were the focus during the field assessment.

8.5.2 SITE VERIFICATION

Site surveys were conducted on 18 March 2020 and again on 23 June 2020. The site surveys were undertaken to supplement and confirm several findings indicated during the desktop analysis. This will serve as a fatal flaw analysis to determine whether there are any major ecological concerns with regards to the development.

Specific aspects that were investigated during the site verification were potential impacts of the development on the remaining natural environment and the status of the current natural environment within the study area, indicating indigenous nature and habitat integrity.

The following data was recorded during the site verification:

- All identifiable indigenous and exotic flora species;
- All identifiable fauna species encountered during the site verification; and
- General ecological and habitat data that may assist in the description of the ecological context of the study area.

As part of the site verification a Species of Conservation Concern (SSC) scan was undertaken for SCC floral species identified during the desktop assessment.

A plotless sampling method was used to record data. Fauna and flora species observed in the study area during the time of the study were recorded and included in the species lists. Plant species identification was done following the checklist of Germishuizen & Meyer (2003).

8.5.3 BIOMES

The project area lies within the Savanna Biome, which is the largest biome in South Africa, covering 34.3% of the country (about 435 000 km^2). It is a mixture of grasses and trees or shrubs. Savanna stretches from the Kalahari in the north-west across to the Lowveld in the north-east and southwards to the lowlands of KwaZulu Natal and the Eastern Cape. It is found from sea level to about 2 000 metres above sea level. More than 5 700 plant species grow in the Savanna Biome. They include various types of grasses (e.g. Rooigras) and trees like the Baobab, Mopane, Camel Thorn and Knob Thorn.

Rain falls in summer and varies greatly across the region, from about 235 mm per year in the Kalahari to over 1000 mm per year in the east.

8.5.3.1. Vegetation types

According to the National Vegetation Map (2018) the project site falls within the Sekhukhune Mountain Bushveld, Sekhukhune Plains Bushveld, with a small section representative of the Sekhukhune Montane Grassland.

None of the three vegetation types is listed in the National List of Threatened Ecosystems, the Government Gazette (2011), No. 34809, General Notice 1002. However, the Sekhukhune Mountain Bushveld and Sekhukhune Montane Grassland form part of the Sekhukhune Mountainlands (MP3) which is listed as Endangered in the National List of Threatened Ecosystems.

Figure 8-12: Vegetation types of the study site

A summarised description of the vegetation types, extracted from the CD accompanying Mucina & Rutherford (2006), is presented below.

8.5.3.2. Sekhukhune Mountain Bushveld (SVcb 28)

The Sekhukhune Mountain Bushveld ecosystem is located in the Limpopo and Mpumalanga Provinces. It is distributed across Mountains and undulating hills above the lowlands of the SVcb 27 Sekhukhune Plains Bushveld, including the steep slopes of the Leolo Mountains, Dwars River Mountains (except areas of Gm 19 Sekhukhune Montane Grassland) and Thaba Sekhukhune, and a number of isolated smaller mountains (e.g. Phepane and Morone). Also the undulating small hills in the valley of the Steelpoort River up to and along the Klip River flowing past Roossenekal.

The vegetation type is characterised by dry, open to closed microphyllous and broad-leaved savanna on hills and mountain slopes that form concentric belts parallel to the north-eastern escarpment. Open bushveld often associated with ultramafic soils on southern aspects. Bushveld on ultramafic soils contain a high diversity of edaphic specialists. Bushveld of mountain slopes generally taller than in the valleys, with a well-developed herb layer. Bushveld of valleys and dry northern aspects usually dense, like thicket, with a herb layer comprising many short-lived perennials. Dry habitats contain a number of species with xerophytic adaptations, such as succulence and underground storage organs.

A list of expected common and dominant species in undisturbed vegetation includes the following (those with a "d" are considered to be dominant) (Mucina and Rutherford, 2006):

- **Trees:** *Acacia nigrescens, Acacia senegal* var. *leiorhachis* (d), *Combretum apiculatum* (d), *Kirkia wilmsii* (d), *Terminalia prunioides* (d), *Vitex obovata* subsp. *wilmsii* (d), *Ziziphus mucronata* (d), *Bolusanthus speciosus*, *Boscia albitrunca*, *Brachylaena ilicifolia*, *Combretum molle*, *Commiphora mollis*, *Croton gratissimus*, *Cussonia transvaalensis*, *Hippobromus pauciflorus*, *Ozoroa sphaerocarpa*, *Pappea capensis*, *Schotia latifolia*, *Sterculia rogersii, Aloe marlothii* subsp. *marlothii*.
- **Shrubs:** *Dichrostachys cinerea* (d), *Euclea crispa* subsp. *crispa* (d), *Combretum hereroense*, *Euclea linearis*, *Pavetta zeyheri*, *Tinnea rhodesiana*, *Triaspis glaucophylla, Elephantorrhiza praetermissa* (d), *Grewia vernicosa* (d), *Asparagus intricatus*, *Barleria saxatilis*, *B. senensis*,

Clerodendrum ternatum, *Commiphora africana*, *Hermannia glanduligera*, *Indigofera lydenburgensis*, *Jatropha latifolia* var. *angustata*, *Melhania prostrata*, *Phyllanthus glaucophyllus*, *Psiadia punctulata*, *Rhus keetii*, *Rhynchosia komatiensis, Aloe castanea* (d), *A. cryptopoda* (d), *Clematis brachiata* (d), *Rhoicissus tridentata* (d), *Acacia ataxacantha, Sarcostemma viminale*.

- **Graminoids:** *Aristida canescens* (d), *Heteropogon contortus* (d), *Panicum maximum* (d), *Setaria lindenbergiana* (d), *Themeda triandra* (d), *Aristida transvaalensis*, *Cymbopogon pospischilii*, *Diheteropogon amplectens*, *Enneapogon scoparius*, *Loudetia simplex*, *Panicum deustum*, *Setaria sphacelata*.
- **Herbs:** *Berkheya insignis* (d), *Commelina africana* (d), *Cyphostemma woodii*, *Kyphocarpa angustifolia*, *Senecio latifolius, Hypoxis rigidula*, *Sansevieria hyacinthoides, Huernia stapelioides*.
- **Biogeographically Important Taxa** ([N]Northern Sourveld endemic, [CB]Central Bushveld endemic, [SK]Sekhukhune endemic): *Lydenburgia cassinoides*[SK], *Rhus sekhukhuniensis*[SK], *Euclea sekhukhuniensis*[SK], *Petalidium oblongifolium*[CB], *Plectranthus venteri*[Z], *Rhus batophylla*[SK], *Asparagus sekukuniensis*[SK], *Rhoicissus sekhukhuniensis*[SK], *Chlorophytum cyperaceum*[SK], *Raphionacme chimanimaniana*[Z].
- **Endemic Taxa:** *Acacia ormocarpoides, Euphorbia sekukuniensis, Plectranthus porcatus.*

8.5.3.3. <u>Sekhukhune Plains Bushveld (SVcb 27)</u>

The Sekhukhune Plains bushveld is distributed across Limpopo and Mpumalanga Provinces, in the lowland area from Burgersfort and the lower basin of the Steelpoort River in the south, northwards through the plains of the Motse River basin to Jobskop and Legwareng (south of the Strydpoort Mountains). Continues up the basin of the Olifants River to around Tswaing and the valleys of the Lepellane and Mohlaletsi Rivers.

A list of expected common and dominant species in undisturbed vegetation includes the following (those with a "d" are considered to be dominant) (Mucina and Rutherford, 2006):

- **Trees:** *Acacia erioloba*, *Philenoptera violacea, Acacia mellifera* subsp. *detinens* (d), *A. nilotica* (d), *A. tortilis* subsp. *heteracantha* (d), *Boscia foetida* subsp. *rehmanniana* (d), *Acacia grandicornuta*, *Albizia anthelmintica*, *Balanites maughamii*, *Combretum imberbe*, *Commiphora glandulosa*, *Maerua angolensis*, *Markhamia zanzibarica*, *Mystroxylon aethiopicum* subsp. *schlechteri*, *Ptaeroxylon obliquum*, *Schotia brachypetala*, *Ziziphus mucronata*. Succulent Tree: *Euphorbia tirucalli* (d).
- **Tall Shrubs:** *Rhus engleri* (d), *Cadaba termitaria*, *Dichrostachys cinerea*, *Ehretia rigida* subsp. *rigida*, *Grewia bicolor*, *Karomia speciosa*, *Maerua decumbens*, *Rhigozum brevispinosum*, *R. obovatum*, *Tinnea rhodesiana*, *Triaspis glaucophylla*.
- **Low Shrubs:** *Felicia clavipilosa* subsp. *transvaalensis* (d), *Seddera suffruticosa* (d), *Gnidia polycephala*, *Gossypium herbaceum* subsp. *africanum*, *Jamesbrittenia atropurpurea*, *Jatropha latifolia* var. *latifolia*, *Lantana rugosa*, *Melhania rehmannii*, *Monechma divaricatum*, *Myrothamnus flabellifolius*, *Pechuel-Loeschea leubnitziae*, *Plinthus rehmannii*.
- **Succulent Shrubs:** *Aloe cryptopoda* (d), *Euphorbia enormis* (d), *Kleinia longiflora* (d), *Aloe castanea*, *A. globuligemma*.
- **Woody Succulent Climber:** *Sarcostemma viminale*.
- **Herbaceous Climbers:** *Coccinia rehmannii*, *Decorsea schlechteri*. Graminoids: *Cenchrus ciliaris* (d), *Enneapogon cenchroides* (d), *Panicum maximum* (d), *Urochloa mosambicensis* (d), *Aristida adscensionis*, *A. congesta*, *Eragrostis barbinodis*, *Paspalum distichum*, *Schmidtia pappophoroides*, *Stipagrostis hirtigluma* subsp. *patula*, *Tragus berteronianus*.
- **Herbs:** *Becium filamentosum* (d), *Phyllanthus maderaspatensis* (d), *Blepharis integrifolia*, *Corchorus asplenifolius*, *Hibiscus praeteritus*, *Ipomoea magnusiana*.
- **Geophytic Herbs:** *Drimia altissima*, *Sansevieria pearsonii*.
- **Biogeographically Important Taxa** ([N]Northern Sourveld endemic, [CB]Central Bushveld endemic, [SK]Sekhukhune endemic, [D]Broadly disjunct distribution): *Lydenburgia cassinoides*[SK], *Nuxia gracilis*[D], *Amphiglossa triflora*[D], *Asparagus fourei*[N], *Hibiscus barnardii*[SK], *Orthosiphon*

fruticosus[CB], *Petalidium oblongifolium*[CB], *Rhus batophylla*[SK], *Asparagus sekukuniensis*[SK], *Aneilema longirrhizum*[SK], *Chlorophytum cyperaceum*[SK], *Piaranthus atrosanguineus*[CB].

8.5.3.4. Sekhukhune Montane Grassland (Gm 19)

The Sekhukhune Montane Grassland vegetation Type is located in the Mpumalanga Province, on continuous undulating norite hills in the Roossenekal region, from Stoffberg in the south, northwards through Mapochs Gronde to Schurinksberg in the north, with the Steelpoort River in the west. The ecosystem is characterised by major chains of hills transecting the area and have a north-south orientation, creating moderately steep slopes with predominantly eastern and western aspects. Large norite boulders and stones cover the shallow soils on the hillsides. Dense, sour grassland occur on slopes of mountains and undulating hills, with scattered clumps of trees and shrubs in sheltered habitats. Dense, tall grassland is found on the plains and encroachment by indigenous or invasion by alien microphyllous tree species is common in places.

A list of expected common and dominant species in undisturbed vegetation includes the following (those with a "d" are considered to be dominant) (Mucina and Rutherford, 2006):

- **Trees**: *Protea caffra* subsp. *caffra* (d), *Acacia caffra*, *Apodytes dimidiata* subsp. *dimidiata*, *Canthium suberosum*, *Cussonia transvaalensis*, *Seemannaralia gerrardii*.
- **Shrubs:** *Rhoicissus tridentata* (d), *Jasminum quinatum*, *Triaspis glaucophylla, Euclea crispa* subsp. *crispa* (d), *Brachylaena ilicifolia*, *Diospyros austro-africana*, *Euclea linearis*, *Pavetta zeyheri, Gnidia caffra* (d), *Senecio microglossus* (d), *Dyschoriste rogersii*, *Elephantorrhiza praetermissa*, *Leonotis leonurus, Polygala uncinata*, *Rhus discolor*, *R. tumulicola* var. *meeuseana*, *R. wilmsii*, *Elephantorrhiza elephantina*.
- **Graminoids:** *Aristida junciformis* subsp. *galpinii* (d), *Diheteropogon amplectens* (d), *Elionurus muticus* (d), *Eragrostis chloromelas* (d), *E. racemosa* (d), *Heteropogon contortus* (d), *Microchloa caffra* (d), *Monocymbium ceresiiforme* (d), *Setaria sphacelata* (d), *Themeda triandra* (d), *Tristachya leucothrix* (d), *Andropogon schirensis*, *Aristida aequiglumis*, *Brachiaria serrata*, *Cymbopogon caesius*, *Digitaria diagonalis*, *D. monodactyla*, *Ehrharta capensis*, *Eragrostis capensis*, *E. nindensis*, *E. plana*, *Hyparrhenia hirta*, *Loudetia simplex*, *Panicum natalense*, *Setaria nigrirostris*, *Trachypogon spicatus*, *Triraphis andropogonoides*.
- **Herbs:** *Acalypha punctata* (d), *Berkheya setifera* (d), *Rotheca hirsuta* (d), *Senecio latifolius* (d), *Tephrosia purpurea* subsp. *leptostachya* (d), *Berkheya insignis*, *Gerbera jamesonii*, *Helichrysum nudifolium* var. *nudifolium*, *Ipomoea crassipes*, *Jamesbrittenia silenoides*, *Macledium zeyheri* subsp. *argyrophylum*, *Pegolettia lanceolata*, *Pentanisia prunelloides* subsp. *prunelloides*, *Senecio coronatus*, *Vernonia galpinii*, *V. natalensis*, *V. oligocephala*, *Xerophyta retinervis, Hypoxis rigidula* var. *pilosissima* (d), *Cheilanthes hirta*, *Eucomis montana*, *Hypoxis hemerocallidea*, *Pachycarpus transvaalensis*, *Kleinia stapeliiformis*.
- **Biogeographically Important Taxa** ([N]Northern sourveld endemic, [SK]Sekhukhune endemic): *Euclea sekhukhuniensis*[SK], *Lydenburgia cassinoides*[SK], *Rhus sekhukhuniensis*[SK], *Rhoicissus sekhukhuniensis*[SK], *Vitex obovata* subsp. *wilmsii*[N], *Dyschoriste perrottetii*[SK], *Grewia vernicosa*[N], *Helichrysum uninervium*[N], *Jamesbrittenia macrantha*[SK], *Melhania randii*[N], *Aloe castanea*[N], *Berkheya densifolia*[N], *Cyanotis pachyrrhiza*[N], *Graderia linearifolia*[N], *Ipomoea bathycolpos* var. *sinuatodentata*[SK], *Rhynchosia rudolfii*[N], *Tetraselago wilmsii*[N], *Gladiolus sekukuniensis*[SK], *Zantedeschia pentlandii*[SK], *Huernia insigniflora*[N].
- **Endemic Taxa:** *Aloe reitzii* var. *reitzii*, *Delosperma deilanthoides, Resnova* sp. nov. (‘*megaphylla*’), *Zantedeschia pentlandii*.

8.5.3.5. Sekhukhuneland Centre of Endemism

The site forms part of the Sekhukhuneland Centre of Endemism (SCOE). The importance to evaluate the vegetation on the site as part of the Sekhukhuneland Centre of Endemism cannot be underestimated. Most of southern Africa’s endemic plants are concentrated in only a few, relatively small areas, known as regions or centres of endemism. Not only do these centres hold clues to the origin and evolution of the botanical diversity within a particular area, but these are also areas that, if conserved, would safeguard the greatest number of plant species (Van Wyk & Smith, 2001).

Sekhukhuneland have been identified through previous studies as one of the most important centres of endemism in the Mpumalanga and Limpopo Provinces. The centre falls within the rainfall shadow of the Drakensberg Escarpment, and it is relatively more arid than the areas to the east. The endemic plants of this area are primarily edaphic specialists that are derived from a unique ecology. The substrate consists of heavy soils derived from the norite, pyroxenite and anorthosite formations that predominate over the region. Endemics are both herbaceous and woody with endemism high in the Anacardiaceae, Euphorbiaceae, Liliaceae and Lamiaceae (Van Wyk & Smith, 2001). The site lies inside the Sekhukhuneland Centre of Endemism and the shallow, rocky areas of the development site can be considered especially sensitive as part of the centre of endemism, and will almost certainly show similar vegetation patterns to the endemic regions, especially since the vegetation is still in a natural state. Other important attributes of this region's flora are summarized in Table 8-7 below:

Table 8-7: Attributes of the Sekhukhuneland Centre of Plant Endemism

Centre of Endemism Size:	5 449.4 km^2
Total Number of Species / Taxa	± 2 200
Endemic / Near endemic taxa:	>100
Rate of endemism:	4.5%
Area in Limpopo Province:	2 794 km^2
Proportion in Limpopo Province:	51.7%
Total % transformed:	28.57%

8.5.3.6. POSA Plant Species

The study area falls within the 2430CC Quarter Degree Square. Information on plant species recorded was extracted from the POSA online database hosted by SANBI, based on a 25 km x 25 km square surrounding the project area. A list of plant species that have previously been recorded in the aforementioned area (25 km x 25 km square) is provided in Appendix 5.1.

The results indicate that approximately 416 plant species occur within the square, consisting of 93 families. The most prominent family is Asteraceae, with 37 species, followed by Fabaceae, with 35 species. Fifty-two (52) endemic species were found to possibly occur in the area. Eleven exotic species are known to occur within the area queried.

Table 8-8: Floral species summary for QDS (POSA)

Number of families	Number of species	SCC	Exotic species
93	416	61	11

Sixty-one (61) plant species listed for the area are classified as species of conservation concern (SCC) according to the IUCN Red List status (Appendix 5.1), the ToPS list, their endemism, the NFA and the LEMA.

Table 8-9: Species of conservation concern recorded for the 2430 CC QDS

Family	*Species*	Conservation (SCC)
Passifloraceae	*Adenia fruticosa*	Endemic; IUCN: NT
Asphodelaceae	*Aloe longibracteata*	Endemic; LEMA: Protected
Asphodelaceae	*Aloe pienaarii*	LEMA: Protected
Asphodelaceae	*Aloe pretoriensis*	LEMA: Protected
Apocynaceae	*Aspidoglossum albocoronatum*	Endemic
Acanthaceae	*Barleria rotundifolia*	Endemic
Asteraceae	*Berkheya subulata*	Endemic
Capparaceae	*Boscia albitrunca*	NFA: Protected
Asphodelaceae	*Bulbine latifolia*	Endemic

Family	***Species***	**Conservation (SCC)**
Pteridaceae	*Cheilanthes dolomiticola*	Endemic
Agavaceae	*Chlorophytum cyperaceum*	Endemic
Acanthaceae	*Crabbea angustifolia*	Endemic
Linderniaceae	*Craterostigma wilmsii*	Endemic
Amaryllidaceae	*Cyrtanthus stenanthus*	LEMA: Protected
Acanthaceae	*Dicliptera fruticosa*	Endemic; IUCN: NT
Ebenaceae	*Diospyros lycioides*	Endemic
Fabaceae	*Dolichos peglerae*	Endemic
Acanthaceae	*Dyschoriste erecta*	Endemic
Fabaceae	*Elephantorrhiza praetermissa*	Endemic; LEMA: Protected
Euphorbiaceae	*Euphorbia enormis*	Endemic
Iridaceae	*Gladiolus reginae*	Endemic; IUCN: CR
Malvaceae	*Grewia vernicosa*	Endemic
Amaryllidaceae	*Haemanthus montanus*	LEMA: Protected
Malvaceae	*Hermannia montana*	Endemic
Malvaceae	*Hermannia umbratica*	Endemic
Asteraceae	*Hilliardiella nudicaulis*	Endemic
Apocynaceae	*Huernia stapelioides*	LEMA: Protected
Apocynaceae	*Huernia zebrina*	LEMA: Protected
Hypoxidaceae	*Hypoxis interjecta*	Endemic
Convolvulaceae	*Ipomoea bathycolpos*	Endemic
Scrophulariaceae	*Jamesbrittenia macrantha*	Endemic; IUCN: NT
Scrophulariaceae	*Jamesbrittenia silenoides*	Endemic
Oleaceae	*Jasminum quinatum*	Endemic
Euphorbiaceae	*Jatropha latifolia*	Endemic
Asteraceae	*Kleinia stapeliiformis*	Endemic
Hyacinthaceae	*Ledebouria atropurpurea*	Endemic
Hyacinthaceae	*Ledebouria dolomiticola*	Endemic; IUCN: VU
Hyacinthaceae	*Ledebouria humifusa*	Endemic
Fabaceae	*Leobordea hirsuta*	Endemic
Celastraceae	*Maytenus deflexa*	Endemic
Scrophulariaceae	*Nemesia zimbabwensis*	IUCN: EN
Stilbaceae	*Nuxia gracilis*	Endemic
Lamiaceae	*Ocimum tubiforme*	Endemic
Apocynaceae	*Orbea carnosa*	LEMA: Protected
Lamiaceae	*Orthosiphon fruticosus*	Endemic
Asteraceae	*Osteospermum auriculatum*	Endemic
Rubiaceae	*Pavetta glaucophylla*	Endemic
Geraniaceae	*Pelargonium multicaule*	Endemic
Acanthaceae	*Petalidium oblongifolium*	Endemic
Polygalaceae	*Polygala krumanina*	Endemic
Polygalaceae	*Polygala sekhukhuniensis*	IUCN: VU
Vitaceae	*Rhoicissus sekhukhuniensis*	Endemic
Anacardiaceae	*Searsia batophylla*	Endemic; IUCN: VU
Anacardiaceae	*Searsia engleri*	Endemic
Anacardiaceae	*Searsia keetii*	Endemic
Anacardiaceae	*Searsia rigida*	Endemic
Anacardiaceae	*Searsia sekhukhuniensis*	Endemic

Family	*Species*	Conservation (SCC)
Anacardiaceae	*Searsia wilmsii*	Endemic
Anacardiaceae	*Searsia zeyheri*	Endemic
Lamiaceae	*Stachys caffra*	Endemic
Malpighiaceae	*Triaspis glaucophylla*	Endemic

8.5.3.7. Invasive species

Invasive and exotic species tend to increase in disturbed environments (DEA & DMR, 2013). Therefore, the construction and operational phases of developments can increase the spread and growth of invasive species. Eleven (11) plant species not indigenous to South Africa were listed for the project area, five of which are listed as alien and invasive plant (AIP) species in NEMBA, 2004 (Act No. 10 of 2004).

Table 8-10: Exotic plant species listed for the 2430CC QDS

Species	Common name	NEMBA AIP Category
Cirsium vulgare	Spear thistle	NEMBA: AIP 1b
Populus alba	White poplar	NEMBA: AIP 2
Senna septemtrionalis	Arsenic bush	NEMBA: AIP 1b
Tecoma stans	Yellow bells	NEMBA AIP: 1b
Verbena brasiliensis	Brazilian verbena	NEMBA AIP 1b

Category 1 is the strictest category of species and none of these species are allowed to occur and/or become established on any land area except for the use of a biological control reserve. They possess characteristics that are harmful to humans, animals or the environment. Category 1b is described in NEMBA (2004) as invasive species that may not be owned, imported into South Africa, grown, moved, sold, given as a gift or dumped in a waterway. Category 1b species are major invaders that may need government assistance to remove.

NEMBA Category 2 AIP species are regulated by area. A demarcation permit is required to import, possess, grow, breed, move, sell, buy or accept as a gift any plants listed as Category 2 plants. No permits will be issued for Cat 2 plants that occur in riparian zones.

An Alien Invasive Plants Control plan assessment was conducted by Envass Environmental Assurance (Pty) Ltd in July 2017 Appendix 5.2. Some species were found to occur over the entire extent of the property. The site was divided, per accepted practice, into separate “management units” and surveyed systematically. Management units makes the control of invasive plants much easier as it becomes apparent which areas on the site (in its entirety) is prioritised above other areas (see Table 8-11 for a summary).

A photographic guide of all invasive alien species identified during this study can be found in various guides, but a summary is provided in photographs taken from the survey below.

Table 8-11: Identified Invasive Plant Species

Species	Common Name
Flaveria bidentis	Smelter’s Bush
Lantana camara	Lantana, Tick-berry, Cherry Pie
Melia azedarach	Seringa
Morus alba	White Mulberry / Witmoerbei
Pennisetum setaceum	Fountain Grass
Solanum mauritianum	Bugweed
Tecoma stans	Yellow Bellow
Xanthium strumarium	Spiny Cocklebur

Figure 8-13: Common weed on site: Lantana bushes (*Lantana camara*)

Figure 8-14: Several individuals and groupings of Yellow Bells (*Tecoma stans*) were identified on site

Figure 8-15: Close-up of the flowers and leaves of the dominant invasive species on site: Yellow Bells

Figure 8-16: A large population of Jimson Weed (Xanthium stramonium) was identified at Lannex Mine

Figure 8-17: Tufts of Fountain Grass (Pennisetum setaceum) was observed in various areas

8.5.3.8. Medicinal plant species

Some of the species that were listed for the QDS have cultural and/or medicinal use. Various medicinal books and peer reviewed articles were used to verify whether the species have any medicinal uses. Thirty (30) species were found to possibly occur on site that has medicinal uses.

Table 8-12: Medicinal plant species recorded for the 2430CC QDS

Family	Species
Asteraceae	*Artemisia afra*
Asteraceae	*Athrixia phylicoides*
Asteraceae	*Brachylaena ilicifolia*
Scrophulariaceae	*Buddleja saligna*
Fabaceae	*Calpurnia aurea*
Apocynaceae	*Carissa bispinosa*
Euphorbiaceae	*Croton gratissimus*
Fabaceae	*Dichrostachys cinerea*
Ebenaceae	*Diospyros lycioides*
Ebenaceae	*Euclea undulata*
Orchidaceae	*Eulophia speciosa*
Orchidaceae	*Eulophia streptopetala*
Asteraceae	*Helichrysum nudifolium*
Apiaceae	*Heteromorpha arborescens*
Sapindaceae	*Hippobromus pauciflorus*
Aquifoliaceae	*Ilex mitis*
Verbenaceae	*Lippia javanica*
Celastraceae	*Mystroxylon aethiopicum*
Oleaceae	*Olea capensis*
Oleaceae	*Olea europaea*
Pteridaceae	*Pellaea calomelanos*
Rubiaceae	*Pentanisia prunelloides*
Ranunculaceae	*Ranunculus multifidus*
Rhamnaceae	*Rhamnus prinoides*
Dipsacaceae	*Scabiosa columbaria*

Family	Species
Fabaceae	*Senna italica*
Solanaceae	*Solanum retroflexum*
Solanaceae	*Withania somnifera*
Velloziaceae	*Xerophyta retinervis*
Rhamnaceae	*Ziziphus mucronata*

These plants are important from a cultural perspective and are used for traditional/cultural purposes. Traditional medicine in South Africa is an important practice on which seventy two percent of the Black African population relies, that accounts for 26.6 million consumers. Approximately 133 000 people are employed in the trade of traditional medicine, especially rural women (Appendix 5.1).

8.5.4 Site Evaluation

The proposed opencast areas and access roads are largely situated on mountainous areas and associated slopes, with a number of watercourses occurring on the proposed opencast areas. The proposed TSF alternatives are located on the plains down gradient of the mountain slopes.

Land uses, on and adjacent to the project area, currently consist of natural wilderness area, villages, livestock grazing, accommodation and leisure facilities and existing mining operations.

Vegetation units were identified according to plant species composition, previous land use and topography. The state of the vegetation of the proposed mining area varies from being natural to completely degraded.

The following broad classification of Vegetation Units (VU) was found to occur on the proposed project footprint:

1. Mountain slopes bushveld (VU1);
2. Plains bushveld (VU2);
3. Watercourses and riparian bushveld (VU3); and
4. Degraded and transformed areas (VU4).

The vegetation units, as identified during site visit, databases and aerial imagery are indicated in Figure 8-21. The table below list the flora species identified during the site verification in conjunction with their conservation status and the sites at which they occurred. Four trees protected in terms of the National Forest Act, 1998 (Act No. 84 of 1998) were identified on the project footprint, namely *Balanites maughamii, Boscia albitrunca, Lydenburgia cassinoides* and *Sclerocarya birrea.* Three species listed in Schedule 12 (Protected Plants) of LEMA occur on the projects footprint, namely *Aloe cryptopoda, Aloe spicata* and *Searsia batophylla.*

Table 8-13 lists the plant species identified per VU during the site survey.

8.5.4.1. Vegetation Unit 1 (VU1)

This vegetation unit occurs on the upper and lower slopes of the mountains. The areas of this VU will be cleared entirely as part of the opencast preparation. The vegetation structure is bushveld with a well-developed herb layer. The bushveld of valleys and northern aspects are more thicket-like. Land use in VU1 is largely related to natural wilderness and grazing. Current impacts to the vegetation composition of this VU are from dirt roads, footpaths, grazing and wood harvesting. The VU is considered to be largely natural with few disturbances to the vegetation composition.

Dominant woody plant species in this VU include: *Balanites maughamii* (Greenthorn), *Kirkia wilmsii* (Mountain seringa), *Searsia pyroides* (Firethorn crowberry), *Terminalia prunioides* (Purplepod clusterleaf), *Lydenburgia cassinoides* (Sekhukhune bushman's tea), *Triaspis glaucophylla* (Blue-leaved saucer-fruit) and *Combretum apiculatum* (Red bushwillow).

Figure 8-18: Vegetation Unit 1

Dominant grass species recorded during the site survey included: *Aristida canescens* (Pale three-awn), *Aristida congesta* (Tassel three-awn), *Enneapogon scoparius* (Bottlebrush grass), *Eragrostis chloromelas* (Curley leaf), *Eragrostis rigidior* (Curly leaf (broad)), *Heteropogon contortus* (Spear grass) and *Panicum maximum* (White buffalo grass).

The vegetation unit is classified as having a high sensitivity due to the largely natural state of this vegetation unit and the species of conservation concern occurring in it.

8.5.4.2. Vegetation Unit 2 (VU2)

This vegetation unit is located on the semi-arid plains between the foot slopes of mountains. The VU is characterised by open thornveld and has lower plant diversity than recorded for VU1.

TSF alternatives are located in this VU and the area to be developed for the TSF footprint (one of the alternatives) will be cleared entirely. This VU exhibits various impacts to the vegetation, such as heavy livestock grazing, intensive wood and plant gathering, mining activities, footpaths, roads, and villages and associated impacts. Erosion dongas occur in areas. The VU is considered to be largely natural, but with many disturbances to the vegetation composition.

Dominant woody plant species in this VU include: *Balanites maughamii, Kirkia wilmsii, Terminalia prunioides* and *Triaspis glaucophylla.*

Dominant grass species recorded during the site survey included: *Aristida canescens, Enneapogon scoparius, Urochloa mosambicensis, Aristida adscensionis* and *Stipagrostis hirtigluma.*

The vegetation unit is classified as having a medium sensitivity due to the moderately disturbed state of this vegetation unit and the regional importance of the ecosystem.

Figure 8-19: Typical characteristics of VU2

8.5.4.3. Vegetation Unit 3 (VU3)

VU3 is located along the watercourses located on the proposed project footprint. The vegetation associated with the watercourses was found to have moderate floral diversity. Disturbances to vegetation condition included the presence of Alien Invasive Plants (AIP), existing infrastructure and road crossings.

No obligate species were identified in or around the streams and only two facultative wetland species were identified, namely *Aristida bipartita* (Rolling grass) and *Andropogon eucomus* (Snowflake grass). Apart from slightly denser plant growth in the immediate vicinity of the watercourses no riparian zone could be identified in relation to the surrounding vegetation. The vegetation immediately adjacent to the drainage lines is representative of the vegetation found in the general area and are not considered indicators of riparian conditions.

One exotic species, listed in the NEMBA as invasive, was identified, namely, *Datura stramonium* (Common thorn-apple). However, this species did not occur in high densities, but rather as scattered individuals.

Figure 8-20: Typical Vegetation Unit 3

8.5.4.4. Vegetation Unit 4 (VU4)

VU4 consists of exiting hauls roads, residential areas, current mining operational areas, and previously mined areas, where little or no natural vegetation remains. The proposed WRD extension and smaller sections of the proposed opencast is situated on this VU.

The vegetation unit is classified as having a low sensitivity due to the state of degradation, development can be supported in the area. Care should however be taken regarding impacts on the adjacent bushveld and sensitive mountainous terrain.

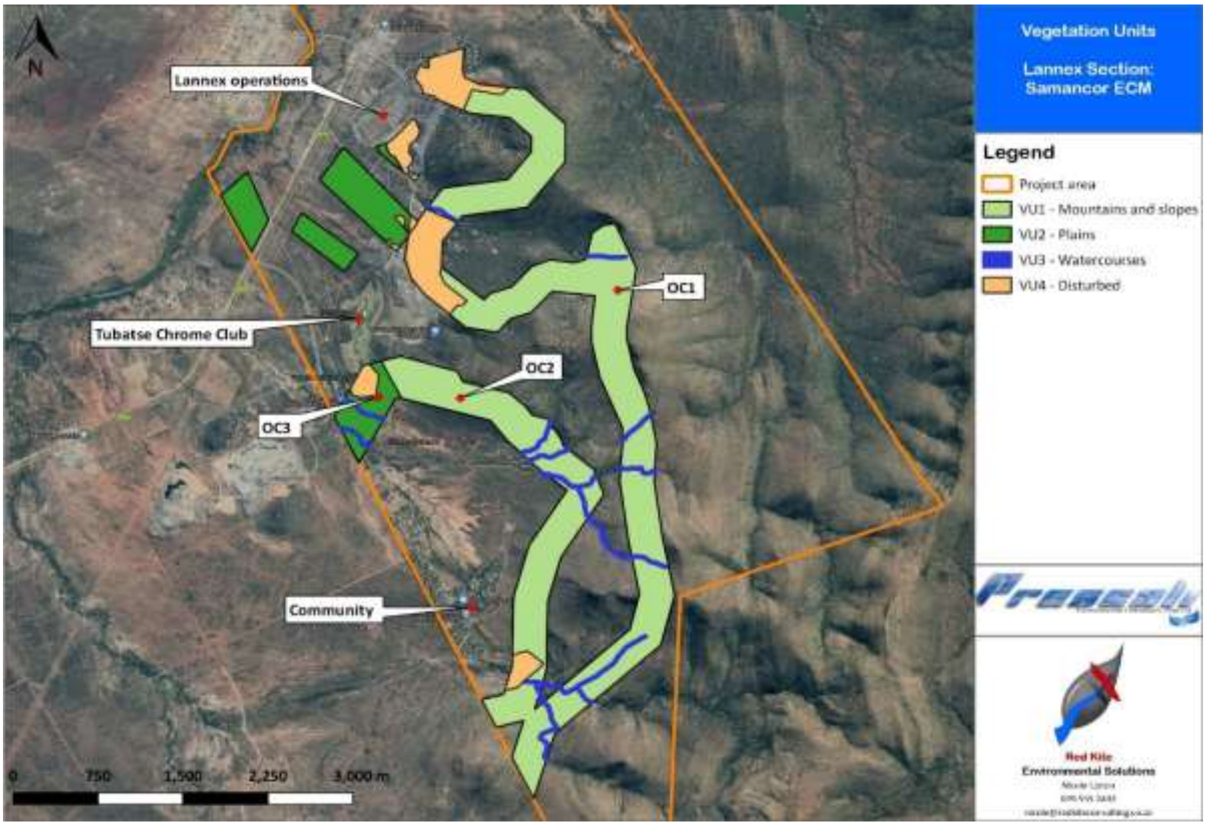

Figure 8-21: Vegetation Units for project footprints

The table below list the flora species identified during the site verification in conjunction with their conservation status and the sites at which they occurred. Four trees protected in terms of the National Forest Act (Act No. 84 of 1998) were identified on the project footprint and 200 m project buffer, namely *Balanites maughamii, Boscia albitrunca, Lydenburgia cassinoides* and *Sclerocarya birrea.* Three species listed in Schedule 12 (Protected Plants) of LEMA occur on the projects site and 200 m project buffer, namely *Aloe cryptopoda, Aloe spicata* and *Searsia batophylla.*

Table 8-13: Flora species identified during site survey

Species	**Common name**	**Conservation**	**Vegetation Units**
Aloe cryptopoda	Geelaalwyn	Medicinal; LEMA: Protected	VU1; VU2; VU3
Aloe fosteri	Foster's spotted aloe		VU2; VU3
Aloe marlothii	Mountain aloe		VU1
Aloe spicata	Lebombo aloe	Medicinal; LEMA: Protected	VU1
Andropogon chinensis	Hairy blue grass		VU2; VU3
Aristida adscensionis	Annual three-awn		VU2; VU3
Aristida bipartita	Rolling grass		VU1; VU2; VU3
Aristida canescens	Pale three-awn		VU1; VU2
Aristida congesta	Tassel three-awn		VU1
Aristida diffusa	Iron grass		VU1
Aristida rhiniochloa	Rough three-awn		VU1; VU2
Aristida scabrivalvis	Purple three-awn		VU2

Species	Common name	Conservation	Vegetation Units
Balanites maughamii	Greenthorn	NFA: Protected, medicinal	VU1; VU2; VU3
Barleria elegans	White bushveld barleria		VU1
Berkheya insignis	-		VU1
Bidens pilosa	Common blackjack	Exotic	VU2; VU3
Boscia albitrunca	Shepherd's tree	NFA: Protected, medicinal	VU1
Boscia foetida	Smelly shepherd's tree		VU1
Bothriochloa insculpta	Pinhole grass		VU2; VU3
Bothriochloa radicans	Stinking grass		VU2
Carissa bispinosa	Lowveld numnum	Medicinal	VU1; VU2
Cenchrus ciliaris	Blue buffalo grass		VU1
Chloris gayana	Rhodes grass		VU1
Cleome angustifolia	Yellow mouse-whiskers		VU1
Combretum apiculatum	Red bushwillow		VU1
Combretum erythrophyllum	River bushwillow		VU1
Combretum hereroense	Mouse-eared bushwillow	Medicinal	VU1; VU2
Combretum molle	Velvet bushwillow	Medicinal	VU1
Combretum zeyheri	Large-fruited bushwillow	Medicinal	VU1
Commiphora mollis	Velvet corkwood		VU2; VU3
Commiphora pyracanthoides	Firethorn corkwood		VU1
Commiphora tenuipetiolata	White-stemmed corkwood		VU2; VU3
Croton gratissimus	Lavender feverberry	Medicinal	VU1; VU2; VU3
Cymbopogon caesius	Broad-leaved turpentine grass		VU1
Cymbopogon pospischilii	Narrow-leaved turpentine grass		VU2
Dactyloctenium aegyptium	Common crowfoot	Exotic	VU2
Datura stramonium	Common thorn-apple	AIP 1b; Medicinal	VU2; VU3
Dichanthium annulatum	Vlei finger grass		VU2
Dichrostachys cinerea	Sickle bush	Medicinal	VU1; VU2
Digitaria eriantha	Common finger grass		VU1; VU2; VU3
Dodonaea viscosa	Sandolive	Medicinal	VU2
Ehretia rigida	Puzzlebush	Medicinal	VU2; VU3
Ekebergia capensis	Cape-ash	Medicinal	VU2
Elephantorrhiza burkei	Broadpod elephantroot	Medicinal	VU1
Enneapogon cenchroides	Nine-awned grass		VU1
Enneapogon scoparius	Bottlebrush grass		VU1; VU2
Eragrostis superba	Saw-tooth love grass		VU2
Eragrostis chloromelas	Curley leaf		VU1
Eragrostis curvula	Weeping love grass		VU2
Eragrostis rigidior	Curly leaf (broad)		VU1
Eragrostis superba	Saw-tooth love grass		VU1
Eragrostis trichophora	Hairy love grass		VU2; VU3

Species	Common name	Conservation	Vegetation Units
Euclea linearis	Lance-leaves Guarri		VU2
Fingerhuthia africana	Thimble grass		VU1; VU2; VU3
Geigeria burkei	Knoppiesvermeerbos		VU2
Grewia bicolor	White-leaved donkeyberry	Medicinal	VU1
Grewia flavescens	Donkeyberry		VU1
Grewia monticola	Grey donkeyberry		VU2; VU3
Grewia occidentalis	Crossberry		VU2
Heteropogon contortus	Spear grass		VU1; VU2; VU3
Hippobromus pauciflorus	False-horsewood	Medicinal	VU1; VU2; VU3
Kirkia wilmsii	Mountain seringa		VU1; VU2; VU3
Kyphocarpa angustifolia	Silky burweed		VU1; VU2; VU3
Lantana rugosa	Bird's brandy	LC	VU1; VU2; VU3
Lydenburgia cassinoides	Sekhukhune bushman's tea	NFA: Protected, medicinal	VU1; VU2; VU3
Melinis repens	Natal red-top		VU1; VU2
Mundulea sericea	Corkbush	Medicinal	VU1
Panicum deustum	Broad-leaved panicum		VU1; VU2; VU3
Panicum maximum	White buffalo grass		VU1
Pappea capensis	Jacketplum	Medicinal	VU1; VU2
Pechuel-loeschea leubnitziae	Stinkbush		VU2
Pennisetum setaceum	Fountain grass	AIP 1b	VU2
Polygala hottentotta	Small purple broom	Medicinal	VU1
Psiadia punctulata	Sticky psiadia		VU1; VU2; VU3
Rhoicissus tridentata	Bushman's grape	Medicinal	VU1
Rhynchosia minima	Siesta carpet bean		VU2
Rhynchosia nitens	Silver rhynchosia bush		VU1; VU2; VU3
Sanseveria hyacinthoides	Mother-in-law's tongue		VU1
Schkuhria pinnata	Dwarf marigold	Exotic	VU2
Schotia brachypetala	Weeping boerbean	Medicinal	VU1
Sclerocarya birrea	Marula	NFA: Protected, medicinal	VU1; VU2; VU3
Searsia batophylla	Bramble currant	Endemic; LEMA: Protected	VU1; VU2; VU3
Searsia leptodictya	Mountain karee		VU1
Searsia pyroides	Firethorn crowberry	Medicinal	VU1
Searsia sekhukhuniensis	Sekhukhune Karee	Endemic	VU1
Senegalia ataxacantha	Flamepod thorn		VU1
Senegalia erubescens	Blue thorn		VU1; VU2; VU3
Senegalia mellifera	Hook thorn		VU2
Senegalia nigrescens	Knob thorn		VU1; VU2; VU3
Senegalia senegal	Slender three-hook thorn		VU1
Sterculia rogersii	Star-chestnut		VU1
Stipagrostis hirtigluma	Blue bushman grass		VU1; VU2; VU3
Stipagrostis uniplumis	Silky bushman grass		VU1

Species	Common name	Conservation	Vegetation Units
Tarchonanthus camphoratus	Camphorbush	Medicinal	VU1
Terminalia prunioides	Purplepod clusterleaf		VU1; VU2; VU3
Themeda triandra	Red grass		VU1; VU2
Tinnea rhodesiana	Brown tinnea		VU1; VU2
Tragus berteronianus	Carrot-seed grass		VU2
Triapsis glaucophylla	Blue-leaved saucer-fruit		VU1; VU2; VU3
Urochloa mosambicensis	Bushveld signal grass		VU2; VU3
Vachellia exuvialis	Flaky-bark thorn		VU1; VU2
Vachellia grandicornuta	Horned thorn		VU2
Vachellia karoo	Sweet thorn		VU2
Vachellia tortillis	Umbrella thorn		VU2
Vachellia xanthophloea	Fever tree		VU2
Vitex obovata	Hairy fingerleaf		VU1
Zinnia peruviana	Redstar zinnia	Exotic	VU2
Ziziphus mucronata	Buffalo-thorn	Medicinal	VU1

8.5.4.5. Alien Invasive Plant (AIP) Species

Invasive and exotic species tend to increase in disturbed environments (DEA & DMR, 2013). Therefore, the construction and operational phases of developments can increase the spread and growth of invasive species. Of the 113 plant species identified during the site assessment, eight species not indigenous to South Africa were identified of which two are listed as alien and invasive plant (AIP) species in NEMBA, 2004 (Act No. 10 of 2004).

Table 8-14: AIP species identified during site survey

Scientific name	Common name	NEMBA AIP Category
Bidens pilosa	Common blackjack	Exotic. Not listed in NEMBA
Dactyloctenium aegyptium	Common crowfoot	Exotic. Not listed in NEMBA
Datura stramonium	Common thorn-apple	NEMBA: AIP Category 1b
Opuntia ficus-indica	Sweet prickly pear	NEMBA: AIP Category 1b
Pennisetum setaceum	Fountain grass	NEMBA: AIP 1b
Schkuhria pinnata	Dwarf marigold	Exotic. Not listed in NEMBA
Zinnia peruviana	Redstar zinnia	Exotic. Not listed in NEMBA

8.5.4.6. Medicinal Species

Some of the species that were encountered during the field survey have cultural and/or medicinal use. Various medicinal books and peer-reviewed articles were used to verify whether the species have any medicinal uses. The table below lists the twenty-nine (29) species that were found to occur on site that have medicinal uses * (asterisk) denoted exotic species.

Table 8-15: Medicinal plant species recorded during site survey

Species	Common name
Aloe cryptopoda	Geelaalwyn
Aloe spicata	Lebombo aloe
Balanites maughamii	Greenthorn
Boscia albitrunca	Shepherd's tree
Carissa bispinosa	Lowveld numnum

Species	Common name
Combretum hereroense	Mouse-eared bushwillow
Combretum molle	Velvet bushwillow
Combretum zeyheri	Large-fruited bushwillow
Croton gratissimus	Lavender feverberry
* *Datura stramonium*	Common thorn-apple
Dichrostachys cinerea	Sickle bush
Dodonaea viscosa	Sandolive
Ehretia rigida	Puzzlebush
Ekebergia capensis	Cape-ash
Elephantorrhiza burkei	Broadpod elephantroot
Grewia bicolor	White-leaved donkeyberry
Hippobromus pauciflorus	False-horsewood
Lydenburgia cassinoides	Sekhukhune bushman's tea
Mundulea sericea	Corkbush
* *Opuntia ficus-indica*	Sweet prickly pear
Pappea capensis	Jacketplum
Polygala hottentotta	Small purple broom
Rhoicissus tridentata	Bushman's grape
Schotia brachypetala	Weeping boerbean
Sclerocarya birrea	Marula
Searsia pyroides	Firethorn crowberry
Tarchonanthus camphoratus	Camphorbush
Triaspis glaucophylla	Blue-leaved saucer-fruit
Ziziphus mucronata	Buffalo-thorn

These plants are important from a cultural perspective and are used for traditional/cultural purposes. Traditional medicine in South Africa is an important practice on which seventy two percent of the Black African population relies, that accounts for 26.6 million consumers. Approximately 133 000 people are employed in the trade of traditional medicine, especially rural women (Appendix 5.1).

8.5.5 FAUNA

8.5.5.1. MAMMALS

Two (2) mammal species were found to possibly occur within the QDS, one (1) has been included within the National Red Data List, however this species is not likely expected on the specific footprint, but could possibly utilise the wider regionas part of their range, since it has fairly large range requirements:

- *Panthera pardus* - Leopard – Vulnerable (2016) – *Not expected on site during mining activities, but rather may occur as part of larger range requirement*

The *Panthera pardus* (Leopard) has a wide habitat tolerance, including woodland, grassland savannah and mountain habitats but also occur widely in coastal scrub, shrubland and semi-desert (Hunter, et al., 2013) (Stein, et al., 2016). Although Leopards occur in numerous protected areas across their range, the majority of the population occurs outside of protected areas, necessitating a need for improved conflict mitigation measures, trophy hunting management, non- lethal mitigation actions, centralized monitoring of trophy harvest and quality, issuing of permits as well as providing education programmes to ensure Leopards do not become locally threatened (Swanepoel, et al., 2016). The Leopard’s range may include the larger Sekhukhune areas, but will in effect not likely be expected on-site, especially since some of the area (OC3 and extended OC2) also falls within the Tubatse Chrome Club (including a golf course) or adjacent to the existing Lannex operations, with constant human activity and movement.

OC1 and it extension has many natural valleys and slopes where undisturbed faunal activity may take place. The largest section of its footprint is fairly natural and extends well in terms of landscape continuity and corridor to the valleys at the back (which is also completely natural).

8.5.5.2. Avifaunal

According to data collected during the Southern African Bird Atlas Project 2 (SABAP2[2]) the site is located within pentad 2445_3010 and ninety-four (94) bird species listed for this area. No avifaunal SCC has been indicated for the specific pentad relevant to the development.

8.5.5.3. Butterflies

Thirty-three (33) butterfly species were found for the 2430CC, all of which are categorized as Least Concern by SANBI.

8.5.5.4. Other invertebrates

Nineteen (19) species of Dung beetles were recorded for the QDS, all not listed on the IUCN Red list. Three (3) Odonata species are known to occur within the area, all of which has a Least Concern rating. Two (2) species of Lacewing are known to occur within the region, none red listed on the SANBI Database.

8.5.5.5. Reptiles

Thirty-three (33) reptile species are recorded for the QDS, the list of species that may possibly occur in the QDS are presented in Appendix 5.1. One of the species has a red listed status:

- *Platysaurus orientalis fitzsimonsi* - FitzSimons' Flat Lizard - Near Threatened (SARCA 2014).

8.5.5.6. Amphibians

Eight (8) amphibian species were listed within this QDS (Appendix 5.1) and none of these species were red listed for the QDS.

8.5.6 Site Evaluation

Field assessments were conducted on the 18th of March 2020 and the 23rd of June 2020. The Lannex tailings alternatives sites and the WRD expansion had been surveyed along with the original OC1, OC2, OC3 footprints during the March field assessment. The areas additionally surveyed included the footprints (and a 200 m buffer area) around the sites, where possible:

- OC1 and extended footprint;
- OC2 and extended footprint; and
- OC3 at Tubatse Chrome Club.

Large sections of the areas surveyed included the mountainous area where the opencast developments are proposed (OC1, OC2 and OC3 and their potential extended footprints). An area in proximity of OC3 was found to have been previously mined and was in a rehabilitated state. Vegetation has successfully re-established within this area and although diversity remains impacted, it is commended for its success.

OC3 is located within this housing development and club, and part of OC3 overlaps with a section of the golf course. Constant movement and activity is already present within this area (Tubatse Chrome Club).

The second field visit included the potentially extended footprints of the opencast sections, and these were found to be in various states of transformation (near Lannex) and other sections completely natural. Sites and important characteristics are described below.

[2] http://sabap2.adu.org.za,

8.5.6.1. Opencast Survey

The following images are provided to show the different zones of habitat available and condition based on the opencastlayouts and extended footprint options provided.

Transformed area OC1

OC1 is located directly above the current Lannex operations and show signs of disturbance, particularly at the beginning of the section proposed.

Natural mountainous area- OC and extended footprint

The remainder of OC1 and extended opencast areas is proposed over the mountainous terrain and constitutes fairly natural habitat. The vegetation structure was thought to be slightly different than those observed at OC2 and OC3, but the habitat structure and integrity of this section will have the same ecological value in terms of habitat and functionality.

Figure 8-22: (left) impacted nature where OC1 starts; (right) Landscape of OC1

Natural mountainous areas – OC 2 and extended footprint

OC2 and its extension is proposed to start slightly further up from the transformed areas associated with Tubatse Chrome Club and from there extends along the slopes of the mountain towards the south-eastern side, across the valley along the mountain which is also the approximate location for the majority of OC1. These areas are currently less impacted and may be categorised as natural and pristine habitat for species on both sides of the mountain.

The area proposed for OC2 contained a ventilation shaft entrance, which is currently utilised as a cave structure by animal species and specifically porcupine quills were found to occur within this “artificial cave” as shown in the figure below. From this observation, it could also be concluded that bats and other species will utilise the cave structure as it is found high up in the mountain where no/little human activity is taking place. The many porcupine quills found within the opening could also signify that other larger predatory species have dragged the porcupine into the shaft and may indicate a struggle or feeding signs as the amount of quills present is thought to be abnormal for a natural shedding event.


Figure 8-23: (left) Landscape associated with OC 2; (right) Entrance to old ventilation shaft currently utilised as a cave structure on the footprint of OC 2 (24°47'52.45"S; 30°10'35.00"E)

<u>**Disturbed / Transformed habitat associated with OC 2 and OC 3**</u>

OC3 is located adjacent to areas previously mined and rehabilitated. The footprint of OC2 and OC3, which were surveyed first in March 2020, are shown in the figure below.


Figure 8-24: (left) Rehabilitated landscape adjacent to OC3 (beginning of extended OC2); (right)

Figure 8-25: Photographs taken down towards Tubatse Chrome Club showing giraffes (extended OC2)

8.5.6.2. Waste Rock Dump Extension

Based on observations made during the field assessment, the WRD area has already been fenced off and the footprint could be described as impacted. No natural habitat remains, and no animal species were sighted.

Figure 8-26: WRD and extension area

8.5.6.3. Tailings Storage Facility

 

Figure 8-27: (left) Areas associated with LNX 1; (right) LNX 1 – rocky banks and outcrops present within footprint

Lannex site 2 (LNX2) had similar characteristics as those associated with LNX1. LNX4 also had the same characteristics, but had more grass cover, which was different when compared to the alternative sites assessed.

 

Figure 8-28: (left) LNX2; (right) LNX4

LNX3 is located where the existing TSF is remined at present and current operations of Lannex are taking place. The area is fenced off with access control and no remaining natural habitat exists for this area in question. The site also coincides with the beginning of OC1 extension footprint (most northern point).

Figure 8-29: Sites associated with alternative LNX 3

8.5.6.4. Species encountered during the field assessments

The species sighted mostly occurred in the natural areas surrounding the opencast footprints and the footprints which have natural habitat remaining (the remainder did not have natural habitat left).

Table 8-16: Animal species sighted during site visit

Family	Species	Common Name	Sighting/Finding	Status and IUCN
Invertebrates and Butterflies				
Tenebrionidae	*Zophosis testudinaria*	Frantic tortoise Beetle (Koffie-pit)	Sightings	Least Concern
Bolboceratidae	*Meridiobolbus sp - likley Meridiobolbus faustus*	Dor Beetles	Sighting	Least Concern
Pyrrhocoridae	*Dysdercus nigrofasciatus*	Cotton Stainer	Sighting	Least Concern
Pyrgomorphidae	*Phymateus morbillosus*	Milkweed Locust	Sighting	Least Concern
Mantidae	*Epioscopomantis chalybea*	Grass Mantis	Sightings	Least Concern
Pamphagidae	*Hoplolopha sp.*	Saw-backed locust	Sightings	Least Concern
Pisauridae	*Perenethis simoni*	Nursery web spider	Sightings	Least Concern
Araneidae	*Gasteracantha versicolor*	Long-winged kite spider	Sightings	Least Concern
Araneidae	*Argiope australis*	Garden orb spider	Sightings	Least Concern
Agelenidae	Species unknown	Funnel-web spiders	Sightings	Least Concern
Nymphalidae - Satyrinae	*Bicyclus safitza*	Common Bush Brown	Sightings	Least Concern
Pieridae	*Colotis eris*	Banded Gold Tip	Sightings	Least Concern
Pieridae	*Belenois aurota*	Brown-veined white	Sightings	Least Concern
Nymphalidae	*Byblia ilithyia*	Spotted Joker	Sighting	Least Concern
Nymphalidae	*Danaus chrysippus*	African Monarch	Sighting	Least Concern
Nymphalidae	*Junonia hierta*	Yellow Pansy	Sightings	Least Concern
Reptiles				
No reptile species observed				
Amphibian				
No amphibian species observed				
Mammalians				
Cercopithecidae	*Papio ursinus*	Chacma baboon	Sightings during both field assessments	Least Concern (2016), Schedule 8 LEMA
Cercopithecidae	*Chlorocebus pygerythrus*	Vervet monkey	Sightings during both field assessments	Least Concern (2016), Schedule 8 LEMA
Leporidae	*Lepus saxatilis*	Scrub hare	Sightings and signs during	Least Concern (2016), Schedule 4

Family	Species	Common Name	Sighting/Finding	Status and IUCN
			both field assessments	LEMA (Game)
Hystricidae	*Hystrix africaeaustralis*	Cape porcupine	Sighting of quills within cave structure at OC 1	Least Concern (2016)
Giraffidae	*Giraffa camelopardalis giraffa*	South African giraffe	Sightings	Associated with Tubatse Chrome Club, Least Concern (2016), Global: Vulnerable, Schedule 3 LEMA (Protected Wild Animals), ToPs Protected
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	Sightings and dung	Associated with Tubatse Chrome Club and surrounds, Least Concern (2016), Schedule 4 LEMA (Game)
Bovidae	*Connochaetes sp:* *C. taurinus or C. gnou*	Wildebeest	Reported to occur – Not sighted	Associated with Tubatse Chrome Club, Least Concern (2016), Schedule 4 LEMA (Game), ToPs Protected
Equidae	*Equus quagga*	Zebra	Reported to occur – Not sighted	Associated with Tubatse Chrome Club, Least Concern (2016), Global: Near Threatened (NT), ToPs Listed (Endangered) if *Equus zebra zebra*
Bovidae	*Tragelaphus angasii*	Nyala	Reported to occur – Not sighted	Associated with Tubatse Chrome Club, Least Concern (2016), Schedule 4 LEMA (Game), ToPs Protected
Bovidae	*Kobus ellipsiprymnus*	Waterbuck	Reported to occur – Not sighted	Associated with Tubatse Chrome Club, Least Concern (2016), Schedule 4 LEMA (Game)
Bovidae	*Tragelaphus sylvaticus* or *Tragelaphus scriptus*	Southern Bushbuck	Reported to occur – Not sighted	Associated with Tubatse Chrome Club, Least Concern (2016), Schedule 4 LEMA (Game), ToPs Protected
Bovidae	*Aepyceros melampus*	Impala	Tracks, signs and dung	Associated with Tubatse Chrome Club, Least Concern (2016),

Family	Species	Common Name	Sighting/Finding	Status and IUCN
				Schedule 4 LEMA (Game)
Bovidae	*Sylvicapra grimmia*	Grey duiker	Tracks and signs	Least Concern (2016), Schedule 4 LEMA (Game)
Bovidae	*Raphicerus campestris*	Steenbok	Dung	Least Concern (2016), Schedule 3 LEMA (Protected Wild Animals)
Avifaunal				
Turnicidae	*Turnix sylvaticus*	Common buttonquail	Sightings	Least Concern
Leiothrichidae	*Turdoides jardineii*	Arrow-marked Babbler	Sightings	Least Concern
Picidae	*Dendropicos fuscescens*	Cardinal Woodpecker	Sighting	Least Concern
Alaudidae	*Mirafra africana*	Rufous-naped Lark	Sightings	Least Concern
Estrildidae	*Estrilda astrild*	Common waxbill	Sightings	Least Concern
Ploceidae	*Euplectes albonotatus*	Widowbird White-winged	Sightings	Least Concern
Numididae	*Numida meleagris*	Helmeted guineafowl	Feathers, Sightings	Least Concern
Ploceidae	*Plocepasser mahali*	White browed sparrow-weaver	Sightings	Least Concern
Alaudidae	*Eremopterix leucotis*	Chestnut-backed sparrow-lark	Sightings	Least Concern
Viduidae	*Vidua funerea*	Dusky Indigobird	Sightings	Least Concern
Dicruridae	*Dicrurus adsimilis*	Fork-tailed Drongo	Sightings	Least Concern
Leiothrichidae	*Turdoides bicolor*	Southern Pied Babbler	Sighting	Least Concern
Cuculidae	*Centropus burchelli*	Burchell's Coucal	Sightings	Least Concern
Upupidae	*Upupa africana*	Hoopoe, African	Sightings	Least Concern
Hirundinidae	*Riparia cincta*	Martin, Banded	Sighted	Least Concern
Ploceidae	*Ploceus intermedius*	Lesser masked weaver	Sighted	Least Concern
Ploceidae	*Euplectes afer*	Yellow-crowned bishop	Sighted	Least Concern
Ploceidae	*Euplectes orix*	Red bishop	Sighted	Least Concern

8.5.7 Sensitivity and Conservation Status

None of the three vegetation types is listed in the National List of Threatened Ecosystems. However, the Sekhukhune Mountain Bushveld and Sekhukhune Montane Grassland form part of the Sekhukhune Mountainlands (MP3) which is listed as Endangered in the National List of Threatened Ecosystems.

The closest area protected in terms of NEMPAA is the Apiesboomen Private Nature Reserve, which is 9 km to the north-east of the project area. Sites OC1, OC2, LNX1, LNX2 and the WRD area are located / partially located on areas earmarked in terms of the National Protected Areas Expansion Strategy – Focus Areas, namely Mpumalanga Mesic Grasslands.

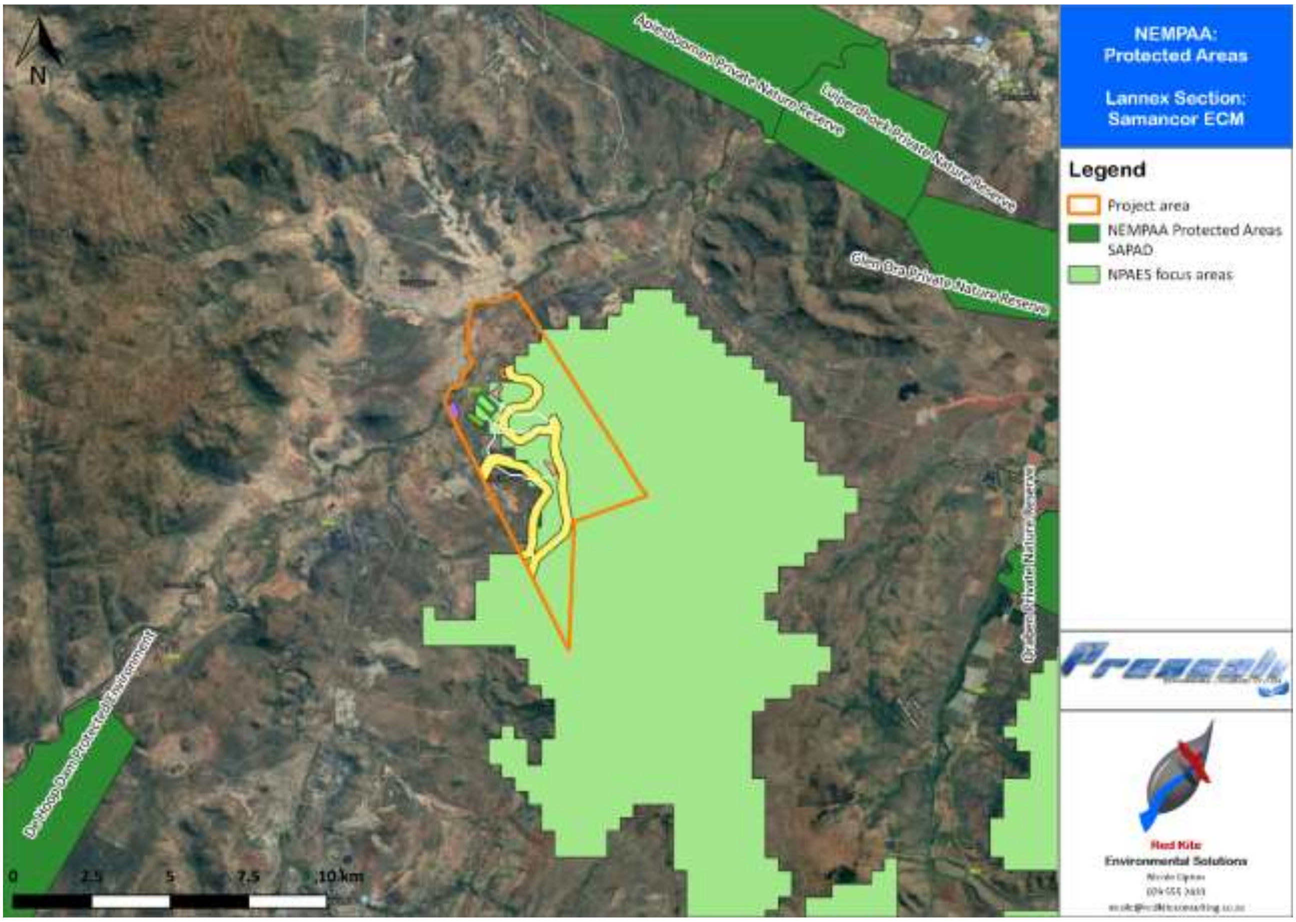

Figure 8-30: Protected areas and NPAES areas

In terms of the Limpopo Conservation Plan, LNX1, LNX2 and LNX4 are located on areas classified as Critical Biodiversity Areas (CBA2) and LNX3, OC1, OC2 and OC3 are all situated on an area classified as Ecological Support Area (ESA1). The most southern parts of OC1 and OC2 fall within CBA 1.

- The crests of VU1 and a 100 m buffer was rated as No-go areas, based on the undisturbed condition of the vegetation, the presence of endemic species and species of conservation concern and the irreplaceable value of the crests as habitat for faunal SCC.
- The mountainous areas and slopes bushveld vegetation unit (VU1) was rated as having a High sensitivity, based on the undisturbed condition of the vegetation, the presence of endemic species and species of conservation concern and that the vegetation unit is situated in the Sekhukhune Mountainlands (MP 9) which is classified as Endangered.
- The plains bushveld vegetation unit (VU2) was rated as having a Medium sensitivity, based on the moderately disturbed state of the vegetation in this unit and that sections of this unit are categorised as Critical Biodiversity Areas (CBA) in the Limpopo Conservation Plan.

- Watercourses (VU3): According to the National Water Act, 1998 (Act No. 36 of 1998), riparian areas are classified as a water resource and are therefore considered to be sensitive. The riparian areas on site are denoted as having High sensitivity.
- Transformed areas (VU4) are totally disturbed and cannot be considered sensitive. Therefore, a low sensitivity was assigned to this vegetation unit.

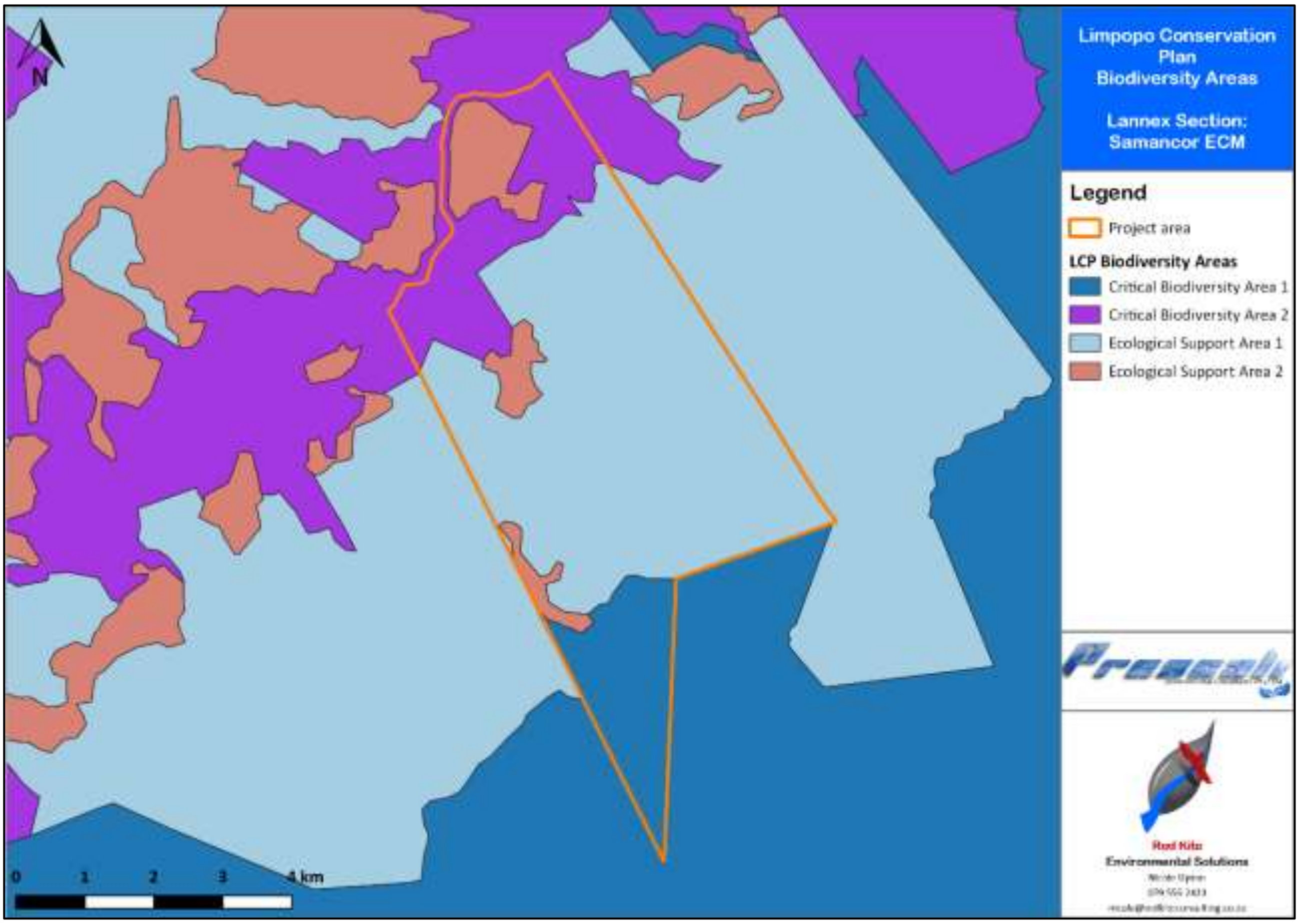

Figure 8-31: Limpopo biodiversity areas in relation to the project

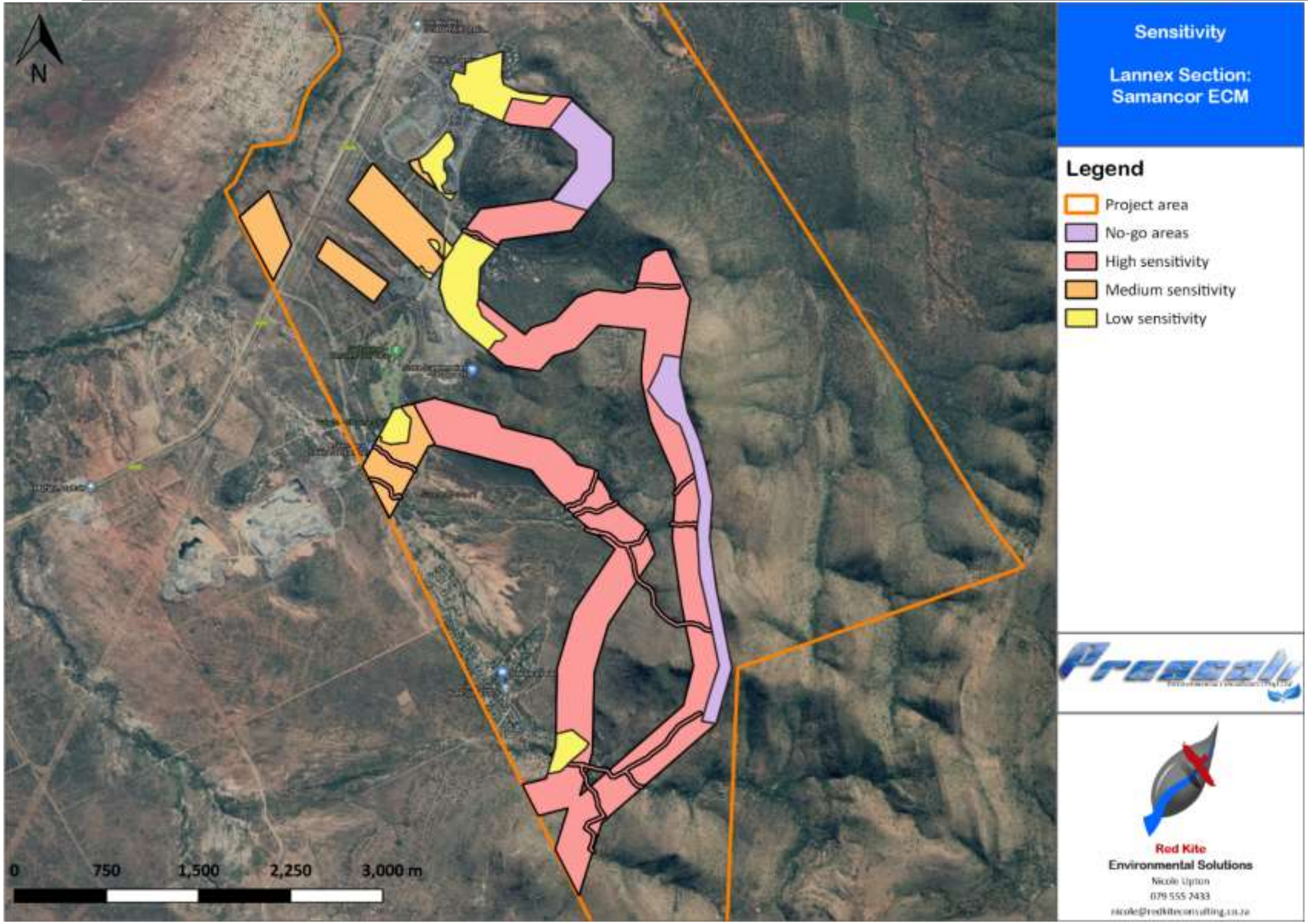

Figure 8-32: Sensitivity Map for project alternatives

8.6. SURFACE WATER

8.6.1 Regional Aquatic Environment

8.6.1.1. Affected River Basin

The Lannex mine is situated in the Olifants River Water Management Area (WMA) (B4 Primary catchment), specifically quaternary catchment B41J in the Steelpoort sub-WMA (Figure 8-33). The Olifants River originates to the east of Johannesburg and initially flows northwards before gently curving eastwards towards the Kruger National Park (KNP), where it is joined by the Letaba River before flowing into Mozambique (DWAF, 2004).

Economic activity in the WMA is highly diverse and ranges from mining and metallurgic industries to irrigation, dry land and subsistence agriculture, and eco-tourism.

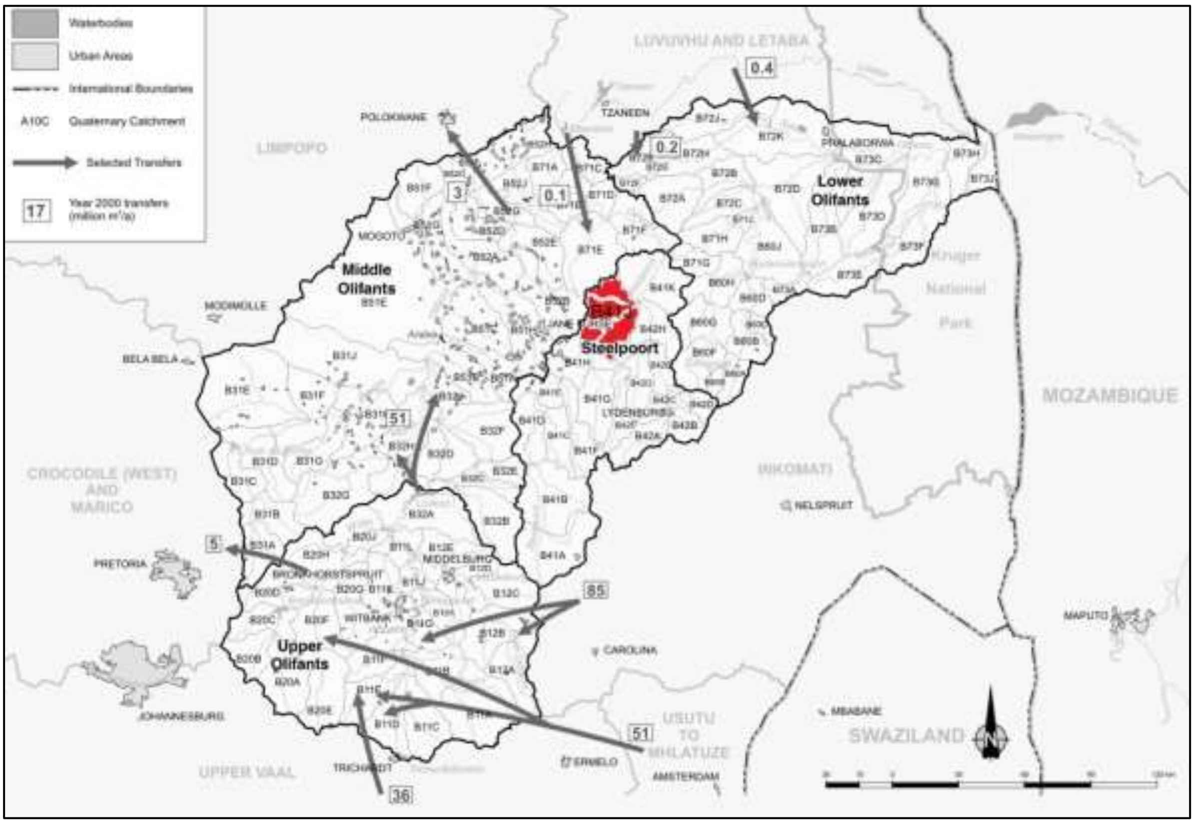

Figure 8-33: Base map of the Olifants water management area and its sub-areas (DWAF, 2004)

Most surface runoff originates from the higher rainfall southern and mountainous areas and is controlled by several large dams (DWAF, 2004). The naturalised Mean Annual Run-off (MAR) and Ecological Reserve requirements as determined for the Olifants River catchment is listed in Table 8-19.

From the reconciliation of data available it was determined that there is a deficit of water in 2000 (Table 8-17), which is still applicable in the year 2025 in the Steelpoort sub-management area (Table 8-18).

Table 8-17: Reconciliation of water requirements and availability for the Steelpoort sub-management area Year 2000 (million m^3/a)

Natural resource		Usable return flow			Total local yield (1)	Transfers in	Grand Total
Surface water	Ground water	Irrigation	Urban	Mining and Bulk			
42	14	3	1	1	61	0	61
(1) After allowance for the impacts on yield of: ecological component of Reserve, River losses, alien vegetation, rain-fed agriculture and urban runoff							
Local Requirements			**Transfers out**			**Balance**	
95			0			-34	

Table 8-18: Reconciliation of water requirements, Base scenario (million m^3/a) for the Steelpoort sub-management area Year 2025

Available water			Water requirements			Balance (3)
Local yield (1)	Transfers in	Total	Local requirements (2)	Transfers out	Total	
62	0	62	96	0	96	-34
(1) Based on existing infrastructure and under construction in the year 2000. Also includes return flows resulting from growth in requirements (2) Based on normal growth in water requirements as a result of population growth and general economic development. Assumed no general increase in irrigation (3) Brackets around numbers indicate negative balance						

8.6.1.2. Steelpoort Sub-WMA

The Steelpoort Sub-area is largely rural with agriculture the predominant land use (DWAF, 2004) though vanadium and chrome mining and mineral processing are also taking place. The newly constructed De Hoop dam is located upstream of this quaternary catchment.

8.6.1.3. Quaternary Catchments

Lannex Section is located within the B41J Quaternary catchment (Figure 8-34) of the Steelpoort sub-management area of the Olifants River Catchment.

The Mean Annual Evaporation, Mean Annual precipitation and MAR for the B41J quaternary catchment is indicated in Table 8-19.

Table 8-19: Applicable catchment areas MAR, MAP and MAE information (Baily & Pitman, 2015)

Area	Catchment area		MAE (mm) (S-pan)	MAP (mm)	MAR (million m^3/a)
	Nett (km^2)	Gross (km^2)			
Olifants WMA	54 534	50 443	1 619 – 1 642	562 - 628	2 008.48
Lower Olifants WMA	42 272	38 770	1 642	562	1 413
Steelpoort sub WMA	7 136	7 136	1 467 – 1 514	658 - 727	350.8
B41J	691	691	1 552	598	13.12
LNX1: TSF and RWD	0.32612				0.006
LNX3: Residue deposit and crushing and screening plant	0.054251				0.001
WRD (whole area)	0.162211				0.003
Opencast area 1	0.23687				0.004
Opencast area 2	0.322195				0.006
Opencast area 3	0.386898				0.007
Opencast Complete area	5.280925				0.100
Lannex existing operations - North	0.632859				0.012
Lannex existing operations - South	0.590308				0.011

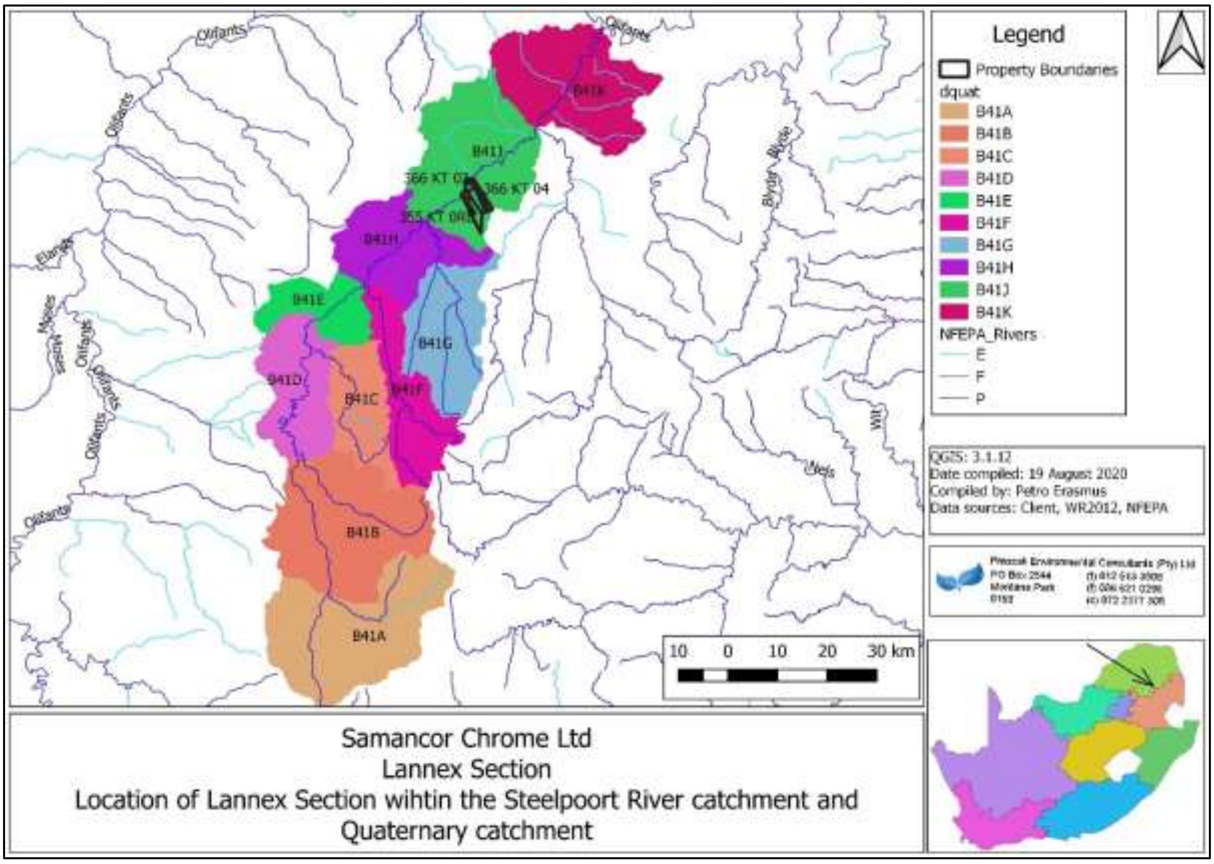

Figure 8-34: Location of Lannex section within quaternary drainage areas

8.6.1.4. River Resource Classification

a) Steelpoort River

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

The Minister of Water and Sanitation is required to establish a classification system, and to determine the class and resource quality objectives for all or part of the resources considered to be significant. From the desktop data assessment is can be seen that Steelpoort River was classified as Class C (moderately modified) in 1999 and that the Present ecological status was reclassified as Class D (Largely Modified). The Ecological Importance and Sensitivity Class (EI and ES) of the Steelpoort River in the applicable reach are High[3].

Table 8-20: Classification of the Steelpoort River Reach directly affected by Lannex Section (CSIR, 2018)

	Steelpoort River
Flow	Permanent
Order	3
Mainstem	1
PES	Class C: Moderately Modified
Ecoregion	9
Geomorphic Zone	E - Lower foothills
River Type	9_P_L

[3] http://www.dwa.gov.za/iwqs/rhp/eco/peseismodel.aspx 18 June 2019

FFRID	0
FFRREGION	Null
FFRFlagship	0 – Not a Flagship River
PES_2018	D – Largely Modified
NBA2018ETS	EN – Endangered
NBA2018PL	PP – Poorly protected
FRID_2018	0 – Not a free-flowing river
FRFAG_2018	0 – Not a Flagship River
FEPA Code	2 – Fish Support Area or Fish Corridor
EI and ES	B41J – Steelpoort River – High

- FFRID: Free flowing river identification. Each system and its tributaries have the same identifier.
- FFRREGION: The lumped ecoregion into which free-flowing rivers fall, used to achieve representation of free-flowing rivers across the country.
- FFRFlagship: Flagship free-flowing rivers as identified through an expert review process.
- PES_2018: Data that became available between 2011 and 2017 from Reserve or Ecological Water Requirement (EWR) and Water Resource Classification System (WRCS) studies.
- NBA2018ETS: Ecosystem threat status (ETS) of river ecosystem types: this was based on the extent to which each river ecosystem type had been altered from its natural condition.
- NBA2018PL: Ecosystem protection level (EPL) of river ecosystem types: river ecosystem types in protected areas needed to be in good condition rivers (A or B ecological category) to be considered as protected. Well protected, moderately protected, poorly protected river ecosystem types have at least 100%, 50%, 5% of their biodiversity target in protected areas and in natural or near-natural ecological condition; not protected river ecosystem types have < 5%.
- FRID_2018: Free-flowing river ID. Each system and its tributaries have the same identifier.
- FRFAG_2018: In NBA 2018 where no river condition changes were recorded the free-flowing/flagship rivers remained unchanged.

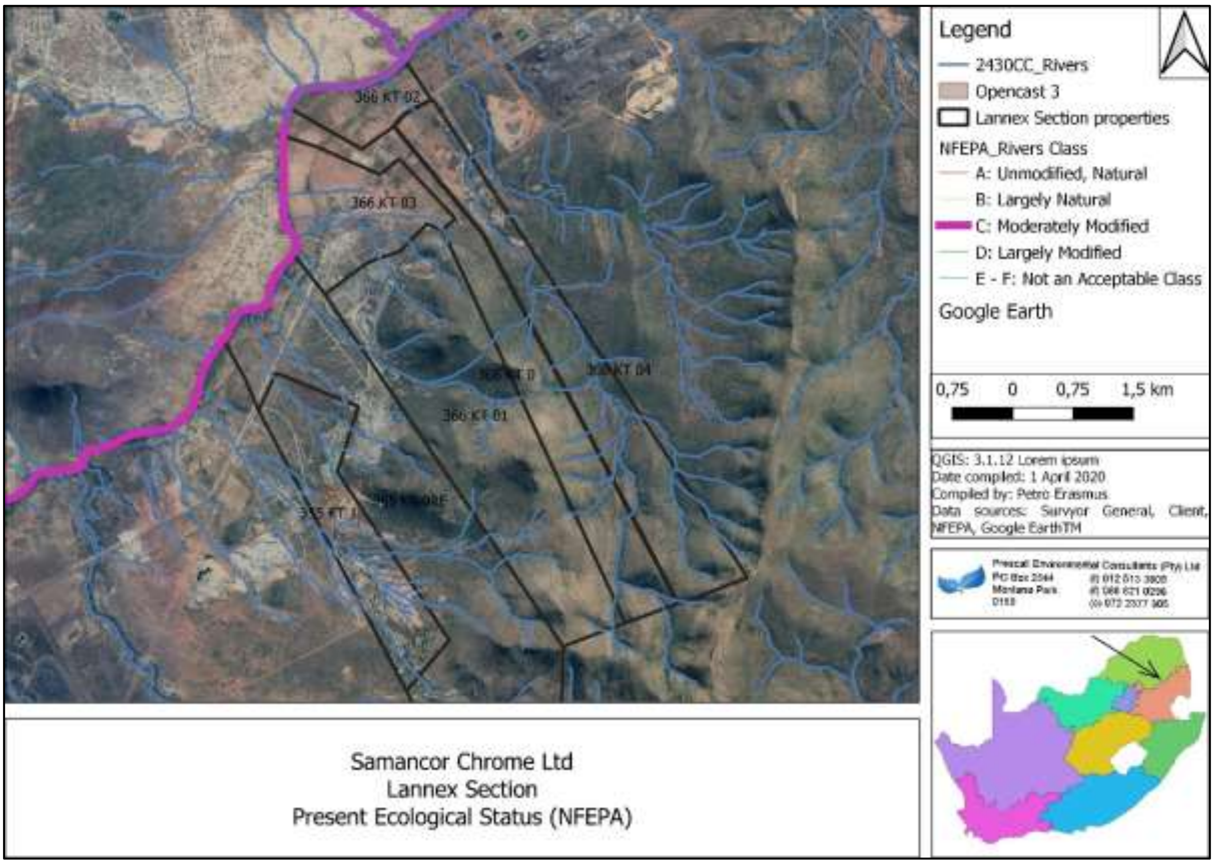

Figure 8-35: Present Ecological Status of the Steelpoort River (NFEPA as available from SANBI)

Ecoregion 9 (20 0298.8 km^2), the Eastern Bakenveld, consists of closed hills and mountains with a moderate to high relief together with North-Eastern Mountain Grassland and Mixed Bushveld. Vegetation consists mainly of Mixed Bushveld and North Eastern Mountain Grassland while other are Sour Lowveld Bushveld, Clay thorn bushveld (limited), Ricky Highveld Grassland, Moist Sandy Highveld Grassland and patched of AfroMontane Forest (Kleynhans, et al., 2005).

Bio-monitoring was conducted on 9 and 10 March 2015 in the Steelpoort River by M2 Environmental Connection (Pty) Ltd at two sites in the Steelpoort River, Figure 8-36.

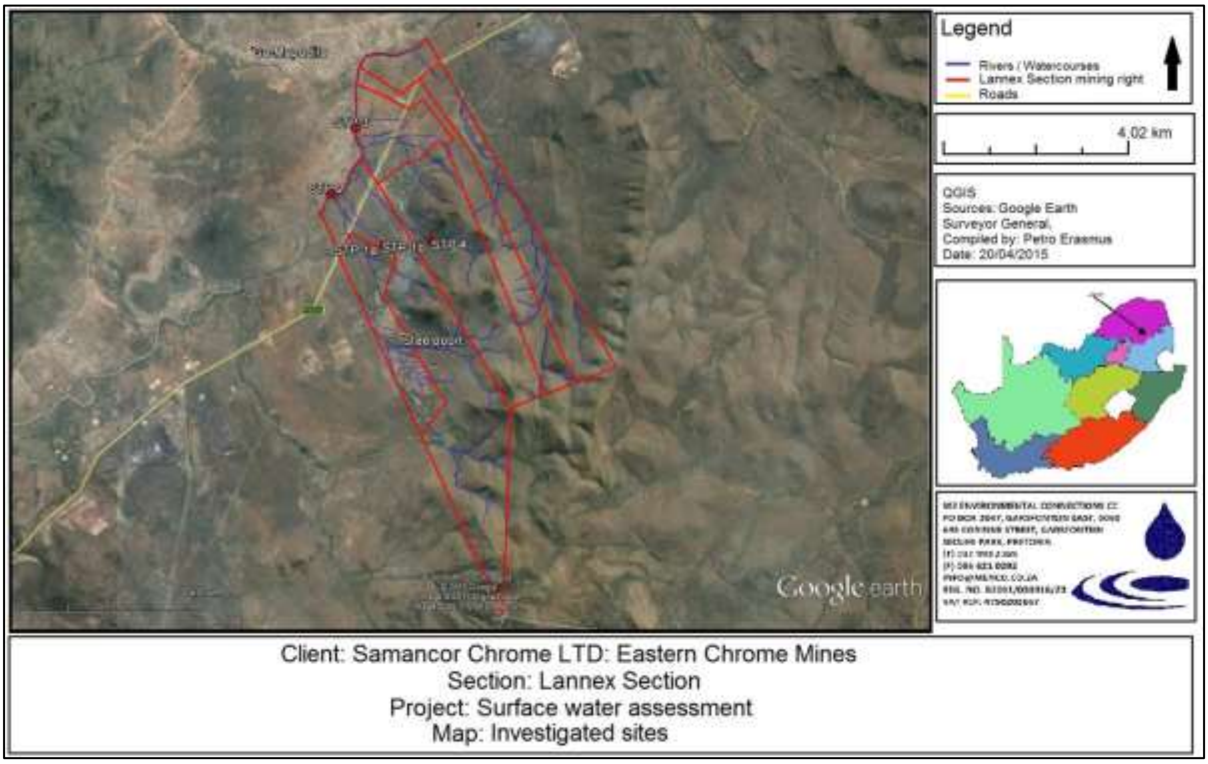

Figure 8-36: Location of biomonitoring conducted in 2015 in the Steelpoort River

Taking the ASPT scores obtained during the March 2015 wet season into account, together with the IHAS scores, SASS5 scores and the water quality, the Steelpoort River was evaluated and the PES on the aquatic ecosystem was indicated as Health Class A (Table 8-21).

Table 8-21: Data score comparison for the 2015 wet season survey

Sites	pH	EC	SASS5	ASPT	IHAS	Health Class
LSTP 2	7.9	35.3	152	6.61	79	A
LSTP 3	8.2	36.5	158	6.11	83	A

Of the families identified during the March 2015 assessment, eleven are considered as sensitive to pollution (SASS score >7). The sensitive species that were recorded was found within the Steelpoort River at both the sites. The species are presented below.

- Perlidae Stoneflies
- Baetidae > 2sp Mayflies
- Leptophlebiidae Prongills
- Oligoneuridae Brushlegged mayflies
- Tricorythidae Stout Crawlers
- Calopterygidae Demoiselles
- Naucoridae Creeping water bugs
- Hydropsychidae >2sp Caseless Caddisflies
- Elmidae Riffle bugs
- Psychomyiidae Caseless Caddisflies
- Platycnemidae Stream Damselflies

The table below summarises the ecological status of the B41J catchment that are associated with the Lannex Section using the water quality, the Habitat Integrity and the SASS5 data obtained during the wet assessment in March 2015. From the March 2015 assessment the Steelpoort River reach as applicable to the Lannex Section can be classified as a Health Class A category.

Table 8-22: Overall EcoStatus of the Steelpoort River

Water Quality	SASS5	IHAS	Health Class
			Good (Moderately used or Impacted)
Good	A	B	

8.6.1.5. NFEPA and Fish population assessment

The B41J quaternary catchment has a NFEPA code 2 classification: Fish support area. Background information as available from SANBI indicates the following with regards to fish populations in the Steelpoort River for the applicable quaternary catchment areas in relation to Lannex Section:

- It falls within a fish sanctuary area for threatened species;
- It does not fall within a fish relocation area for threatened species;
- It does not fall within a fish translocation area for threatened species;
- It does not fall within a fish rehabilitation area for threatened species; and
- It does not fall within a fish Corridor area for threatened species.

From the data provided in the ESA_FishSupportAreas database, one fish species was recorded in the Steelpoort River (it should be noted that more fish species will occur in the Steelpoort River but that these were note recorded on the database):

- 195: *Opsaridium peringueyi* – Southern Barred Minnow (LC – Least Concern).

8.6.1.6. Background Water Quality

Samancor has been monitoring the Steelpoort River at two locations on a quarterly basis since May 2013 and the data (average concentration) is represented in Table 8-23.

From the available quality data, it can be seen that the water quality in the Steelpoort is generally of good quality and with the exception of Turbidity is suitable for domestic use. The only parameter that exceeded the TWQR for aquatic use is Ammonia. The water is not recommended for irrigation use due to the impact that it could have on irrigation equipment and crop quality (Chloride, Electrical Conductivity, pH, Suspended Solids, Total Dissolved Solids).

Table 8-23: Average Background surface water quality in the Steelpoort River

Parameter		LSR01	LSR02	SANS 241-1:2015	Aquatic	Domestic	Agriculture	
							Livestock	Irrigation
Alkalinity	mg $CaCO_3$/l	144.44	145.88	N/A	N/A	N/A	N/A	N/A
Aluminium	mg/l	0.0093	0.0523	≤300 (OP)	≤ 0.005	≤ 0.015	≤5	<5
Ammonia	mg NH_3/l	0.082	0.0795	≤1.5 (AS)	< 0.007	≤ 1.0	N/A	N/A
Barium	mg/l	0.0185	0.0197	≤700 (CH)	N/A	N/A	N/A	N/A
Calcium	mg Ca/l	29.3	29.668	N/A	N/A	< 32	< 1000	N/A
Chloride	mg/l	21.5496	21.644	≤300 (AS)	N/A	100	<1500 Monogastrics and poultry; <3000 other livestock	<1
Chromium (VI)	mg/l	BDL	BDL	N/A	< 0.007	<0.005	< 1	<0.1
Chromium	mg/l	BDL	BDL	N/A	<0.012 Chromium(III)	N/A	N/A	N/A
Electrical conductivity	mS/m	34.616	34.716	≤170 (AS)	15% from normal	< 70	156 (Dairy Pigs and Poultry), 313 Cattle & Horses, 469 (Sheep)	6.25
Iron	mg/l	0.0082	0.0459	≤2000 (CH); ≤300 (AS)	N/A	< 0.1	< 10	< 5
Magnesium	mg/l	17.72	17.568	N/A	N/A	< 30	< 500	N/A
Manganese	mg/l	BDL	0.0003	≤400 (CH); ≤100 (AS)	< 0.18	< 0.05	< 10	< 0.02
Nitrate	mg/l	1.1816	1.2113	≤11 (AH)	N/A	< 6 NO_3	< 100 NO_3;	N/A
pH	pH units	8.5496	8.528	≤5.0 to ≤9.7 (OP)	5% from normal	6 - 9	N/A	6.5 - 8.4
Potassium	mg/l	1.9224	1.8992	N/A	N/A	< 50	N/A	N/A
Sodium	mg/l	21.876	21.984	≤200 (AS)	N/A	< 100	< 2000	< 70
Sulphate	mg/l	22.984	22.0388	≤500 (AH); ≤250 (AS)	N/A	< 200	< 1000	N/A
Suspended Solids	mg/l	121.3692	141.9528		N/A	N/A	N/A	< 50*
Total Dissolved Solids	mg/l	226.44	222.6		Guideline	< 450	< 1000 Dairy, pigs and Poultry; < 2000 Cattle and horses; < 3000 Sheep	<40
Turbidity	NTU	124.9984	136.4676	≤1 (OP); ≤5 (AS)	N/A	< 1	N/A	N/A

*Clogging of drip irrigation systems
CH: Chronic Health
AS: Aesthetics

8.6.2 Surface Water Quantity

8.6.2.1. Mean Annual Runoff

The MAR is indicated in Table 8-19.

8.6.2.2. Flow

Flow in the Steelpoort River is measured at the De Hoop Dam at site B4H023 (Table 8-24) and data is available from 01 January 2010 till 03 November 2019 (information provided by email from DWS). During this time the highest flow was recorded on 6 January 2012 as 91.183 m^3/s (i.e. cumec). The monthly flow in the Steelpoort River is as available from the DWS website is provided in Table 8-24.

Table 8-24: Flow data for B4H023 (cumecs)

	Count	Minimum	Average	Maximum
October	9	28.766	93.9348	259.247
November	9	54.848	104.5301	264.438
December	10	52.702	186.7701	471.084
January	10	61.344	302.9554	1014.637
February	10	64.433	187.2164	356.738
March	10	66.185	138.8812	214.035
April	10	48.467	184.2520	597.077
May	10	39.793	127.0489	281.111
June	10	39.919	93.3104	178.688
July	10	30.664	78.1599	135.427
August	10	30.457	67.3071	104.868
September	10	30.475	74.4681	193.508

The daily flow is indicated below.

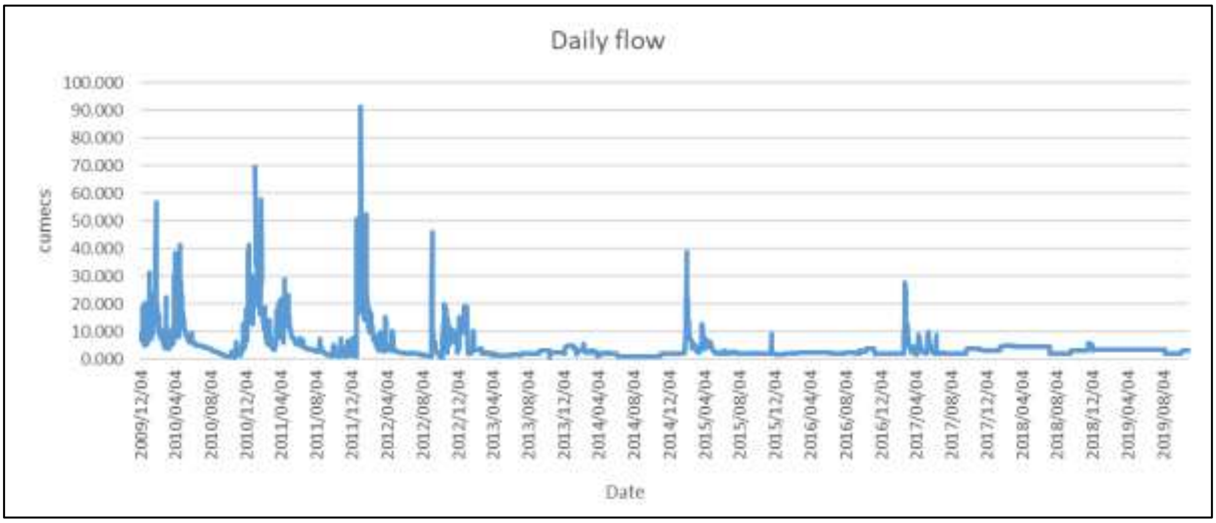

Figure 8-37: Daily average flow rate at De Hoop Dam

8.6.3 Site Specific Aquatic Ecosystem Descriptions

8.6.3.1. Aquatic ecosystem types

Aquatic ecosystems can be classified into two types namely[4]:

- Lentic Ecosystems: and
- Lotic Ecosystems.

8.6.3.2. Lentic Ecosystems – Wetlands, Impoundments, Lakes

Lentic ecosystems refer to standing or basin ecosystems and include lakes, impoundments and

[4] http://www.egyankosh.ac.in/bitstream/123456789/16255/1/Unit-8.pdf 18 August 2020

wetlands[4].

a) Lakes

Generally, lakes are formed in basins created by geological activities e.g. warping and faulting of the earth's crust or as a result of glacial activities[4]. There are no lakes at Lannex Section.

b) Impoundments

Impoundments, or dams are manmade infrastructures and can be onstem (i.e. the watercourse itself is dammed) or offstem (i.e. the dam is located a distance from the watercourse and water is pumped from the watercourse / underground reservoir to the dam) [4]. There are no onstem dams at Lannex section and the offstem dams are related to waste water containment e.g. return and storm water.

c) Wetlands

A wetland as defined by the NWA means "land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil". As described by (DWAF, 2005) the word "wetland" refers to ecosystems of which the primary driving force is water. Its prolonged presence in wetlands is a fundamental determinant of soil characteristics and plant and animal species composition. Any part of the landscape where water accumulates for long enough and often enough to influence the plants, animals and soils occurring in that area, is thus a wetland. The objective of the delineation procedure is to identify the outer edge of the temporary zone. This outer edge marks the boundary between the wetland and adjacent terrestrial areas.

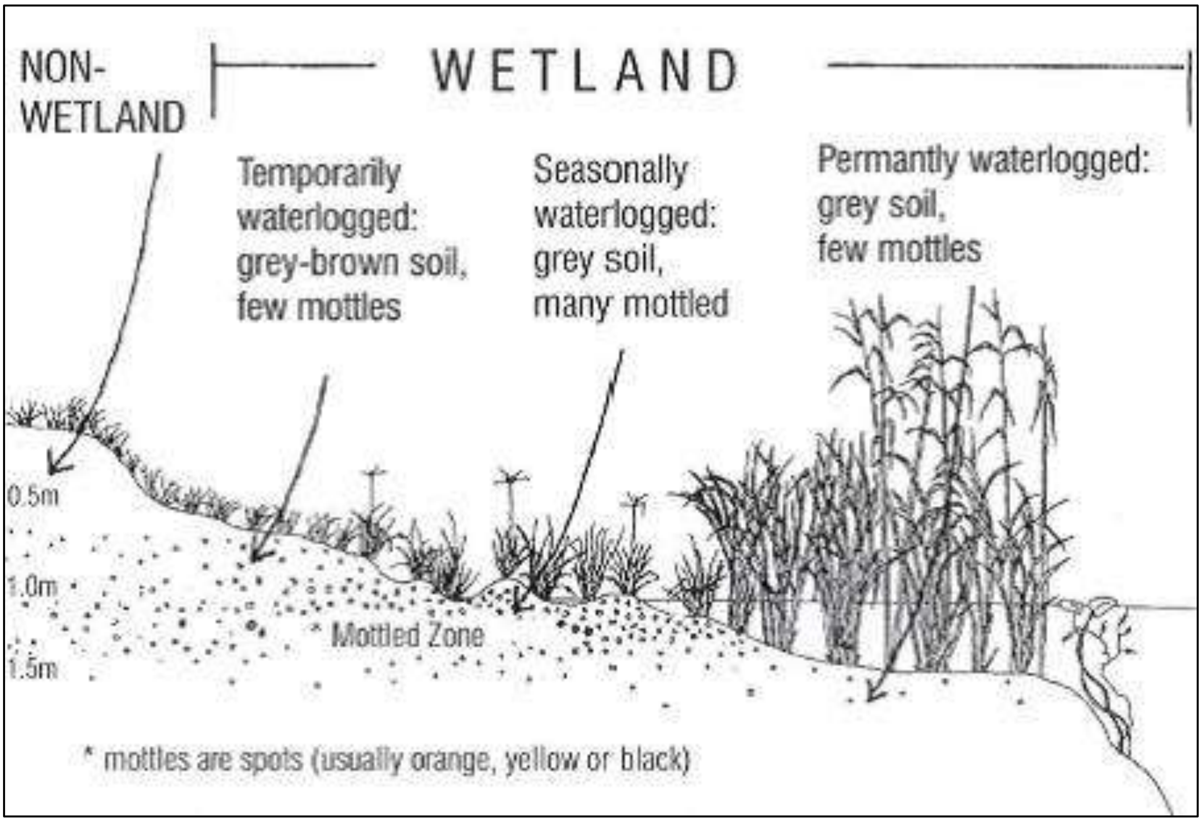

Figure 8-38: Cross section through a wetland (DWAF, 2005)

Wetlands must have one or more of the following indicators:

- Wetland (hydromorphic) soils that display characteristics resulting from prolonged saturation;
- The presence, at least occasionally, of water loving plants (hydrophytes);
- A high-water table that results in saturation at or near the surface, leading to anaerobic

conditions developing in the top 50 cm of the soil; and

- Terrain Unit indicator to identify the locality of the wetland within the landscape.

No natural wetlands were identified at the Lannex Section using the NFEPA database, Figure 8-39. This was confirmed using the 2018 Wetlands database and confidence level information (CSIR, 2018).

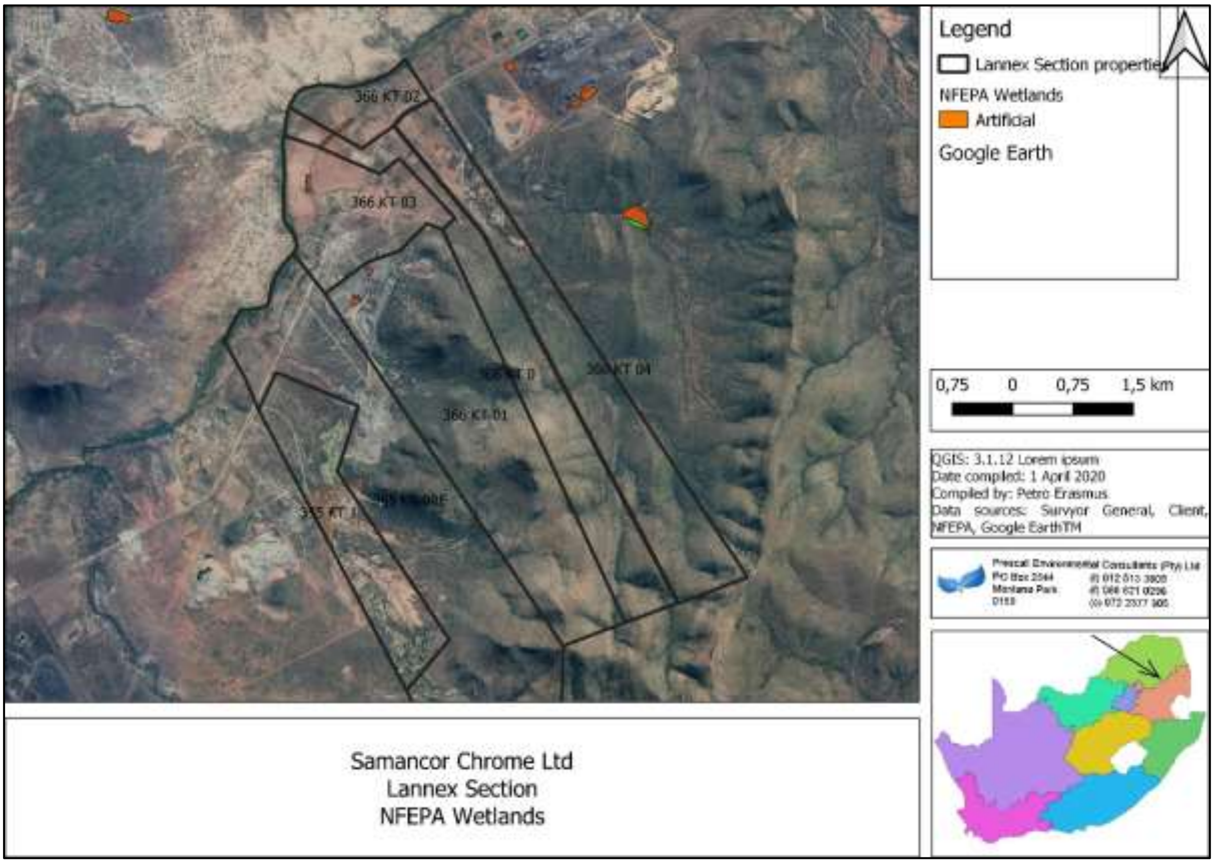

Figure 8-39: Wetlands as per the NFEPA database

8.6.3.3. Lotic ecosystems – Rivers, streams etc.

Lotic systems include rivers and the most outstanding feature of such habitats are flowing water which moulds the characteristics of the water bed and influences the distribution of the organisms therein[4].

A water course is defined by the NWA as:

- River or spring;
- A Natural channel in which water flows regularly, or intermittently;
- A Wetland, lake or dam into which, or from which water flows (refer to Section 8.6.3.2); and
- Any collection of water that the Minister may, by notice in the Gazette, declare to be a water course, and a reference to a watercourse includes where relevant, its bed and banks.

For the purpose of this assessment, the applicable river / watercourse reaches was classified according to the guidelines by DWS in "*A practical field procedure for identification and delineation of wetlands and riparian areas*" as shown in Figure 8-40. Using this classification, three sections along the length of a watercourse are defined based on their position relative to the zone of saturation in the riparian area:

- Section "A" is defined as being above the zone of saturation and it therefore does not carry baseflow. They are mostly too steep to be associated with alluvial deposits and are not flooded with sufficient frequency to support riparian habitat or wetlands. This type does however carry storm runoff during fairly extreme rainfall events, but the flow is of short duration, in the absence of baseflow. The "A" watercourse sections are the least sensitive watercourses in terms of impacts on water yield from the catchment.

- Section B reaches are in the zone of the fluctuating water table, baseflow is intermittent and dependant on the current height of the water table and as the channel bed is in contact with or in close proximity to the water table residual pools are often observed when flow cease. The top end of the B Section is marked by the most headward extent of base flow in the channel during wet periods, when the water table is high, and the bottom end of the B Section is marked by the most downstream extent of zero flow during dry periods (when the water table is low). With regards to slope, the channel bed is flat enough to allow for the deposition of material and initial signs of flood plain development may be observed.
- Section C streams are perennial streams and thus always have contact with the zone of saturation (except during extreme drought conditions). These sections are very flat and a flood plain is usually present.

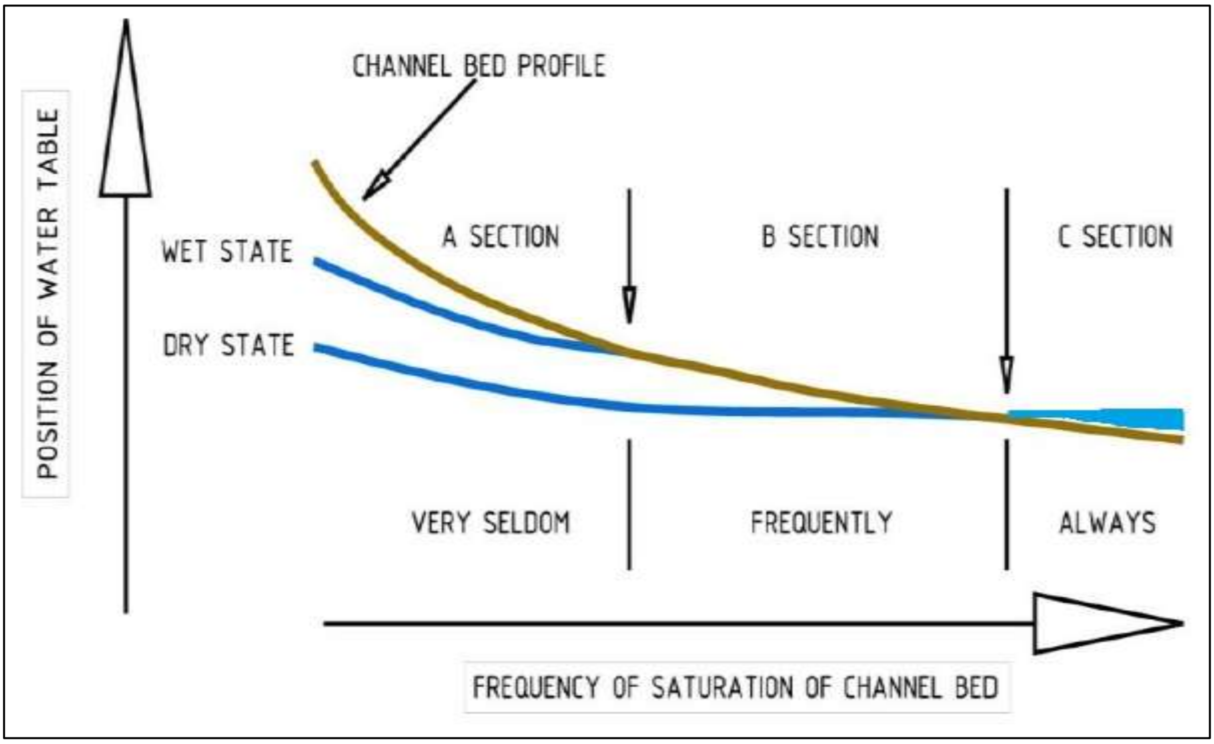

Figure 8-40: River classification (DWAF, 2005)

Several watercourses traverse the Lannex Section (Figure 8-35) and all are classified as Section A (originating in the mountain range) and progress to Section B as they flow through the Lannex mining property. All the watercourses merge with the perennial Steelpoort River (Section C) directly downstream of the Lannex Section.

For easy reference the watercourses will be discussed using the following two figures as reference:

- Southern operational area which includes the existing mining operations and the following expansion activities: WRD expansion, LNX3 residue deposit area, LNX1 TSF1 new tailings storage facility, opencast areas and access roads;
- Northern operational area which includes the existing golf course and Tubatse village, expansion activities include access roads and opencast sections.

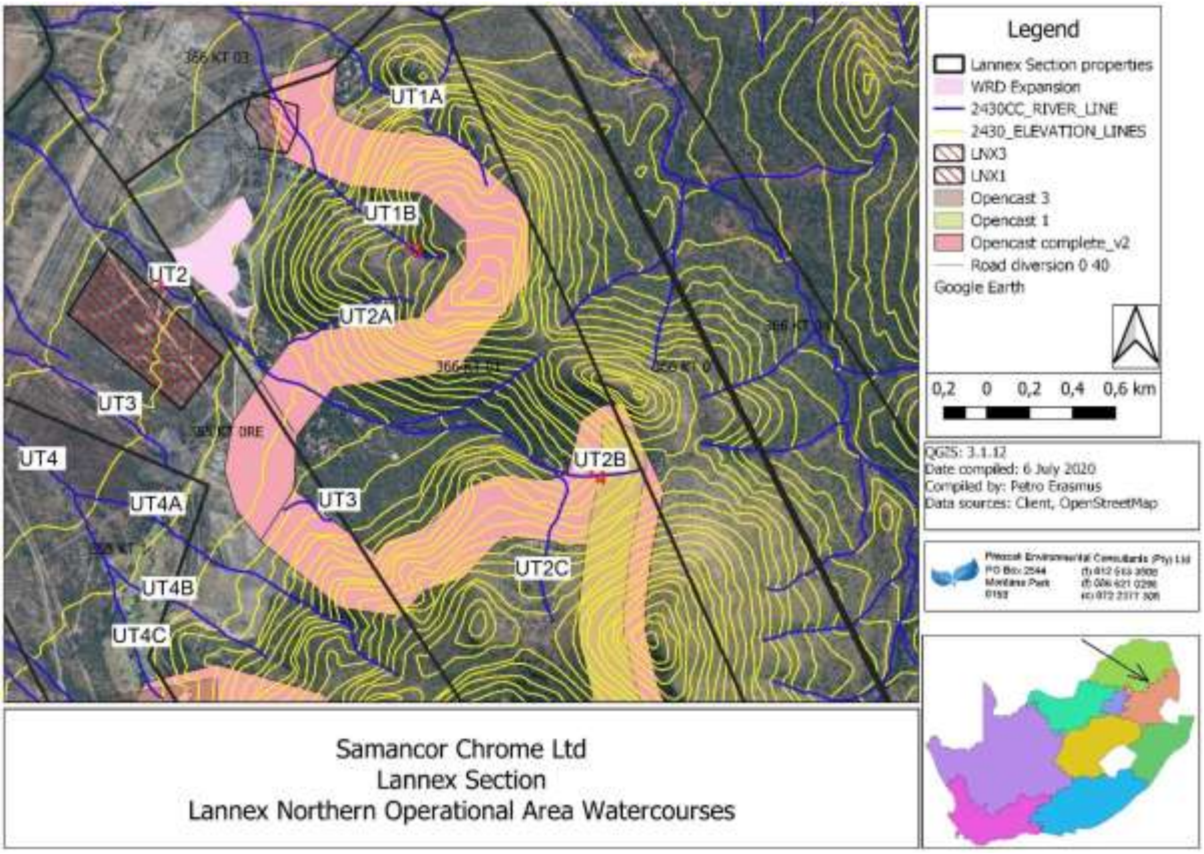

Figure 8-41: Northern operational area

a) **Unnamed tributary (UT) 1A and 1B**

UT1A will not be impacted by any of the expansion activities but is already impacted by the existing residential area. UT1B has no connectivity to the downstream area as a result of the existing operational activities, the proposed LNX3 site for a residue deposit has already been impacted by the historic tailings storage facility (reclaimed) that was on the same footprint. This watercourse is ephemeral in nature and only flow during rainfall events. UT1B was also assessed for riparian vegetation (Site 3), refer to Section 8.6.5.

b) **Unnamed tributary 2 (UT2)**

UT2 has been impacted by existing activities, however connectivity between the upstream reaches and the downstream reach has not been impacted. Existing impacts include access roads, culverts and residential houses. This watercourse is ephemeral in nature, with a well-defined bank and bed and during the site visit no shallow baseflow was noted. The bed varied between sandy, gravelly, rocks and boulders (refer to riparian Sites 1 and 4, Section 8.6.5).

The upper reach of the tributary will be impacted by the proposed opencast section (UT2B and UT2C). Downstream in the B section of the watercourse, the proposed road diversion, Waste Rock Dump Expansion and new Tailings storage facility will be located outside of the 1 in 100-year flood, 100 m from the watercourse and outside riparian vegetation.

c) **Unnamed tributary 3 (UT3)**

UT3 has already been impacted by historical opencast activities and existing residue deposits and mining infrastructure and as a result connectivity between the Section A and Section B reach has been lost. The watercourse is ephemeral in nature and during the site visit no shallow baseflow was noted in the watercourse sections visited. The upper reach of the watercourse will be impacted by the proposed opencast footprint.

d) Unnamed tributary 4 (UT4)

UT4 has already been impacted by historical opencast activities and the golf course and as a result the watercourse is not well defined. Once of the upper reaches (UT4C) will be impacted by the proposed opencast footprint.

e) Unnamed tributary 5B

UT5B has been impacted by historic opencast activities that will now be expanded to include Opencast 3. This is an ephemeral watercourse with shallow baseflow daylighting in several sections of the watercourse upstream of the proposed Opencast 3 expansion in the Section B reach. Though historically impacted, connectivity to the downstream reach was in the process of re-establishing. Refer to riparian Site 2 in Section 8.6.5.

f) Unnamed tributary 5C

UT5C has been impacted by the Tubatse residential area, access roads though upstream and downstream connectivity has been maintained. The proposed opencast 3 expansion footprint will result in the connectivity from upstream to downstream being lost. The Section A upper reaches of the tributary will be impacted by the opencast footprint area. During the site visit, water flow was observed in this watercourse in several areas and for long stretches, the author thus classifies this watercourse as perennial especially as a potential spring was observed (24º 48’ 19.81” S, 30º 10’ 16.46” E, refer in Appendix 5.3). It was confirmed by Lannex Section that there is no water pipeline in that area. A water sample was collected and the results are discussed in Appendix 5.3

g) Unnamed tributary 6

Flowing through the Tubatse village the areas applicable to the opencast is a Greenfields area and ephemeral in nature. The site could not be accessed due to security fencing. Dense vegetation on the banks of the watercourse indicated subsurface flow.

8.6.4 SITE SPECIFIC WATER QUALITY – UT5C

A water sample was collected on 15 July 2020 and submitted to Water lab (Appendix 5.3) for analyses. From the results it can be seen that the water is not suitable for domestic and irrigational use. During the site visit salt deposits were noted in the river bed and this is confirmed by the water quality. It is believed this is a direct result of the interaction with the geology of the area as well as the low flow of the river and the high evaporation rate of the area. Based on the phosphorous concentration the water can be classified as hypertrophic which could result in blue green algae blooms, nuisance growth of aquatic plants.

Table 8-25: Water quality of UT5C

Parameter		**UT5C**	**SANS 241-1:2015**	**Aquatic** (DWAF, 1996)	**Domestic** (DWAF, 1996)	**Agriculture**	
						Livestock (DWAF, 1996)	**Irrigation** (DWAF, 1996)
Calcium	mg/l	58	N/A	N/A	< 32	< 1000	N/A
Chloride	mg/l	258	≤300 (AS)	N/A	< 100	<1500 Monogastrics and poultry; <3000 other livestock	<1
Chromium	mg/l	<0.025	N/A	<0.012 Chromium(III)	N/A	N/A	N/A
Electrical conductivity	mS/m	190	≤170 (AS)	15% from normal	< 70	156 (Dairy Pigs and Poultry), 313 Cattle & Horses, 469 (Sheep)	6.25
Iron	mg/l	<0.025	≤2000 (CH); ≤300 (AS)	N/A	< 0.1	< 10	< 5
Magnesium	mg/l	154	N/A	N/A	< 30	< 500	N/A
Manganese	mg/l	<0.025	≤400 (CH); ≤100 (AS)	< 0.18	< 0.05	< 10	< 0.02
Nitrate Nitrite	mg/l	4.5 <0.05	≤11 (AH)	N/A	< 6 NO_3	< 100 NO_3;	N/A
pH	pH units	8.4	≤5.0 to ≤9.7 (OP)	5% from normal	6 - 9	N/A	6.5 - 8.4
Phosphorous as P	mg/l	0.595	N/A	< 5 ug/l (inorganic)	N/A	N/A	N/A
Potassium	mg/l	3.6	N/A	N/A	< 50	N/A	N/A
Sodium	mg/l	107	≤200 (AS)	N/A	< 100	< 2000	< 70
Total Dissolved Solids	mg/l	1104	≤ 1 200	<15% change from normal	< 450	< 1000 Dairy, pigs and Poultry; < 2000 Cattle and horses; < 3000 Sheep	<40
Zinc	mg/l	<0.025	≤ 5	<0.002	<3	<20	<1

8.6.5 RIPARIAN ASSESSMENT

Riparian habitat (as defined by the NWA): *includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils (deposited by the current river system), and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas*. Riparian zones are specified as water resources and thus fall under the custodian of the Department of Water Affairs and are thus subject to the relevant authorisations governing use and protection (DWAF, 2008). These areas are not usually saturated for a long enough duration for redoximorphic features to develop and instead develop in response to the physical disturbances caused by overbank flooding from the associated river or stream channel. Riparian zones are distinguished from terrestrial area through their association with the physical structure (banks) of the river / stream and the distinctive structural and compositional vegetation zones between the riparian and upland terrestrial areas.

Generally, the riparian zone is expected to be small in headwater stream and becomes larges in mid-sized streams. For large streams the riparian zone may form physical complex floodplains with long periods of seasonal flooding, lateral channel migration, oxbow lakes in cut-off channels and an associated diverse vegetative community.

Both perennial and non-perennial streams support riparian vegetation which may have characteristics of both aquatic and upland habitats (DWAF, 2008). Riparian areas perform a variety of functions e.g.:

- store water and help reduce flood peaks;
- stabilize stream banks;
- improve water quality by trapping sediment and nutrients;
- maintain natural water temperature through shading for aquatic species;
- provide shelter, food and migration corridors for movement of both aquatic and terrestrial species;
- act as a buffer between aquatic ecosystems and adjacent upslope land uses;
- can be used as recreational sites; and
- provide material for building, muti, crafts and curios.

Indicators of riparian areas are:

- Landscape position:
    - Crest (hilltop);
    - Scarp (cliff);
    - Midslope (often a convex slope);
    - Footslope (often a concave slope); and
    - Valley bottom (most likely area for riparian vegetation to develop i.e. adjacent to the river or stream channels; along the banks comprised of the sediment deposited by the channel).
- Alluvial soils and recently deposited material; Alluvial soils may be present at riparian areas and thus cannot be used as primary indicator, however it can be used to confirm the topography and vegetative indicators;
- Topography associated with riparian areas; and
- Vegetation associated with riparian areas. Using vegetation, the outer boundary of the riparian area can be defined as the point where a distinctive change occurs (DWAF, 2008):

- in species composition relative to the adjacent terrestrial area and indicator species can be used to delineate riparian areas (Obligate riparian[5], Preferential riparian[6], Facultative riparian[7] and Upland[8]); and
- in the physical structure, such as vigour or robustness of growth forms of species similar to that of adjacent terrestrial areas as a result of 1) more water being available to species and 2) increased levels of flooding. Growth form refers to the health, compactness, crowding, size, structure and/or numbers of individual plants.

Four sites were used to determine the riparian vegetation in the affected watercourses

a) <u>Site 1 (LNX1) – UT2</u>

Site 1 was located along the section of UT2 situated along the northern border of LNX1 and LNX Alt and south of WRD Expansion. The site was selected and verified to be representative of drainage lines located on the plains area associated with the project.

The stream had a defined channel with a rocky and sandy bed at the site survey location. There was no flow in the stream and it was reported that it only flows during and immediately after rain events.

The vegetation associated with the riparian zone of the tributary of the Steelpoort River was found to have moderate floral diversity. Vegetation condition and groundcover adjacent to the stream was found to be fair and few bare patches were observed. Disturbances to vegetation condition included existing infrastructure, human movement and road crossings.

No obligate species were identified in or around the stream and only one facultative wetland species was identified, namely *Aristida bipartita* (Rolling grass). Apart from slightly denser plant growth in the immediate vicinity of the watercourse, no riparian zone could be identified in relation to the surrounding vegetation. As can be seen from the photo below, little vegetation occurs within the bed of the drainage line and the vegetation immediately adjacent to the drainage line is representative of the vegetation found in the general area and are not considered indicators of riparian conditions.

Dominant species included trees and shrubs such as *Terminalia prunioides* (Purplepod clusterleaf), *Balanites maughamii* (Greenthorn), *Kirkia wilmsii* (Mountain seringa), *Lydenburgia cassinoides* (Sekhukhune bushman's tea) and *Triaspis glaucophylla* (Blue-leaved saucer-fruit). Dominant grass species included *Fingerhuthia africana* (Thimble grass), *Stipagrostis hirtigluma* (Blue bushman grass) and *Heteropogon contortus* (Spear grass).

One exotic species, listed in the NEMBA as invasive, was identified, namely, *Datura stramonium* (Common thorn-apple). However, this species did not occur in high densities, but rather as scattered individuals.

b) <u>Site 2a (western/central section of opencast) – UT5B</u>

Site 2 was located in the riparian zone of UT5B located toward the western-most proposed opencast area. The site was selected and verified to be representative of drainage lines located on the plains area associated with the project.

---

[5] these are species that occur almost exclusively in the riparian zone (> 90% probability). Seldom found in non-riparian areas they still indicate wetness. They are not likely to occur in the upland.
[6] these are species that are preferentially, but not exclusively, found in the riparian zone (>75% probability). Where found in non-riparian areas they are used as indicators of wetness.
[7] these species may occur in either riparian zones or the upland (>25% probability of occurrence in the riparian zone) as they can habituate to more mesic conditions with a high probability of survival, or can tolerate higher levels of flooding disturbance or soil moisture. They are not good national indicators, but rather circumstantial indicators good for particular regions.
[8] these species are rarely found in riparian zone (<25% probability) and characterize terrestrial landscapes that border riparian zones. Upland species usually occur naturally in the upper parts of the riparian zone, but with low relative abundance.

The drainage line had a poorly defined channel and riparian zone at the survey location. There was no flow in the drainage line at the time of the survey.

Vegetation condition and groundcover adjacent to the drainage line was found to be fair and dense. Floral diversity is considered to be low. No obligate species were identified in or around the stream and only one facultative wetland species was identified, namely *Andropogon eucomus* (Snowflake grass). Apart from slightly denser plant growth in the immediate vicinity of the watercourse, no riparian zone could be identified in relation to the surrounding vegetation. The vegetation immediately adjacent to the drainage line is representative of the vegetation found in the general area and is not considered indicative of riparian conditions.

Dominant grass species included: *Bothriochloa radicans* (Stinking grass), *Eragrostis trichophora* (Hairy love grass), *Enneapogon scoparius* (Bottle brush grass) and *Aristida scabrivalvis* (Purple three-awn). Dominant tree and shrub species included species such as *Vachellia tortillis* (Umbrella thorn), *Dodonaea viscosa* (Sandolive), *Senegalia erubescens* (Blue thorn), *Pechuel-loeschea leubnitziae* (Stinkbush) and *Ekebergia capensis* (Cape-ash).

c) <u>Site 2b – UT5C</u>

Further south of Site 2 is a drainage line characterized by large erosion areas (24° 48' 14.23" S, 30° 10' 11.22" E). During the 15 July 2020 site survey limited flow was observed in the main drainage line. Obligate plant species such as rushes and sedges and the facultative wetland species, *Andropogon eucomus* (Snowflake grass) were observed to occur in some sections of this drainage line. The aforementioned species are indicators of riparian conditions. These plants occurred in and along the edges of the watercourse bed. Algae was also recorded

d) <u>Site 3 (northern section of opencast) – UT1B</u>

Site 3 was located along UT1B (as indicated on topographical maps) toward the northern end of the proposed opencast pit. Although maps and the topography indicate that a watercourse may be situated at this site, no watercourse or associated riparian conditions were observed. This is due to the haul roads and waste rock dumps located at Site 3 as a result of historic underground mining.

Dominant species included trees and shrubs such as *Combretum apiculatum* (Red bushwillow), *Kirkia wilmsii* (Mountain seringa), *Dichrostachys cinerea* (Sickle bush) and *Grewia bicolor* (White-leaved donkeyberry). Dominant grass species are typical of the area: *Heteropogon contortus* (Spear grass), *Aristida canescens* (Pale three-awn), *Aristida canescens* (Pale three-awn), *Cenchrus ciliaris* (Blue buffalo grass), *Eragrostis rigidior* (Curly leaf), *Eragrostis curvula* (Weeping love grass) and *Stipagrostis hirtigluma* (Blue bushman grass).

e) <u>Site 4 (Bridge 2 / Access Road Option 1) – UT2B</u>

Site 4 was located along UT2B, located from the upper to the lower reaches of the stream associated with Bridge 2 / Access Road Option 1. The stream was selected and verified to be representative of streams located on the slopes of the mountain.

The stream had a defined channel with a rocky bed at the site survey location. There was no flow in the stream and will most likely only flow during and immediately after rainfall.

The vegetation associated with the riparian zone of the tributary of the Steelpoort River was found to have moderate floral diversity. Vegetation condition and groundcover adjacent to the stream was found to be fair and few bare patches were observed. Disturbances to vegetation condition included human movement and road crossings.

No obligate species were identified in or around the stream and only one facultative wetland species was identified, namely *Aristida bipartita* (Rolling grass). Apart from slightly denser plant growth in the immediate vicinity of the watercourse, no riparian zone could be identified in relation to the surrounding vegetation. As can be seen from the photo below, the vegetation immediately adjacent to the drainage line is representative of the vegetation found in the general area and are not considered indicators of riparian conditions.

Dominant species included trees and shrubs such as *Terminalia prunioides* (Purplepod clusterleaf), *Balanites maughamii* (Greenthorn), *Kirkia wilmsii* (Mountain seringa), *Lydenburgia cassinoides (*Sekhukhune bushman's tea) and *Rhoicissus tridentata* (Bushman's grape). Dominant grass species included *Eragrostis superba* (Saw-tooth love grass), *Aristida canescens* (Pale three-awn), *Aristida bipartita* (Rolling grass), *Heteropogon contortus* (Spear grass) and *Panicum maximum* (White buffalo grass).

The table below lists the flora identified at the sites surveyed for the riparian vegetation description, the sites they were observed at and the wetland / riparian indicator status of the flora species. Note that only species with an indicator status of "obligate" or "facultative wetland" have been listed in the table below.

Table 8-26: Floral species identified in the riparian zones of the two sties

Species	Common name	Ecology	Site
Andropogon eucomus	Snowflake grass	Facultative wetland	2
Aristida bipartita	Rolling grass	Facultative wetland	1 & 4
Balanites maughamii	**Greenthorn**	**Facultative - often along riverbanks** **NFA: Protected Tree**	1 & 4
Lantana rugosa	Bird's brandy	Facultative - thrives in riverine vegetation	1 & 4
Panicum deustum	Broad-leaved panicum	Facultative - often along riverbanks	Site 1
Searsia batophylla	Bramble currant	Facultative - often along riverbanks	1 & 4

8.6.5.1. Normal Dry Weather Flow

No flow data is available for the site-specific tributaries. Of specific concern is UT5 as surface flow was noted during the assessment and as indicate previously a spring was identified. During the sample collection it took approximately 150 seconds to fill 1 litre (6.66667^{-06} cumecs).

8.6.5.2. Drainage Density

The drainage density for the properties as indicated (33.766 km^2) was calculated as 2.147 km/km^2. The total length of the drainage lines across the study area is 72.503 km (MENCO, 2015).

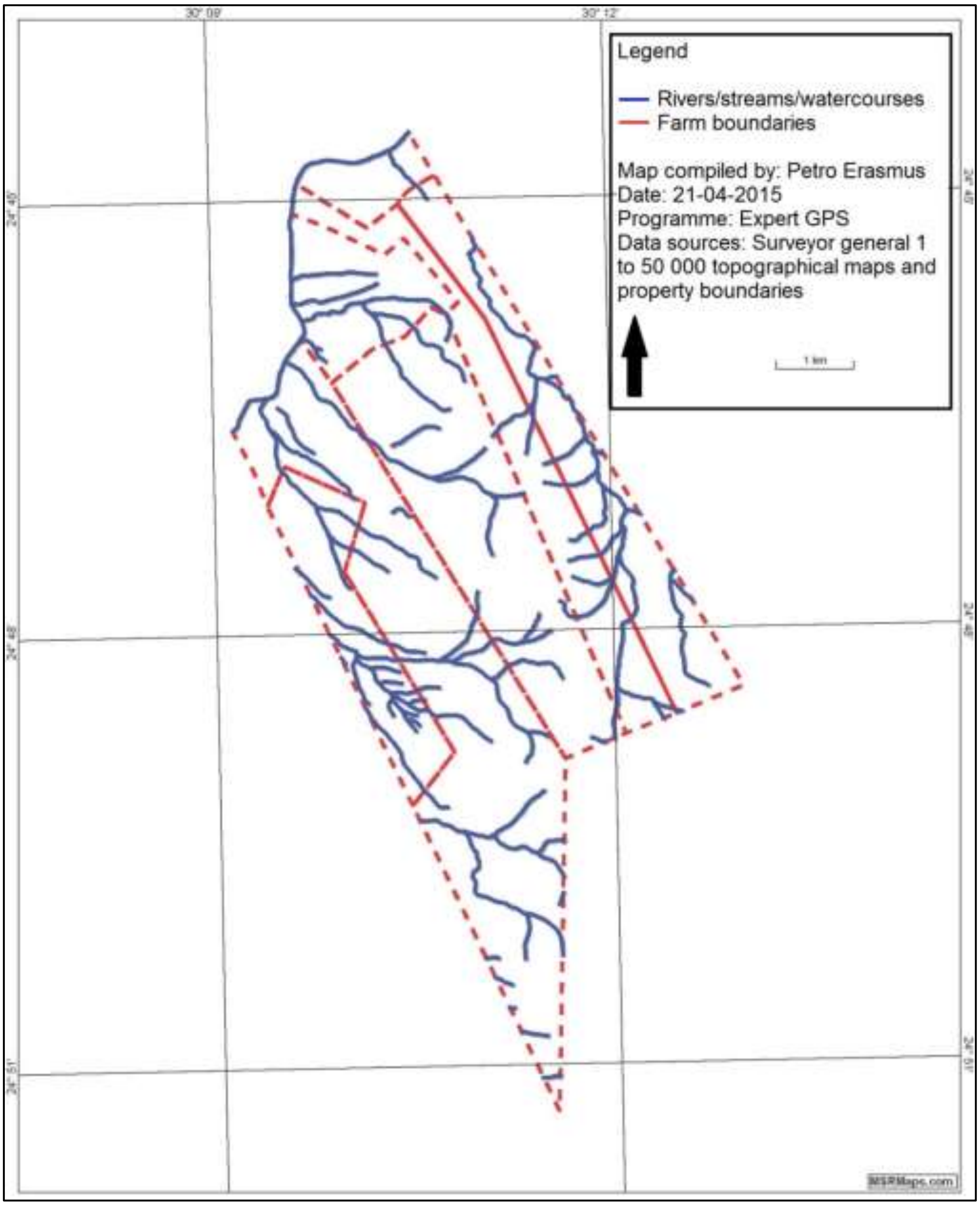

Figure 8-42: Location of surface drainage lines and surface water areas used to calculate the drainage density of the study area (MENCO, 2015)

8.6.5.3. Flood Lines

Flood lines for the Steelpoort River and selected tributaries were determined in 2020 as part of the opencast and TSF expansion project Appendix 5.4and the results are provided in the figures below. From the maps it can be concluded that:

- The TSF is located outside of the 1:50 and 1:100-year flood but located within the 100 m legislated buffer area.
- A river diversion will be needed at the opencast area and this will be done by the Engineers appointed for the storm water management plan for the opencast area.

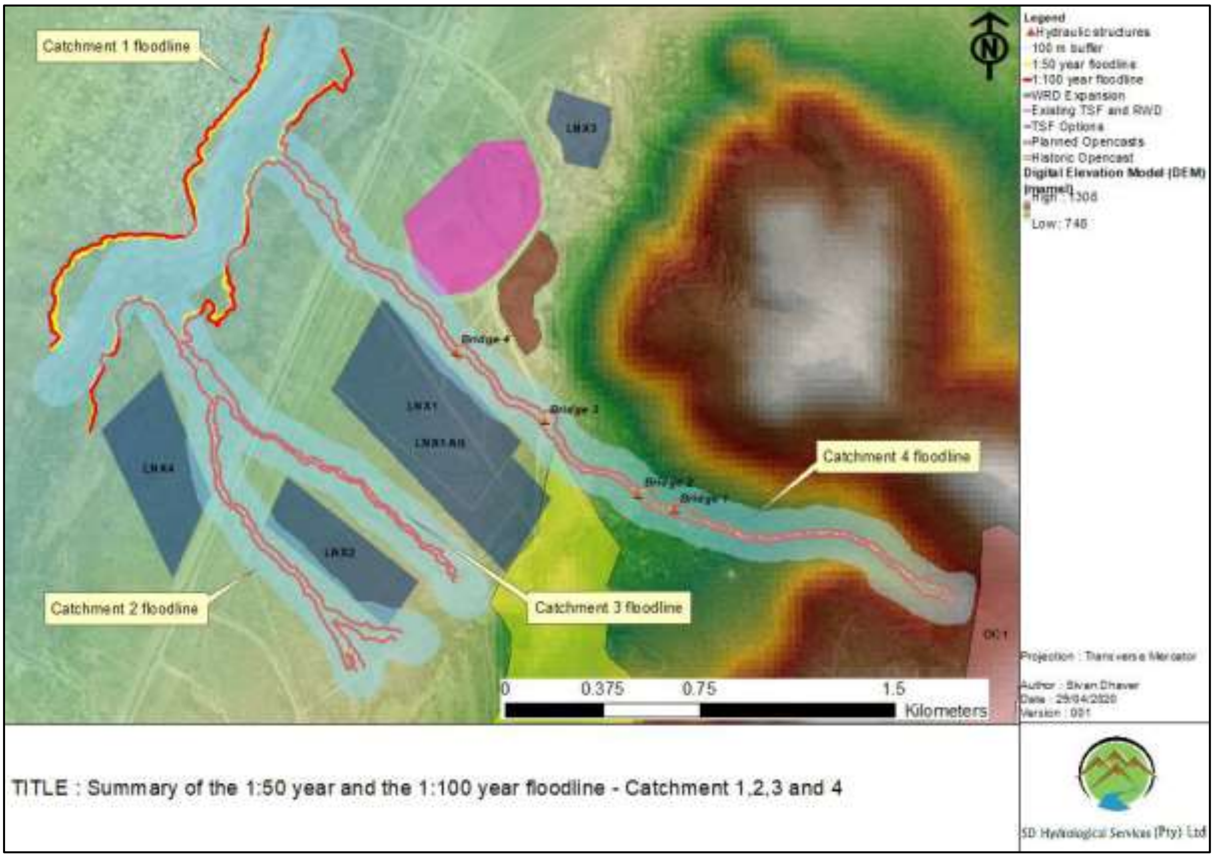

Figure 8-43: Flood line delineation for watercourses at the proposed tailings storage facility

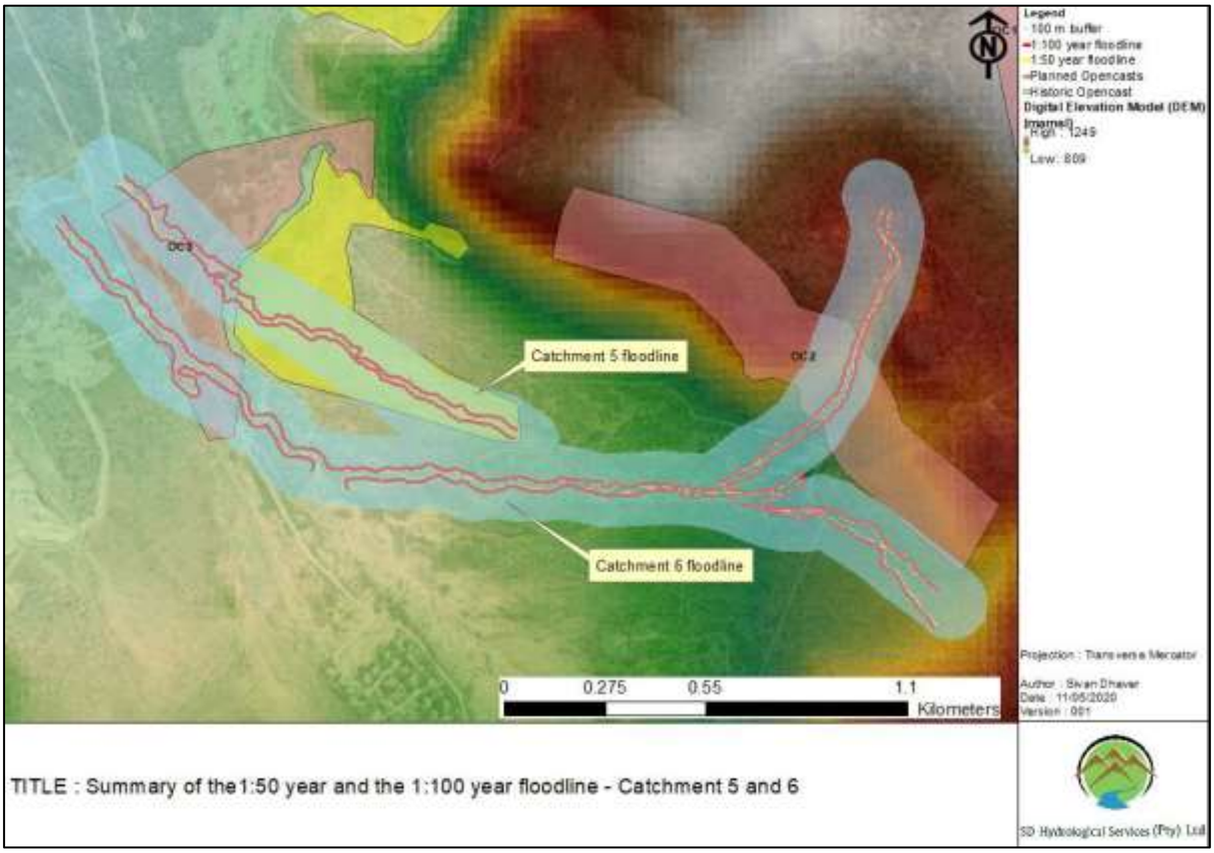

Figure 8-44: Flood line determination at the opencast areas

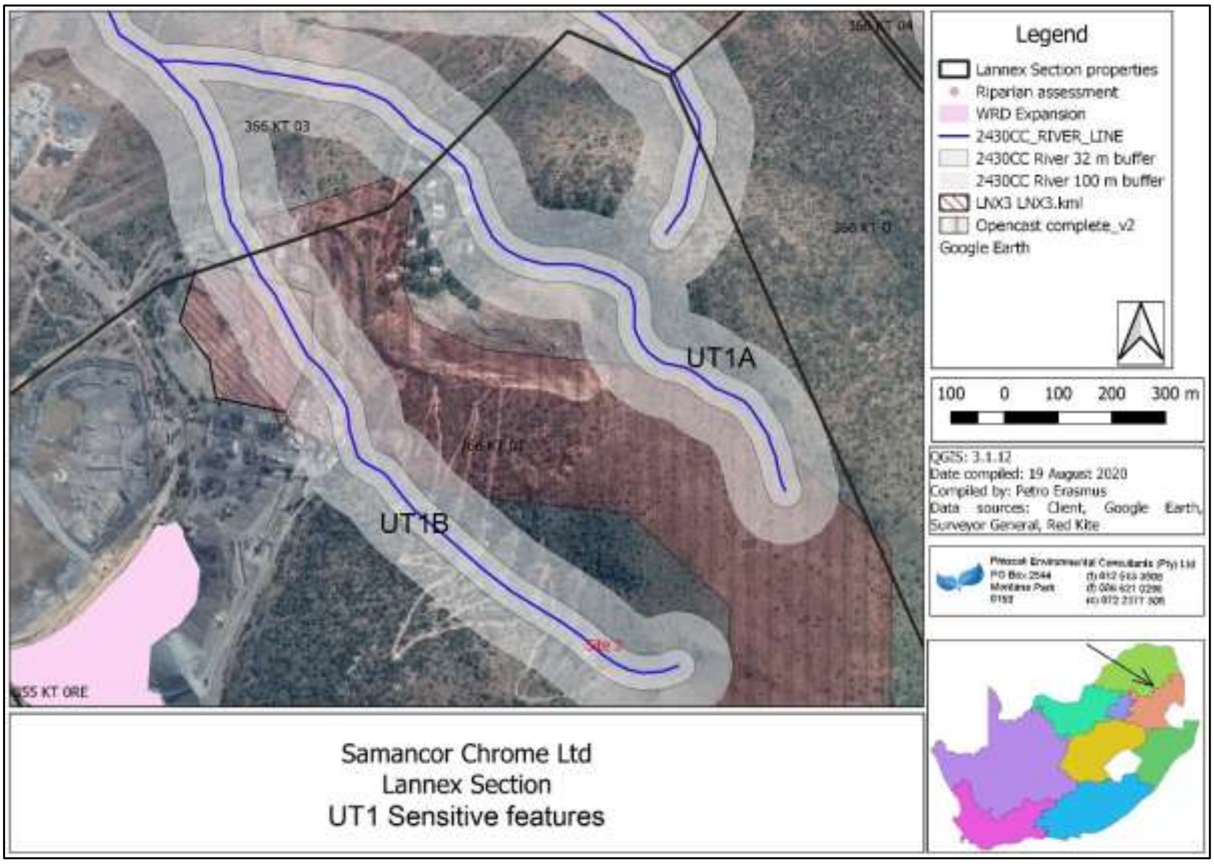

Figure 8-45: Sensitive features at UT1 (UT1A High sensitivity, UT1B Low sensitivity)

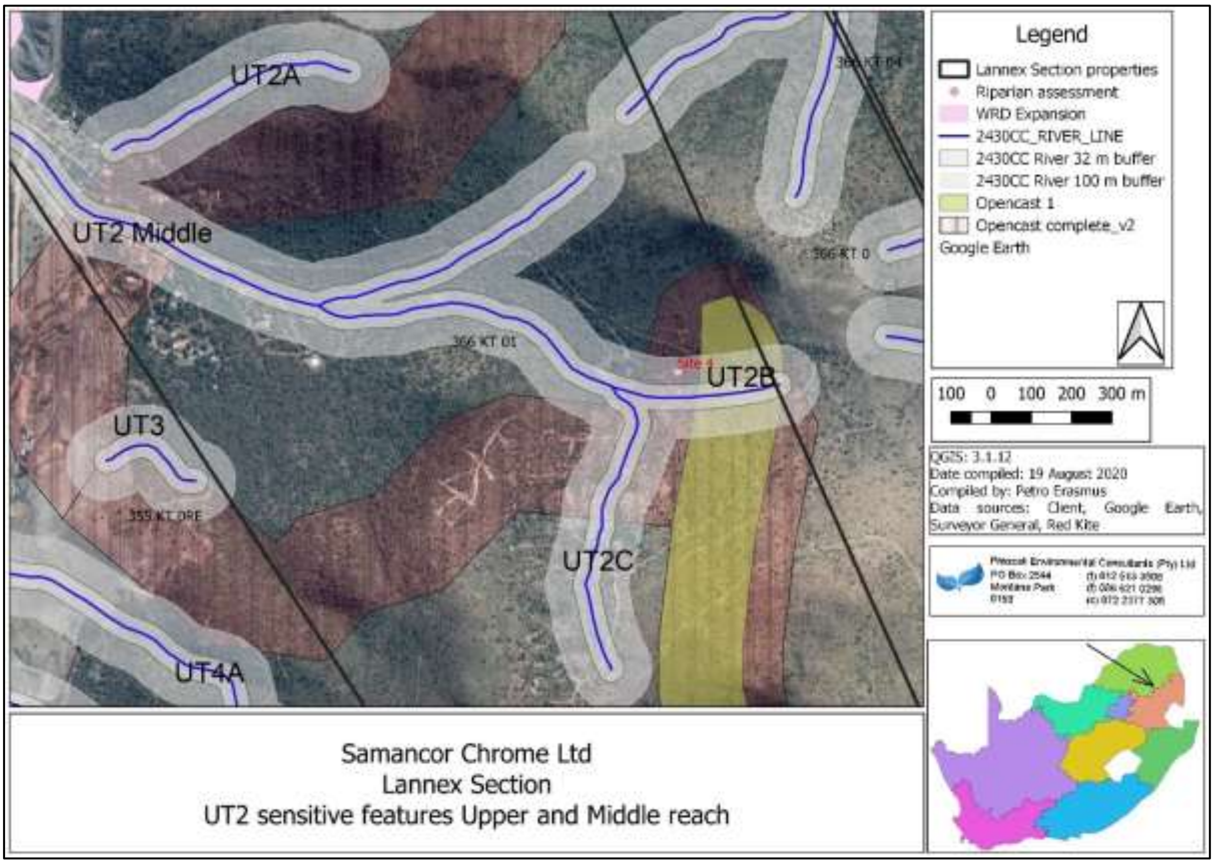

Figure 8-46: Sensitive features at UT2 – upper and middle reaches (High sensitivity) and UT3 Upper (Low sensitivity) and UT4A (Low sensitivity)

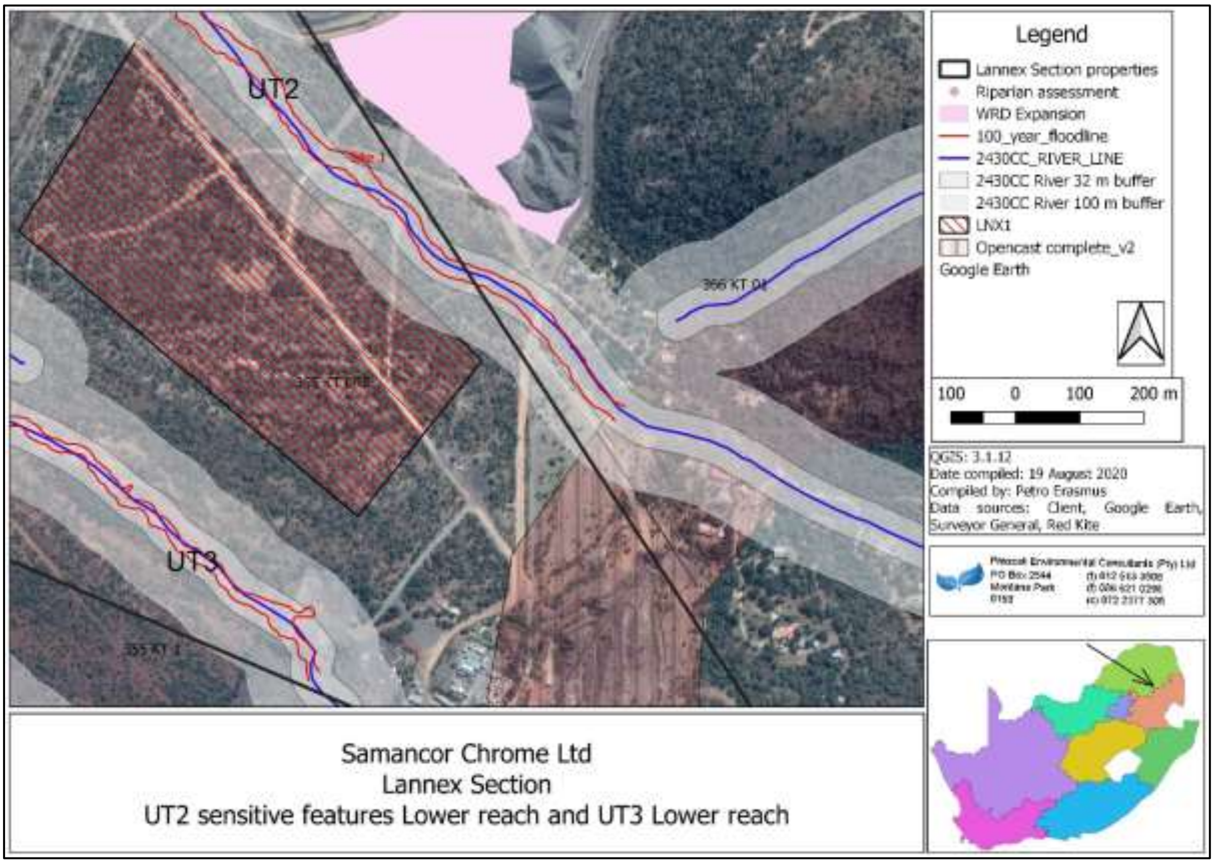

Figure 8-47: Sensitivity features at UT2 lower reach (Low sensitivity) and UT3 Lower reach (high Sensitivity)

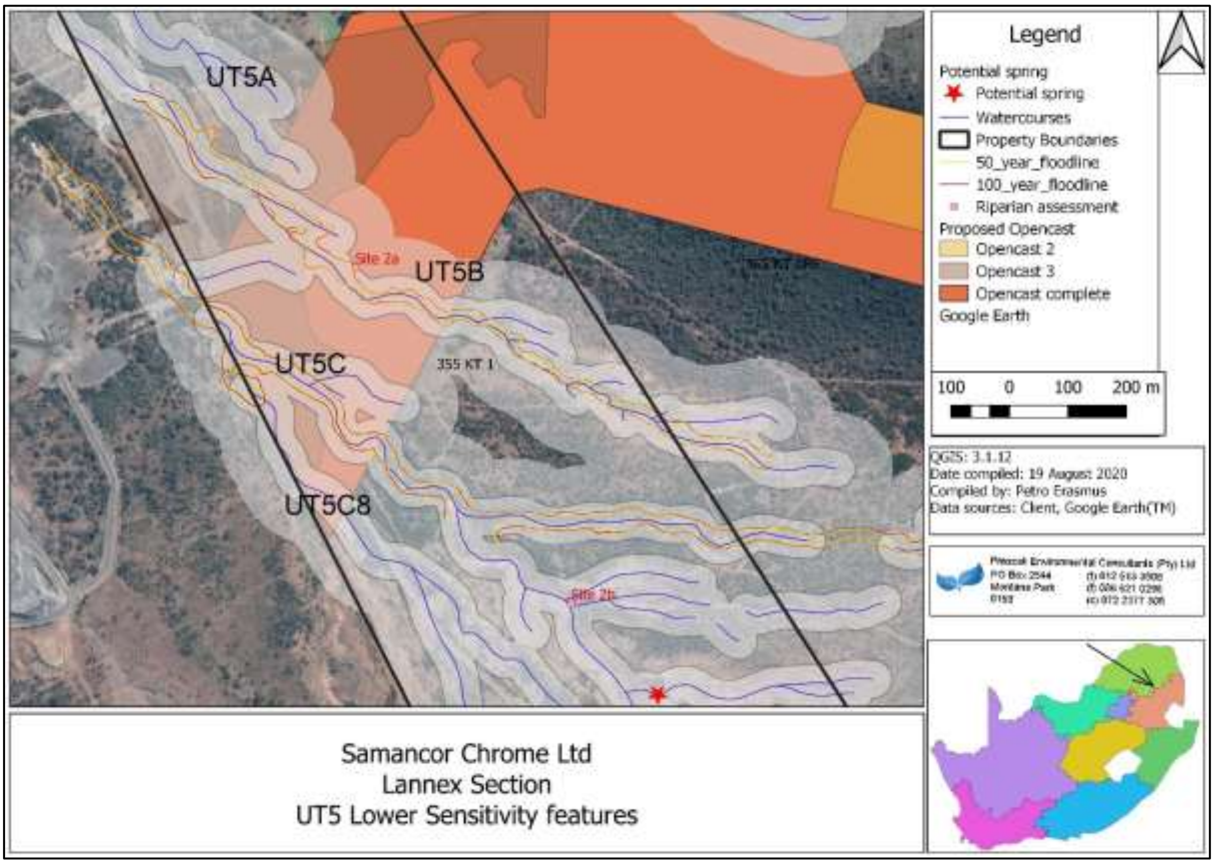

Figure 8-48: Sensitivity features for UT5 lower reach (UT5A – Low sensitivity; UT5B, C and Upper – High sensitivity)

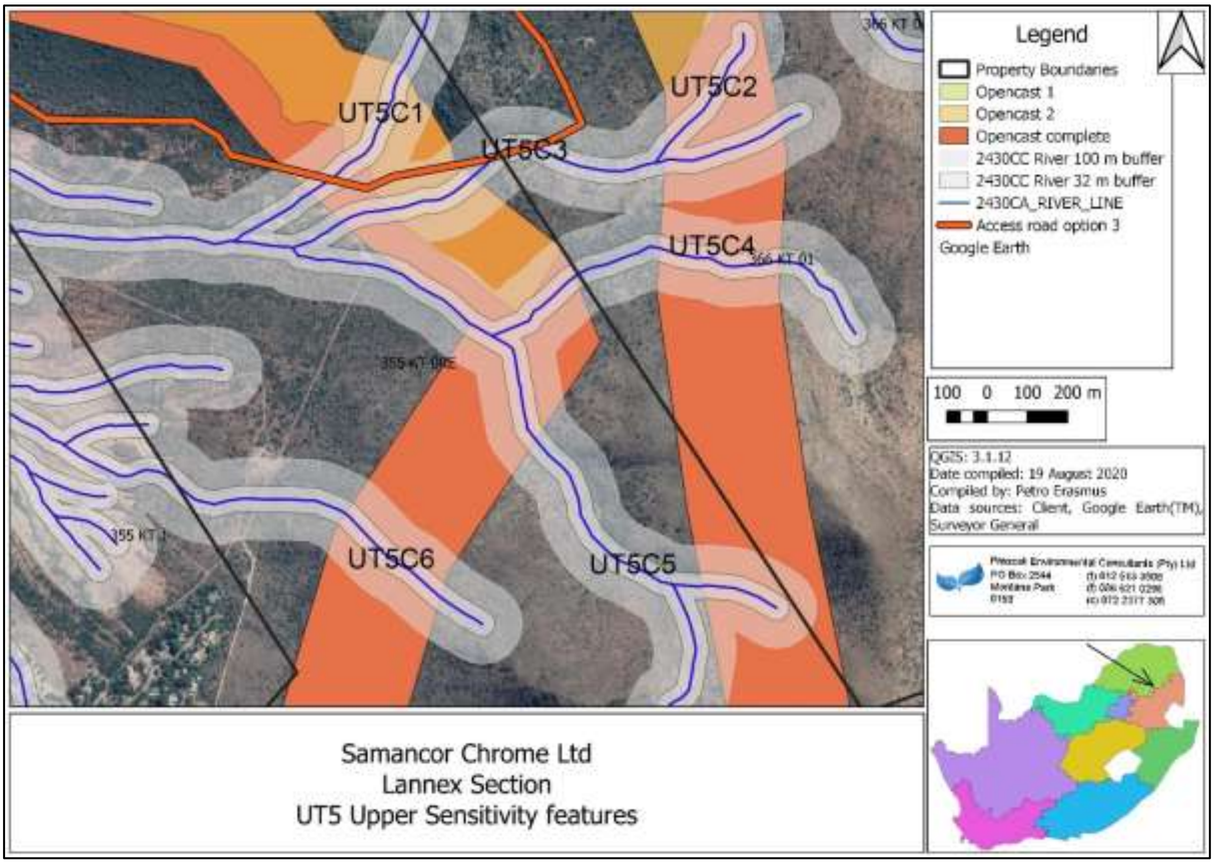

Figure 8-49: Sensitivity features for UT5 Upper reach (high sensitivity)

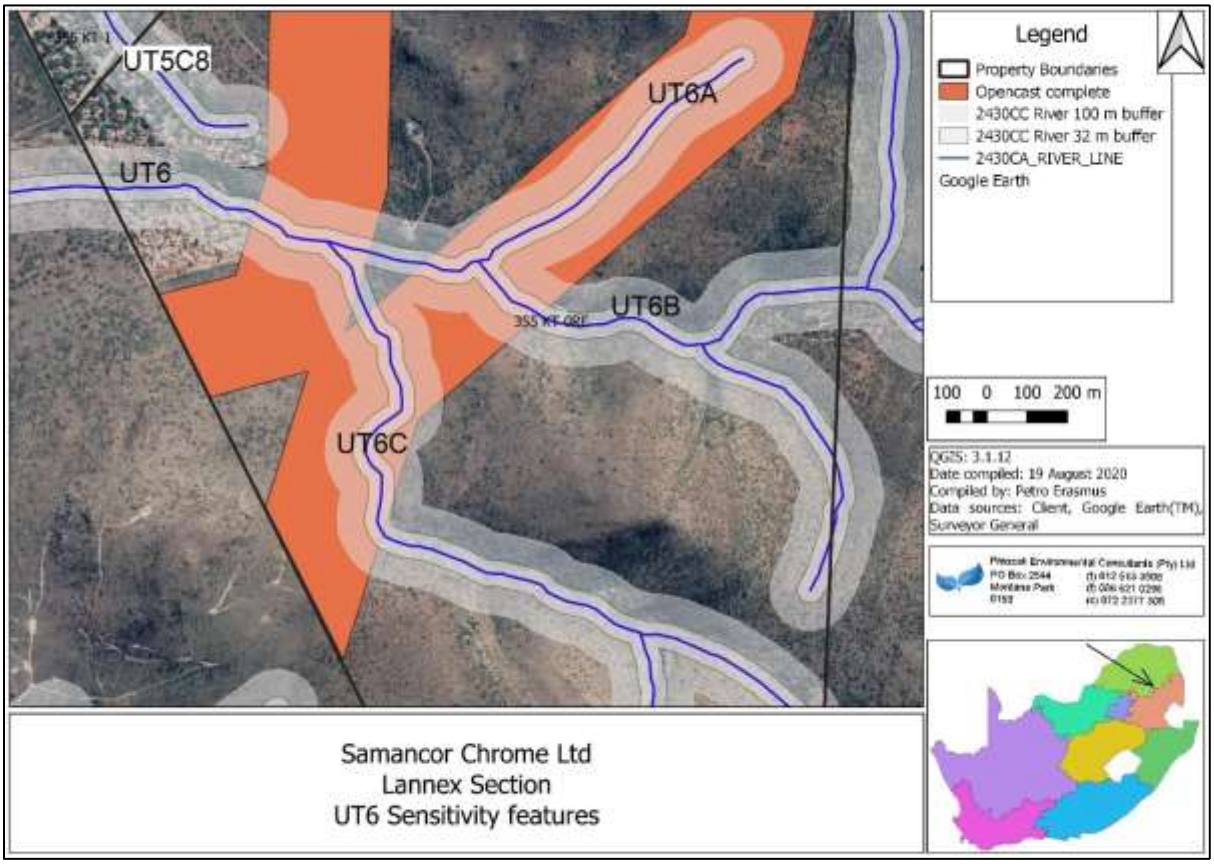

Figure 8-50: Sensitivity features for UT6 (UT5C8 – Low sensitivity, UT6 – High sensitivity)

8.6.6 Surface Water Uses

The surface water uses in the study area comprises of the Ecological Reserve, agricultural activities (informal irrigation, livestock watering), informal domestic use (washing of clothes and dishes), recreational use (swimming) and mining activities.

8.6.6.1. Water Authority

The Department of Water and Sanitation act as the Regional Water Authority through their office that is located in Lydenburg.

8.6.6.2. Water Use Authorisation

Lannex Section has a Water Use Licence (Licence Number 24014415) signed 22/07/2010 which is valid for 10 years (till 22 July 2020) for the following Water uses:

- Section 21(a) for the taking of water from underground for re-use;
- Section 21(g): for various activities, e.g. tailings dam, waste rock dump, return water dam; and
- Section 21(j) for the removal of water from underground.

Several new activities have been identified for inclusion into the new water use licence:

- Section 21(b) for instream dams upstream of opencast activities;
- Section 21(c) and (i) for existing bridges / culverts, river diversions and the impacts on drainage lines at the proposed opencast sections; and
- Section 21(g) for the new tailings and return and storm water dams.

8.7. GROUNDWATER

A Hydrogeological Impact assessment was compiled by GPT Global in November 2020 (See Appendix 5.5). Findings and baseline information is summarized below.

8.7.1 Hydrocensus

The hydrocensus was done as a site familiarisation exercise and the collection of data from the study area and surrounding environments. It comprised a census of key boreholes, wells, springs and any other groundwater related information.

8.7.2 Geophysical Survey

Geophysics to map preferential flow paths within the sub-surface as close as possible to the TSF. Please note that these methods can only be applied in areas where no sensitive receptors, power lines, metals and infrastructure are present.

A ground geophysical survey was conducted at the proposed LNX TSF1. The magnetic method was used. The data from this survey was used to interpret the location of geological structures which may act as preferential flow paths for groundwater.

8.7.3 Sampling and Chemical Analyses

8.7.4

8.7.4.1. Groundwater Sampling

Groundwater was sampled in accordance with the GPT's Standard Operating Procedure for groundwater sampling by bailing.

8.7.4.2. Groundwater Analysis

The following groundwater cation/anion parameters as listed in Table 8-27 were analysed by an accredited laboratory for interpretation.

Table 8-27: Groundwater Cation/Anion Parameters Analysed

Parameter

Physical Properties	Total Alkalinity
	pH
	Electrical Conductivity
	TDS by Calculation
Inorganic: Anions	Nitrite
	Nitrate
	Chloride
	Fluoride
	Sulphate
	Phosphate
Inorganic: Cations	Ammonia
	Calcium
	Magnesium
	Potassium
	Sodium
Inorganic: Other	HCO3
	Al
	Cr
	Cr6+
	Cu
	Fe
	Mn
	Si
	Zn

8.7.5 Groundwater Recharge Calculations

Recharge to the shallow, unconfined aquifer was calculated using the RECHARGE program developed by the Institute for Groundwater Studies at the University of the Free State, South Africa. The calculated recharge percentage equates to approximately 5 %.

Table 8-28: Groundwater Recharge Estimation

Method	mm/a	% of rainfall	Certainty (Very High = 5 ; Low = 1)
Chloride	19.90	3	4
Various schematic maps			
Soil	70.2	10.7	3
Geology	48.0	7.3	3
Vegter	65.0	9.9	2
Acru	20.0	3.0	2
Harvest Potential	4.0	0.6	3

8.7.6 Groundwater Modelling

Modelling was performed as a representation of a groundwater flow system and/or geochemical system that attempts to mimic the natural processes. It is therefore a simplified version of the natural system, compiled with geological, hydrogeological, hydrological and meteorological data, which utilises governing equations to incorporate all this data and simulates the hydraulic properties or geochemical properties of the system.

These models were utilised to provide a quantitative understanding of a groundwater system in terms of existing conditions as well as induced stresses, which inherently aids in the identification of cost-effective and efficient solutions to groundwater contamination and management challenges.

8.7.6.1. Numerical modelling

Numerical groundwater modelling is considered to be the most reliable method of anticipating and quantifying the likely impacts on the groundwater regime.

The finite difference numerical model was created using AquaVeo's Groundwater Modelling System (GMS10.0) as Graphical User Interface (GUI) for the well-established Modflow and MT3DMS numerical codes.

MODFLOW is a 3D, cell-centred, finite difference, saturated flow model developed by the United States Geological Survey. MODFLOW can perform both steady state and transient analyses and has a wide variety of boundary conditions and input options. It was developed by McDonald and Harbaugh of the US Geological Survey in 1984 and underwent eight overall updates since. The latest update (MODFLOW NWT) incorporates several improvements extending its capabilities considerably, the most important being the introduction of the new Newton formulation and solver, vastly improving the handling of dry cells which has proven to be problematic in the past.

8.7.6.2. Transport modelling

Transport modelling was performed using MT3DMS. MT3DMS is a 3-D model for the simulation of advection, dispersion, and chemical reactions of dissolved constituents in groundwater systems. MT3DMS uses a modular structure similar to the structure utilized by MODFLOW, and is used in conjunction with MODFLOW in a two-step flow and transport simulation. Heads are computed by MODFLOW during the flow simulation and utilized by MT3DMS as the flow field for the transport portion of the simulation.

8.7.7 Metal Leaching Potential

According to previous work done by (SRK, 2019), the waste rock leachate from Annex Grootboom (Lannex) waste rock is neutral (pH 6.9). Dissolved metal concentrations in the waste rock leachate are generally low with no metal concentrations above the Lannex WUL limits. The tailings leachate is alkaline (pH8.4). Aluminium (Al), Ba, Ca, Cl, Mg, Na, NO_3, SO_4 and TDS levels in the tailing's supernatant exceed the Lannex WUL limits. Groundwater quality monitoring data indicates that the groundwater is alkaline and impacted by mining activities with the Al, Ca, Cl, Ca, Mg, Mn, Na, NO_3, SO_4 and TDS levels above the Lannex WUL limits.

8.7.8 Waste Type and Landfill Disposal Requirements

Based on the TC and LC limits of the elements and chemical substances in the waste exceeding the corresponding TCT and LCT limits respectively, the study done by (SRK, 2019) identified the waste type as described below. The exceedance of the different threshold values determines the level of risk associated with the disposal of the waste to landfill. The waste assessed in terms of the Norms and Standards for Assessment of Waste for Landfill Disposal set in terms of Section 7(1) of the Act must then be disposed of to a licensed Landfill.

Table 8-29: Criteria, waste type and landfill disposal requirements

Criteria	Waste Type	Landfill Disposal Requirement
LC>LCT3 or TC>TCT2	Type 0	No disposal – treatment, and re-assessment required in terms of the Norms and Standards for Assessment of Waste for Landfill Disposal
LCT2<LC≤LCT3 or TCT1<TC≤TCT2	Type 1	Class A
LCT1<LC≤LCT2 and TC≤TCT1	Type 2	Class B
LCT0<LC≤LCT1 and TC≤TCT1	Type 3	Class C
LC≤LCT0 and TC≤TCT0	Type 4	Class D
TC>TCT2 and LC<LCT3	Type 1	Class A
LC<LCT0, irrespective of TC	Type 3	Class C

8.7.8.1. Waste Rock

The waste rock material for Annex Grootboom (Lannex) was classified as a Type 3 waste due to their total copper and nickel contents that exceeded TCT0 limits.

8.7.8.2. Tailings

According to previous studies, the Annex Grootboom (Lannex) tailings are Type 3 waste in terms of section 7(2) (d) of the N&S (No. R. 635) which states …"waste with any element or chemical substance concentration above the LCT0 but below or equal to the LCT2 limits and all TC concentrations below or equal to TCT1 limits (LCT0 < LC ≤ LCT1 and TC ≤ TCT1) are Type 3 wastes."

The constituents with TC and LC exceeding their TCT0 and LCT threshold limits include the following:

- Annex Grootboom – Total Ni and Zn, and leachable TDS, SO4 and NO3 as N.

Applying the Norms and Standards for Disposal of Waste to Landfill, the strict interpretation of this assessment is that the disposal of the Type 4 waste rock would require a barrier consistent with a Class D barrier system and the disposal of Type 3 waste rock and tailings would require a barrier consistent with a Class C barrier system.

8.7.9 GEOHYDROLOGY

According to the Appendix 5.5 the Rustenburg Layered Suite rocks typically act as secondary aquifers (intergranular and fractured rock aquifers with average yields ranging between 2 l/sec to 5 l/sec). However, the multi-layered weathering system present on these rocks could prove to have up to two aquifer systems present in the form of a shallow, saprolitic aquifer with a weathered, intergranular soft rock base associated with the contact of fresh bedrock and the weathering zone; and a fractured bedrock aquifer.

Rocks belonging to this Suite are characterised by a well-developed igneous layering and various rock units which form part of it, have a fairly uniform composition and may be traced over appreciable distances. The Suite consists mainly of mafic rocks including norite, gabbro, magnetite gabbro, anorthosite, pyroxenite and others. The groundwater potential is generally good with 42% of the successful boreholes yielding >2 l/s. Water occurs mainly in deeply weathered and fractured mafic rocks. Due to the relative high permeability of the weathered and fractured rock, these basins can be extremely good aquifers. Problems have been experienced in some of the mines outside the map area where large volumes of water are intercepted in fractured anorthosite at depths of 300m. Water is also obtained in fault and associated shear or fracture zones, contact zones and dyke contacts. The borehole yield analysis reveals that approximately 27% of 119 boreholes documented yield between 2 – 5 l/s, 26% yield between 0.5 – 2 l/s, 23% between 0.1 – 0.5 l/s, and 15% are stronger than 5 l/s. The median borehole yield is 1.0 l/s and the maximum encountered was 25 l/s.

Average hydraulic conductivity values used in earlier modelling studies for the different aquifer systems are given below in Table 8-30.

Table 8-30: Typical hydraulic conductivities for the mining area and neighbouring aquifer systems.

Aquifer	Average hydraulic conductivity (m/day)
Weathered	1.3
Alluvial	3
Bushveld Igneous Complex	0.003 – 0.05

8.7.10 GROUNDWATER LEVELS

During the hydrocensus, eight (8) boreholes were visited (Figure 8-52) and one (1) borehole was available for groundwater level measurement (8.69 mgbl). The remaining boreholes were equipped (had no access in measuring the water levels). It was recorded that these boreholes were mainly used for domestic purpose.

Groundwater level data was provided by the client for the entire monitoring period 2012 to 2019. A total of 14 boreholes were available for groundwater level measurement in June 2019. The groundwater levels varied between a minimum of 5 m and a maximum of 20 m below ground level (Table 8-31). The average depth to water level is 11.3 m. The relationship, using the boreholes from the current mine, is shown in Figure 8-51 below.

Table 8-31: Available groundwater level statistics

Groundwater level statistics	
Number of boreholes available	14
Number of boreholes with anomalous water levels	-
Min water level (mbgl)	5.36
Max water level (mbgl)	20.19
Mean water level (mbgl)	11.3

Usually a good relationship should hold between topography and static groundwater level. This relationship can be used to distinguish between boreholes with water levels at rest, and boreholes with anomalous groundwater levels due to disturbances such as pumping or local hydrogeological heterogeneities.

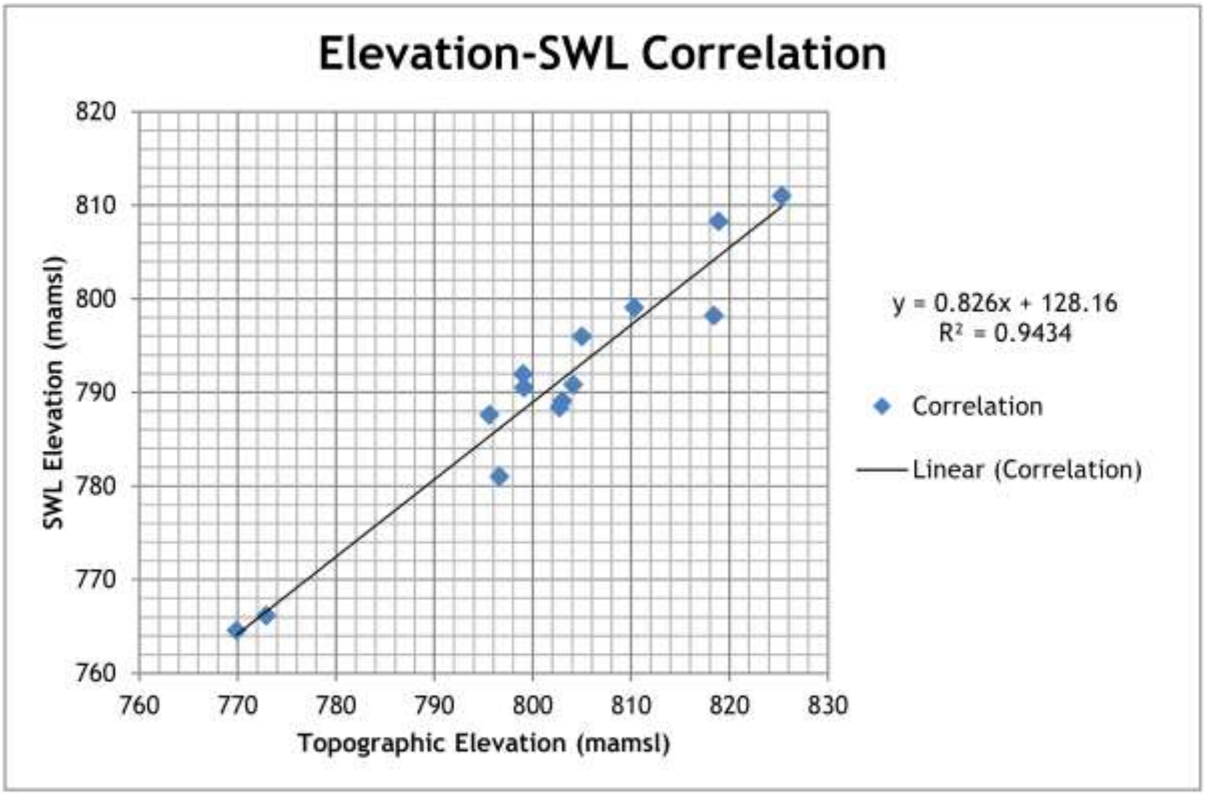

Figure 8-51: Correlation graph of topography vs available groundwater levels

This general relationship shows a good correlation with a regression value (R^2) of 0.9.

However, due to the heterogeneity of the subsurface, these relationships should not be expected to hold everywhere under all circumstances, and deviations could thus be expected.

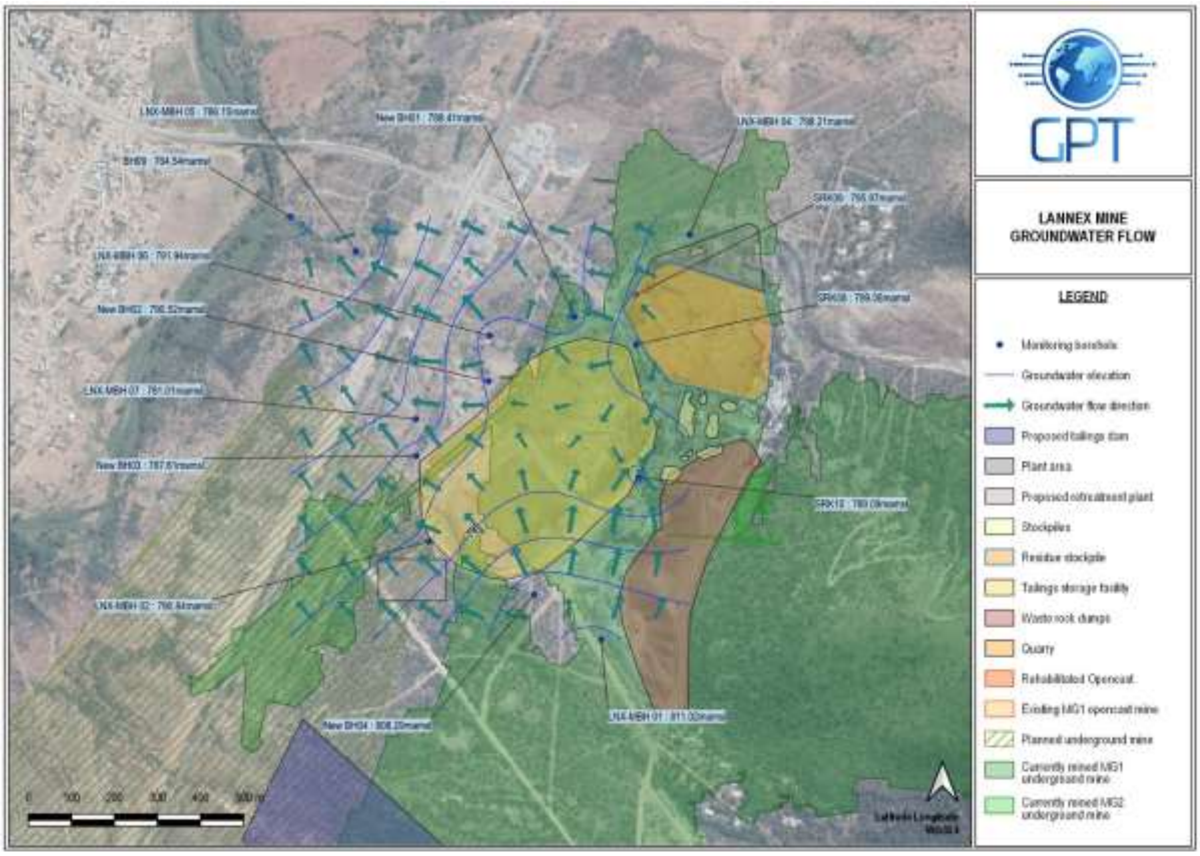

Figure 8-52: Groundwater Levels

8.7.11 GEOPHYSICS

In order to delineate and target geological structures that may act as preferential groundwater flow paths, a ground geophysical survey was conducted. The survey consisted of magnetic Traverses conducted at the planned footprint of the proposed LNX TSF1 site. The magnetic traverses were conducted using the magnetic (Geotron G5) method. The station spacing used with the magnetic method was 15 m.

The geophysical survey was conducted through three traverses. Data for the geophysical profiles are presented in Appendix C. Eight (8) subsurface anomalies were identified in the area within the planned LNX TSF1 site of mining. The details of the ground geophysical traverses conducted are given in Table 8-32.

The geophysical results indicate the presence of a horizontal sill and might act as preferential groundwater flow paths at these anomalies identified.

Table 8-32: Details of actual ground geophysical traverses conducted

Line No	Start Coordinate (ºWGS84)	End Coordinate (ºWGS84)	Traverse Length (m)	Anomalies Identified at (m)
Traverse 1	-24.782496, 30.168375	-24.776134, 30.163192	902	120, 405, 915, 960
Traverse 2	-24.775982, 30.165467	-24.778710, 30.163701	359	150, 255
Traverse 3	-24.782753, 30.168008	-24.780742, 30.169155	259	90, 210

8.7.12 GROUNDWATER QUALITY

8.7.12.1. Groundwater quality from hydrocensus boreholes

Water samples were collected from 8 boreholes around the site during the hydrocensus. The water results are compared with the maximum recommended concentrations for domestic use as defined by the SANS 241-1: 2015 target water quality limits. The SANS 241-1: 2015 standard is applicable to all water services institutions and sets numerical limits for specific determinants to provide the minimum assurance necessary that the drinking water is deemed to present an acceptable health risk for lifetime consumption. Colours of individual cells refer to the drinking water classification of the specific groundwater sample.

The results of the screening for groundwater are presented in Table 8-33 and discussed in the sections below.

8.7.12.2. Groundwater quality vs SANS standards

Nitrate as N concentrations are elevated in BH2, BH4, BH6 and BH8 possibly due to effluent from human and animal excreta. There are no formalised sewage systems and residents make use of pit latrines.

8.7.12.3. Health Effects on Human Health

- BH2: Methaemoglobinaemia may occur in infants. No effects in adults.
- BH4: Methaemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults.
- BH6: Methaemoglobinaemia may occur in infants. No effects in adults.
- BH8: Methaemoglobinaemia occurs in infants. Occurrence of mucous membrane irritation in adults.

8.7.12.4. Spatial analysis of groundwater quality

The pie diagrams (Figure 8-53) and Piper diagram (Figure 8-55) show both the individual ions present in a water sample and the total ion concentrations in meq/l or mg/l. They are useful in making quick comparisons between waters from different sources and present the data in a convenient manner for visual inspection. The following observations were made:

- The majority of boreholes in and around the active mining area have a HCO_3^- unpolluted shallow groundwater.

Table 8-33: Water qualities of hydrocensus boreholes compared to SANS 241

Parameter		Unit	SANS 241: 215 Recommended Limits	Risk	Results							
					BH1	BH2	BH3	BH4	BH5	BH6	BH7	BH8
Physical & Aesthetic Determinants												
Electrical conductivity at 25C	EC	mS/m	≤ 170	Aesthetic	77.1	106	36.4	121	113	124	96.9	133
Total Dissolved Solids	TDS	mg/litre	≤ 1200	Aesthetic	540	743	255	845	792	868	678	930
pH at 25C		pH units	≥ 5 to ≤ 9.7	Aesthetic	7.53	7.89	7.87	7.84	7.33	7.76	7.68	7.51
Chemical Determinants - Macro Determinants												
Nitrate as N	NO_3	mg/litre	≤ 11	Acute Health	4.38	16.6	0.221	20.1	10.4	14.8	7.65	46.5
Sulphate	SO_4	mg/litre	Acute health ≤ 500; Aesthetic ≤250	Acute Health/Aesthetic	23.3	36.4	13.5	35.1	46.5	65	28.6	104
Fluoride	F	µg/litre	≤ 1500	Chronic Health	193	122	149	123	94	95	117	49
Ammonia as N	NH_3	mg/litre	≤ 1.5	Aesthetic	0	0	0	0	0	0	0	0
Chloride	Cl	mg/litre	≤ 300	Aesthetic	42.7	77.7	20	104	111	109	80.3	111
Sodium	Na	mg/litre	≤ 200	Aesthetic	47.9	61.1	21	67.6	76.1	73.2	56.1	36.2
Zinc	Zn	µg/litre	≤ 5	Aesthetic	0	0	0	0	0	750	0	0
Total Iron	Fe	mg/litre	Acute health ≤ 2; Aesthetic ≤0.3	Acute/Aesthetic	0	0	0	0	0	0	0	0
Total manganese	Mn	mg/litre	Acute health ≤ 0.4; Aesthetic ≤0.1	Acute/Aesthetic	0	0	0	0	0	0	0	0
Aluminium	Al	µg/litre	≤ 300	Operational	0	0	0	0	0	0	0	0
Concentration deemed to present an unacceptable health risk for lifetime consumption.												

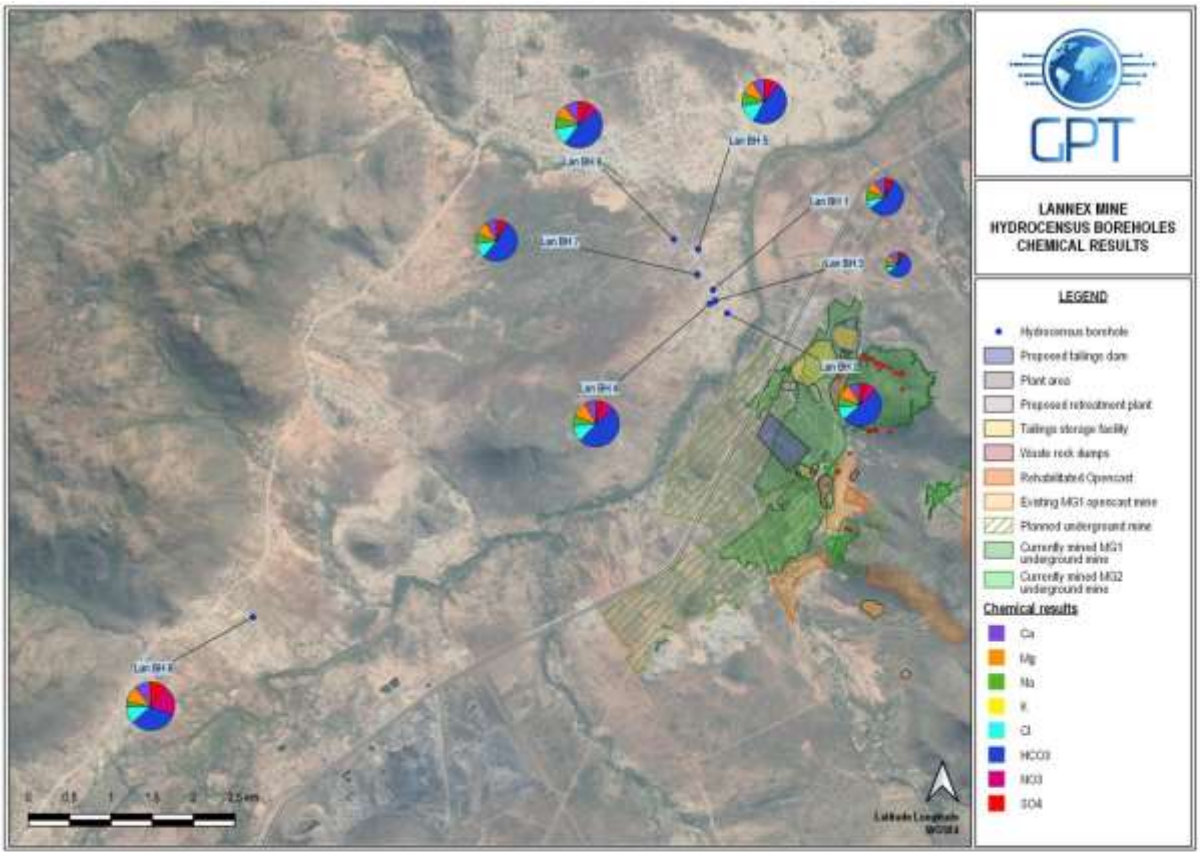

Figure 8-53 : Pie diagrams for groundwater samples taken during the hydrocensus (28 November 2019)

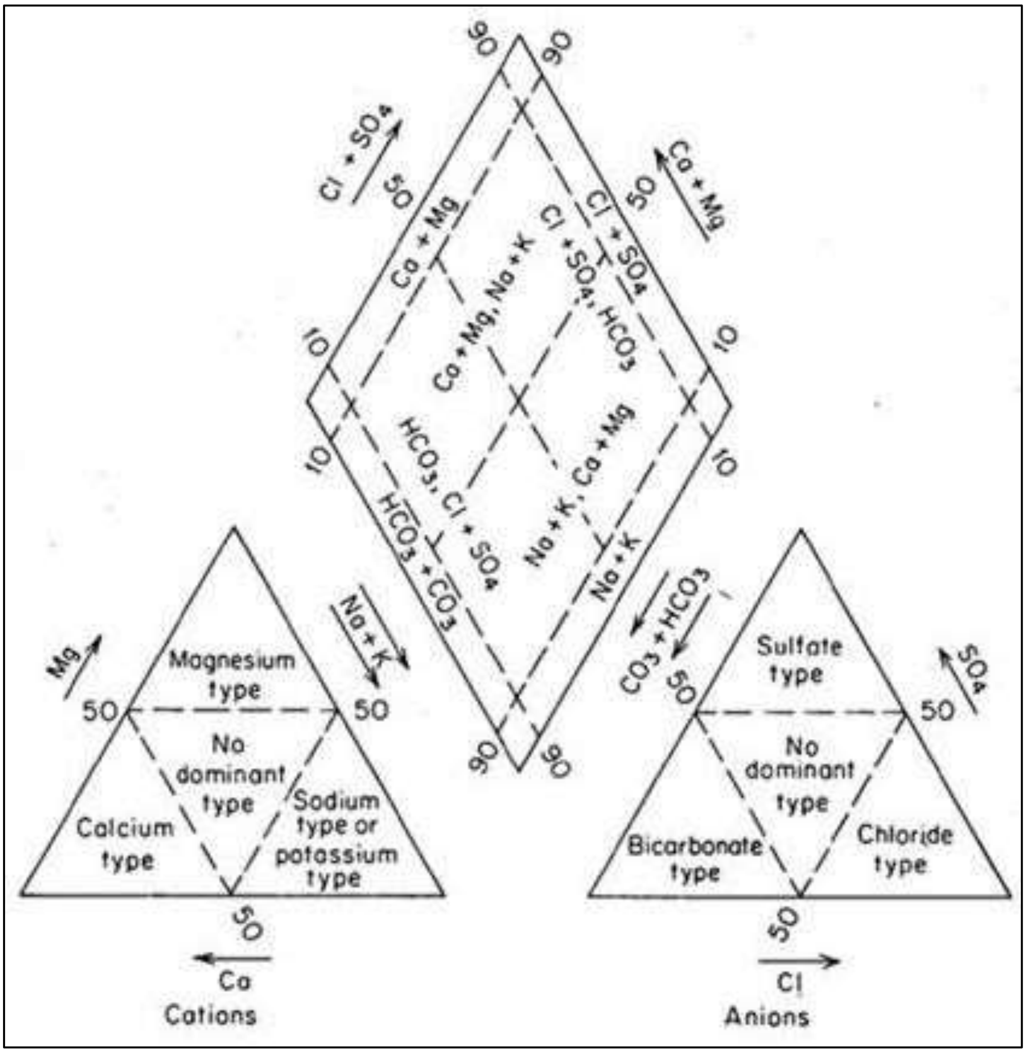

Figure 8-54: Explanation of the hydrochemical facies in the piper diagram

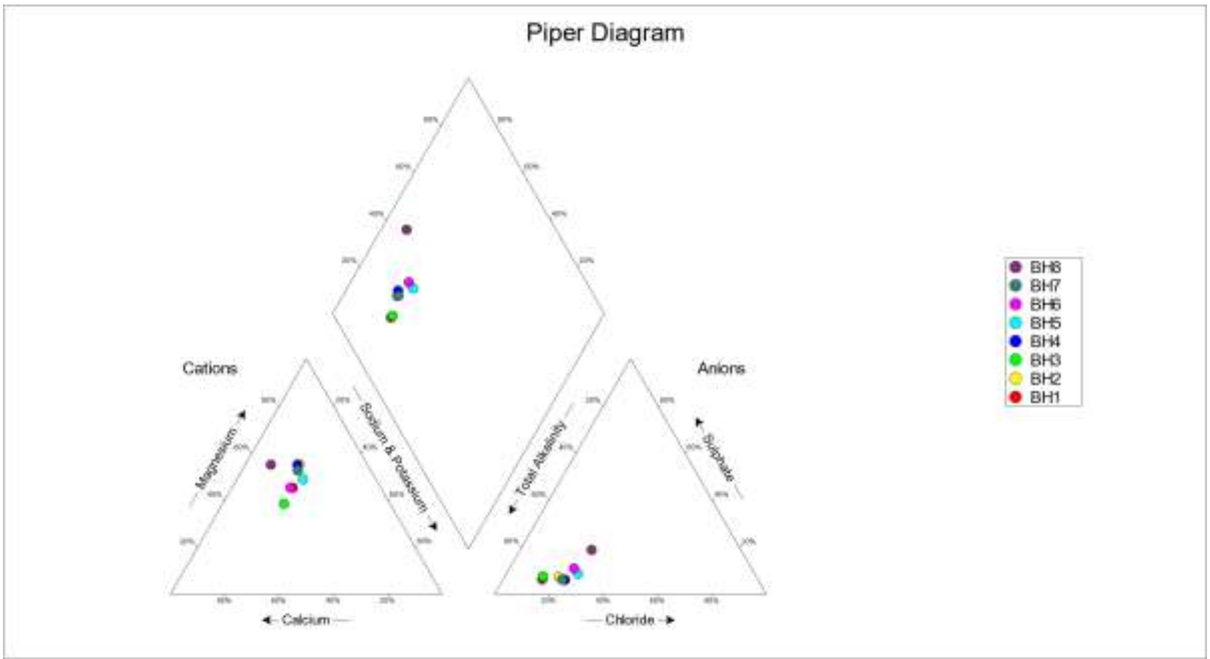

Figure 8-55: Piper diagram for hydrocensus boreholes (28 November 2019)

8.7.13 GROUNDWATER QUALITY DATA

Groundwater quality data was provided by the client up to date from October 2012 to June 2019. The monitoring positions for ground- and surface water are shown in Figure 8-56. The water results are compared with the maximum recommended concentrations for domestic use as defined by the SANS 241-1: 2015 target water quality limits. The SANS 241-1: 2015 standard is applicable to all water services institutions and sets numerical limits for specific determinants to provide the minimum assurance necessary that the drinking water is deemed to present an acceptable health risk for lifetime consumption. Colours of individual cells refer to the drinking water classification of the specific groundwater sample.

The results of the screening for groundwater are presented in Table 8-34 and discussed in the sections below:

8.7.13.1. Groundwater quality vs SANS standards

- EC levels exceed the limit in the majority of groundwater samples.
- TDS concentration exceeds the limit in the majority of groundwater samples.
- High EC and TDS levels have an aesthetic effect on water and are thought to be naturally occurring in the area.

8.7.13.2. Surface water quality vs SANS standards

- EC and TDS levels exceed the drinking water limit in samples, LNX-DS (dust suppression water), TNS Storm Water Dam, RWD-LNX (return water dam) and Tailings-LNX (tailings dam).
- Steelpoort River samples complied with drinking water standards for the targeted parameters.

8.7.13.3. Health Effects on Human Health

- TDS: Water has a marked, salty taste and would probably not be used on aesthetic grounds if alternative supplies are available. Consumption of water does not appear to produce adverse health effects in the short term.

8.7.13.4. Spatial analysis of groundwater quality

The pie diagrams (Figure 8-57) and Piper diagram (Figure 8-58) show both the individual ions present in a water sample and the total ion concentrations in meq/l or mg/l. They are useful in making quick comparisons between waters from different sources and present the data in a convenient manner for visual inspection. The following observations were made:

- The majority of boreholes in and around the active mining area have a HCO_3^-/Mg^{2+} signature, typical of unpolluted shallow groundwater.

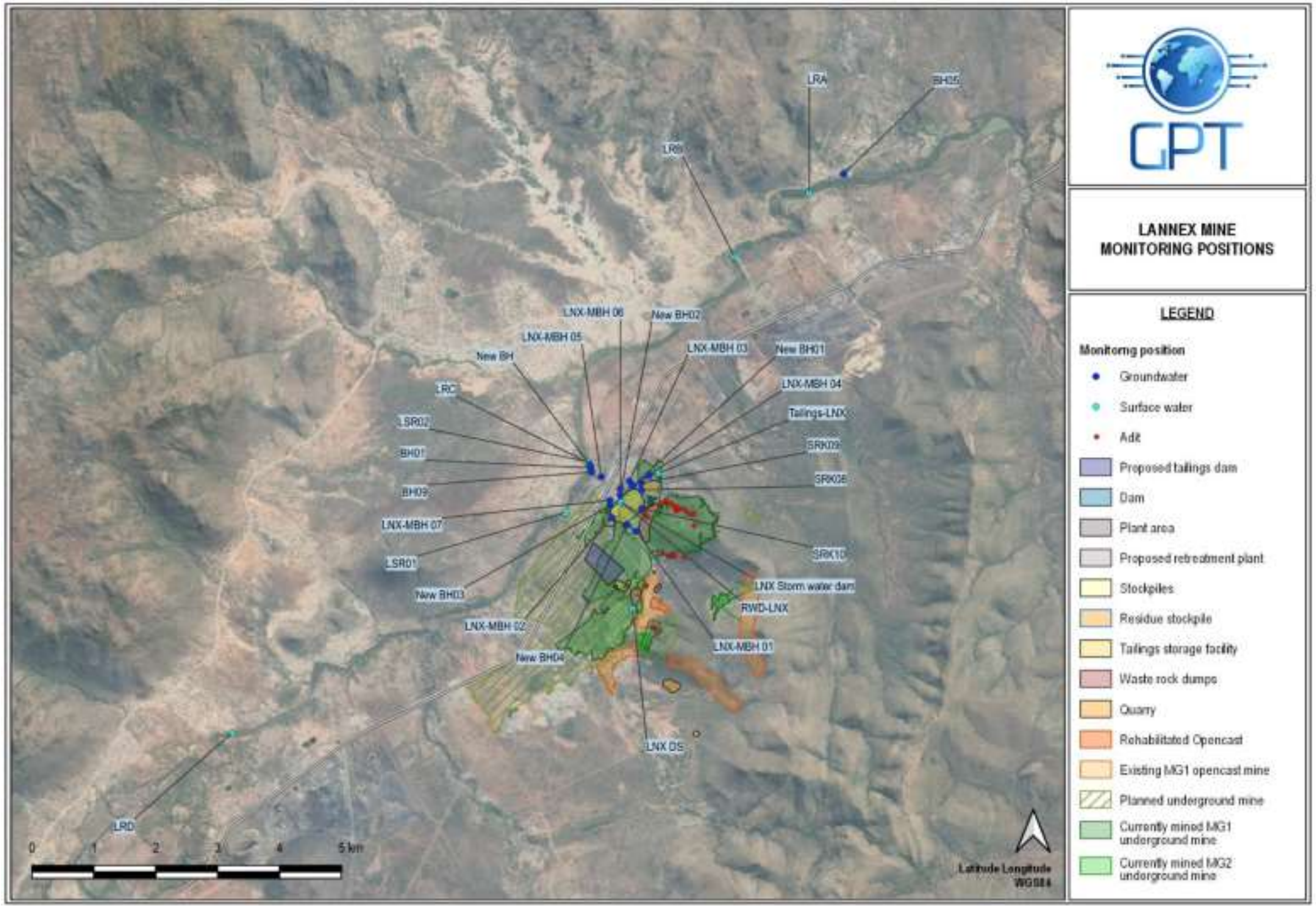

Figure 8-56: Ground and Surface water sampling positions (July 2019)

Table 8-34: Water qualities compared to SANS 241- 1: 2015 guidelines for human consumptions (26 June 2019)

Lannex		Groundwater Monitoring (June 2019)														Standard	
SANS 241:2015 Guidelines	Units	BH09	LNX-MBH 01	LNX-MBH 02	LNX-MBH 04	LNX-MBH 05	LNX-MBH 06	LNX-MBH 07	New BH01	New BH02	New BH03	New BH04	SRK08	SRK09	SRK10	SANS 241 Lower Limit	SANS 241 Upper Limit
Al	mg/l	BDL	0	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL		0.3
Alkalinity	mg/l $CaCO_3$	501	445	566	650	255	432	1313	408	516	347	487	626	926	411		
Ca	mg/l	87	136	121	152	16.6	88.1	97.2	135	102	53.6	102	142	104	78.9		
Cl	mg/l	189	115	170	236	100	212	218	180	208	61.8	99	271	83.2	105		300
Cr	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL		0.05
Cu	mg/l	0.018	0.02	0.019	0.018	0.016	0.019	0.018	0.018	0.02	0.016	0.019	0.022	0.017	0.018		
EC	mS/m	172	181	204	228	96.5	182	278	185	193	97.2	160	284	175	147		170
F	mg/l	BDL	0.534	BDL	BDL	BDL	BDL	0.557	BDL	BDL	1	BDL	BDL	BDL	BDL		1.5
Fe	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.3	2
K	mg/l	3.24	1.82	2.13	14	3.08	3.81	21.7	2.69	2.94	2.54	2.1	11.8	20.7	4.59		
Mg	mg/l	168	127	187	180	81	147	177	133	162	68.9	133	223	147	114		
Mn	mg/l	0.02	0.00	0.00	0.17	0.07	0.01	0.20	0.00	0.02	0.00	0.00	0.01	0.14	0.00	0.1	0.4
Na	mg/l	73.00	69.20	82.90	55.30	56.80	86.60	96.50	84.90	98.10	59.50	50.90	152.00	44.70	91.60		200
NO_3 as N	mg/l	6.7	72.6	35.5	2.9	-0.459	11	-0.459	26.8	8.72	11	49	85.1	-0.459	29.1		11
pH		8.15	7.41	7.5	7.98	8.19	7.88	7.61	7.66	7.74	8.63	7.59	7.52	7.44	7.65	5	9.7
Si	mg/l	26	36.6	34.8	23.3	1.81	21.4	25.4	36.1	34.7	30.4	37.9	38.9	30.9	33		
SO_4	mg/l	314	238	401	344	127	335	5.01	391	400	107	176	428	7.83	248	250	500
TDS	mg/l	1104	1264	1386	1440	480	1244	1608	1328	1112	548	1022	1992	892	994		1200
Zn	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL		5
Concentration deemed to present an unacceptable health risk for lifetime consumption																	
BDL = Below detection limit																	

Lannex		Surface Water Monitoring (June 2019)						Drinking Water Standard	
SANS 241:2015 Guidelines	Units	LNX DS	LNX Storm water dam	LSR01	LSR02	RWD-LNX	Tailings-LNX	SANS 241 Lower Limit	SANS 241 Upper Limit
Al	mg/l	BDL	BDL	BDL	BDL	BDL	BDL		0.3
Alkalinity	mg/l $CaCO_3$	274	206	137	147	243	231		
Ca	mg/l	76.7	57.9	27.6	28.3	63.9	65.9		
Cl	mg/l	223	143	14.5	14.4	166	161		300
Cr	mg/l	0.012	BDL	BDL	BDL	BDL	BDL		0.05
Cu	mg/l	0.021	0.018	0.006	0.006	0.019	0.017		
EC	mS/m	195	186	30.3	29.6	210	215		170
F	mg/l	BDL	0.47	BDL	BDL	BDL	0.559		1.5
Fe	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	0.3	2
K	mg/l	12.6	24.7	2.52	2.37	29.3	29.5		
Mg	mg/l	141	115	14.1	13.8	133	133		
Mn	mg/l	0.03	0.11	0.00	0.00	0.19	0.25	0.1	0.4
Na	mg/l	90.60	129.00	15.60	15.60	148.00	145.00		200
NO_3 as N	mg/l	93.2	67.9	0.479	0.488	76.2	89.6		11
pH		7.64	7.92	8.33	8.37	8.06	7.76	5	9.7
Si	mg/l	31.4	12.6	7.49	7.63	13.8	14.1		
SO_4	mg/l	136	388	14.8	11.6	402	472	250	500
TDS	mg/l	1332	1180	186	220	1344	1486		1200
Zn	mg/l	0.009	BDL	BDL	BDL	BDL	BDL		5
Concentration deemed to present an unacceptable health risk for lifetime consumption									
BDL = Below detection limit									

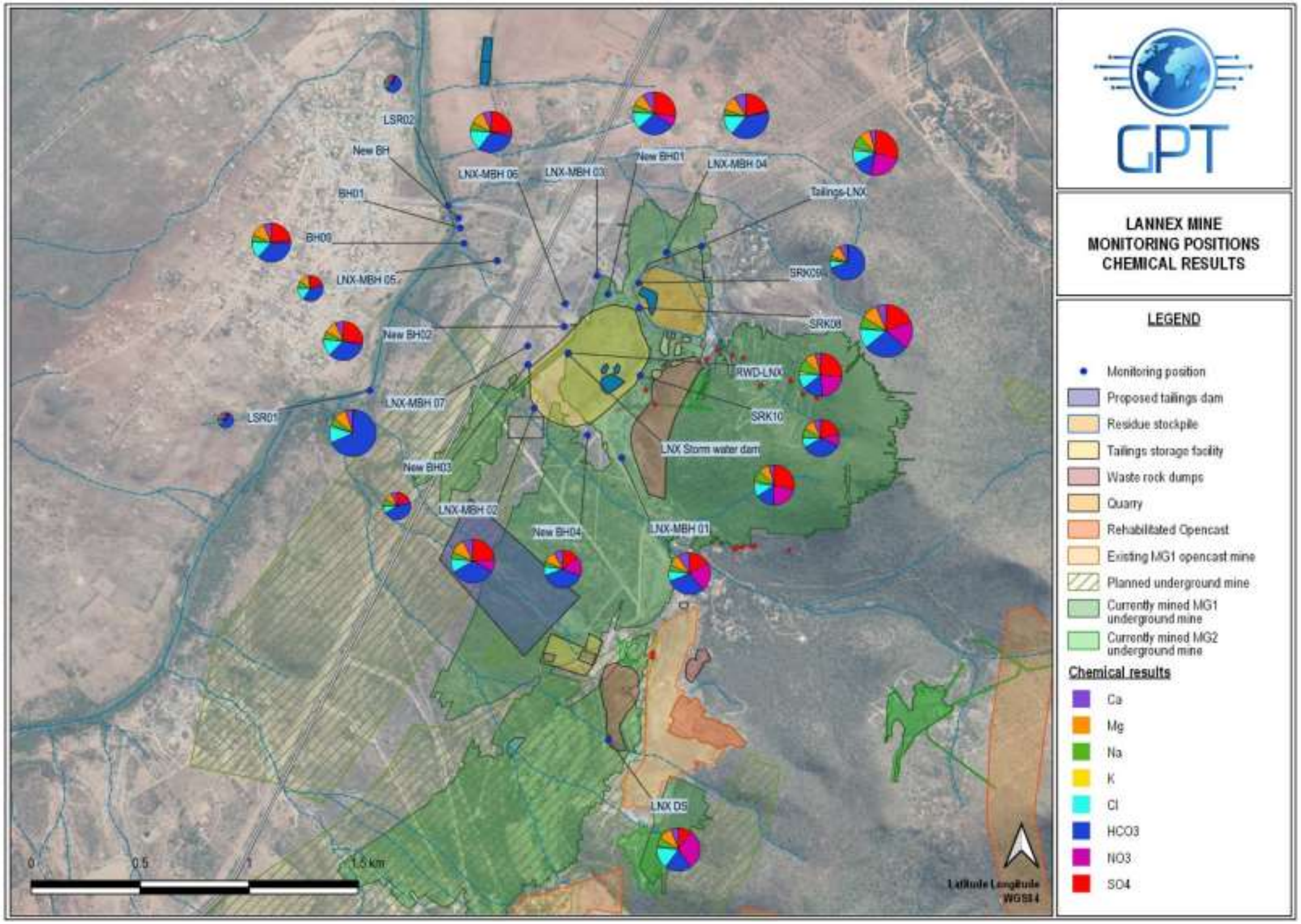

Figure 8-57: Pie diagrams for groundwater and surface water samples (June 2019)

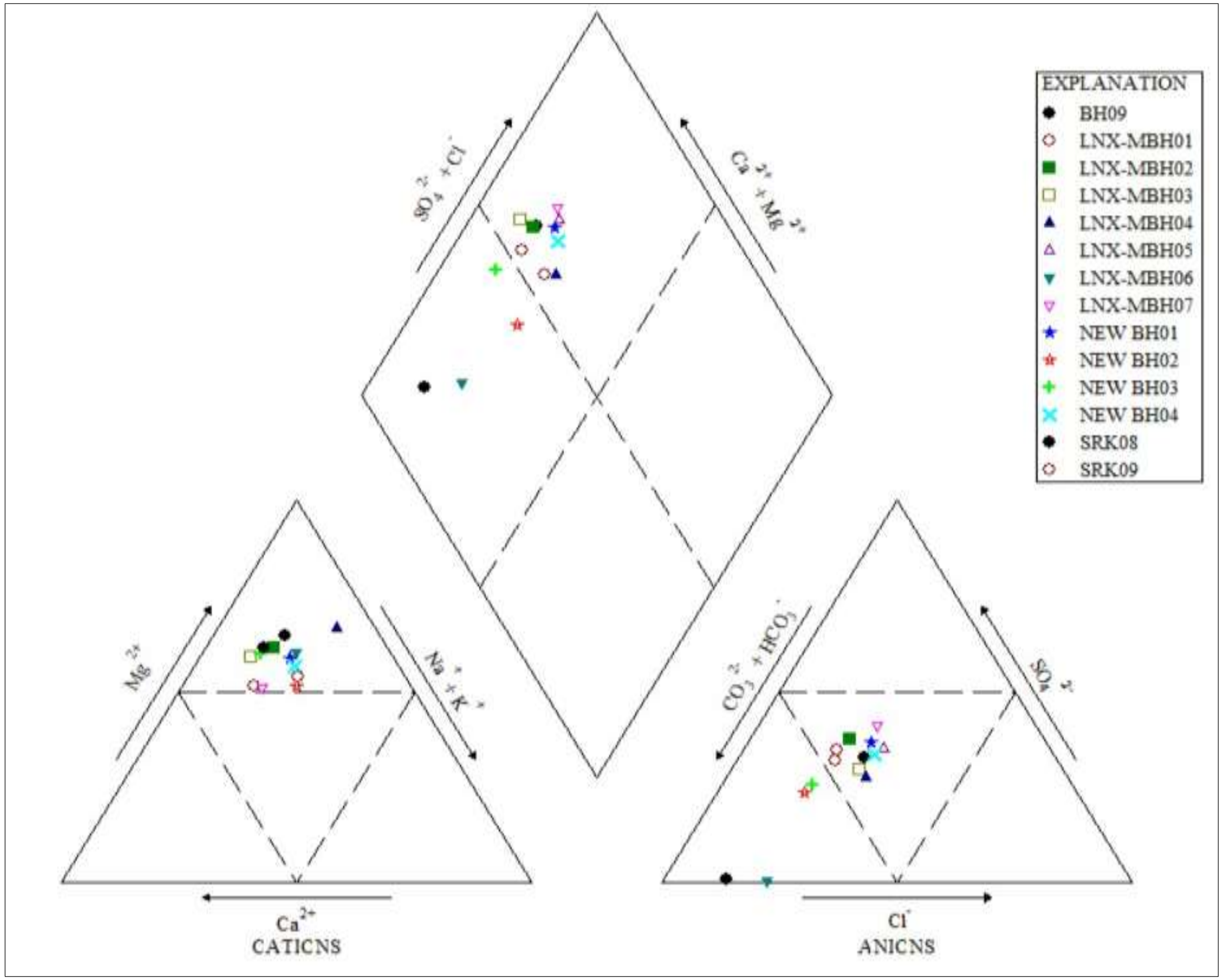

Figure 8-58: Piper Diagram

8.7.14 AQUIFER CHARACTERISATION

The term aquifer refers to a strata or group of interconnected strata comprising of saturated earth material capable of conducting groundwater and of yielding usable quantities of groundwater to boreholes and /or springs (Vegter, 1994). In the light of South Africa's limited water resources, it is important to discuss the aquifer sensitivity in terms of the boundaries of the aquifer, its vulnerability, classification and finally protection classification, as this will help to provide a framework in the groundwater management process.

8.7.14.1. Aquifer Vulnerability

Aquifer vulnerability assessment indicates the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer. Stated in another way, it is a measure of the degree of insulation that the natural and manmade factors provide to keep contamination away from groundwater.

- Vulnerability is high if natural factors provide little protection to shield groundwater from contaminating activities at the land surface.
- Vulnerability is low if natural factors provide relatively good protection and if there is little likelihood that contaminating activities will result in groundwater degradation.

The following factors have an effect on groundwater vulnerability:

- Depth to groundwater: Indicates the distance and time required for pollutants to move through the unsaturated zone to the aquifer.
- Recharge: The primary source of groundwater is precipitation, which aids the movement of a pollutant to the aquifer.
- Aquifer media: The rock matrices and fractures which serve as water bearing units.
- Soil media: The soil media (consisting of the upper portion of the vadose zone) affects the rate at which the pollutants migrate to groundwater.
- Topography: Indicates whether pollutants will run off or remain on the surface allowing for infiltration to groundwater to occur.
- Impact of the vadose zone: The part of the geological profile beneath the earth's surface and above the first principal water-bearing aquifer. The vadose zone can retard the progress of the contaminants.

The Groundwater Decision Tool (GDT) was used to quantify the vulnerability of the aquifer underlying the site using the below assumptions.

- Depth to groundwater below the site was estimated from water levels measured during the hydrocensus inferred to be at mean of ~12.63 mbgl.
- Groundwater recharge of ~18.5 mm/a (2.5 % recharge).
- Bushveld Igneous Complex vadose zone.
- Gradient of 5% were assumed and used in the estimation.

The aquifer vulnerability for a contaminant released from surface to a specified position in the groundwater system after introduction at some location above the uppermost aquifer was determined using the criteria described below and assuming a worst-case scenario:

- Highly vulnerable (> 60), the natural factors provide little protection to shield groundwater from contaminating activities at the land surface.
- Medium Vulnerable = 30 to 60%, the natural factors provide some protection to shield groundwater from contaminating activities at the land surface, however based on the contaminant toxicity mitigation measures will be required to prevent any surface contamination from reaching the groundwater table.
- Low Vulnerability (< 30 %), natural factors provide relatively good protection and if there is little likelihood that contaminating activities will result in groundwater degradation.
- The GDT calculated a vulnerability value of 51%, which is medium.

8.7.14.2. Aquifer Classification

The aquifer(s) underlying the subject area were classified in accordance with “A South African Aquifer System Management Classification, December 1995.”

The main aquifers underlying the area were classified in accordance with the Aquifer System Management Classification document[9]. The aquifers were classified by using the following definitions:

- Sole Aquifer System: An aquifer which is used to supply 50% or more of domestic water for a given area, and for which there is no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.
- Major Aquifer System: Highly permeable formations, usually with a known or probable presence of significant fracturing. They may be highly productive and able to support large abstractions for public supply and other purposes. Water quality is generally very good (Electrical Conductivity of less than 150 mS/m).
- Minor Aquifer System: These can be fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important for local supplies and in supplying base flow for rivers.
- Non-Aquifer System: These are formations with negligible permeability that are regarded as not containing groundwater in exploitable quantities. Water quality may also be such that it renders the aquifer unusable. However, groundwater flow through such rocks, although imperceptible, does take place, and needs to be considered when assessing the risk associated with persistent pollutants.

Based on information collected during the hydrocensus it can be concluded that the aquifer system in the study area can be classified as a “Sole Aquifer System”, based that an aquifer which is used to supply 50% or more of domestic water for a given area, and for which there is no reasonably available alternative sources should the aquifer be impacted upon or depleted. Aquifer yields and natural water quality are immaterial.

In order to achieve the Aquifer System Management and Second Variable Classifications, as well as the Groundwater Quality Management Index, a points scoring system as presented in Table 8-35 and Table 8-36 was used.

Table 8-35: Aquifer System Management and Second Variable Classifications.

Aquifer System Management Classification		
Class	Points	Study area
Sole Source Aquifer System:	6	6
Major Aquifer System:	4	
Minor Aquifer System:	2	
Non-Aquifer System:	0	
Special Aquifer System:	0 – 6	
Second Variable Classification (Weathering/Fracturing)		
Class	Points	Study area
High:	3	
Medium:	2	2
Low:	1	

Table 8-36: Ratings – Groundwater Quality Management (GQM) Classification System.

Aquifer System Management Classification		
Class	**Points**	**Study area**
Sole Source Aquifer System: Major Aquifer System: Minor Aquifer System: Non-Aquifer System: Special Aquifer System:	6 4 2 0 0 – 6	6
Aquifer Vulnerability Classification		
Class	**Points**	**Study area**
High: Medium: Low:	3 2 1	2

As part of the aquifer classification, a Groundwater Quality Management (GQM) Index is used to define the level of groundwater protection required. The GQM Index is obtained by multiplying the rating of the aquifer system management and the aquifer vulnerability. The GQM index for the study area is presented in Table 8-37.

The vulnerability, or the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer, in terms of the above, is classified as medium.

The level of groundwater protection based on the Groundwater Quality Management Classification:

GQM Index = Aquifer System Management x Aquifer Vulnerability
= 6 x 2 = 12

Table 8-37: GQM Index for the Study Area.

GQM Index	Level of Protection	Study Area
<1	Limited	
1 – 3	Low Level	
3 – 6	Medium Level	
6 – 10	High Level	
>10	Strictly Non-Degradation	12

8.7.14.3. Aquifer Protection Classification

A Groundwater Quality Management Index of 12 was estimated for the study area from the ratings for the Aquifer System Management Classification. According to this estimate a Strictly Non-Degradation level groundwater protection is required for the aquifer. Reasonable and sound groundwater protection measures based on the modelling will therefore be recommended to ensure that no cumulative pollution affects the aquifer, even in the long term.

DWA's water quality management objectives are to protect human health and the environment. Therefore, the significance of this aquifer classification is that measures must be taken to limit the risk to the following environments:

- The protection of the underlying aquifer.
- Groundwater users in and around the mine.
- The Steelpoort River and its associated ecological system including biodiversity.

8.8. AIR QUALITY

8.8.1 Regional Air Quality

South Africa is located in the sub-tropics where high pressures and subsidence dominate. However, the southern part of the continent can serve as a source of hot air that intrudes sub-tropics, and that sometimes lead to convective movement of air masses. On average, a low pressure will develop over the southern part of the continent, while the normal high pressures will remain over the surrounding oceans. These high pressures are known as Indian High-Pressure Cells and Atlantic High-pressure Cells. The intrusion of continents will allow for the development of circulation patterns that draw moisture (rain) from either tropics (hot air masses over equator) or from the mid-latitude and temperate latitudes.

Southern Africa is influenced by two major high-pressure cells, in addition to various circulation systems prevailing in the adjacent tropical and temperate latitudes. The mean circulation of the atmosphere over Southern Africa is anticyclonic throughout the year (except near the surface) due to the dominance of the three high pressure cells, namely South Atlantic High Pressure, off the west coast, the South Indian High Pressure off the east coast and the Continental High Pressure over the interior.

It is these climatic conditions and circulation movements that are responsible for the distribution and dispersion of air pollutants within the proposed Lannex Project area and between neighbouring provinces and countries bordering South Africa.

An Air Quality Impact Assessment was conducted by Eco Elementum in August 2020 Appendix 5.8. The following baseline information was established:

8.8.2 SENSITIVE RECEPTORS

Sensitive receptors identified in the immediate vicinity of the study area and proposed project area has been listed below:

- The town of Steelpoort; and
- Various informal settlements.

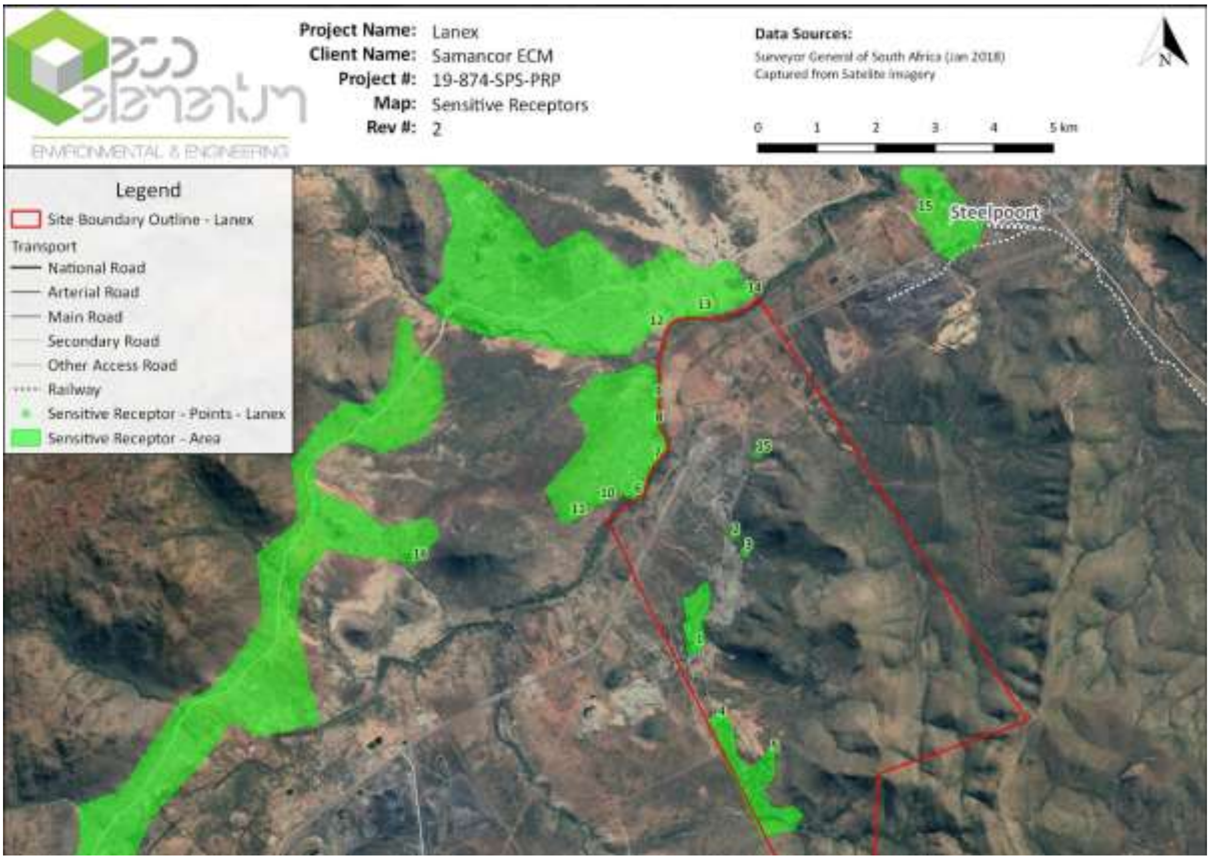

Figure 8-59: Sensitivity Receptors in the immediate area of the mining boundary

8.8.3 SOURCES OF EMISSIONS

8.8.3.1. Vehicle exhaust gases

Vehicle exhausts contain a number of pollutants including carbon dioxide (CO^2), carbon monoxide (CO), hydrocarbons, oxides of nitrogen (NOx), sulphur and PM_{10}. Tiny amounts of poisonous trace elements such as lead, cadmium and nickel are also present. The quantity of each pollutant emitted depends upon the type and quantity of fuel used, engine size, speed of the vehicle and abatement equipment fitted. Once emitted, the pollutants are diluted and dispersed in the ambient air. Pollutant concentrations in the air can be measured or modelled and then compared with ambient air quality criteria.

8.8.3.2. Veld fires

Veld fires are widespread across the world, occurring in autumn, winter and early spring. In addition to controlled burning for fire-breaks and veld management, many fires are set deliberately for mischievous reasons. Some are accidental, notably those started by motorists throwing cigarettes out of car windows. Emissions from veld fires are similar to those generated by coal and wood combustion. Whilst veld fire smoke primarily impacts visibility and landscape aesthetic quality, it also contributes to the degradation of regional scale air quality. Dry combustible material is consumed first when a fire starts. Surrounding live, green material is dried by the large amount of heat that is released when there are veld fires, sometimes this material also burns. The major pollutants from veld burning are particulate matter, carbon monoxide, and volatile organics. Nitrogen oxides are emitted at rates from 1 to 4 g/kg burned, depending on combustion temperatures. Emissions of sulphur oxides are negligible (USEPA, 1996).

8.8.3.3. Trucks passing on the Roads, Loading and Offloading raw materials

Dust emissions occur when soil is crushed by a vehicle, as a result of the soil moisture level being low. Vehicles used on the roads will generate PM_{10} emissions throughout the area and they carry soils onto the paved roads which would increase entrainment PM-10 emissions. The quantity of dust emissions from unpaved roads varies linearly with the volume of traffic.

8.8.3.4. Wind Erosion as a result of RoM Material and Topsoil stockpiles

The topsoil and waste rock stockpiles generated during the construction phase will be minimal and probably used for construction purposes on site (berm and foundations for buildings), reason being that this will be limited to the mining areas – since the project is mainly an opencast operation. At the ROM stockpile, there will be constant transfer of ore from the opencast to the stockpile.

8.8.3.5. Material Handling (Loading, Hauling and Tipping

Material handling during loading, hauling and tipping as mining processes has been known to have influence on dust generation in terms of increasing the fugitive dust emissions being generated. With the different kind of materials – topsoil, soft, and hard, tipping will be negligible. The tipping is mostly associated with the RoM at the processing plant vicinity. During these activities factors such as the surrounding wind regime, the material tipping rate, and the moisture content of the material all have an influence on the dust generation at the tipping transfer points.

8.8.3.6. Other Mining Activities

Other mining operations in the area contribute to emissions in the project area, the following can be likely sources:

- Particulate emissions generated due to wind erosion from exposed areas;
- Material handling; and
- Vehicle entrained dust on paved and unpaved road surfaces.

Figure 8-60: Predicted average annual concentrations for PM10 for the proposed Lannex project when unmitigated

Figure 8-61: Predicted average annual concentrations for PM_{10} for the proposed Lannex Project operations when mitigated

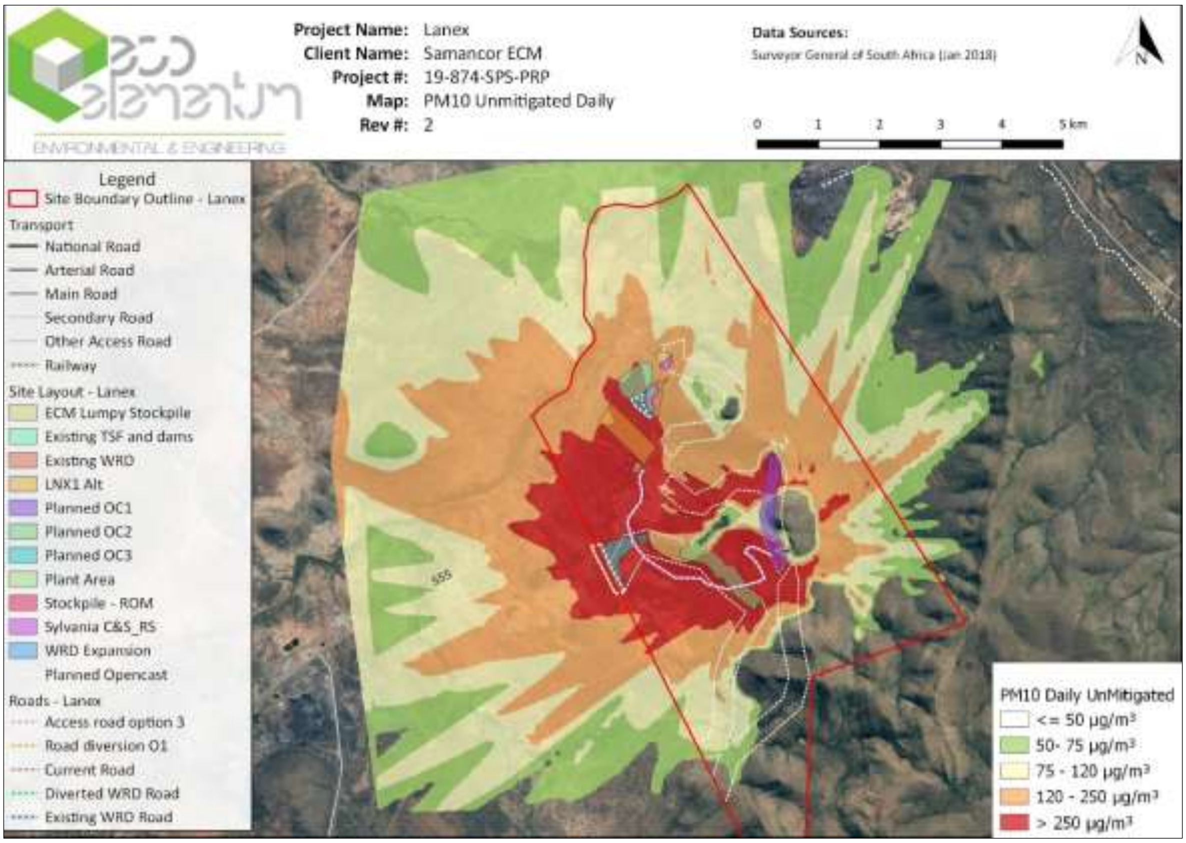

Figure 8-62: Predicted 2nd Highest daily concentrations for PM_{10} for the proposed Lannex project when unmitigated

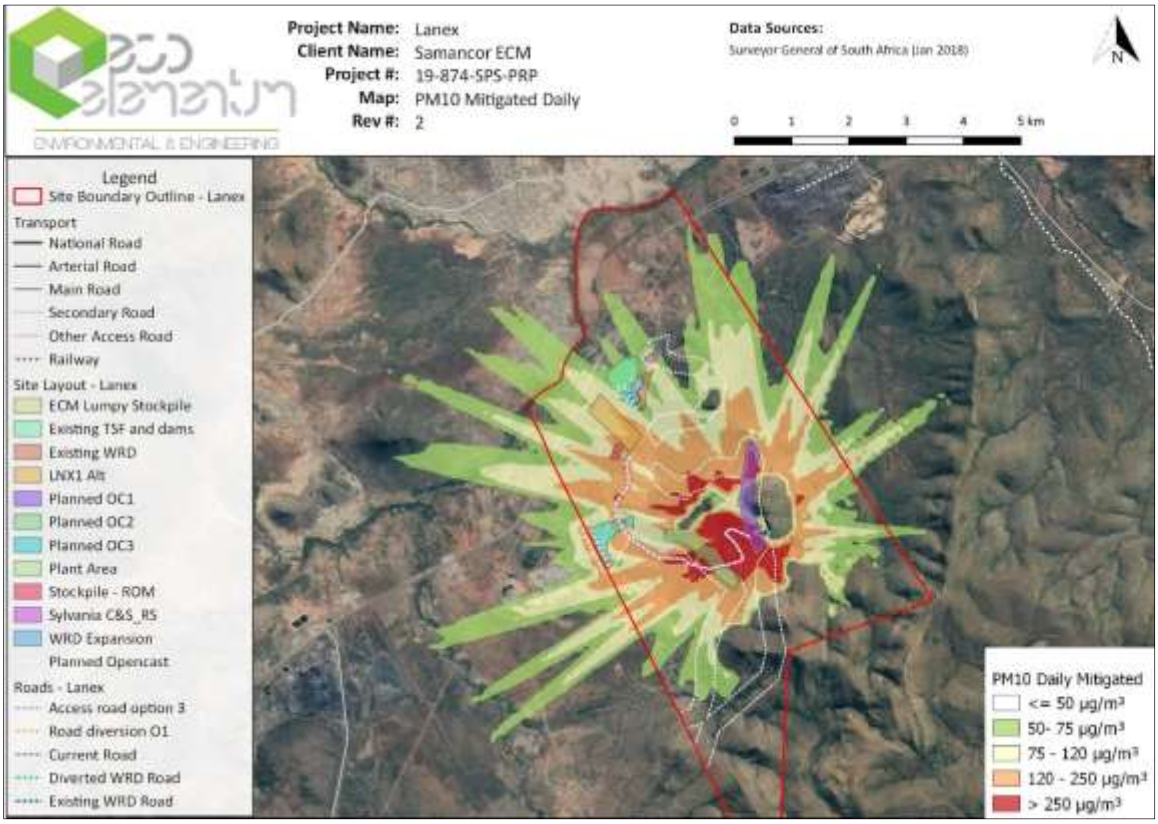

Figure 8-63: Predicted 2nd highest daily concentrations for PM_{10} for the proposed Lannex project operations when mitigated

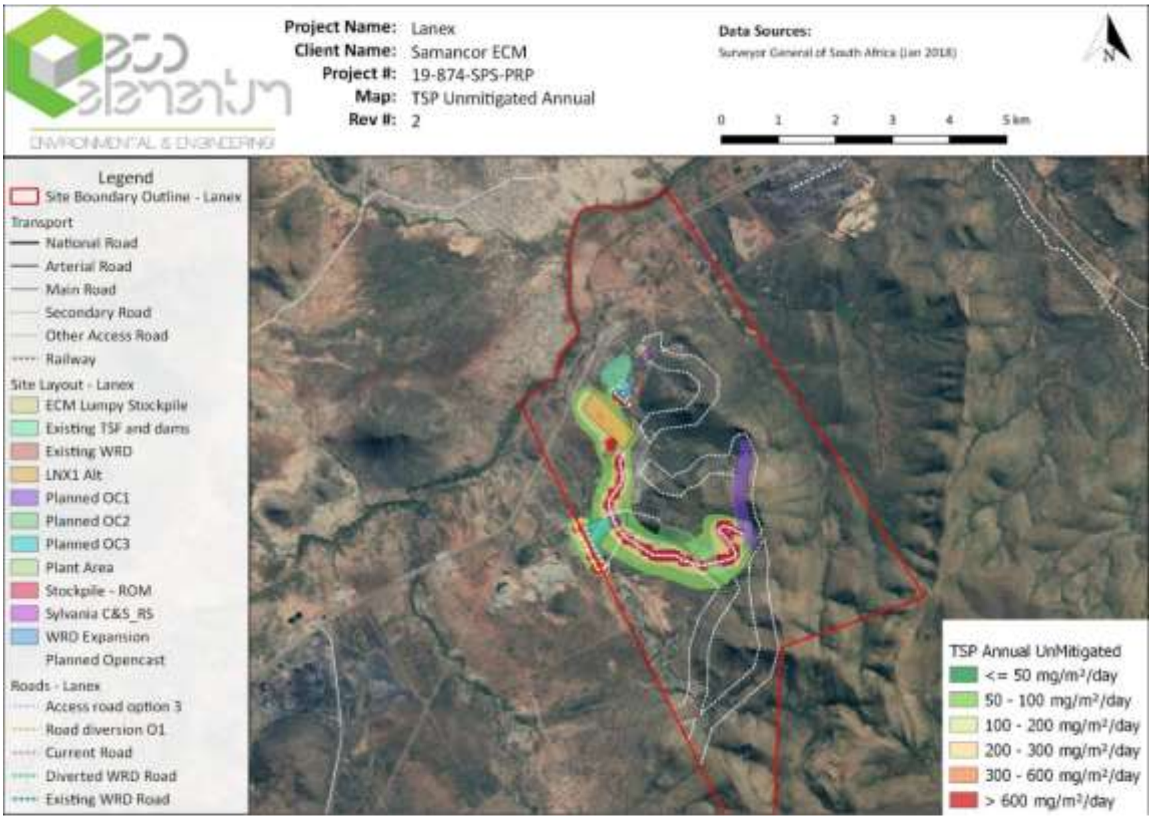

Figure 8-64: Predicted average annual deposition for TSP for the proposed Lannex project operations when unmitigated

Figure 8-65: Predicted average annual deposition for TSP for the proposed Lannex operations when mitigated

Figure 8-66: Predicted highest monthly deposition for TSP for the proposed Lannex Operations when unmitigated

Figure 8-67: Predicted highest monthly deposition for TSP for the proposed Lannex project operations when mitigated

8.9. NOISE

8.9.1 AMBIENT INFORMATION FROM 2013

An ambient noise assessment was conducted for 2013 EMPr by Francois Malherbe of Acoustic Consultants and a summary is presented below.

Ambient noise levels were measured around the site in order to gain insight into the noise caused by the mining operation attenuates over distances in each specific environment.

Noise is accepted to mean any acoustic phenomenon perceived as disagreeable or disturbing by an individual or group, and it may therefore be defined as any unwanted sound or sound that is loud, unpleasant or unexpected. Noise impact may be understood to mean one of a combination of negative physical, physiological or psychological responses experienced by individuals, whether consciously or unconsciously, caused by exposure to sound. There will be an impact when individuals or groups are limited or prevented from undertaking their normal activities, where communication is inhibited, where sleep is disturbed or where aural health is detrimentally affected.

Noise nuisance/disturbance can result from either a continuous unacceptable level of noise, from intrusive single events or from a combination of both. The stage at which noise becomes unacceptable to an individual or community depends on the total noise exposure and the activity that the receiver is involved in. This means that someone who is engaged in a particular activity and is exposed to a fluctuating noise over a certain period can be expected to react in a similar way to someone exposed to a dosage of noise at a constant level which produces the same energy over the same period.

The ambient noise level near the R555 is dominated by road traffic, with relatively quiet periods in between. The measured ambient noise level of 51, 5 dBA is well within the limit of 70 dBA set for industrial areas by SANS 10103.

The ambient noise level in the pit area of Lannex open cast mine is very high, i.e.74.4 dBA and is dominated by the noise emissions from diesel powered earth moving and mining equipment. It must be noted that at such locations the issue of noise is not controlled by the guidelines of SANS 10103, but by the legally binding SANS 10083. This is due to the fact the in these areas hearing conservation takes precedence over issues related to environmental noise.

The distance between the main receptor (residential areas) and the actual mining activities is at present quite large, and the intervening ground cover provides for acoustically ‘soft’ ground conditions. Consequently, the current noise levels are not sufficiently high to cause a significant disturbance. However, depending on the equipment used and the proximity of future mining operations the ambient noise levels are likely to increase.

8.9.2 AMBIENT NOISE ASSESSMENT 2020

A Noise impact assessment was conducted by Enviro Acoustic Research in 2020 (see Appendix 5.9) for the proposed Lannex project. The baseline information compiled is detailed below.

8.9.2.1. Sound measurements - procedure

Ambient (background) noise levels were measured from 10 - 12 June 2020 in accordance with the South African National Standard SANS 10103:2008 "***The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication***" considering the protocols defined in GG 43110. The protocol defined the SANS guidelines to be used and time periods (in which measurements must be collected), with the guidelines specifying the acceptable techniques for sound measurements including:

- type of equipment (Class 1);
- minimum duration of measurement;
- microphone positions and height above ground level;

- calibration procedures and instrument checks; and
- supplementary weather measurements and observations.

Ambient sound levels were measured at two locations using two class-1 Sound Level Meters (SLMs) – the measurement localities are presented in Figure 8-68. The SLMs would measure “average” sound levels over 10-minute periods, save the data and start with a new 10 minute measurement till the instrument was stopped.

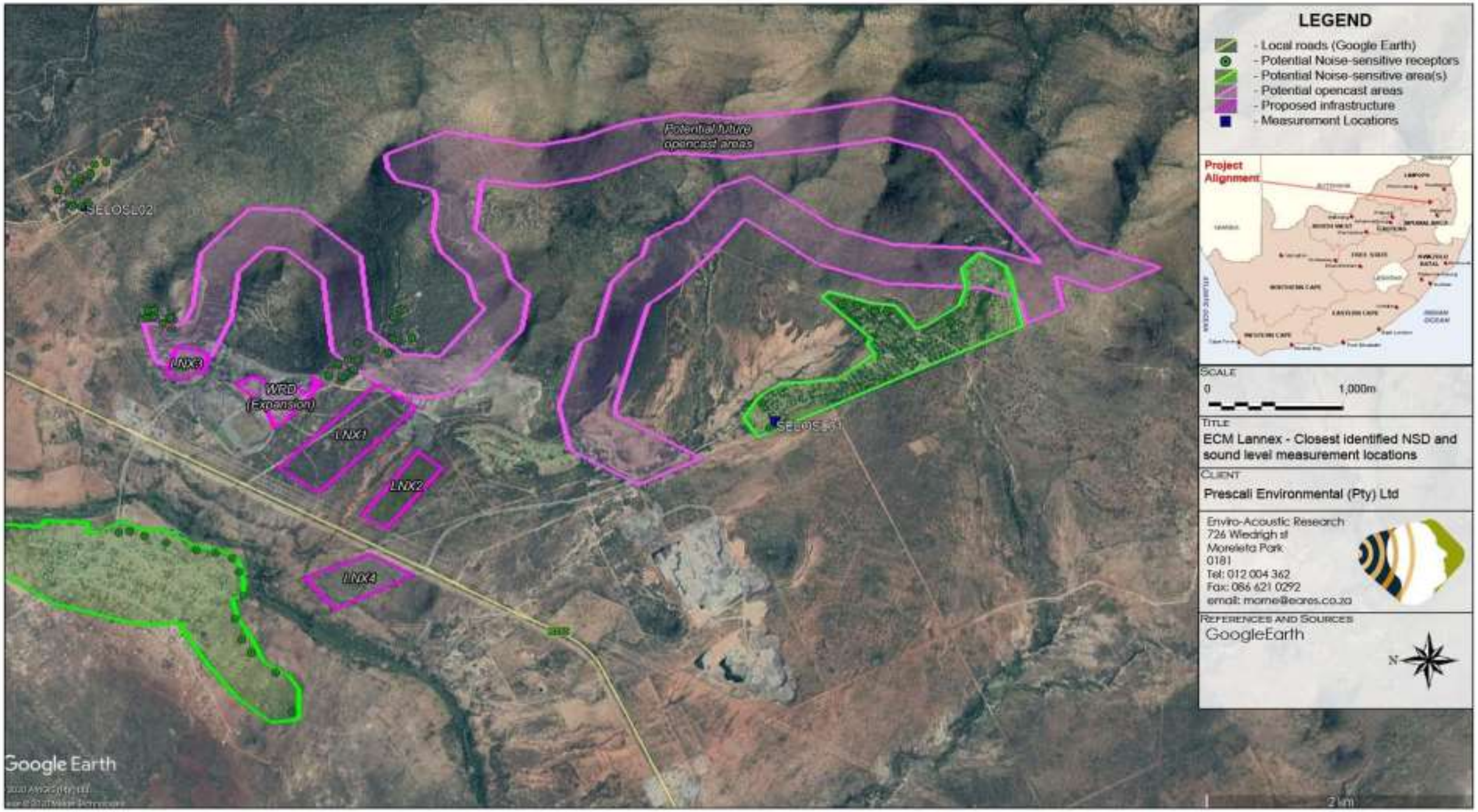

Figure 8-68: Localities where ambient sound levels were measured

8.9.2.2. Long-term Measurement Location SELOSL01: Tubatse Village

The equipment defined in Table 8-38 was used for gathering data.

Table 8-38: Equipment used to gather data (Svan 977) at SELOSL01

Equipment	Model	Serial no	Calibration Date
SLM	Svan 977	34160	March 2020
Pre-amplifier	SV 12L	32395	March 2020
Microphone	ACO 7052E	54645	March 2020
Calibrator	Quest QC-20	QOC 020005	Jun 2020

* Microphone fitted with the RION WS-03 outdoor all-weather windshield.

The measurement location was selected to be indicative of potential ambient sound levels in the Tubatse Village. A photo of the measurement location is presented Appendix 5.9.

Refer to Table 8-39 highlighting sounds heard during equipment deployment and collection.

Table 8-39: Noises/sounds heard during site visits at SELOSL01

Noises/sounds heard during onsite investigations		
Magnitude Scale Code: • Barely Audible • Audible • Dominating	**During equipment deployment**	
	Faunal and Natural	Birds clearly audible and dominant.
	Residential	-
	Industrial & transportation	Vehicle noises audible during passing. Slight humming sound audible in area from direction of Lannex area.
	During equipment collection	
	Faunal and Natural	Birds dominant. Wind induced noise quite significant at times.
	Residential	-
	Industrial & transportation	Mining sounds just audible. Reverse alarms in distance.

8.9.2.3. Summary of Ambient Sound levels measured

Impulse time-weighted equivalent sound levels $L_{Aleq,10min}$ and fast time-weighted equivalent sound levels $L_{AFeq,10min}$ are presented in Figure 8-69 and summarized in Table 8-40 below. The maximum (L_{Amax}), minimum (L_{Amin}) and 90th percentile (L_{A90}) statistical values are illustrated in Figure 8-70.

The impulse time-weighted sound descriptor is mainly used in South Africa to define sound and noise levels. Fast-weighted equivalent sound levels are included in this report as this is the sound descriptor used in most international countries to define the Ambient Sound Level.

The L_{A90} level is presented in this report to define the "background ambient sound level", or the sound level that can be expected if there were little single events (loud transient noises) that impacts on average sound level. The L_{A90} level is elevated, indicating the presence of constant noises in the area that raises the noise levels.

There were a number of times when night-time ambient sound levels exceeded 65 dBA, with the maximum noise levels exceeding 65 dBA at least 16 times the second night. If maximum noise levels exceed 65 dBA more than 10 times at night, it may increase the probability where a receptor may be awakened at night, ultimately impacting on the quality of sleep.

Table 8-40: Sound levels considering various sound level descriptors at SELOSL01

	LAmax,i (dBA)	LAeq,i (dBA)	LAeq,f (dBA)	LA90,f (dBA90)	LAmin,f (dBA)

Day arithmetic average	-	51.4	48.8	34.7	-
Night arithmetic average	-	40.6	38.8	31.2	-
Day minimum	-	32.5	30.8	-	26.3
Day maximum	93.8	69.1	59.7	-	-
Night minimum	-	28.4	27.7	-	24.6
Night maximum	81.3	57.3	53.6	-	-
Day 1 equivalent	-	53.7	50.4	-	-
Night 1 Equivalent	-	45.7	43.8	-	-
Day 2 equivalent	-	53.4	50.6	-	-
Night 2 Equivalent	-	47.3	44.9	-	-
Day 3 equivalent	-	52.5	47.0	-	-

The numerous 10-minute measurements are further classified for the day- and night-time periods in terms of the SANS 10103:2008 typical noise district areas in Figure 8-71 (day) and Figure 8-72 (night).

8.9.2.4. Spectral Frequencies

a) **Lower frequencies (20 – 250 Hz):** This frequency band is generally dominated by noises originating from anthropogenic activities (vehicles idling and driving, pumps and motors, etc.) as well as certain natural phenomena (wind, ocean surf splash etc.). Motor vehicle engine rpm (revolutions per minute, 1000 - 6000 rpm) mostly convert to this range of frequency. Lower frequencies (above infrasound etc.) also have the potential to propagate much further than the higher frequencies.
Night-time data: There were peaks in the 50 and 100Hz frequencies during quieter periods, with sounds from various sources impacting on this frequency bands.
Daytime data: There is no clear character with various sounds increasing the acoustic energy in this frequency band.

b) **Middle frequencies surrounding 1,000 Hz (200 – 2,000 Hz)** – This range contains energy mostly associated with human speech (350 Hz – 2,000 Hz; mostly below 1,000 Hz) and dwelling noises (including sounds from larger animals such as chickens, dogs, goats, sheep and cattle). Road-tyre interaction (from vehicular traffic) normally features in 630 – 1,600 Hz range. Ventilation fans could also increase acoustic energy in this frequency band.
Night-time data: There is no clear character with various sounds increasing the acoustic energy in this frequency band.
Daytime data: There is no clear character with various sounds increasing the acoustic energy in this frequency band.

c) **Higher frequency (2,000 Hz upwards)** – Smaller faunal species such as birds, crickets and cicada use this range to communicate and hunt etc.
Night-time data: There is a slight peak at 4,000Hz (quiet times), though there is general little acoustic energy in this frequency range with no specific character.
Daytime data: There is no clear character with various sounds increasing the acoustic energy in this frequency band.

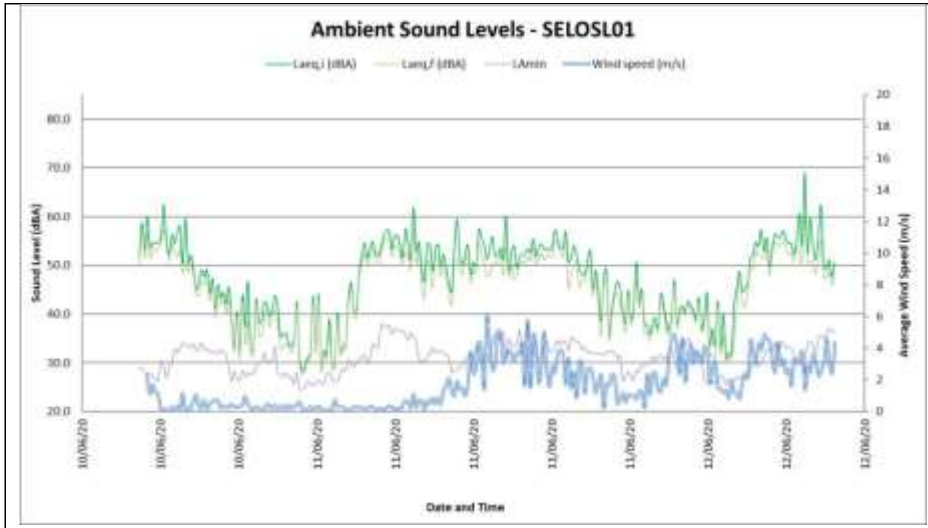

Figure 8-69: Ambient Sound levels at SELOSL01

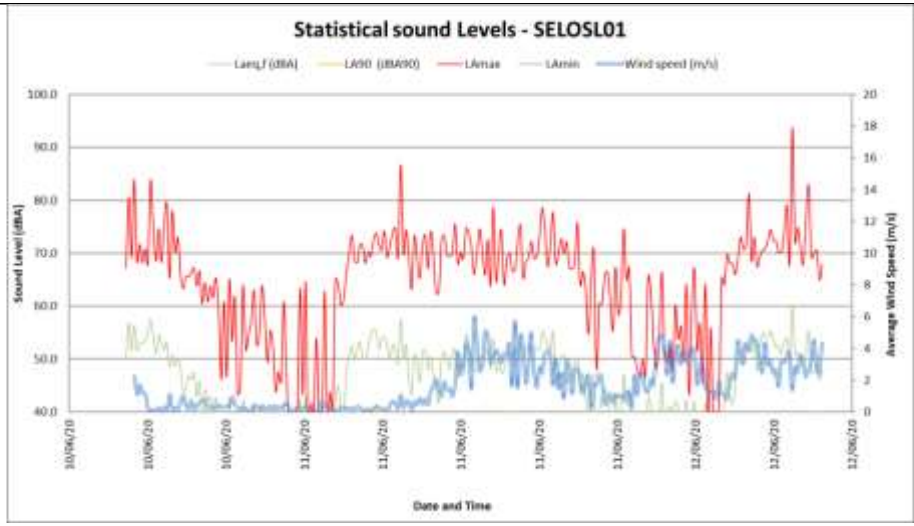

Figure 8-70: Maximum, minimum and statistical sound levels at SELOSL01

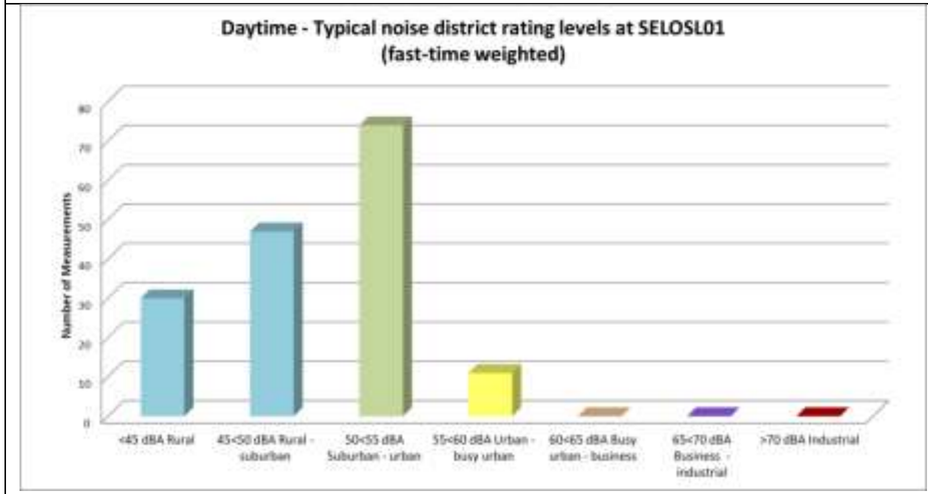

Figure 8-71: Classification of daytime measurements in typical noise districts at SELOSL01

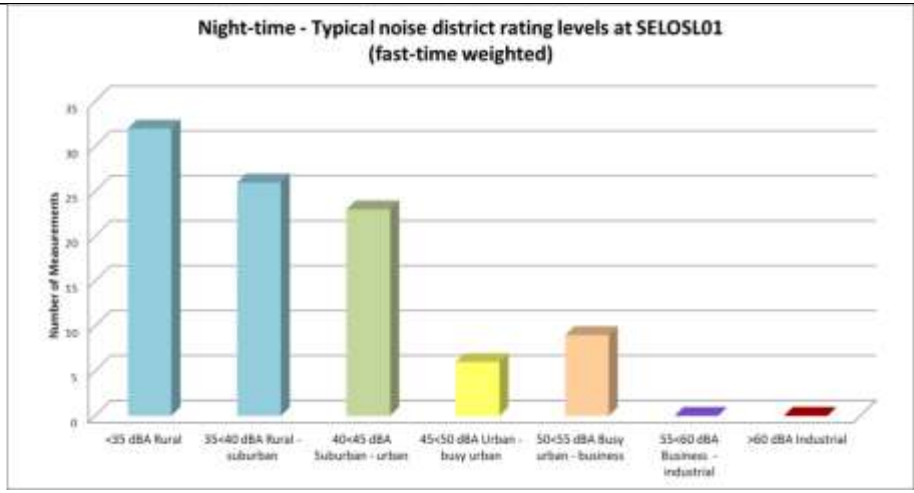

Figure 8-72: Classification of night-time measurements in typical noise districts at SELOSL01

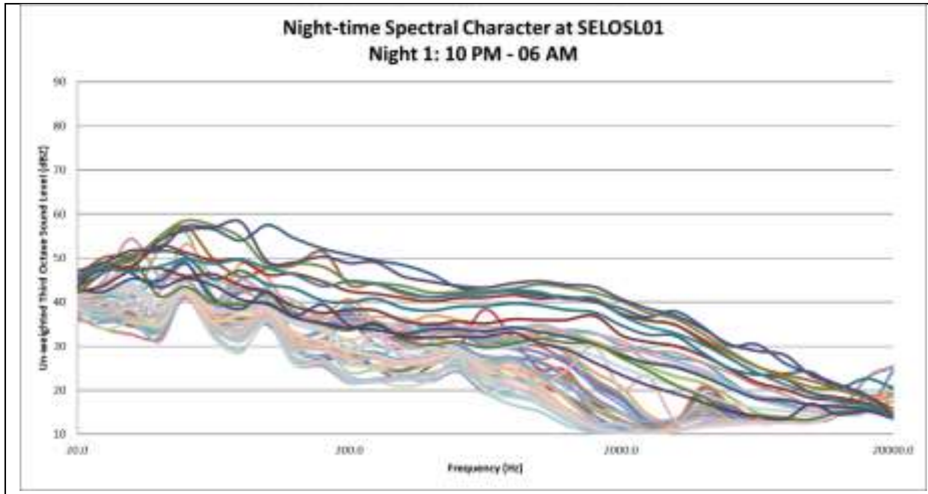

Figure 8-73: Spectral frequencies – SELOSL01, Night 1

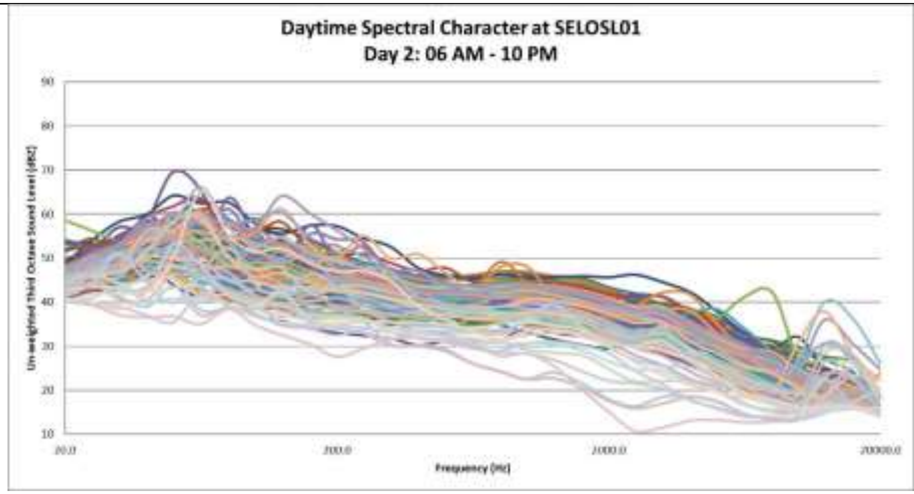

Figure 8-74: Spectral frequencies - SELOSL01, Day 2

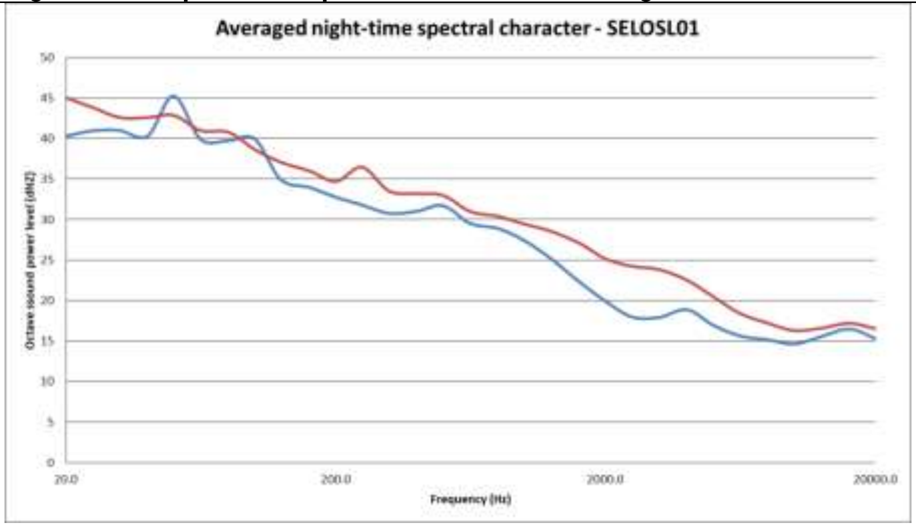

Figure 8-75: Average night-time frequencies - SELOSL01

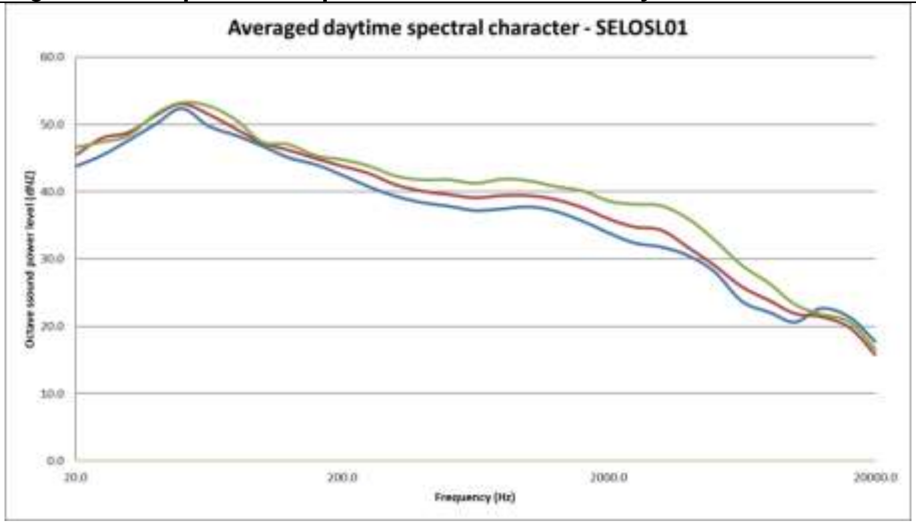

Figure 8-76: Average daytime frequencies - SELOSL01

8.9.2.5. Long-Term Measurement Location SELOSL02: Chrome Carriers

The equipment defined in Table 8-41 was used for gathering data.

Table 8-41: Equipment used to gather data (Rion NA-28) at SELOSL01

Equipment	Model	Serial no	Calibration
SLM	Rion NA-28	00901489	April 2019
Pre-amplifier	NH-23	01533	April 2019
Microphone	UC-59	02087	April 2019
Calibrator	Quest QC-20	QOC 020005	June 2020
Anenometer	WH3081PC	-	-

* Microphone fitted with the RION WS-03 outdoor all-weather windshield.

The measurement location was selected to be reflective of ambient sound levels in the area. Refer to Table 8-42 highlighting sounds heard during equipment deployment and collection.

Table 8-42: Noises/sounds heard during site visits at SELOSL02

Noises/sounds heard during onsite investigations		
Magnitude – Colour Code Used **Barely Audible** **Audible** **Dominating**	During equipment deployment	
	Faunal and Natural	Bird noises significant and dominant. Some wind induced noise during wind gusts.
	Residential	-
	Industrial & transportation	Fans of Tubatse Ferro-Chrome Plant audible in distance.
	During equipment collection	
	Faunal and Natural	Wind induced noises significant and dominant. Birds audible.
	Residential	-.
	Industrial & transportation	Noises from Lannex operation just audible with wind blowing from Lannex operation.

8.9.3 SUMMARY OF AMBIENT SOUND LEVELS MEASURED

Impulse time-weighted equivalent sound levels $L_{Aleq,10min}$ and fast time-weighted equivalent sound levels $L_{AFeq,10min}$ are summarized in Table 8-43 below. The maximum (L_{Amax}), minimum (L_{Amin}) and 90th percentile (L_{A90}).

The impulse time-weighted sound descriptor is mainly used in South Africa to define sound and noise levels. Fast-weighted equivalent sound levels are included in this report as this is the sound descriptor used in most international countries to define the Ambient Sound Level.

The L_{A90} level is presented in this report to define the "background ambient sound level", or the sound level that can be expected if there were little single events (loud transient noises) that impacts on average sound level. The L_{A90} level is elevated, indicating the presence of constant noises in the area that raises the noise levels.

Maximum noise level exceeded 65 dBA only a few times at night. If maximum noise levels exceed 65 dBA more than 10 times at night, it may increase the probability where a receptor may be awakened at night, ultimately impacting on the quality of sleep.

Table 8-43: Sound level descriptors as measured at SELOSL02

	$L_{Amax,i}$ (dBA)	$L_{Aeq,i}$ (dBA)	$L_{Aeq,f}$ (dBA)	$L_{A90,f}$ (dBA90)	$L_{Amin,f}$ (dBA)

Day arithmetic average	-	43.7	40.4	33.5	-
Night arithmetic average	-	39.5	38.1	32.1	-
Day minimum	-	30.9	30.0	-	22.9
Day maximum	86.7	64.2	59.5	-	-
Night minimum	-	30.7	30.0	-	20.4
Night maximum	96.3	72.6	66.6	-	-
Day 1 equivalent	-	40.9	36.9	-	-
Night 1 Equivalent	-	55.9	50.1	-	-
Day 2 equivalent	-	49.9	45.7	-	-
Night 2 equivalent	-	53.5	48.0	-	-
Day 3 equivalent	-	46.5	40.4	-	-

8.10. VISUAL

8.10.1 VIEWSHED ANALYSIS 2013

A view shed analysis was undertaken of the opencast extension for the 2013 EMPr, using maps and digital elevation model data. The extension was assessed to determine areas where the opencast will be visible and the likely sensitive receptors.

The other components of this addendum formed part of the current mine infrastructure and are therefore considered within that context.

The opencast is located in a rural area characterised by a system of valley and surrounding koppies. There are three dominant landscape types: rocky hills and koppies, flat rolling plains and the Olifants River valley, with its associated drainage lines. Man-made interventions include the R555 to the west and the Lannex mining complex. The view shed analysis demonstrated that the proposed extensions will be visible from the surrounding and high lying areas. The extension of opencast operations to the North will be visible from the R555 and the informal settlements situated on the opposite side of the road. Similarly, the extension of opencast at the Annex club will be visible from both Annex club, Annex village and the R555. It should be noted that mining activities are prominent within the area and the visual impact of such activities were largely accepted.

8.10.2 VISUAL IMPACT ASSESSMENT 2020

A view shed analysis was undertaken for the proposed activities in August 2020 by Eco Elementum (see Appendix 5.7). A viewshed analysis was done for the proposed Lannex expansion project and the results are discussed below with images and ranking tables.

8.10.2.1. Slope

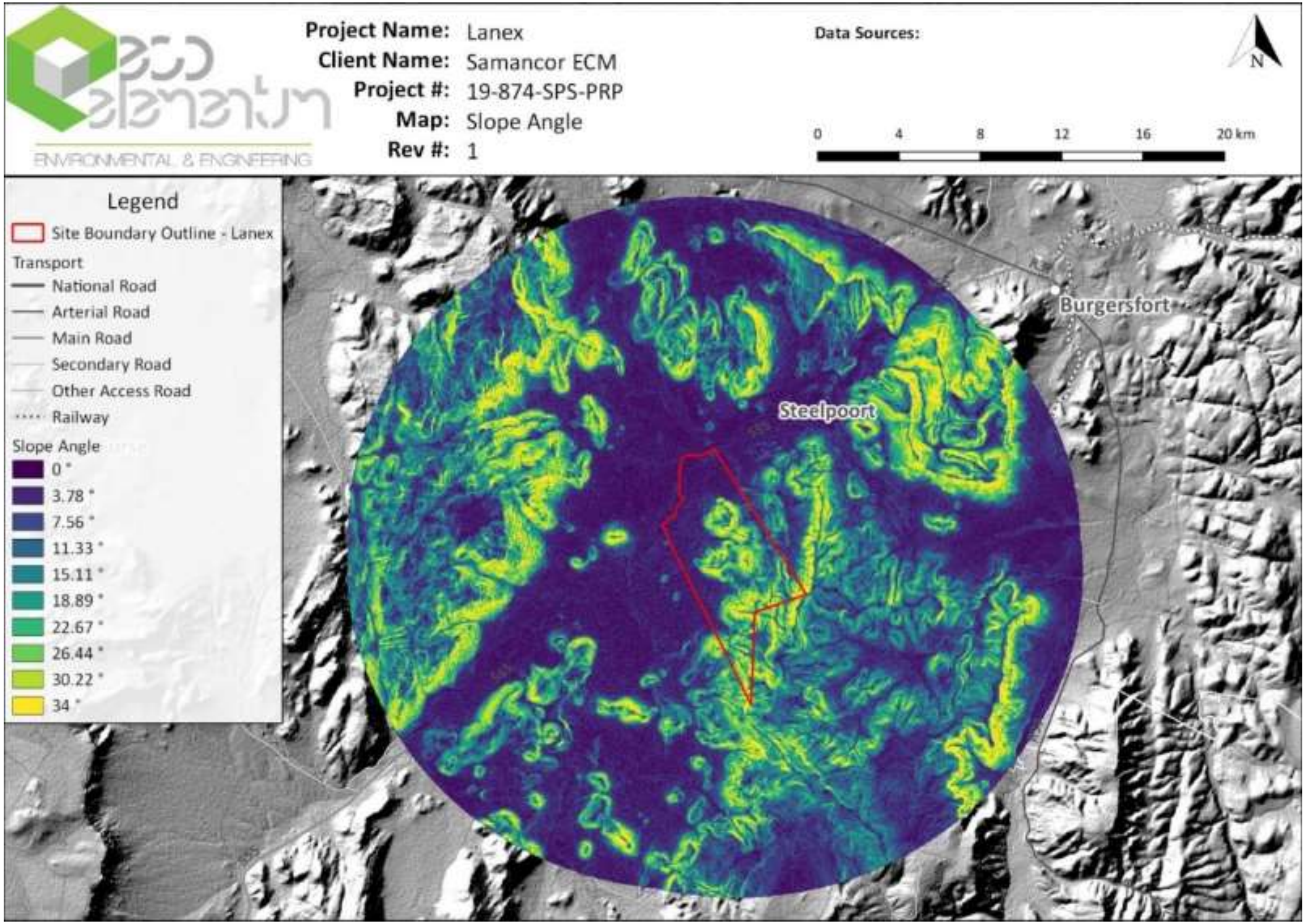

Figure 8-77: Slope angles of the terrain in the 5km buffer area surrounding the proposed Lannex project

8.10.2.2. Aspect

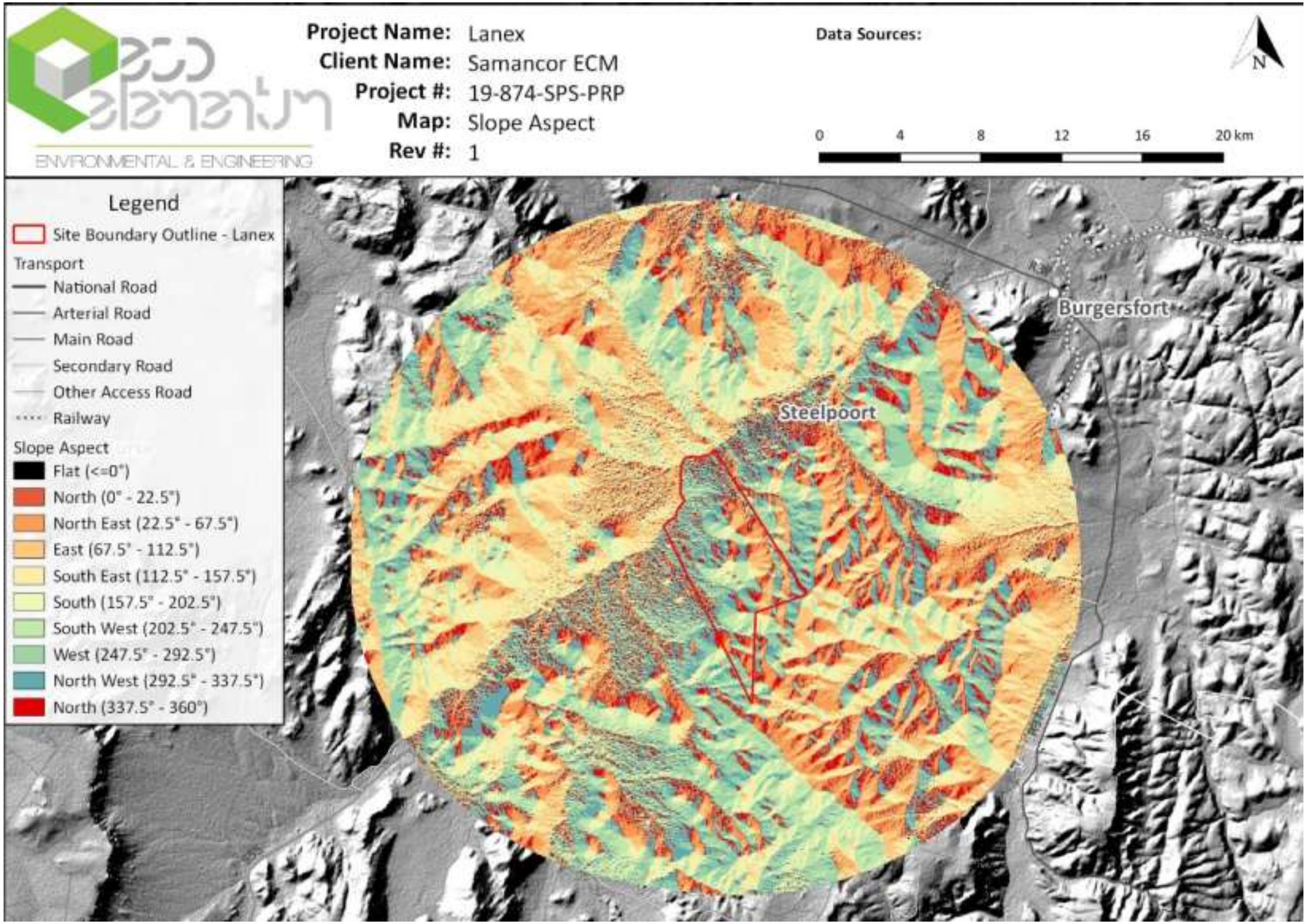

Figure 8-78: Aspect direction of the terrain in a 15km buffer area surrounding the proposed Lannex project

8.10.2.3. Terrain Ruggedness

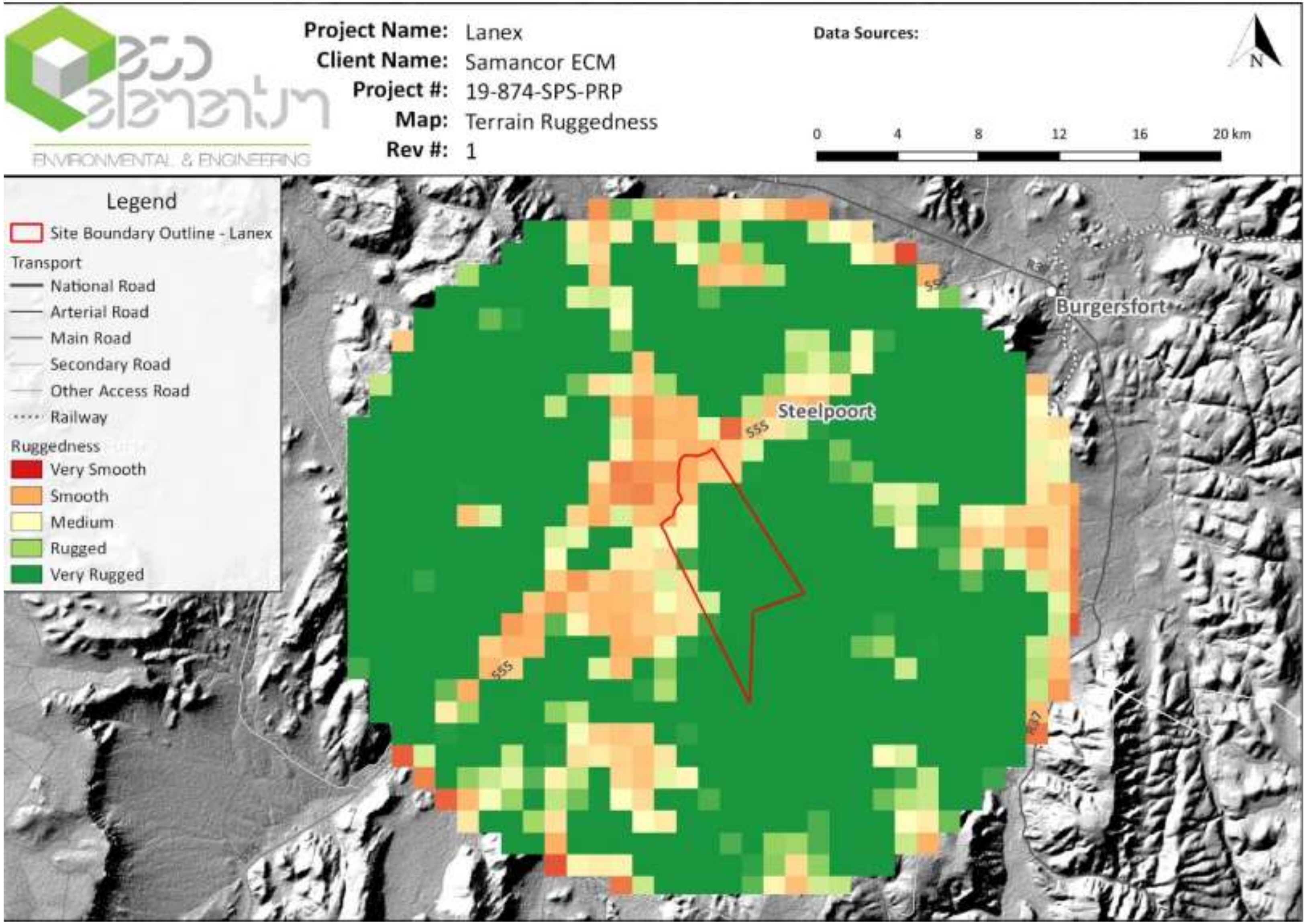

Figure 8-79: Terrain ruggedness in a 15km buffer area surrounding the proposed Lannex project

8.10.2.4. Relative Elevation

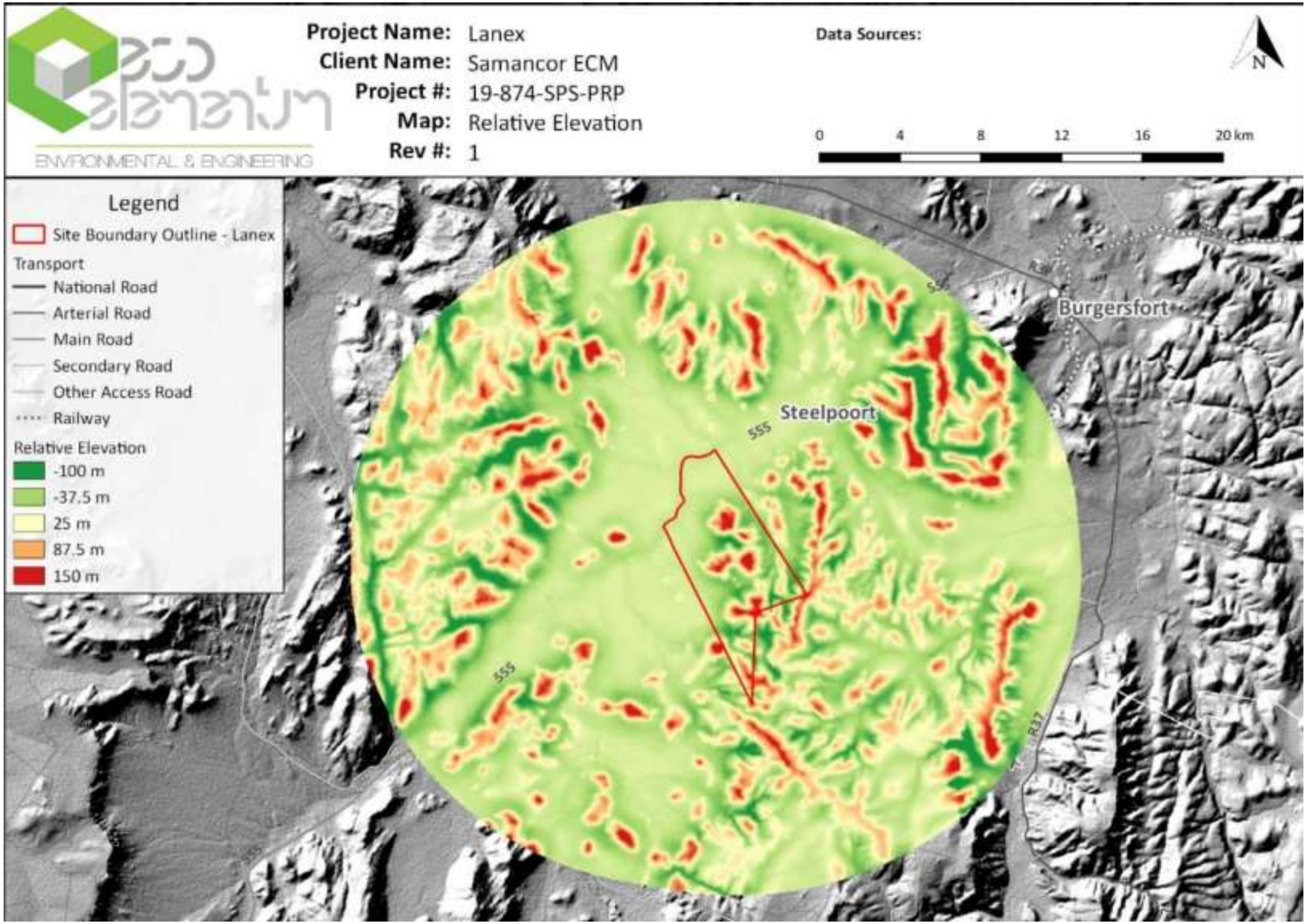

Figure 8-80: Relative elevation of terrain in 15km buffer area surrounding the proposed Lannex project

8.10.2.5. Landforms

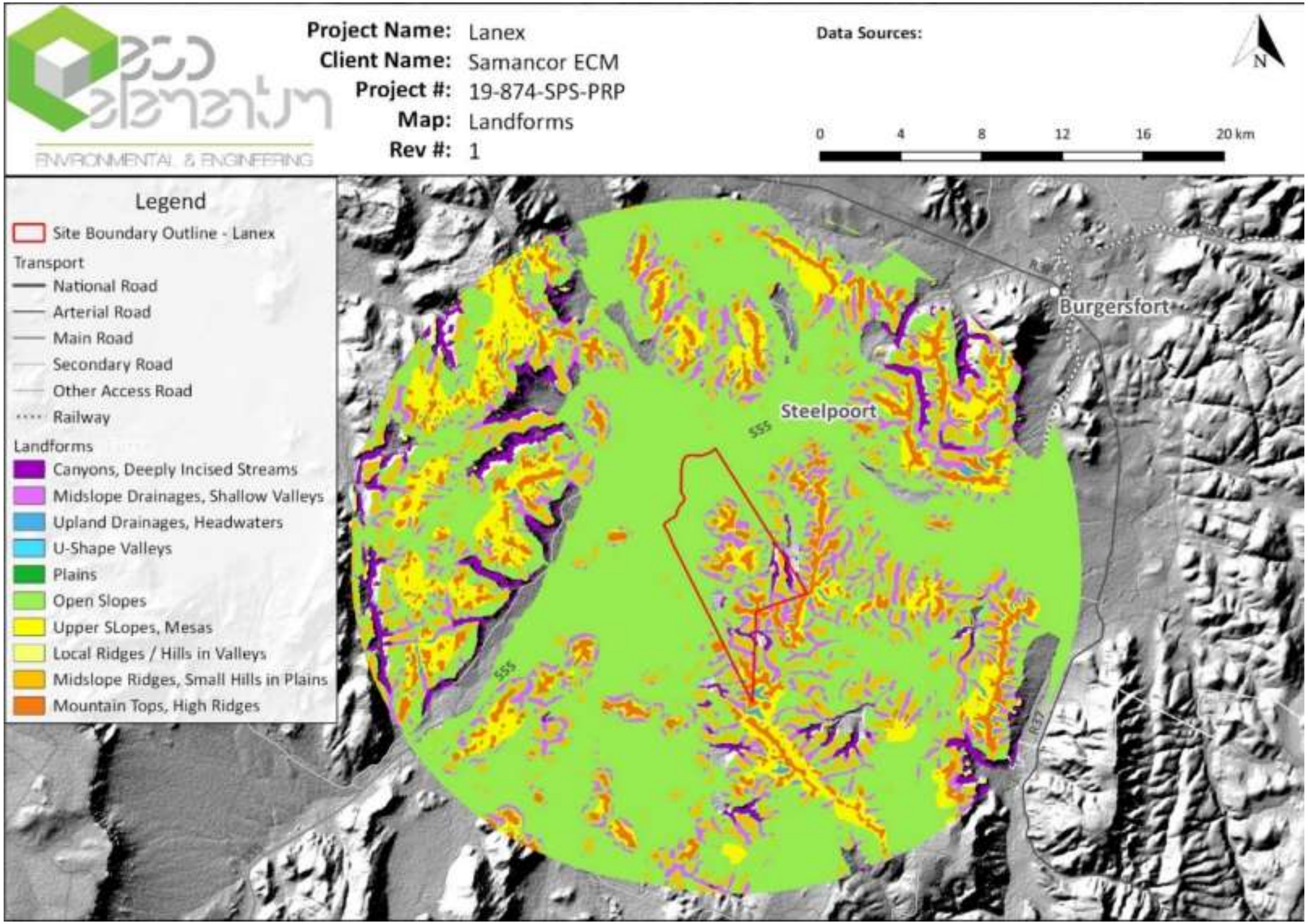

Figure 8-81: Landforms in a 15km buffer area surrounding the Lannex Project

8.10.2.6. Slope Position

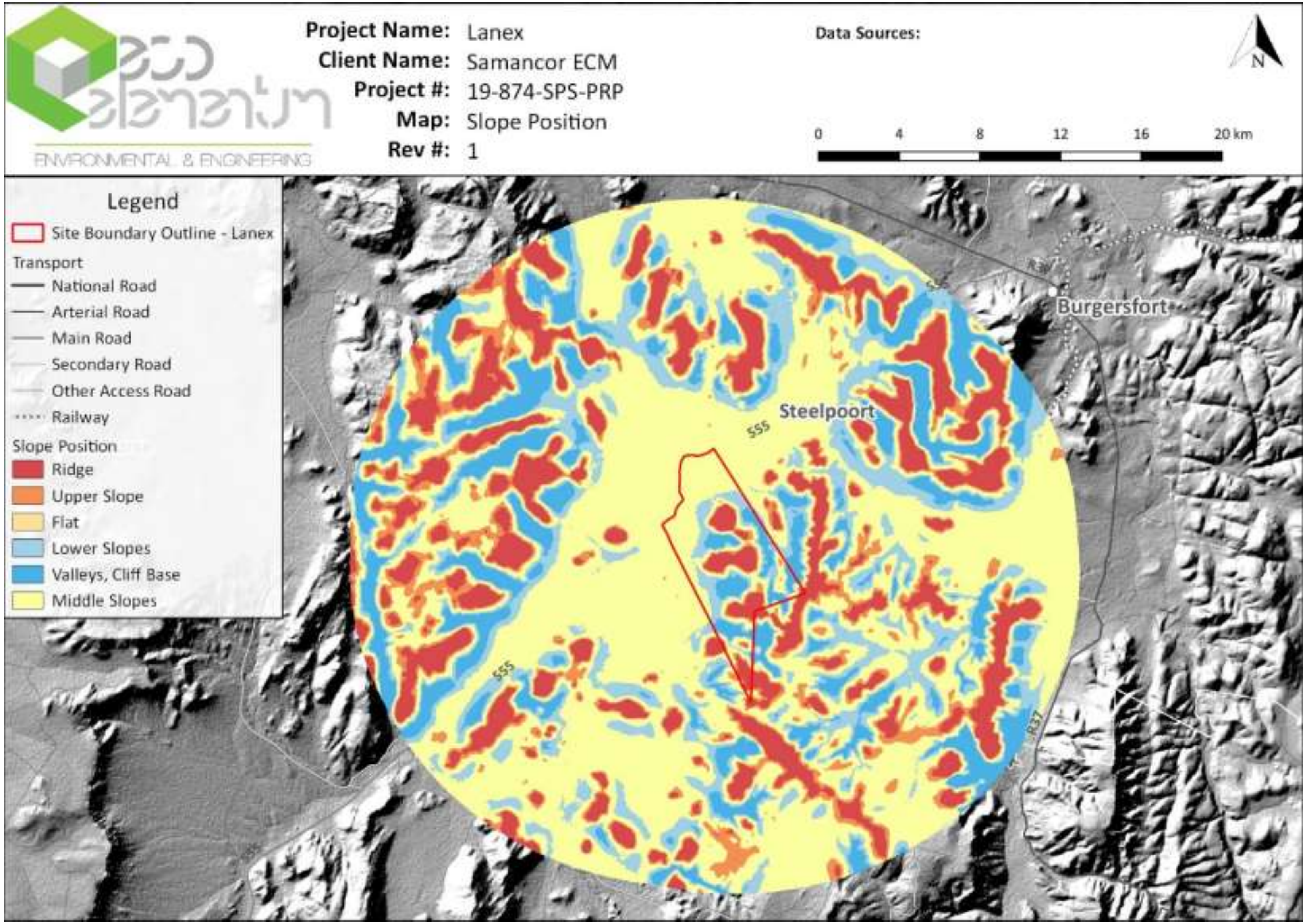

Figure 8-82: Slope position in a 15 km buffer area surrounding the proposed Lannex project area

8.10.2.7. Land Cover VAC

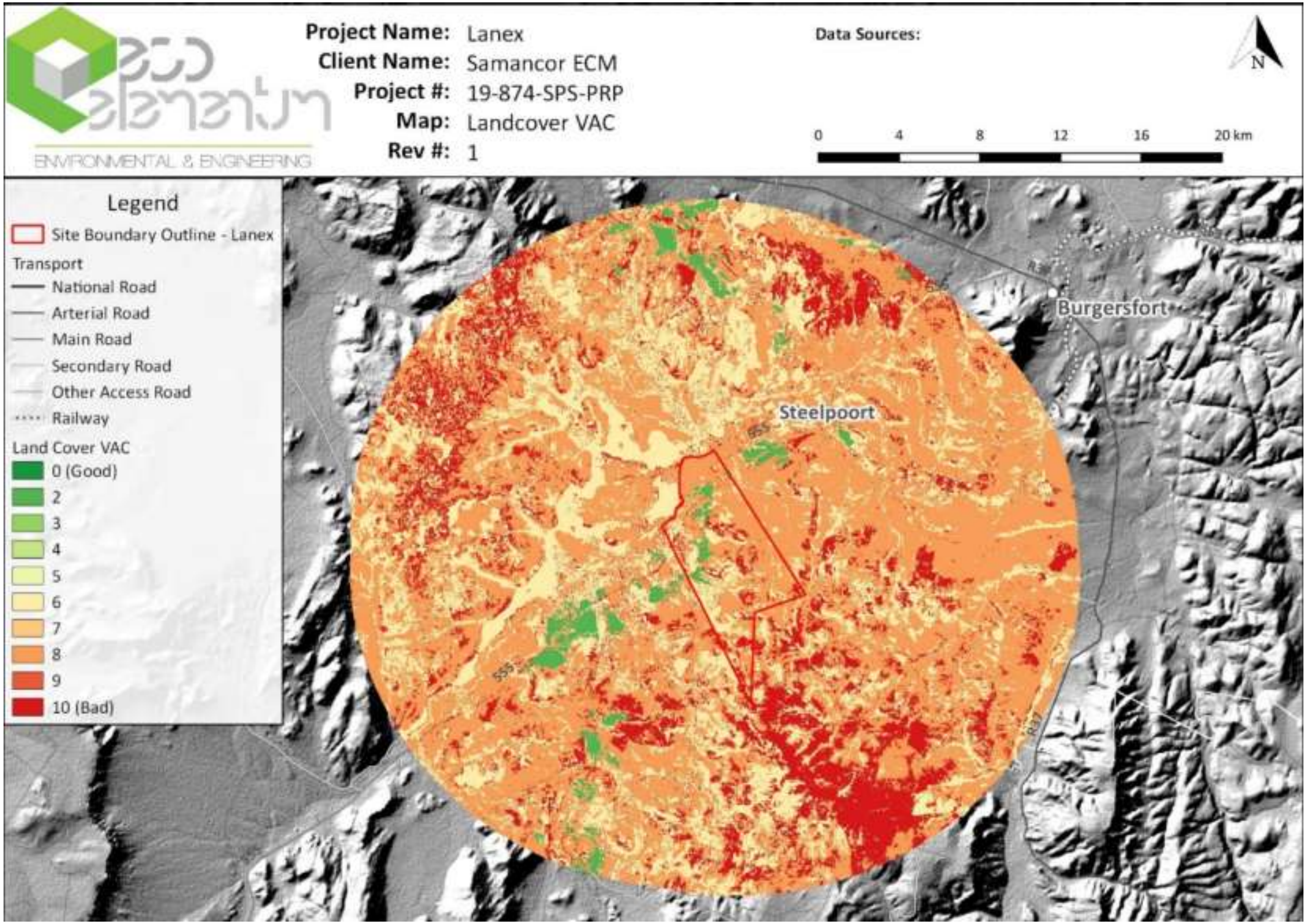

Figure 8-83: Possible VAC of the landcover in a 15 km buffer area surrounding the proposed Lannex project

8.10.2.8. Viewshed visibility

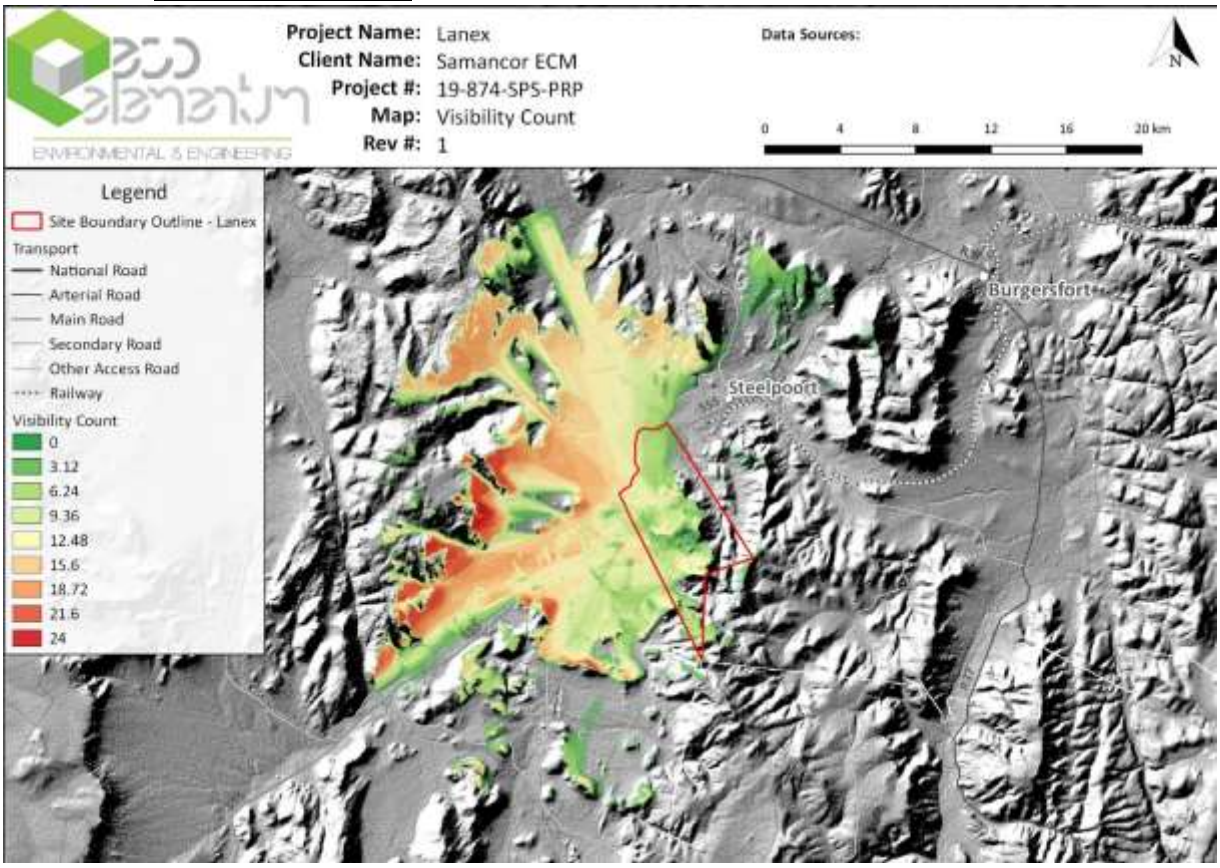

Figure 8-84: Viewshed of proposed Lannex project- Visibility count (how many surface infrastructure locations can be seen from any location on the map)

For the assessment of the visibility of the area, the viewshed has been calculated for the amount of surface infrastructure features that can be seen from any point on the map.

Table 8-44: Visibility rating- Count of infrastructure visible for the proposed development

0 Structures	Very Low
1 - 6 Structures	Low
7 - 13 Structures	Medium
14 - 20 Structures	High
20+ Structures	Very High

8.10.2.9. Viewshed Visibility- Distance Ranking

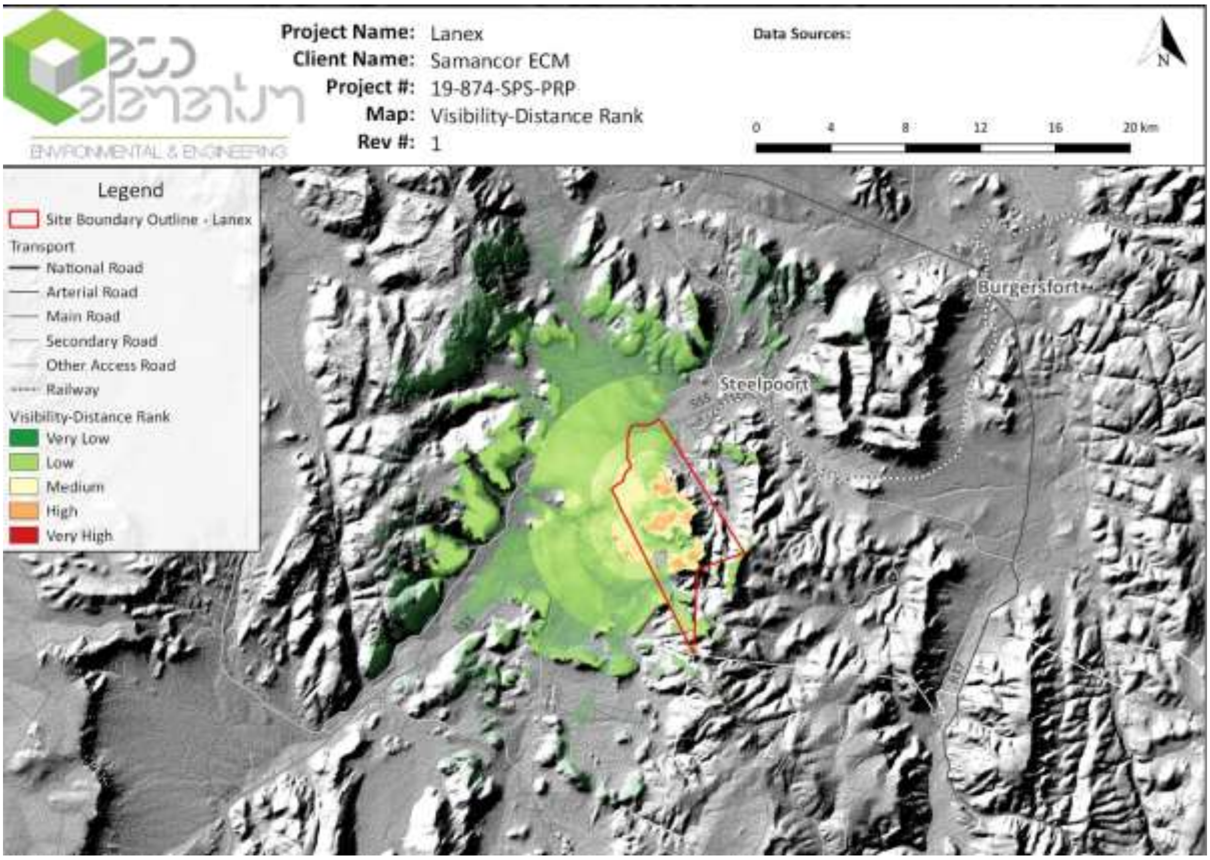

Figure 8-85: Viewshed of the proposed Lannex project- Visibility count (How many surface infrastructure locations can be seen from any location on the map) ranked according to distance from source

The View Counts from the visibility section above is then further ranked based on distance from the centre of the proposed infrastructure site. Distances are ranked according to the table below.

Table 8-45: Visibility Rating- Distance from proposed infrastructure

12 – 15 km	Very Low
9 – 12 km	Low
6 – 9 km	Medium
3 – 6 km	High
0 – 3 km	Very High

8.10.2.10. Visual Exposure Ranking

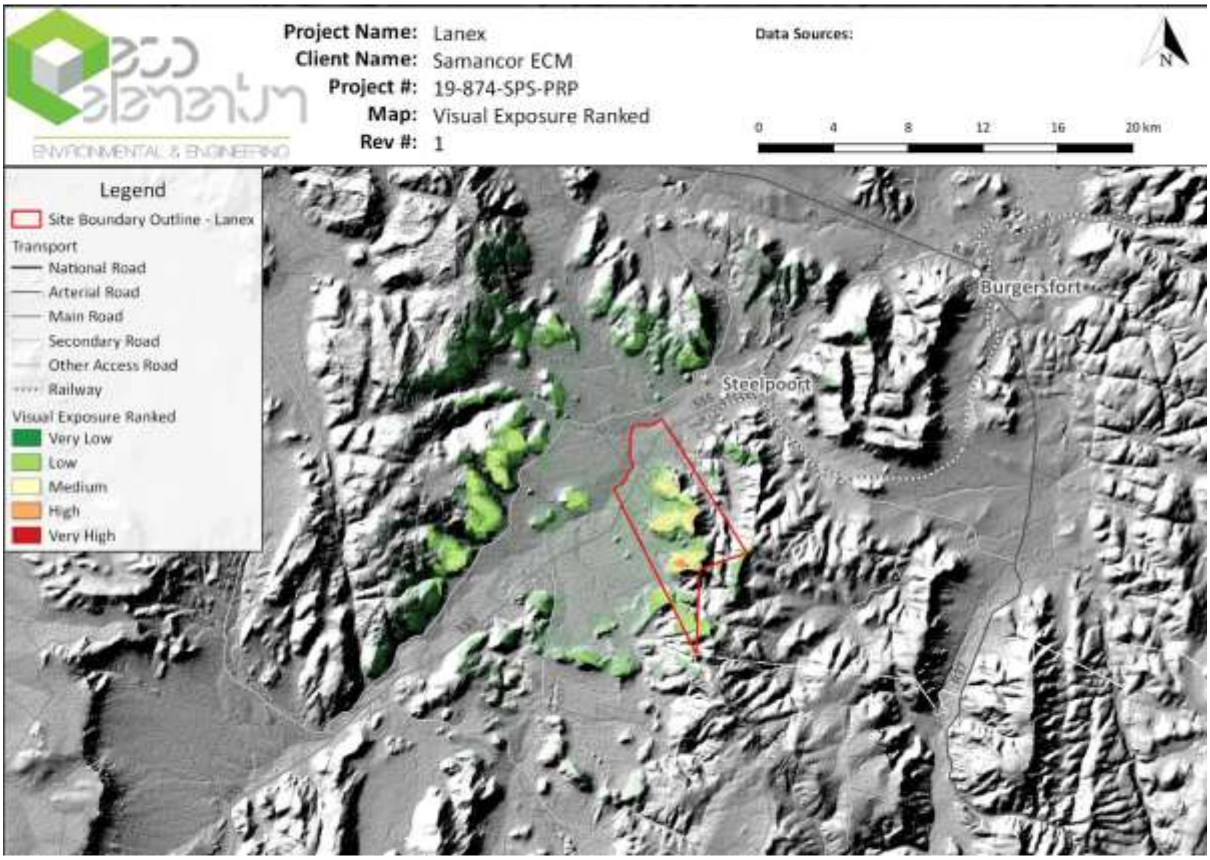

Figure 8-86: Visual Exposure ranking within a 15 km radius for the proposed Lannex Project

The visible infrastructure count is combined with the distance from the source ranking together with the VAC of the land cover types, the slope, aspect, ruggedness, relative elevation, landforms and slope position to get a quantitative Visual Exposure ranking of all the areas where it may be possible to see the proposed development.

Table 8-46: Visual Exposure ranking

1	Very Low
2	Low
3	Medium
4	High
5	Very High

8.10.2.11. Viewpoints

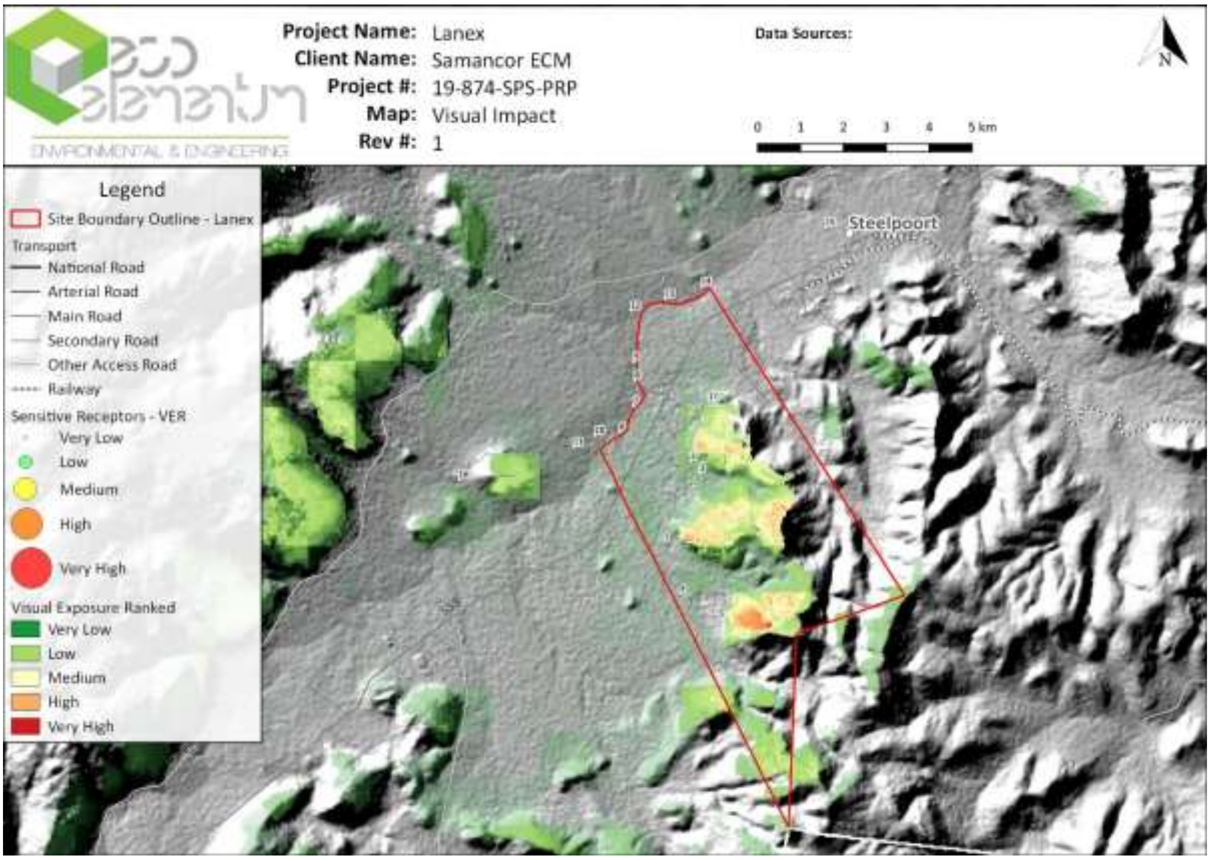

Figure 8-87: Viewpoint sensitivity receptors overlaid on the visual exposure ranking

Each identified sensitive receptor is then overlaid on the Visual Exposure Ranking and the value extracted to that pixel to give a quantitative ranking for each of the identified sensitive receptors. Ranking is done from 1 to 10, 1 being very low and 10 very high.

Due to fact that topographic modification can take place by agricultural, vegetation and other activities in the area, the viewshed is only a theoretical study. The viewpoints have been identified based on the sensitivity of the areas to visual disturbance and areas that canbe negatively impacted by the related structures.

Table 8-47: Quantified ranking of visual exposure each identified sensitivity receptor may have due to proposed infrastructure

Visibility ratings	
ID	**Rating**
1	0.6
2	1.3
3	1.1
4	0.4
6	0.3
7	0.3
8	0.1
9	0.2
10	0.2
11	0.3
12	0.2

Visibility ratings	
ID	**Rating**
13	0.1
14	0.1
17	0.6

8.11. CULTURAL AND HERITAGE

8.11.1 BACKGROUND INFORMATION 2013 EMPR

The Phase I HIA for the Lannex North Open Cast Mine revealed the following types and ranges of heritage resources, as outlined in Section 3 of the National Heritage Resources Act (Act No 25 of 1999)

- The remains of two villages dating from the recent past but with possible historical connections (site RP01 and RP02).
- An informal graveyard, which can be associated with one of the villages (site GY01).
- Scattered stone tools, dating from the Stone Age, in a donga crossing the mining area.

The Phase I HIA for the proposed new Annex Conservation Open Cast Mine revealed the following types and ranges of heritage resources, as outlined in Section 3 of the National Heritage Resources Act (Act No 25 of 1999) as shown in Figure 2-16.

- Four potsherds from the Early Iron Age (AD300 to 800).

8.11.2 BACKGROUND INFORMATION 2020

8.11.2.1. Palaeontology (Appendix 5.10)

The eastern part of the area earmarked for development is underlain by the Pretoria Group rocks that are considered to have a High Palaeontological Sensitivity. The western part of the study area is underlain by rocks of the Rustenburg Layered Suite of the Bushveld Igneous Complex that are considered to be of No Palaeontological Significance. The igneous rocks of the Rustenburg Suite are overlain towards the west by Quaternary aged sediments that are considered to have a Low Palaeontological Significance.

The Transvaal Supergroup was set down from approximately 2.7 to 2.5 billion years ago and consists of layers of sedimentary and volcanic rocks. The Transvaal Supergroup rocks include quartzite, mudstone, shale, siltstone, conglomerate, limestone, diamictite, tuff and andesite suggesting a range of depositional sources ranging from alluvial fans, floodplains, deltas to coastal and deep basinal environments.

The Silverton Formation constitutes the oldest geological unit in the study area. The fine-layered mudstones and shales are separated by the fine-grained tuff, agglomerate and lava in places. This suggests that these sediments settled down deep underwater from suspension but also at times by means of gravity flow and during storms on an offshore shelf along the eastern margins of the Kaapvaal Craton.

It has been suggested that the organic carbon found in the shales of the Silverton Formation has been formed due to microbial activity. Although no domal stromatolites, like those found in the north-eastern part of the Tansvaal Basin were found in the study suggests that the thin carbonate horizons in this formation could have been formed by stromatolites.

Figure 8-88: Manchuriophyscus (Bosch & Eriksson (2008). Picture by Pieter Bosch)[10]

Figure 8-89: Rolled-up mat fragments (Source: Eriksson et al., 2007)[11]

Rocks of the Bushveld Igneous Complex and diabase intrusions are exposed at several places in the study area (Figure 8-88). It is expected that these igneous intrusions would have destroyed the fossils in the adjacent Transvaal Supergroup rocks during contact thermal metamorphosis.

Alluvium, scree, sand, gravel and soil dating from the Late Cenozoic to Recent cover the Transvaal Supergroup, diabase and Bushveld Igneous rocks in places in the study area (Figure 8-89). The alluvium consists mostly of mud, sand and gravel that have been eroded from the surrounding landscape and were deposited on the flats between the mountain ranges and in the valley bottoms. Although no fossils or sub-fossils been reported from the Quaternary sediments in this region, there is always the possibility that something may be discovered. In spite of these Quaternary fossiliferous deposits being extremely rare there are well documented cases of remains of tortoises, snail shells, ostrich eggs, termitaria, bones etc. that have been discovered elsewhere.

8.11.2.2. Phase 1 Archaeological Assessment (Appendix 5.11)

[10] https://www.researchgate.net/publication/304076637_ Synaeresis_Crack_Polygons/figures?lo=1

[11] https://www.researchgate.net/publication/259343767_Mat-destruction_features/figures?lo=1

The Archaeological Assessment concluded the following:

A number of known cultural heritage (archaeological and historical) sites exist in the larger geographical area within which the study area falls, while some sites of cultural heritage (archaeological and/or historical) origin or significance are known to occur in close proximity.to the study area. Previous work (2010) by the author (for Archaetnos cc) identified some archaeological sites at Lannex. These were mitigated in 2010.

Four (4) sites were identified in the study area during the September 2020 fieldwork, dating to the Stone- and Iron Age periods, and it is very likely that many more are located in the OC3 area and in the expansive erosion donga that is partially situated within the new Opencast pit.

With only a section of the erosion donga located in the OC3 pit area assessed in any detail, itis highly likely that other similar sites occur in the development area. Some sites and finds are possibly also still covered by topsoil in un-eroded sections, preserving them fairly in-tact.It is therefore imperative that the OC3 area be studied in more detail as part of Phase 2 Archaeological Mitigation before mining activities commence here. This will entail the following:

- Detailed mapping of the OC3 area and erosion donga system in order to determine the extent of the archaeological deposit and sites located here
- The sampling of surface material dating to the Stone Age and Iron Age. For this an archaeological permit will be required from SAHRA
- The excavation of surface features dating to the Iron Age (such as Site 3) in order to determine the age of and extent of the Iron Age in the study area. A permit from SAHRA will have to be obtained for this purpose as well.

8.12. SOCIO-ECONOMY

A Socio- Economic Assessment was conducted by Gudani Environmental and Social Consultants (See Appendix 5.12), the following socio-economic environment was established.

8.12.1 Population and Demography

Fetakgomo Tubatse Local Municipality is part of Sekhukhune District and the largest municipality in the district. Its population is approximately 429 471 (Census 2011) with 106 050 households; these makes the municipality a municipality with highest population in the Sekhukhune district (Draft IDP 2018/2019). Due to the high mountain ranges, the population is sparsely distributed with many settlements located in valleys. In certain areas the topography is very steep making it impossiblefor inhabitation.

The Municipality features approximately 342 sparsely populated and dispersed rural settlements, with Burgersfort, Ohrigstad, and Steelpoort constituting the main/first order urban centres. The urban centre closest to the Lannex project site is Steelpoort, which is approximately 9km north-east of the site. The spatial location of these first order centres generally coincides with the municipality's dominant economic activities. Despite having been influenced by the spatial demarcation of the former homeland areas, the spatial occurrence of settlements has also been influenced by:

- The spatial location of major agricultural and mining activity areas;
- The spatial location of major rivers traversing the municipality; and
- The spatial location of major roads such as R37, R36 and R555.

It is estimated that a total of 11 245 people reside in the affected village of Tukakgomo. The village comprise of approximately 3544 households with an average of 3 persons per household. In terms of the demography of the population 48% are female and 52% are male. There are a high (13%) number of children between 0- 4 years, youth between 20-24 years (11%) and 25- 29 years (12%) which indicates a potential for marked rise in local population in the next decade as pre-adolescent reach child bearing age. This group can be viewed as being high vulnerable to HIV/Aids and other sexually transmitted diseases in the absence of health education. Their vulnerability is also increased due to the fact that employment opportunities are low in the area, with the exception of mining which is predominantly taken by men.

A higher number of households (38%) have at least one person. Only 15% are two people living on the same stand and in one household, which may be interpreted as couples. 11% are 3 person households, 12% are four person households, 9% amounted to five person households, 6% to six person households, and 4% to seven person households, 3% comprises of eight person households, 1% to nine person households and 2% to ten or more persons in each household. It is not uncommon however, to have two or more households living in one stand. While some households may have immediate and extended families on the same stand, the head families may use the extra room to rent out to workers and other relocating families as temporary residencies in the form of shacks and backroom until a permanent solution is reached. It is therefore quite common to have more than one household living in one stand in rural areas.

It may be interpreted that of the two and more household sizes, some may be single parents and some may have live-in partners and children. The average size of a family in a rural area is likely to be more than that in an urban area. In rural areas the culture of extended family relations is still highly practiced as opposed to urban areas whereby families are more independent of their immediate relatives.

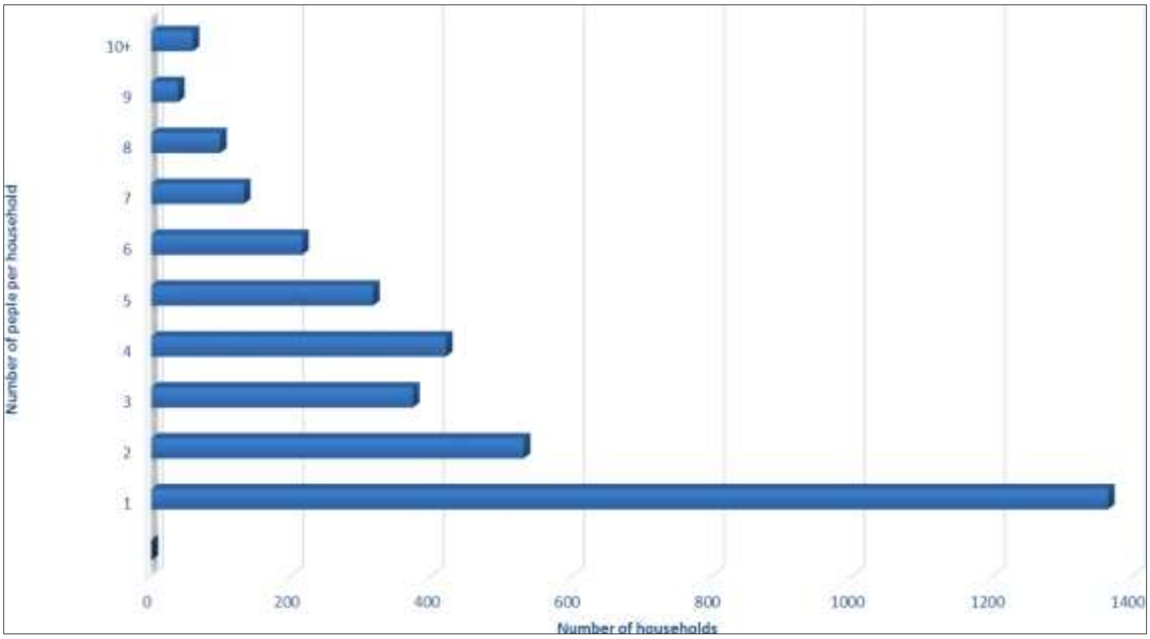

Figure 8-90: Number of people per household

8.12.2 INSTITUTIONAL ARRANGEMENT AND COMMUNITY STRUCTURE

Tukakgomo village is located in the middleveld in Sekhukhune District Municipality, Limpopo Province. It is under tribal jurisdiction, but also has ward councillors who work with the respective Tribal Authority to promote local economic development.

The village is the responsibility of the chief (Kgoshi) and Tribal Council. The said tribal council consists of the chief, advisers and headmen. Traditional authorities play a significant role in local governance in the context of community leadership structures and land related issues.

Internally the village has a number of prominent institutions that allow for more efficient allocation and use of scarce resources for the greater benefit, given the low incomes generated by many. These institutions include burial societies; churches/religious groups, savings groups and production groups.

8.12.3 ECONOMIC ACTIVITIES, EMPLOYMENT AND INCOME

The Fetakgomo Tubatse Local Municipality economy is a strange mixture of overwhelmingly negative features. It has the highest unemployment and poverty rates in the Limpopo Province and extensive positive opportunities – including abundance of mining potential within the area. The major economic drivers in the local municipality are mining, agriculture and tourism, with mining as the mainstay of the local economy. It would therefore suffice to say that mining (both large and small scale) has a huge potential for the immediate future.

8.12.3.1. Agricultural Sector

The significance of agriculture in Fetakgomo Tubatse Local Municipality cannot be over-emphasized. Agriculture in the area is a mixture of both commercial and subsistence farming. Agricultural activities occur closer to water sources, namely the Spekboom River, Steelpoort River the Olifant River, where the flood plains have fertile soils and the irrigation opportunities are in abundance.

Despite agriculture being an important contributor to employment within the local municipality, low capacity utilization (due to poor investment in mechanization schemes) and the uncertainty created by land claims is discouraging the expansion of commercial agricultural activities within the municipality.

8.12.3.2. Tourism Sector

The tourism sector in the Fetakgomo Tubatse Local Municipality is connected to the local economic activities, mainly mining, which has overshadowed the areas potential to attract tourism activities. The municipality hosts heritage sites and tourism assets that can reinforce future growth potential for the sector. However, there exist tourist attractions such as the scenic De Hoop Dam, the Potlake Game Reserve, Sehlakwe Waterfalls, Phahlamanoge Wind Stones, Tjate Heritage Site, Lenao-La-Modimo, Platinum Belt and the Strydom Tunnels.

Although tourism has been viewed as one of the emerging growth sectors in the municipality, the municipality lacks major product to draw a sizable portion of holiday tourists to the area. A major draw card could however firmly place the municipality on established tourist routes to the Blyde River Canyon and Kruger National Park.

Fetakgomo Tubatse Local Municipality has multiple (15) nature reserves which form part of its protected areas as the municipality deems it important to preserve its natural environment. A large portion (80%) of land, in Fetakgomo Tubatse Local Municipality is natural environment, which comprises of bushveld and areas of thinly dispersed and scattered grassland. The Kruger to Canyon biosphere, stretches onto the municipality's northern borders, this presents benefits for the municipality. The following table (Table 8-48) shows the Nature Reserves that are found within the municipality.

Table 8-48: Nature Reserves in Fetakgomo Tubatse Local Municipality

Name	WMCM Type	Site Type
Presswomen Private Nature Reserve	National	Nature reserve
Berghoek Private Nature Reserve	National	Nature reserve
Blyderivierspoort Nature Reserve	National	Nature reserve
De Bad Nature Reserve	National	Nature reserve
De Hoop Private Nature Reserve	National	Nature reserve
G. L. Vosloo Private Nature Reserve	National	Nature reserve
Glen Ora Private Nature Reserve	National	Nature reserve
Kasma Private Nature Reserve	National	Nature reserve
Luiperdhoek Private Nature Reserve	National	Nature reserve
Milford Private Nature Reserve	National	Nature reserve
Oraben Private Nature Reserve	National	Nature reserve
Potlake Nature Reserve	National	Nature reserve
Rietkom Private Nature Reserve	National	Nature reserve

Name	WMCM Type	Site Type
Sonia Schoeman Private Nature Reserve	National	Nature reserve
Steelpoort Private Nature Reserve	National	Nature reserve

8.12.3.3. Mining Sector

Modern mining has been carried out in the larger area (Sekhukhune district) for well over a century, and it generally involved the exploitation of andalusite, asbestos, chromite and platinum deposits from the Merensky Reef, which forms part of the mineral rich Bushveld Complex. The District features the world's largest deposit of the platinum group metals (PGMs) and 70% of the world chrome deposit.

Previous bouts of mining activity in the area let to the opening and closing, and occasionally re-opening of mines due to the fluctuating commodity prices. When prices rose, new exploration and development took place in the Sekhukhune mining sector. On the other hand, when prices fell, mines in the area closed. This is an important characteristic to observe when planning and expanding mining operations in the District.

At present, operational mines found within the Fetakgomo Tubatse Local Municipality are presented in Table 8-49, with the majority of activity situated along the Dilokong Corridor (R37 and R555). The Dilokong corridor stretches across the Fetakgomo and Greater Tubatse Local Municipalities. Major mining companies operating in the municipality include Anglo Platinum, Xstrata, Samancor Chrome Limited, BHP Billiton, Implats, ASA Metals, Corridor Mining Resources and Marula Platinum.

In spite of the involvement of major mining companies, mining in the municipality has not yet reached maximum production limits.

Table 8-49: List of existing medium and large-scale mining operations within Fetakgomo Tubatse Local Municipality

Name of Mine	Type of Mine	Mineral Mined
Modikwa Platinum Mine	Opencast and Underground	Platinum
Marula Platinum	Underground	Platinum
Assmang Chrome Dwarsrivier Mine	Underground	Chrome
Samancor Eastern Chrome Mine • Tweefontein • Winterveld	Underground	Chrome
Twickenham Mine	Underground	Platinum
Haverchroft Andalusite Mine	Opencast	Andalusite
Dilokong Mine	Underground	Chrome
Two River Mine	Underground	Chrome
Mazista Slate	Opencast	Slate
De Brochen Mine	Underground	Chrome
• Thorncliffe Mine	Opencast	Platinum
• Mototolo		
• Helena		
• Magareng		
Bokoni Platinum Mine	Underground	Platinum
Corridor Mining Resources	Open cast	Chrome

8.12.3.4. Local Employment and Income

In the Tukakgomo village employed persons add up to 37%, 20% is unemployed persons, 4% is discouraged work seekers and 39% is persons not economically active. Only 15% has no means of income but majority (85%) earn income. The annual household percent income distribution in Tukakgomo village is as follows: 3% of the households fall within the income bracket R1-R4800. This income bracket is constituted predominantly by those households earning a living solely from government grant, pension or labour. Those earning between R4801-R9600 constitute 7% and are most likely earning a salary. 11% earn between R9601- R19600, 16% earn between R19601-R38200, 20% earn between R38201-R76400, 17% earn R76401-R153800, 7% earn R153 801-R307 600, 3% earn R307 601-R614 400, 1% earn R614 001-R1 228 800 and another 1% earn R1 228 801 or more. These are most likely to be skilled workers. Most (89%) households fall within the poorest income bracket, while a small (11%) population earns more than R12 000 per month.

8.12.3.5. Health and Medical Facilities

The medical facilities are very limited in the area with Eerstegeluk Clinic as the only clinic providing services to Tukakgomo village. The nearest hospital is the Dilokong Hospital near Burgersfort which is approximately 22km from the mentioned village. It is evident that the existing health care facilities are limited to meet all the health requirements and needs of the community. Pregnant women and the old age are amongst the most vulnerable.

8.12.3.6. Housing

In terms of the Tribal Authority system, permission to occupy (PTO) land for housing and agriculture is granted by the respective local chief (Kgoshi). Most households or homesteads comprise of a dwelling, a small patch of cultivated ground, often with a kraal for livestock. Houses are typical brick and concrete with corrugated iron or tile roof, and few houses are made of stone/rock. Some dwelling also have corrugated iron shack in the backyards.

8.12.3.7. Education levels and Training

There is one secondary and two primary schools in the village. These learning facilities do not offer vocational/technical/business training to locals. The following are existing schools:

- Kgahlanong Secondary School;
- Maelebe Primary School; and
- Kopi Primary School.

According to the 2011 data from Stats SA, 6% of the population in Tukakgomo village have no schooling, 23% have some primary schooling, 4% have complete primary schooling, 38% have secondary schooling, 20% have standard 10/grade 12(matric) and 9% have higher education level. The poor level of education has serious implications for the potential of local people to gain employment. This is worsened by the general shortage of skills in the local community, compounded by the lack of training opportunities in areas of science, computer literacy, technical and technological expertise. With the potential employment opportunities from SECM, Lannex Project, there will be few qualified persons available to fulfil the job specifications. There are a number of people with teaching diplomas, and a few drivers, motor mechanics and builders – however the overall empowerment in the livelihoods of the affected community would largely depend on capacity building and technical skills training from Lannex Project.

8.12.4 LAND HOLDING AND TENURE

Land in rural villages is entrusted to traditional authorities by the state and respective municipality as "Tribal Land". All matters related to the land holdings are controlled by traditional authorities at community level.

Land can be allocated to people from the respective communities to be used for settlement or farming purposes for a nominal once-off fee or free of charge. Non- community members or entities can also obtain land by applying to the chief, butare charged a higher fee. Once the land is allocated to households, it effectively becomes theirs by dint of ongoing residence. Land holders become de facto owners despite the fact that tribal land technically remains the property of the state. The chief in each community is technically able to rescind grants of land, but in reality this only applies to lapsed, unused or unoccupied plots.

In Tukakgomo village plots are owned individually by households. Plots are demarcated by distinct fences or natural markers such as trees and rocks and ranges from 0.2-4 hectare in extent.

8.12.5 LANDUSE AND CAPABILITY

8.12.5.1. Agriculture

Land around Tukakgomo village is predominantly used for agriculture, mining and settlements. Most homesteads in the village have small gardens where vegetables and fruit are grown, often with a kraal for livestock. The climate of the area appears to impose severe limitations on the ability to cultivate the available land. Much of the open plain demarcated as agricultural land did not appear to have been under active cultivation in the recent past. Some land may be standing fallow as part of the rotational cropping cycle, but lack of cultivation may rather be linked to the low amounts of rainfall received.

It should be noted that Tukakgomo village which is the nearest to Lannex is 6.6 km away from the proposed Lannex project site. The land adjacent to the proposed Lannex Project area is flat with dense vegetation cover and is well drained. No grazing of cattle and other livestock was observed during the site visit due to residential areas being further away from the Lannex site.

However, grazing does occur within the community. Grazing area within the land belonging to a community is regarded as communal and can be used by all members of the community in question. Over-grazing during dry periods has denuded much of the area and it is hence extremely susceptible to water and wind erosion.

8.12.5.2. Mining

The activities of the mines around Lannex area are for platinum (Two Rivers Mine), and chrome (Dwarsrivier Mine). Although a great economic asset to the Local Municipality and country, the mines pose substantial threats to the successful further development of the region. The threats are, in part, related to the impacts on the local environment from dust, air pollution, water usage and pollution and waste generation.

The positive impact of mining in the project area include increased business opportunities, greater demand for goods and services, pressures for housing (ability to own houses), etc. The opportunities lie in making the boom contribute to the development of a more sustainable municipality through the appropriate placement of services and facilities and the establishment of new residential areas.

8.12.5.3. Settlements

Four settlement types located within the Fetakgomo Tubatse Local Municipal Areas can be distinguished. These are urban settlements, tribal settlements, rural settlements and informal settlements. These settlement types are distinguished from each other by the presence or absence of security of tenure and basic municipal services such as water and electricity.

8.12.5.4. Urban Settlements

These settlements have a formal township layout. There is a full range of municipal services (water, sewer, electricity and tarred roads) available to residents or the households located within these settlements. The owners have security of tenure (they hold a title deed). There are no such settlements in the immediate vicinity of SECM Lannex Project. Steelpoort town is approximately 9 km north-east of Lannex Project.

8.12.5.5. Tribal Settlements

This type of settlement mainly pertains to the village of Tukakgomo. These settlements are located on tribal land and the households living in these settlements are considered the Bapedi tribe.

8.12.5.6. Rural Settlements

Rural settlements are settlements that are similar in nature to the tribal settlements with regard to the residential densities and functions, but they are not located on tribal land. Therefore, these settlements do not have the same advantages that settlements located on tribal land and administered by the Tribal Councils have. In contrast, they have a lack of security of tenure and they lack basic municipal services.

8.12.5.7. Informal Settlements

The other type of settlement is informal settlements. The locations of these settlements mainly correspond to the mining areas and are therefore located along the edges of the mining belt. These settlements largely contain households of mine employees. The informal settlements are characterized by a lack of security of tenure and a lack of basic municipal services. It is imperative that these settlements are provided with the basic amenities in order to improve the social status and life of the people living in these townships. This type of settlement is likely to encroach the proposed Lannex project site due to job seekers.

8.12.5.8. Business

Big businesses are absent from the Tukakgomo village. The smaller businesses are normally found scattered through the residential village area and are informal in character. Lack of business and employment has caused people to migrate to the bigger towns especially Burgersfort, Polokwane and Lebowa-Kgomo in search job opportunities. Local businesses include taverns, filling stations, shops, hardware stores and car-washing.

8.12.5.9. Water and Sanitation

Water supply in the affected villages is mainly from underground sources. Water is pumped from underground into a reservoir/elevated tank on the surface, from where is directed to various communal/public stand pipes/taps. 25% of the households depend on the communal taps for access to drinking water. Few dwellings (14%) have piped connections and running water in their individual households, a further 25% of the households have boreholes in their respective yards and 36% depend on rain water harvested from the roof tops, springs or dams.

Water availability is extremely scarce in the area and the community experience frequent water shortages – especially during the dry winter months. Use of natural, untreated water sources increases the risk of waterborne diseases.

20% of the households have flush or septic tank toilets in the affected community. Majority of the households (55%) have pit toilets with no ventilation systems and a further 14% have the same pit with ventilation. 2% of the households have no latrine facilities or are using the bucket system, resulting in proper ablution being compromised.

8.12.5.10. Infrastructure, Electricity and Communication

The level of infrastructure in the affected community – Tukakgomo is very low with poor means of transport. There is no commercial infrastructure in the village and 15% of the people have no means of income. The lack of income exacerbated by poor transport links imply that many residents may not be able to afford visit to town frequently and may hence go without supplies. Of the entire Tukakgomo population, only 14% has piped (tap) water inside their dwellings and 25% has piped (tap) water inside the yard. Majority (36%) has no access to piped (tap) water which implies that they rely on rain water or have to walk long distances to fetch water.

There is no police station in the village. Access to local policing services can be sought at Steelpoort and Burgersfort. There is no formal waste disposal site and collection method within the village. The predominant disposal methods are burning or burying.

The electricity provider in Tukakgomo village is ESKOM. The electricity power is mainly used for lighting in households due to financial constraints for other uses such as heating and cooking. It is important to note that some households in the village are not electrified as such, electricity backlogs need to be addressed to ensure electrification in all households. The lack of access to electricity poses a problem to the village and municipality as it impacts negatively on local economic development and community projects.

The use of animal gas and paraffin and wood as an energy source is common in the village and it is ascertained that almost all households without electricity depend on either wood or animal gas as an energy source for cooking or heating. Some households use a combination of wood and paraffin for their energy needs. Wood is a natural source that is generally used in most rural areas. Even in a case where electricity is available, it is typical to find rural households using firewood to heat water and for cooking.

Communication within the Tukakgomo village is by mobile public phones and individual cell phones. Other forms of communication include radio and satellite television.

8.12.5.11. Access Roads

The affected village –Tukakgomo is situated alongside the R555 national road from Burgersfort to Steelpoort. This road currently carries an average of 9200 vehicles during the morning hours (06h00-09h00), approximately 8290 vehicles during daytime (12h00-14h00) and 9100 vehicles in the evening (16h00-18h00).

Access through the affected village is by gravel or small dirt roads. Transport is mainly by mini-bus taxis and buses. Community members have to walk to the main R555 road to access the public transport.

8.12.5.12. Language, Religion, Cultural History and Traditional Practices

The village of Tukakgomo is pedi speaking community. The predominant language in the community is sePedi. The Bapedi originated from the Bakgatla and moved to the Eastern-Central Transvaal. This is where they built a powerful empire in Bopedi, by a skilful combination of diplomacy and military conquest. Their motto, "Fetakgomo o sware Motho, Mofetakgomo ke moriri oa hloga", was used to build a strong and revered Pedi nation. They implemented it practically in building a nation by bringing in small tribes, not slaughtering the weak and defeated people, by using cattle to marry as many women as possible from neighbouring tribes, by admitting outsiders and refugees into the fold of the tribe and by conquering recalcitrant tribes. The empire grew over time to a stage where at the zenith of its success it covered the area between the Lekwe (Vaal) and the Lebepe (Limpopo) rivers, in the south and north, and the Komati River and the Kgalagadi, in the East and in the West respectively (Magubane, 1998:p127). They regarded the entire vast land as their own and Pedi soldiers were sent to check the boundaries. They fought everyone who encroached on it - Boers, British, Swazis, Arab slave traders, and others.

As a consequence, the Marota, as the Bapedi are affectionately addressed, were the de facto rulers of a great empire that included people of other origins, including the Bakgaga, Batau, Bakone, Baroka, Batlokwa, Baphuthi, Bakwena, Bakgatla,Bantwane, BaMongatane, BaMohlala, Mapulana, Matebele, Matlala, Batswana, MaSwazi, Batswako and others. They all owed allegiance and had a common loyalty to the Pedi kings. They even requested initiation sessions from the Pedi kings. So it is clear that, "historically the Pedi were a relatively small tribe who by various means built up a considerable empire. This resulted in their language being accepted as a lingua franca and indeed, with minor adjustments, as the medium for Bantu schools in most of the Transvaal." (Monnig, 1967:v).

"*Initially they were small and weak, but they soon began to establish their authority over a number of other Sotho groups and started to play a dominant role in the area. The basis of the Pedi power was laid by King Thulare (1780-1820). Thulare was a fearless warrior and a wise statesman*." (Van Aswegen, 1990:p63) The Bapedi, like any other tribe, had their kings and royalty, their succession struggles and a powerful culture and tradition.

"*The Pedi owned large herds of cattle and were skilful manufacturers of iron tools*."(Van Aswegen, 1990:63) It is because of their dependence on cattle for their everyday livelihood, that cattle imagery dominated their language in idioms, praise songs, poetry and speech. Cattle represented a concrete expression of Pedi wealth. They therefore dominated such ceremonies and intra- and inter-tribal matters as funerals, marriage, initiation, court fines, song, ancestor worship and traditional rituals.

This dominant role of cattle had a material background in that the Bapedi depended on them for almost everything from ceremonies to building relations, clothing (cow hide), shoes, meat, milk, go kgopha (polish). The Sepedi word for cow and cattle, kgomo and dikgomo, literally dominates the interactions of Bapedi life. They held dikoma, had dikgoro, pitso, moshate, dibego, malapa, mashemo, diruiwa, dingaka, bahlabani and worshiped God through badimo.

They had a fairly democratic and egalitarian society. They had laws, rules and practices that were adhered to, and punished those who transgressed. As Lerumo says, "*The African political and judicial structure was essentially democratic. Important decisions affecting the tribe were referred to a general assembly of the people - the Tswana and Sotho pitso, the Xhosa and Zulu imbizo. The Chief's court, at which disputes were tried publicly and every man had the right to attend and speak, was the pivot of the legal and political structure*." (Lerumo, 1971:p3) In their praise poem the Bapedi talk about their own origins, strengths and tribulations: "*Rena re Bakgatla ba dithebe. Re boa Mohlake, Mohlaka Marole, Mohlopi wa Mmasebutla sa Dimo Seolomathebo, Wa naka dira le magodu. Nna re bowa phooko le phookwane, Mabje-maramaga mabje magolo ka mabedi e kago mae a tshilwane. Re Bahlako ba Raphogole 'a Ngwato. Rena re Marota 'a Mahwibidu, digolokwane tsa Tsate, dibolaya diipolaela, boba tsa Mohlaka*." (Phala, 1935:p88)

In recent historical period, before most of the Sekhukhune District area was turned into mining sites, it had been occupied by Pedi speaking communities (see Hammond-Tooke, 1993). Early and Late Iron Age farming communities occupied the region since the first Millennium AD (also see Huffman 2002: 1-22; Hammond-Tooke 1993). Archaeological studies conducted in the region also show that the Stone Age hunter-gatherer communities were present in this region for thousands of millennium before the present time.

The dominant religious belief in the communities is Christianity. A number of churches exist in the community. A strong culture of community identity exists amongst the local community, together with long-standing connectedness with the environment.

8.13. LAND USE

In the greater surrounding area of the Lannex Section farming is important for the local communities and a wide range of products are cultivated owing to good soil conditions in some parts along the Steelpoort River, the sub-tropical climate and reasonable access to water. Fruit, vegetables, grain, cotton, citrus, maize, tobacco and meat are produced. However, the total value of agricultural products is marginal.

In the direct surroundings of the Lannex Section vast areas are overgrazed due to the impoverished rural communities. The lack of skills, rather than natural properties of the area, prevents the communities from managing their resource for long-term production. Due to the overgrazing the area is vulnerable to periodic droughts that results in a high risks for erosion. The contribution of the Steelpoort River, which flows directly west of the Lannex Section, is minimal towards overall irrigation of crops in the region.

The present Lannex Section mining area has been fenced off, but the fences are broken or removed regularly. The local communities then use the terrain for grazing for cattle due to impoverishment and a lack of alternative grazing sites. The use of the area for grazing has led to overgrazing, enhanced erosion and soil deterioration. Bush encroachment with sickle bush is widespread on the Lannex Section. The top soil has been removed by erosion and top soil only remained around the tree stems, where the plant roots keep the soil from erosion impacts (Appendix 5.6).

Waste rock disposal sites, tailings waste and tailing spoils are present in the vicinity of the identified sites and the area is heavily spoiled and eroded. A golf course at the planned opencast area 3 and LNX 2, human structures, pipelines, waterworks and previous mining areas are present on almost the entire terrain, except in the planned OC 1 and OC 2 areas. The complete opencast area is quite pristine except in the south western leg (township), as well as in the historic opencast areas and at LNX 3. However, the complete opencast area was not assessable and difficult to evaluate and the evaluation could only be done on remote sensing methods (Appendix 5.6).

8.13.1 LAND USE IN THE IMMEDIATE SURROUNDINGS

Land use in the immediate surroundings of the proposed study area is directly impacted by the following:

- Road impacts;
- Infrastructure (housing, buildings, light industries);
- Pipelines;
- Power lines;
- Smelter plant;
- Town and settlement development; and
- Informal communal agriculture and free range grazing.

9. *IMPACTS AND RISKS IDENTIFIED INCLUDING THE NATURE, SIGNIFICANCE, CONSEQUENCE, EXTENT, DURATION AND PROBABILITY OF THE IMPACTS, INCLUDING THE DEGREE TO WHICH THESE IMPACTS CAN BE MANAGED*

(Provide a list of the potential impacts identified of the activities described in the initial site layout that will be undertaken, as informed by both the typical known impacts of such activities, and as informed by the consultations with affected parties together with the significance, probability, and duration of the impacts. Please indicate the extent to which they can be reversed, the extent to which they may cause irreplaceable loss of resources, and can be avoided, managed or mitigated).

9.1. METHODOLOGY USED IN DETERMINING AND RANKING THE NATURE, SIGNIFICANCE, CONSEQUENCES, EXTENT, DURATION AND PROBABILITY OF POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

(Describe how the significance, probability, and duration of the aforesaid identified impacts that were identified through the consultation process were determined in order to decide the extent to which the initial site layout needs revision).

Refer to EIA methodology as given below in Section 10.

9.2. THE POSSIBLE MITIGATION MEASURES THAT COULD BE APPLIED AND THE LEVEL OF RISK

(With regard to the issues and concerns raised by affected parties provide a list of the issues raised and an assessment/ discussion of the mitigations or site layout alternatives available to accommodate or address their concerns, together with an assessment of the impacts or risks associated with the mitigation or alternatives considered).

Please refer to the above-mentioned statements, Table 11-3

9.2.1 MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED.

Lannex is an operational mine and thus the existing infrastrutcures played a big role in the alternatives that were identified and assessed. Not applicable as several alternatives where considered.

9.2.2 STATEMENT MOTIVATING THE ALTERNATIVE DEVELOPMENT LOCATION WITHIN THE OVERALL SITE. (PROVIDE A STATEMENT MOTIVATING THE FINAL SITE LAYOUT THAT IS PROPOSED)

Lannex is an existing mine with existing infrastructure that will be utilised during the proposed opencast and underground expansion. A site selection process was undertaken to consider the possible location of the proposed tailings storage facility, return water dam, plant area, TSF reclamation, and access road. However, the opencast and underground site was selected based on the availability of Chrome and other minerals that ECM is targeting to extract. Minerals can only be mined where identified and verified, therefore it was not practical to select any the mining site. Refer to Section 5.2.1.

10. *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 LAYOUT PLAN) THROUGH THE LIFE OF THE ACTIVITY.*

(Including (i) a description of all environmental issues and risks that where identified during the environmental impact assessment process and (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.)

10.1. METHODOLOGY

The results of the specialist studies were analysed and interpreted in order to assess the potential impacts, which the proposed development may inflict on bio-physical and social systems, devise potential alternatives with respect to selected activities and the development of necessary mitigation measures in order to minimise negative impacts and optimise positive impacts. The specialist recommendations were also incorporated into the Environmental Management Programme (Part B). The activities were described in the project description were assessed in terms of direct, indirect as well as cumulative impacts, where possible.

10.2. SPECIALIST IMPACT IDENTIFICATION AND ASSESSMENT

The specialists specifically differentiated between the environmental impacts associated with the construction, operation and maintenance of the proposed mine. As far as possible, the specialists were required to quantify the suite of potential environmental impacts identified in their studies and assess the significance of the impacts. Each impact was assessed and rated. For the purposes of this EIA process, the term ‘assessment’ refers to “the process of collecting, organising, analysing, interpreting and communicating data relevant to some decisions” (Stauth, et al., 1993). The assessment of the data was, where possible, based on accepted scientific techniques, failing which, the specialists made judgements based on their professional expertise and experience.

10.3. ASSESSMENT CRITERIA

The criteria for the description and assessment of environmental impacts were drawn from the EIA Guidelines (DEAT, 1998) and as amended from time to time (DEAT, 2002).

The level of detail as depicted in the EIA Guidelines (DEAT, 1998) (DEAT, 2002)) was fine-tuned by assigning specific values to each impact. In order to establish a coherent framework within which all impacts could be objectively assessed, it was necessary to establish a rating system, which was applied consistently to all the criteria. For such purposes each aspect was assigned a value, ranging from one (1) to five (5), depending on its definition. This assessment is a relative evaluation within the context of all the activities and the other impacts within the framework of the project.

An explanation of the impact assessment criteria is defined below.

Table 10-1: Impact Assessment Criteria

EXTENT	
Classification of the physical and spatial scale of the impact	
Footprint	The impacted area extends only as far as the activity, such as footprint occurring within the total site area.
Site	The impact could affect the whole, or a significant portion of the site.
Regional	The impact could affect the area including the neighbouring farms, the transport routes and the adjoining towns.
National	The impact could have an effect that expands throughout the country (South Africa).
International	Where the impact has international ramifications that extend beyond the boundaries of South Africa.

EXTENT	
Classification of the physical and spatial scale of the impact	
DURATION	
The lifetime of the impact that is measured in relation to the lifetime of the proposed development.	
Short term	The impact will either disappear with mitigation or will be mitigated through a natural process in a period shorter than that of the construction phase.
Short to Medium term	The impact will be relevant through to the end of a construction phase (1.5 years).
Medium term	The impact will last up to the end of the development phases, where after it will be entirely negated.
Long term	The impact will continue or last for the entire operational lifetime i.e. exceed 30 years of the development, but will be mitigated by direct human action or by natural processes thereafter.
Permanent	This is the only class of impact, which will be non-transitory. Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient.
INTENSITY	
The intensity of the impact is considered by examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning, or slightly alters the environment itself. The intensity is rated as	
Low	The impact alters the affected environment in such a way that the natural processes or functions are not affected.
Medium	The affected environment is altered, but functions and processes continue, albeit in a modified way.
High	Function or process of the affected environment is disturbed to the extent where it temporarily or permanently ceases.
PROBABILITY	
This describes the likelihood of the impacts actually occurring. The impact may occur for any length of time during the life cycle of the activity, and not at any given time. The classes are rated as follows:	
Improbable	The possibility of the impact occurring is none, due either to the circumstances, design or experience. The chance of this impact occurring is zero (0 %).
Possible	The possibility of the impact occurring is very low, due either to the circumstances, design or experience. The chances of this impact occurring is defined as 25 %.
Likely	There is a possibility that the impact will occur to the extent that provisions must therefore be made. The chances of this impact occurring is defined as 50 %.
Highly Likely	It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up before carrying out the activity. The chances of this impact occurring is defined as 75 %.
Definite	The impact will take place regardless of any prevention plans, and only mitigation actions or contingency plans to contain the effect can be relied on. The chance of this impact occurring is defined as 100 %.

The status of the impacts and degree of confidence with respect to the assessment of the significance must be stated as follows:

- **Status of the impact:** A description as to whether the impact would be positive (a benefit), negative (a cost), or neutral.
- **Degree of confidence in predictions:** The degree of confidence in the predictions, based on the availability of information and specialist knowledge.

Other aspects to take into consideration in the specialist studies are:

- Impacts should be described both before and after the proposed mitigation and management measures have been implemented.
- All impacts should be evaluated for the full-lifecycle of the proposed development, including construction, operation and decommissioning.
- The impact evaluation should take into consideration the cumulative effects associated with this and other facilities which are either developed or in the process of being developed in the region.

- The specialist studies must attempt to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. Where appropriate, national standards are to be used as a measure of the level of impact.

10.3.1 MITIGATION

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

10.3.1.1. Determination of Significance-Without Mitigation

Significance is determined through a synthesis of impact characteristics as described in the above paragraphs. It 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 is rated on the following scale:

Table 10-2: Significance-Without Mitigation

NO SIGNIFICANCE	The impact is not substantial and does not require any mitigation action.
LOW	The impact is of little importance, but may require limited mitigation.
MEDIUM	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.
HIGH	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.

10.3.1.2. Determination of Significance- With Mitigation

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

Table 10-3: Significance- With Mitigation

NO SIGNIFICANCE	The impact will be mitigated to the point where it is regarded as insubstantial.
LOW	The impact will be mitigated to the point where it is of limited importance.
LOW TO MEDIUM	The impact is of importance, however, through the implementation of the correct mitigation measures such potential impacts can be reduced to acceptable levels.
MEDIUM	Notwithstanding the successful implementation of the mitigation measures, to reduce the negative impacts to acceptable levels, 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	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	The impact is of major importance. Mitigation of the impact is not possible on a cost-effective basis. The impact is regarded as high importance and taken within the overall context of the project, is regarded as a fatal flaw. An impact regarded as high significance, after mitigation could render the entire development option or entire project proposal unacceptable.

10.3.2 ASSESSMENT WEIGHTING

Each aspect within an impact description was assigned a series of quantitative criteria. Such criteria are likely to differ during the different stages of the project's life cycle. In order to establish a defined base upon which it becomes feasible to make an informed decision, it was necessary to weigh and rank all the criteria.

10.3.2.1. Ranking, Weighting and Scaling

For each impact under scrutiny, a scaled weighting factor is attached to each respective impact (refer Table 10-4). The purpose of assigning weights serves to highlight those aspects considered the most critical to the various stakeholders and ensure that each specialist's element of bias is taken into account. The weighting factor also provides a means whereby the impact assessor can successfully deal with the complexities that exist between the different impacts and associated aspect criteria.

Simply, such a weighting factor is indicative of the importance of the impact in terms of the potential effect that it could have on the surrounding environment. Therefore, the aspects considered to have a relatively high value will score a relatively higher weighting than that which is of lower importance.

Table 10-4: Description of assessment parameters with its respective weighting

EXTENT		DURATION		INTENSITY		PROBABILITY		WEIGHTING FACTOR (WF)		SIGNIFICANCE RATING (SR)	
Footprint	1	Short term	1	Low	1	Probable	1	Low	1	Low	0-19
Site	2	Short to Medium	2			Possible	2	Low to Medium	2	Low to Medium	20-39
Regional	3	Medium term	3	Medium	3	Likely	3	Medium	3	Medium	40-59
National	4	Long term	4			Highly Likely	4	Medium to High	4	Medium to High	60-79
International	5	Permanent	5	High	5	Definite	5	High	5	High	80-100

MITIGATION EFFICIENCY (ME)		SIGNIFICANCE FOLLOWING MITIGATION (SFM)	
High	0.2	Low	0 - 19
Medium to High	0.4	Low to Medium	20 - 39
Medium	0.6	Medium	40 - 59
Low to Medium	0.8	Medium to High	60 - 79
Low	1.0	High	80 - 100

10.3.2.2. Identifying the Potential Impacts Without Mitigation Measures (WOM)

Following the assignment of the necessary weights to the respective aspects, criteria are summed and multiplied by their assigned weightings, resulting in a value for each impact (prior to the implementation of mitigation measures).

Equation 1:

Significance Rating (WOM) = (Extent + Intensity + Duration + Probability) x Weighting Factor

10.3.2.3. Identifying the Potential Impacts With Mitigation Measures (WM)

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

10.3.2.4. Mitigation Efficiency (ME)

The most effective means of deriving a quantitative value of mitigated impacts is to assign each significance rating value (WOM) a mitigation efficiency (ME) rating (refer to Table 10-4). The allocation of such a rating is a measure of the efficiency and effectiveness, as identified through professional experience and empirical evidence of how effectively the proposed mitigation measures will manage the impact.

Thus, the lower the assigned value the greater the effectiveness of the proposed mitigation measures and subsequently, the lower the impacts with mitigation.

Equation 2:

Significance Rating (WM) = Significance Rating (WOM) x Mitigation Efficiency

or WM = WOM x ME

10.3.2.5. Significance Following Mitigation (SFM)

The significance of the impact after the mitigation measures are taken into consideration. The efficiency of the mitigation measure determines the significance of the impact. The level of impact is therefore seen in its entirety with all considerations taken into account.

10.4. LIMITATIONS AND ASSUMPTIONS

Assumptions and limitations applicable to specific to the assessment process and mitigation measures proposed in specific specialist studies include the following:

Table 10-5: Specialist Assumptions and Limitations

Specialist	Assumptions/Limitations
Terrestrial Ecology Assessment	The desktop study was conducted with up-to-date resources. It might however be possible that additional information become available in time, because environmental impact assessments deal with dynamic natural ecosystems. It is therefore important that the report be viewed and acted upon with these limitations in mind. The results, typical flora, herpetofauna, avifauna and mammalian communities found within the study should/can therefore only be used as a general guideline. In order to obtain a comprehensive understanding of the dynamics of the ecology of the study area, surveys should ideally have been replicated over several seasons and over a number of years. However, due to project time constraints such long-term studies are not feasible. This fauna and flora survey was conducted over two seasons, i.e. Summer (March 2020) and Autumn (June 2020). Species flowering only during specific times of the year could be confused with a very similar species of the same genus and some plant species that emerge and bloom during another time of the year or under very specific circumstances and may have been missed entirely. No scientific data was collected or analysed for the calculation of ecological veld condition. Any comments or observations made in this regard are based on observations, the expert knowledge and relevant professional experience of the specialist investigator. The site verification was undertaken during the Summer months (March) and again in June. Climatic and site conditions were suitable for the terrestrial ecology site survey to be undertaken. The general condition and species composition of the site could be established. Limitations should always be kept in mind and therefore management should focus on pro-active measures and the implementation of the precautionary principle. The specialist responsible for this study reserves the right to amend this report, recommendations and/or conclusions at any stage should any additional or otherwise significant information come to light
Surface Water Assessment	**Riparian Assessment** In order to obtain a comprehensive understanding of the dynamics of the vegetation of the study area, surveys should ideally have been replicated over several seasons and over a number of years. However, due to project time constraints such long-term studies are not feasible and this riparian vegetation survey was conducted in one season. Species flowering only during specific times of the year could be confused with a very similar species of the same genus and some plant species that emerge and bloom during another time of the year or under very specific circumstances may have been missed entirely. One site verification was undertaken during the summer months (March) and another during the winter months (June). Climatic and site conditions were suitable for the floral site survey to be undertaken. The general condition and species composition of the site could be established. **Overall Report** This report and the assessment are based on available information as provided by Samancor Chrome Ltd Lannex Section and as outlined in Section 2.1 and throughout Section 5 within the specialist report. No detailed design drawings of the proposed TSF and associated infrastructure were available. In addition, no detailed mine works plan for the opencast section was provided, i.e. outline of active pit sections per month.
Floodline Assessment	**Assumptions** The topographic data provided was of a sufficient accuracy to enable hydraulic modelling at a suitable level of detail. • The DEM used to model the identified drainage/river was obtained from the client.

Specialist	Assumptions/Limitations
	• A sub critical flow regime, steady state hydraulic modelling was selected for the running of the model. • No storage facilities where modelled. • No flood protection infrastructure was modelled. • The floodlines produced should only be used for indicative and environmental purposes, and not for detailed engineering design, unless signed off by a registered engineer.
Hydrogeological Assessment	The Groundwater Decision Tool (GDT) was used to quantify the vulnerability of the aquifer underlying the site using the below assumptions. • Depth to groundwater below the site was estimated from water levels measured during the hydrocensus inferred to be at mean of ~12.63 mbgl. • Groundwater recharge of ~18.5 mm/a (2.5 % recharge). • Bushveld Igneous Complex vadose zone. • Gradient of 5% were assumed and used in the estimation The modelling was done within the limitations of the scope of work of this study and the amount of data available. Although all efforts have been made to base the model on sound assumptions and has been calibrated to observed data, the results obtained from this exercise should be considered in accordance with the assumptions made. Especially the assumption that a fractured aquifer will behave as a homogeneous porous medium can lead to error. However, on a large enough scale (bigger than the REV, Representative Elemental Volume) this assumption should hold reasonably well. No water level data is available for the proposed opencast pit positions It must be cautioned that these calculations have been performed using simplified assumptions of homogeneous aquifer conditions. The reality could deviate substantially from this and the model should thus be updated as more information becomes available.
Visual Impact Assessment	**Assumptions** • The core study area can be defined as an area with a radius of not more than 10 km from the structures and a total study area with a radius of 15 km from the structures. This is because the visual impact of structures beyond a distance of 10 km would be so reduced that it can be considered negligible even if there is direct line of sight. • It is assumed that there are no alternative locations for the structures and that the visual assessment, therefore, assessed only the proposed site; • The height of the VIA is based on the heights as stipulated. • Geographic location within the mining boundary of infrastructure. • The assessment was undertaken during the planning stage of the project and is based on the information available at that time. **Limitations** ▪ Visual perception is by nature a subjective experience, as it is influenced largely by personal values. For instance, what one-viewer experiences as an intrusion in the landscape, another may regard as positive. Such differences in perception are greatly influenced by culture, education and socio-economic background. A degree of subjectivity is therefore bound to influence the rating of visual impacts. In order to limit such subjectivity, a combination of quantitative and qualitative assessment methods was used. A high degree of reliance has been placed on GIS-based analysis viewshed, visibility analysis, and on making transparent assumptions and value judgements, where such assumptions or judgements are necessary.

<table>
<tr><th>Specialist</th><th>Assumptions/Limitations</th></tr>
<tr><td></td><td>The viewshed generated in GIS cannot be guaranteed as 100% accurate. Some viewpoints, which are indicated on the viewshed as being inside of the viewshed, can be outside of the viewshed. This is due to the change of the natural environment by surrounding activities as well as natural vegetation that play a significant role and can have a positive or negative influence on the viewshed.</td></tr>
<tr><td>Air Quality Assessment</td><td>Gaussian-plume models are best used for near-field applications where the steady-state meteorology assumption is most likely to apply. The most widely used Gaussian plume model is the US.EPA AERMOD model.</td></tr>
<tr><td>Noise Impact Assessment</td><td>Limitations - Acoustical Measurements
Ambient sound levels are the cumulative effects of innumerable sounds generated at various instances both far and near. High measurements may not necessarily mean that noise levels in the area are high. Similarly, a low sound level measurement will not necessarily mean that the area is always quiet, as sound levels will vary over seasons, time of the day, faunal characteristics, vegetation in the area and meteorological conditions (especially wind). This is excluding the potential effect of sounds from anthropogenic origin. It is impossible to quantify and identify the numerous sources that influenced a measurement using the reading result at the end of the measurement. Therefore, trying to define ambient sound levels using the result of one 10-minute measurement can be inaccurate (very low confidence level in the results) for the reasons mentioned above. The more measurements that can be collected at a location the higher the confidence levels in the ambient sound level determined. The more complex the sound environment, the longer the required measurement. When singular measurements are used, a precautious stance must be adopted (as done in this report).
Ambient sound levels are dependent not only on time of day and meteorological conditions but also change due to seasonal differences. Ambient sound levels are generally higher in summer months when faunal activity is higher and lower during the winter due to reduced faunal activity. Winter months unfortunately also coincide with lower temperatures and very stable atmospheric conditions, ideal conditions for propagation of noise. Many faunal species are more active during warmer periods than colder periods. Certain cicada species can generate noise levels up to 120 dB for mating or distress purposes, sometimes singing in synchronisation magnifying noise levels they produce from their tymbals .
It is assumed that the measurement locations represent other residential dwellings in the area (similar environment), yet, in practice, this can be highly erroneous as there are numerous factors that can impact on ambient sound levels, including:
the distance to closest trees, number and type of trees as well as the height of trees;
available habitat and food for birds and other animals;
distance to residential dwelling, type of equipment used at dwelling (compressors, air-con);
general maintenance condition of house (especially during windy conditions); and
number and type of animals kept in the vicinity of the measurement locations (typical land use taking place around the dwelling).
Measurements over wind speeds of 3 -5 m/s could provide data influenced by wind induced noises:
Ambient sound levels recorded near rivers, streams, wetlands, trees and bushy areas can be high due to faunal activity, which can dominate the sound levels around the measurement point (specifically during summertime, rainfall event or during the dawn chorus of bird songs). This generally is still considered naturally quiet and accepted as features of the natural baseline, and in various cases sought after and pleasing. Using this data to define the ambient sound level will result in a higher rating level, and data collected close to such measurement locations will not be considered;
Considering one or more sound descriptor or equivalent can improve an acoustical assessment. Parameters such as</td></tr>
</table>

Specialist	Assumptions/Limitations
	LAMin, LAeq, LAMax, LA10, LA90 and spectral analysis forms part of the many variables that can be considered. However, South African legislation requires consideration of the impulse-weighted LAeq setting that will be considered when measuring ambient sound levels; • Exact location of a sound level meter in an area in relation to structures, infrastructure, vegetation, wetlands and external noise sources will influence measurements. It may determine whether you are measuring anthropogenic sounds from a receptors dwelling, or measuring environmental ambient baseline contributors of significance (faunal, roads traffic, railway traffic movement etc.); and • As a residential area develops, the presence of people will result in increased dwelling related sounds. These are generally a combination of traffic noises, voices, animals and equipment (including TVs and radios). The result is that ambient sound levels will increase as an area matures. **Calculating Noise Emissions – Adequacy Of Predictive Methods** Limitations due to the calculations of the noise emissions into the environment include the following: • Many sound propagation models do not consider sound characteristics as calculations are based on an equivalent level (with the appropriate correction implemented e.g. tone or impulse). These other characteristics include intrusive sounds or amplitude modulation; • Most sound propagation models do not consider refraction through the various temperature layers (specifically relevant during the night-times); • Most sound propagation models do not consider the low frequency range (third octave 16 Hz – 31.5 Hz). This would be relevant to facilities with a potentially low frequency issues; • Many environmental models consider sound to propagate in hemi-spherical way. Certain noise sources (e.g. a speakers, exhausts, fans) emit sound power levels in a directional manner; • The impact of atmospheric absorption is simplified and very uniform meteorological conditions are considered. This is an over-simplification and the effect of this in terms of sound propagation modelling is difficult to quantify; • Many environmental models are not highly suited for close proximity calculations; and • Acoustical characteristics of the ground are over-simplified, with ground conditions accepted as uniform. Ground conditions will not be considered in this assessment. Due to these assumptions, modelling generally could be out with as much as +10 dBA, although realistic values ranging from 3 dBA to less than 5 dBA are more common in practice. **Adequacy of Underlying Assumptions** Noise experienced at a certain location is the cumulative result of innumerable sounds emitted and generated both far and close, each in a different time domain, each having a different spectral character at a different sound level. Each of these sounds is also impacted differently by surrounding vegetation, structures and meteorological conditions that result in a total cumulative noise level represented by a few numbers on a sound level meter. As previously mentioned, it is not the purpose of noise modelling to accurately determine a likely noise level at a certain receptor but to calculate a noise rating level that is used to identify potential issues of concern.

Specialist	Assumptions/Limitations
	Uncertainties Associated With Mitigation Measures • Any noise impact can be mitigated to have a low significance; however, the cost of mitigating this impact may be prohibitive, or the measure may not be socially acceptable (such as the relocation of an NSD). These mitigation measures may be engineered, technological or due to management commitment. • For the purpose of the determination of the significance of the noise impact mitigation measures were selected that is feasible, mainly focussing on management of noise impacts using rules, policy and require a management commitment. This, however, does not mean that noise levels cannot be reduced further, only that to reduce the noise levels further may require significant additional costs (whether engineered, technological or management). • It was assumed the mitigation measures proposed for the construction phase will be implemented and continued during the operational phase. **Uncertainties of Information Provided** While it is difficult to define the character of a measured noise in terms of numbers (third octave sound power levels), it is difficult to accurately model noise levels at a receptor from any operation. The projected noise levels are the output of a numerical model with the accuracy depending on the assumptions made during the setup of the model. The assumptions include the following: • This assessment did not include a noise audit to identify all potential noise sources nor to define the sound power emission levels of these activities (and equipment) within the focus area, but used aerial images to identify potential noise generating activities. These noise generating activities was used to develop the noise contours to illustrate the impact from existing activities. • It is technically difficult and time-consuming to improve the measurement of spectral distribution of large equipment in an industrial setting. This is due to the many correction factors that need to be considered (e.g. other noise sources active in the area, adequacy of average time setting, surrounding field non-uniformity etc. as per SANS 9614-3:2005); • That octave sound power levels selected for processes and equipment accurately represent the sound character and power levels of these processes and equipment. The determination of octave sound power levels in itself is subject to errors, limitations and assumptions with any potential errors carried over to any model making use of these results; • Sound power emission levels from processes and equipment changes depending on the load the process and equipment are subject to. While the octave sound power level is the average (equivalent) result of a number of measurements, this measurement relates to a period that the process or equipment was subject to a certain load (work required from the engine or motor to perform action). Normally these measurements are collected when the process or equipment is under high load. The result is that measurements generally represent a worst-case scenario; • As it is unknown which processes and equipment will be operational (when and for how long), modelling considers a scenario where processes and equipment are under full load for a set time period. Modelling assumptions comply with the precautionary principle and operational time periods are frequently overestimated. The result is that projected noise levels would likely be over-estimated; • Modelling cannot capture the potential impulsive character of a noise that can increase the potential nuisance factor; • The XYZ topographical information is derived from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global DEM data, a product of Japan's Ministry of Economy, Trade, and Industry (METI) and the National Aeronautical and Space Administration (NASA). There are known inaccuracies and artefacts in the data set, yet this is still

Specialist	Assumptions/Limitations
	one of the most accurate data sets to obtain 3D-topographical information; • The impact of atmospheric absorption is simplified and very uniform meteorological conditions are considered. This is an over-simplification and the effect of this in terms of sound propagation modelling is difficult to quantify; and • Acoustical characteristics of the ground are over-simplified with ground conditions accepted as uniform. Fifty per cent (50%) soft ground conditions will be modelled as the area where the construction activities are proposed is well vegetated and sufficiently uneven to allow the consideration of soft ground conditions.
Soils, Land Capability and Agricultural Potential	Opencast site 1 and 2 and most of the complete opencast areas were not accessible due to road restrictions, terrain obstacles and mining activity. Remote sensing, visual observations and desktop information were used in this case. Soil samples and soil observations are needed to be done as soon as an access road to opencast 1 and 2, as well as eventual expansion in the complete opencast area is initiated.
Climate Change Assessment	The following are exclusions from the assessment: • The quantified annual average GHG emission was assumed to be constant throughout the operation of the Project. Whilst year on year emissions may vary, the difference is expected to be insignificant. • The assessment was based on emission factors available at the time of the assessment and future changes in emission factors were not considered. • Future changes in mitigation and adaptation scenario for the Project could not be determined and hence, could not be quantified. Therefore, this scenario is considered the most conservative representation of the Project’s emissions. • Leakage of hydrofluorocarbons from air conditioning units and refrigeration – These emissions were negligible compared with the emissions over the life of the Project. However, these negligible emissions may be recorded as part of the Project ongoing greenhouse reporting if deemed necessary. • Leakage of sulphur hexafluoride from electrical equipment – These emissions were negligible compared with the emissions over the life of the Project (Mine). However, these negligible emissions may be recorded as part of the Project ongoing greenhouse reporting if deemed necessary. • Sequestration of carbon dioxide from revegetation of the site. Whilst revegetation will occur onsite throughout the life of the mine, specific details regarding types of vegetation for replanting or a descriptive revegetation plan are not available at this time as such, sequestration calculations cannot be accurately undertaken. Excluding sequestration also assumes a worst-case scenario for greenhouse gas emissions. Therefore, this scenario is considered the most conservative representation of the Project’s emissions.
Blasting Impact Assessment	No Assumptions made
Socio- Economic Assessment	No Assumptions made
Phase 1 Archaeologic Impact Assessment	No Assumptions made
Palaeontological Assessment	No Assumptions made
Geotechnical Investigations	The findings contained in this report are the result of limited discrete investigations conducted in accordance with normal practices and standards. To the best of our knowledge, they representa reasonable interpretation of the general condition of the site.

10.5. THE POSITIVE AND NEGATIVE IMPACTS THAT THE PROPOSED ACTIVITY (IN TERMS OF THE INITIAL SITE LAYOUT) AND ALTERNATIVES WILL HAVE ON THE ENVIRONMENT AND THE COMMUNITY THAT MAY BE AFFECTED

(Provide a discussion in terms of advantages and disadvantages of the initial site layout compared to alternative layout options to accommodate concerns raised by affected parties)

10.5.1 CONSTRUCTION PHASE

10.5.1.1. Topography

Impact on pre-mining and operational topography.

10.5.1.2. Terrestrial Biodiversity

- Most of the impacts on plant species will occur during the construction phase when removal of plant communities will take place on site.
- Vegetation clearance will likely destroy habitats and lead to possible invasive and/or exotic species establishing in the area and edge-effects occurring surrounding the development, although some the area has already been subjected to transformation or other activities. Bare areas may become vulnerable to Alien and Invasive species and these may compete with indigenous species, likely leading to the migration of sensitive species from the site to a more favorable habitat.
- Development related activities will lead to destruction of Highly sensitive habitat (VU1) and overall loss of biodiversity within the clearance area. As a result of the construction activities fragmentation, degradation or compression may occur if heavy construction vehicles are not kept to the demarcated roads.
- Construction, human and vehicle movement and introduction of foreign material e.g. soils may lead to the introduction of alien invader species, impacting on the floral characteristics of the project site and adjacent natural areas. These species may also compete with indigenous species and will degrade the veld condition by making it unfeasible for other land-uses such as grazing and agriculture.
- The onset of construction activities will result in impacts to the natural environment due to increased movement, traffic and large machinery to the area. Heavy machinery and vehicles may result in compaction of the soil and destruction of vegetation habitat which in turn will also impact on the animals that use the area as habitat.
- Development related activities may lead to the loss of floral species of conservation concern. Sixty-one (61) plant species listed on the SANBI database for the area are classified as species of conservation concern (SCC) according to the IUCN Red List status, the ToPS list, their endemism, the NFA and the LEMA. Six plant SCC were identified to occur in VU1 during the site survey.
- The areas where the opencasts are proposed for development are mostly natural and sensitive due to the location on the mountain and slopes. Construction impacts will be significant here, except for OC3, which is located between rehabilitated areas (previously mined) and covers a section of the infrastructure of the Tubatse Chrome Club, such as a section of the golf course.
- This activity could fragment ranges that certain animals may need to sustain adequate foraging area and breeding grounds. This is relevant since the current habitat has value as foraging grounds and corridors for movement between other natural areas (associated with the mountainous areas where the opencast sections are proposed) and the wildlife kept by the Tubatse Chrome Club. Many natural occurring species of the area will move between the different habitat sections provided by both the Tubatse Chrome Club and the sheltered mountainous and valley areas.
- Impacts on Species of Conservation Concern (SCC) associated with the area.
- The TSF areas suggested are disturbed to various degrees and occur adjacent to the main Steelpoort road or between the main operational developments where disturbance is prevalent.

10.5.1.3. Surface Water

- Removal of vegetation within a watercourse will impact on the habitat that has established which in

turn will impact on the biota using these habitats. The removal of vegetation will result in physical changes to the beds and banks that will impact on the water quality and result in increased potential for siltation and erosion. The movement of machinery could also result in compaction and hydrocarbons spills that could impact on water quality, vegetation and biota.
- Removal of vegetation within 32 m of a watercourse will impact on the habitat that has established which in turn will impact on the biota using these habitats. The removal of vegetation will result in physical changes to the beds and banks that will impact on the water quality and result in increased potential for siltation and erosion. The movement of machinery could also result in compaction, hydrocarbons spills that could impact on water quality, vegetation and biota.
- Removal of vegetation could result in increased siltation of watercourses and increase erosion potential.
- Loosening of material as part of the construction of the identified infrastructures would result in additional damage to habitat and biota while increasing impacts on the stability of the watercourse resulting in increased potential for erosion and siltation. In addition, the movement of machinery within the watercourse or within 32 m could result in increased potential for hydrocarbon spills that will impact on water quality and in turn biota and vegetation.
- The potential for increase erosion that could increase siltation of watercourses exists.

10.5.1.4. Floodline
- Siltation of surface water resources.
- Hydrocarbon spillages.
- Alteration of surface water drainage patterns and river banks.
- Reduction of catchment yields.
- Flooding of proposed TSF, RWD, opencast and associated infrastructure.
- Mixing of clean and dirty water.

10.5.1.5. Groundwater
The construction phase is not strictly applicable to the project as it is an ongoing mine. It thus only applies to new activities. It is accepted for the purposes of this document that the construction phase referred to in this document will consist of preparations for the construction of new facilities only.

a) Impacts in groundwater quantity
This phase is not expected to influence the groundwater levels. With the exception of lesser oil and diesel spills, there are also no activities expected that could impact on regional groundwater quality.

b) Impacts on groundwater quality
This phase should thus cause very little additional impacts in the groundwater quality. It is expected that the current status quo will be maintained.

10.5.1.6. Visual
Potential visual impact on the viewpoints that had a visual exposure rating.

10.5.1.7. Air Quality
- Site clearing, removal of topsoil and vegetation.
- Construction of surface infrastructure (e.g access roads, pipes, opencast, TSF).
- General transportation, hauling and vehicle movement on site.

10.5.1.8. Noise
Potential noise impacts during construction activities for TSF,WRD, Opencast blasting, and all other associated infrastructure during day time and night time.

10.5.1.9. Socio- Economy
- Noise.

- Air Pollution.
- Lights and Visual Impacts.
- Landuse and Land Capacity.
- Cultural and Heritage.
- Crime, HIV and Covid-19.
- Economic Opportunities, Infrastructure Development and Employment.
-

10.5.1.10. Soils and land capability

New tailings deposit area, new crushing and screening plant, TSF reclamation and WRD	
Disturbance/loss of soil resources	Construction
Disturbance/loses of soil due to erosion as well as contamination of soils	Construction and Closure Phase
Cumulative: Disturbance, loss and degradation of soils	Construction and Operational
Land capability and Landuse	
Disturbance/loss/sterilisation of inherent land capability and land use	Construction and operation
OC 1,2,3	
Disturbance/loss of soil resources	Construction
Cumulative: Increased/ Decreased Sediment Loads On Downstream Systems	Construction
Land capability and Landuse	
Disturbance/loss/sterilisation of inherent land capability and land use	Planning, construction and operational phase
Access Roads, Opencast, Tubatse Village and stream diversion	
Soils	
Disturbance/loss of soil resources	Construction
Land capability and Landuse	
Disturbance/loss/sterilisation of inherent land capability and land use	Planning, construction and operational phase

10.5.1.11. Blasting

- Ground vibrations at Tubatse community houses, informal houses, and any other building or structures around the mining area.
- Air blast to any building or structure around the mining area.
- Fly rock on roads within and outside mining area.

10.5.1.12. Climate Change

Increased greenhouse gases from all the vehicles, plants and other earth moving equipment.

10.5.2 OPERATIONAL PHASE

10.5.2.1. Geology

- Loss of chrome and other by product resources
- Voids left as a result of chrome and other by products removal as the opencast area.

10.5.2.2. Topography

Impact on pre-mining and operational topography

10.5.2.3. Terrestrial Biodiversity

- The continuous human activity over a longer-term period may further impact on the faunal communities within the area. Associated noise, waste, the smell of humans, physical penetration into sensitive zones and natural areas are problematic and may lead to ever declining populations (where the disturbance of habitat has caused habitat remaining to become unfavorable).

- Invasive plant species may increase during the operational phase of the project. This will mostly take place in the remaining natural areas. Removal of these species is an ongoing process and if not managed regularly could result in severe changes and competition in plant communities.
- Possible impacts on Species of Conservation Concern (SCC) if encountered by visitors and/or contractors.
- Impacts to the wildlife as active mining commences around the perimeter of the mountain, restricting access to the natural areas and specialized niches associated with the mountainous habitat.

10.5.2.4. Surface Water

- The movement of machinery could result in hydrocarbons spills that could impact on water quality, vegetation and biota.
- Damming of water upstream of the opencast sections and allowing the water to be diverted around the opencast will alter the flow regime, habitat and biota composition of the downstream watercourse as no water will be flowing in the original course. In addition, the damming will alter the habitat in the immediate area of the dam as more water would be available for vegetation establishment. Unless the diversion banks are stabilised, the potential for erosion and increases siltation in the diversion and the watercourse to which it will join is increased.
- The containment of dirty storm water will effectively remove water from the natural water resource, this in turn will impact on the habitat and biota of the impacted watercourses. In addition, spills from these infrastructures could negative impact on the downstream water quality which in turn could affect vegetation and biota negatively.
- The containment of rainwater in the opencast pit will effectively remove water from the natural water resource, this in turn will impact on the habitat and biota of the impacted watercourses.
- Opencast pits located within a watercourse will alter the flow regime, habitat and biota composition of the watercourse completely.
- Spills from the tailings pipeline could impact on the water quality should it occur during the rainy season and the watercourse is flowing. This in turn could impact on the habitat and biota of the receiving water resources.
- Spills from the return water pipeline could impact on the water quality should it occur during the rainy season and the watercourse is flowing. This in turn could impact on the habitat and biota of the receiving water resources.
- Increased dust generation could impact on water quality and habitat should the windblown dust from these two infrastructures be deposited in a watercourse. In addition, should there be a problem with the liner system leachate from these could impact on groundwater which in turn could impact on the base flow water quality of watercourses.
- Overburden storage within the watercourse / within 32 m from the watercourse will alter the flow regime of the water courses and could result in increased siltation to downstream areas. In addition, this will also impact on the habitat and biota making use of the watercourses. In addition, leachate from the material could impact on subsurface flow water quality.

10.5.2.5. Floodline

- Siltation of surface water resources.
- Hydrocarbon spillages.
- Alteration of surface water drainage patterns and river banks.
- Reduction of catchment yields.
- Flooding of proposed TSF, RWD, opencast and associated infrastructure.
- Mixing of clean and dirty water.

10.5.2.6. Groundwater

The operational phase is interpreted as the active mining of the proposed and current mining activities. It is inevitable that these effects will impact on the groundwater regime. The potential impacts that will be considered are the groundwater quantity and quality. A summary of the potential impacts during operation can be seen in Table 10-6.

a) Impacts on groundwater quantity

During the operational phase, it is expected that the main impact on the groundwater environment will be de-watering of the surrounding aquifer. Water entering the mining areas will have to be pumped out to enable mining activities. This will cause a lowering in the groundwater table in- and adjacent to the mine.

The dewatering of the aquifer has been calculated for the current as well as planned underground and opencast mining, using the calibrated numerical model as described above. A worst-case scenario has been modelled, assuming that all mines (opencasts as well as underground) would be dewatered. This will obviously not be the case, and the actual drawdown could thus be less. The calculated drawdown of the worst-case scenario is depicted in Figure 10-1 below, as contours of drawdown for the mines being dewatered simultaneously.

The groundwater drawdown at the level of boreholes will most likely affect the yield of boreholes in the areas coloured red in Figure 10-1 and could affect boreholes in yellow areas. However, these impacted areas are mostly close to the mining plant areas and no known privately owned boreholes exist there. In the green areas further to the southwest of the plant areas, groundwater levels in boreholes could decrease by 5 metres or less, which is typical of seasonal variations and should thus not impact significantly on borehole yields.

Despite the modelled predictions, it must again be stressed that structures of preferred groundwater flow have not been modelled. It is known by experience that intrusions will most likely transgress the area, but details are limited and not adequate to model these structure(s). If such a structure is dewatered, any boreholes drilled into the structure might be seriously affected. These effects cannot be predicted with the current knowledge and can only be established through continuous groundwater level monitoring.

The computed total inflow into each mine, assuming that all areas in the mine are dewatered simultaneously, was calculated as tabled below in Table 10-6. However, these figures are overestimations and probably reflect worst-case scenarios. The actual inflow will depend on the area being mined at any one moment in time.

It is important to view these numbers for the water make of the mine in relation to natural evaporation. Evaporation can contribute considerably to the removal of groundwater seepage into the opencast, and the numbers below does not account for that due to the unknown surface area to be open and flooded at any time.

Furthermore, it should be realised that evaporation is a seasonal effect. Direct recharge from rainfall will in turn add to these volumes. The amount of direct recharge will depend on the season as well as the mining layout and storm water management. It is suggested that this is calculated as part of the surface water study.

It must be cautioned that these calculations have been performed using simplified assumptions of homogeneous aquifer conditions. The reality could deviate substantially from this and the model should thus be updated as more information becomes available.

b) Impacts on surface water

Although surface water as such is not part of this study, the impact of the mining on streams in the area can be estimated qualitatively from the model in so far as the groundwater component (base flow) of the stream is concerned. Such an impact assessment will not include possible surface runoff influences caused by mining, but merely addresses the base flow component due to gaining (or losing) of groundwater by the stream.

It can be deduced from the modelled data (Figure 10-2) that the groundwater drawdown at the Steelpoort River close to the mine will have no impact (Table 10-6) and that the privately owned boreholes at the settlements across the river will not be affected.

The modelled drawdown does not extend to the Steelpoort River, even though mining will progress to close to the river; the reason being that the depth of mining is very deep closer to the river and de-pressurising does not extend to surface. Other non-perennial streams in the area serve only as stormwater draining channels following heavy rainfall events. Since flow is then a short-term feature, no decrease in flow due to mining is likely.

c) <u>Impacts on groundwater quality</u>

The flow in the aquifer will be directed towards the mine at this stage and very little groundwater pollution is thus expected.

Table 10-6: Summary of potential groundwater quality

Mining Area	Maximum Drawdown (m)	Cone of depression from edge of mine (m)	Estimated Inflow for the Area (m3/day)	Potential Impacted Receptor	Expected Water Level Decline (m)
Current Underground	10-15	0 - 300	150-300	Steelpoort River Private Boreholes	<10
Planned Underground	5-10	0 - 300	300-400	Steelpoort River Private Boreholes	<10
Western Opencast	15-20	300	100-150	Steelpoort River Private Boreholes	<10

Table 10-7: Summary of potential impacts during operation- spread of pollution

Mining area	Potential impacted receptor	Estimated increase in concentrations duringoperation (mg/ℓ)
Current Underground	Steelpoort River Private Boreholes	0 0
Planned Underground	Steelpoort River Private Boreholes	0 0
Western Opencast	Steelpoort River Private Boreholes	0 0
Surface Infrastructure	Steelpoort River Private Boreholes	0 0

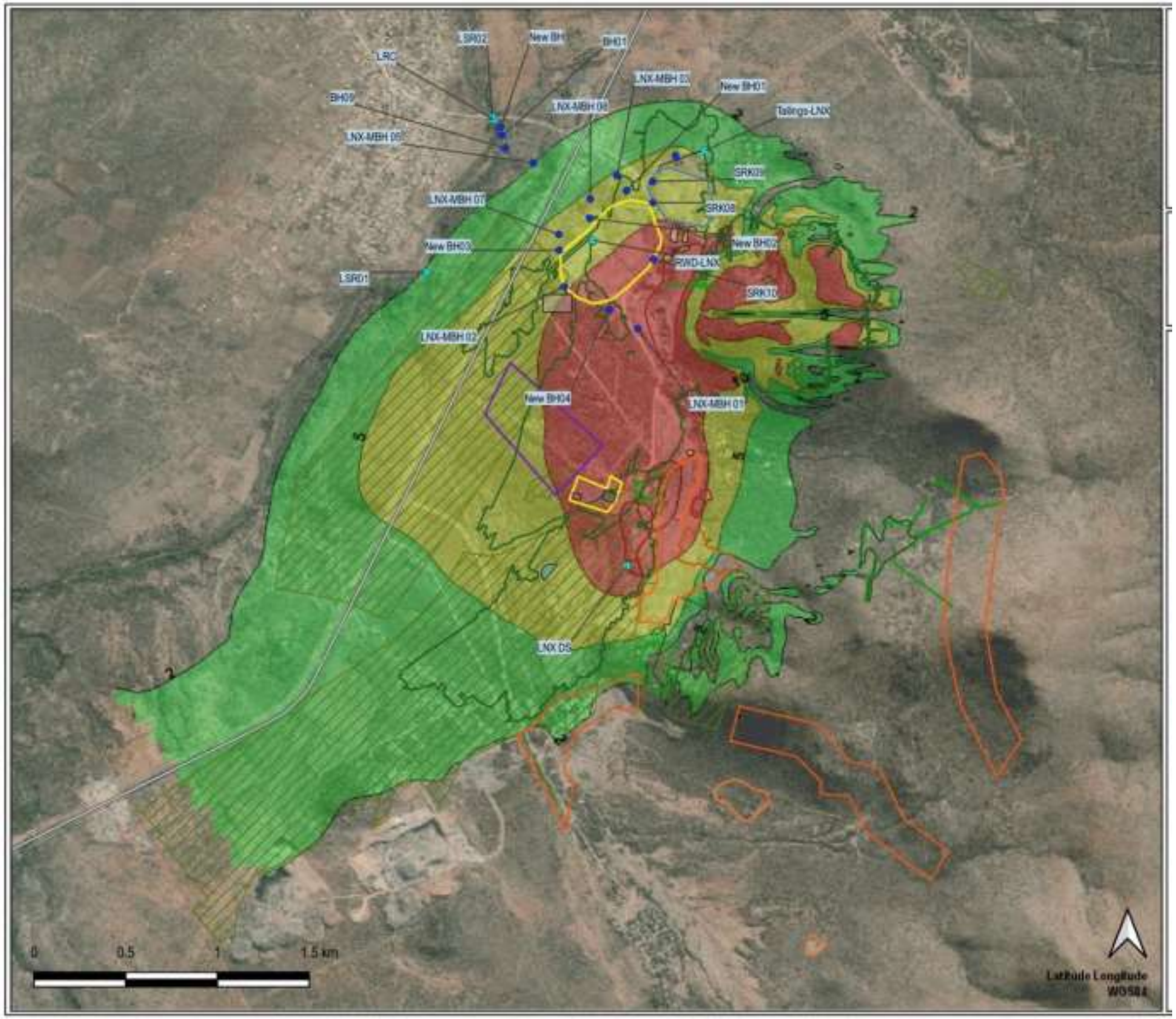

Figure 10-1: Cone of depression during mining (Borehole elevation)

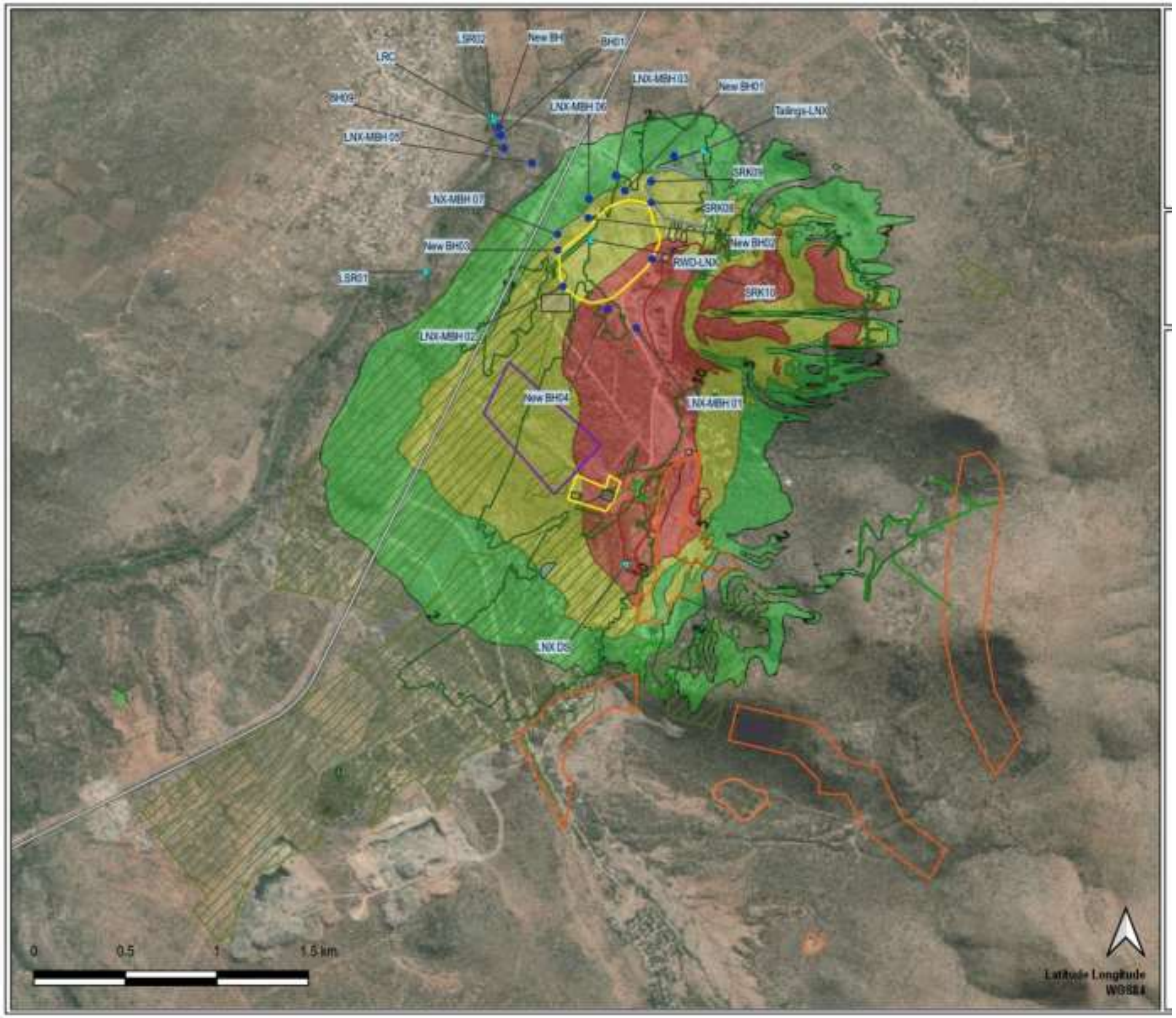

Figure 10-2: Cone of depression during mining (surface elevation)

10.5.2.7. Visual

Potential permanent visual impact on the viewpoints.

10.5.2.8. Air quality

Fugitive emissions impacting ambient air quality from use of maintenance of access roads, dust from material handling, inside and outside the pit area, haul roads for transporting RoM to the processing plant, and wind erosion from stockpile.

10.5.2.9. Noise

Potential noise impact from all the vehicle and earthmoving equipment and blasting activities during day and night time.

10.5.2.10. Socio- Economy

- Noise;
- Air Pollution;
- Lights and Visual Impacts;
- Landuse and Land capacity;
- Cultural and Heritage;
- Crime, HIV and Covid-19; and
- Economic Opportunities, Infrastructure Development and Employment.

10.5.2.11. Soil, Landuse and Land Capability

New tailings deposit area, new crushing and screening plant, TSF reclamation and WRD	
Soil	
Cumulative: Disturbance, loss and degradation of soils	Construction and Operational
Land capability and Landuse	
Disturbance/loss/sterilisation of inherent land capability and land use	Construction and operation
Land capability and Landuse	
Disturbance/loss/sterilisation of inherent land capability and land use	Planning, construction and operational phase
Land capability and Landuse	
Disturbance/loss/sterilisation of inherent land capability and land use	Planning, construction and operational phase

10.5.2.12. Blasting

- Ground vibrations at Tubatse community houses, informal houses, and any other building or structures around the mining area
- Air blast to any building or structure around the mining area
- Fly rock on roads within and outside mining area

10.5.2.13. Climate Change

Increased greenhouse gases from all the vehicles, plants and other earth moving equipment.

10.5.3 DECOMMISSIONING

10.5.3.1. Terrestrial Biodiversity

- Since the previous historic opencasts have been observed during the field assessment, rehabilitation of these areas has been largely successful and therefore the same is expected for the new expansion projects. Decommissioning and rehabilitation will have similar impacts as the construction phase, but thereafter positive impacts as the natural environment starts to recover, restoring balance.

- Rehabilitation could be ineffective if measures are not appropriately complied to or rehabilitation is not planned well in advance. Without the necessary mitigation measures, rehabilitation will be unsuccessful and the environment will not be self-sustaining.
- Increased activity and traffic within a shorter timeframe (closure phase) may degrade the area if adherence is not inline with the Environmental Management Plan (EMP) and Final Rehabilitation programme compiled for the specific Lannex area.

10.5.3.2. Surface Water

- Backfilling of the opencast with overburden could impact on subsurface water flow quality due to the leachate potential from the material. Though backfilled, the pit will still capture run-off due to greater interstitial spaces in the backfilled material resulting in less water reaching the downstream watercourses. If unvegetated, the backfilled material could loosen and during heavy rainfall events result in erosion of the backfilled material and increased siltation to downstream areas.
- This is a positive aspect and will result in slowing down surface run-off flow thus decreasing the potential for erosion.
- Leachate from these areas could negative impact on baseflow water; If not rehabilitated correctly increased windblown dust from these could impact on vegetation and biota of watercourses.
- Removal of the overburden will be a positive as it reduces the potential for siltation from these and will re-establish continuity of the watercourse.
- The removal of the river diversion, containment dams, access roads and culverts will result in loosening of material that could increase erosion risk and siltation. The movement of machinery increase the potential for hydrocarbon spills.
- The historical and existing operations at Lannex have already impacted significantly on several watercourses. The impact relates to the connectivity of watercourses (upstream to downstream) and impact on subsurface water flow quality and quantity.
- By rehabilitating and closure of areas that are no longer needed for support or mining, the dirty footprint area of the mine is reduced and this in turn will increase the water that is released to baseflow and to downstream areas.

10.5.3.3. Groundwater

During this phase it is assumed that dewatering of the mining activity will be ceased, and it will be allowed to flood. The groundwater regime will return to a state of equilibrium once mining has stopped and the removal of water from the mining void has been discontinued.

The rise in groundwater level is predicted to be relatively slow and the water levels are expected to recover only in about 30 years. The slow recovery is ascribed to the low hydraulic conductivity of the surrounding bedrock. The following possible impacts were identified at this stage:

- Following closure of the mine, the groundwater level will rise to an equilibrium that will differ from the pre-mining level due to the disturbance of the bedrock. However, this change is likely to be minimal due to the depth of mining and no drawdown anticipated close to surface.
- Groundwater within the mined areas is expected to deteriorate due to chemical interactions between the geological material and the groundwater. The resulting groundwater pollution plume is expected to commence with downstream movement.

A summary of the potential impacts during the closure of the mine is shown in Table 10-9.

a) Impacts on groundwater quantity

After closure, the water table will rise in the mine to reinstate equilibrium with the surrounding groundwater systems. However, the mined areas will have a large hydraulic conductivity compared to the pre-mining situation.

b) Rebound and Potential Decant

Following the closure of the opencasts and the cessation of the dewatering it is assumed to lead to groundwater rebound.

After rebound has reached equilibrium or water in the pit equal to surrounding host rock, decant has the potential to occur due to excessive rainfall and surface water run-off water entering the pit. The percentage of the rainfall/run-off that is recharged into the rehabilitated opencast and potential decant depends on:

- The slope of the rehabilitated pit and its direct surroundings.
- The thickness and composition of the topsoil. i.e. clay content and compaction.
- The vegetation of the rehabilitation and its direct surroundings.
- The amount rainfall and intensity of the rainfall events.
- The size of the ramps and the final voids.

No decant is predicted for the opencast areas or the underground mining, based on the numerical model. This is most likely due to slope of the topography in relation to that of the ore, both being in the same direction.

Table 10-8: Water recharge-characteristics for opencast mining in the Mpumalanga Area

Water Source	Water into opencast (% rainfall)	Suggested Mean value (% rainfall)
Rain onto ramps and voids	20–100	70
Rain onto not rehabilitated spoils	30–80	60
Rain onto levelled spoils (run-off)	3-7	5
Rain onto levelled spoils (Seepage)	15-30	20
Rain onto rehabilitated spoils (run-off)	5-15	10
Rain onto rehabilitated spoils (seepage)	5-10	8
	(% of total pit water)	**(% of total pit water)**
Surface run-off from pit surroundings	5-15	6
Groundwater seepage	2-15	10

Following the closure of the underground and the cessation of the dewatering it is assumed to lead to groundwater rebound. Using a worst-case scenario, the rebound was estimated at about 10 000 days, or 30 years. The influx of water into the mine void will decrease over time due to the change in groundwater gradient as a result of the rise in water level within the underground.

c) <u>Impacts on groundwater quality</u>

Due to precipitation water that might flow into these opencast pits, polluted water could potentially migrate away from the mining areas. A tracer with a concentration of 100 mg/L was used in the transport modelling. The reason for this is that various contaminants could emerge from the mining, and the contamination plume can easily be calculated tracer reference of 100 as percentage for any contaminant in future. The most common contaminant from the platinum/chrome mines is sulphate where a source concentration of 1 000 mg/L is the norm. Thus, the recommended class 1 and class 2 values for sulphate (250 and 500 mg/L respectively) is thus calculated to coincide with the tracer concentrations of 25 and 52 mg/L correspondingly.

d) <u>Spread of pollution</u>

As some discards and exposed reactive mineral surfaces will remain in the mine, this outflow could be contaminated as a result of mine drainage. As sulphate is normally a significant solute in drainage from mines, sulphate concentration from the mine has been modelled as a conservative (non- reacting) indicator of mine drainage pollution. However, for this study hypothetical tracer with a concentration of 100 mg/L have been modelled as described in the paragraph above. But geological material is a transient contaminant source and decreases in the concentration of released contaminants are expected over time. A 0% and 2% decrease in contaminant concentrations in the mine were incorporated into the transport modelling with the true scenario being somewhere in-between.

The migration of contaminated water from the mining area has been modelled as described, and the results are presented in Figure 10-7 and Figure 10-8 in terms of the extent of the pollution plume 10, 25, 50 and 100 years after the operations have ceased.

As stated previously, the results must be viewed with caution as a homogeneous aquifer has been assumed. Heterogeneities in the aquifer are unknown and the effect of this cannot be predicted. Furthermore, no chemical interaction of the leachate with the minerals in the surrounding bedrock has been assumed. As there must be some interaction and retardation of the plume, this calculation will represent a worst-case scenario.

Within the limitations of the abovementioned assumptions, impacts have been estimated as listed in

- Table 10-9OC Option 1 is expected to receive no inflows as the base of the pit is likely to be above the water table. No drawdown from the opencast is likely to occur. Contamination is expected to affect the Steelpoort River with concentrations of 100 mg/l after mining (will reach the receptor in 58 years). No decant from this opencast is expected to take place.
- OC Option 2 is expected to receive no inflows as the base of the pit is likely to be above the water table. No drawdown from the opencast is likely to occur. Contamination is expected to affect the Steelpoort River with concentrations of 100 mg/l after mining (will reach the receptor in 65 years). No decant from this opencast is expected to take place.
- OC Option 3 is expected to receive no inflows as the base of the pit is likely to be above the water table. No drawdown from the opencast is likely to occur. Contamination is expected to affect the Steelpoort River with concentrations of 100 mg/l after mining (will reach the receptor in 31 years). No decant from this opencast is expected to take place.

Table 10-9: Summary of potential impacts post operations

Mining Area	Potential impacted Receptor	Estimated increase in concentrations during closure (mg/l)	Rebound time (years)	Potential decant (Yes/No)	Potential decant area
Current underground	Steelpoort River Private Boreholes	100-200 0-100	25-30	No	None
Planned underground	Steelpoort River Private Boreholes	100-200 0-100	25-30	No	None
Western opencast	Steelpoort River Private Boreholes	100-200 0-100	25-30	No	None
Surface Facilities	Steelpoort River Private Boreholes	Plume merges with those of the mining	NA	NA	NA

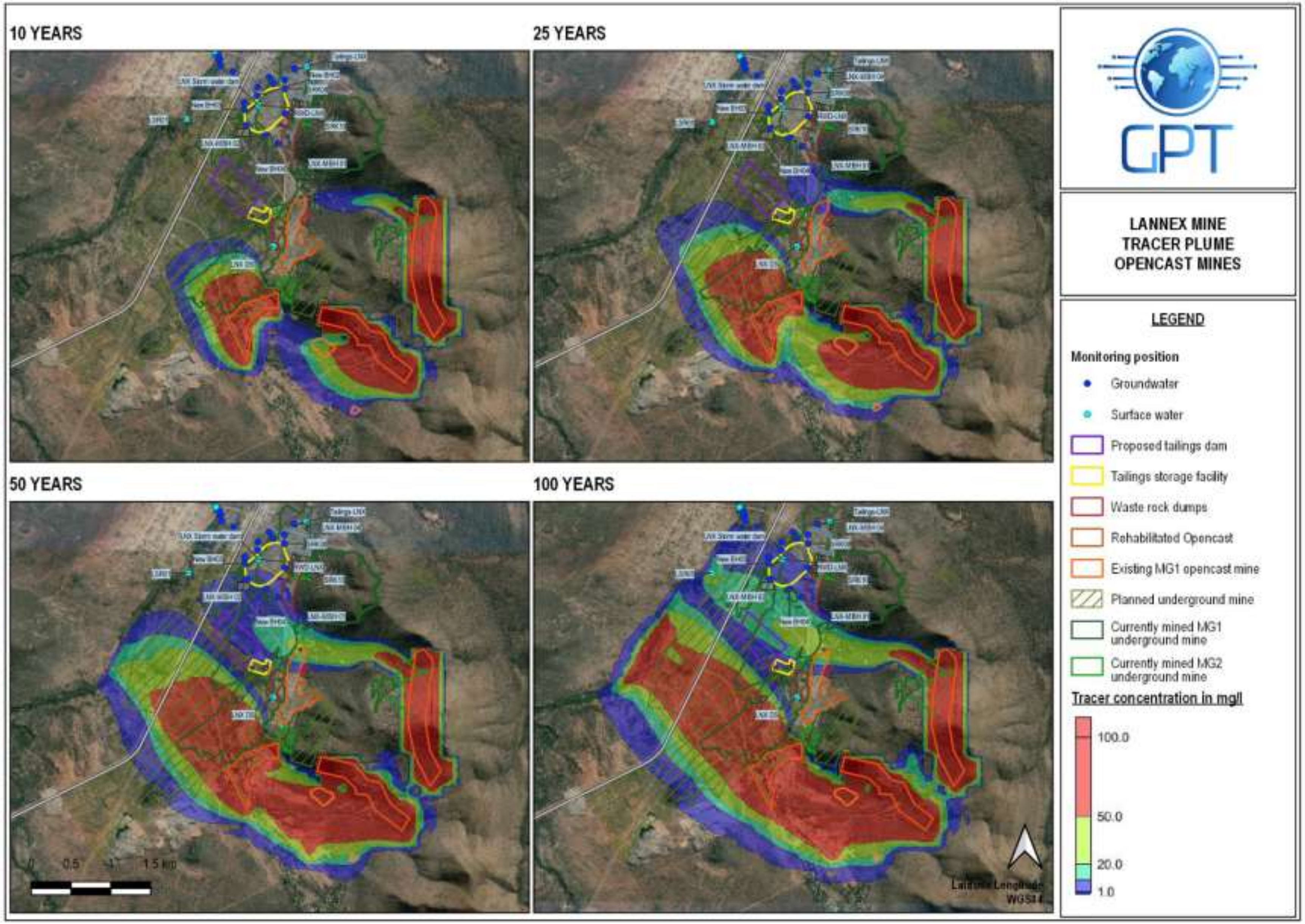

Figure 10-3: Predicted spread of pollution post- closure mining (Proposed opencasts)

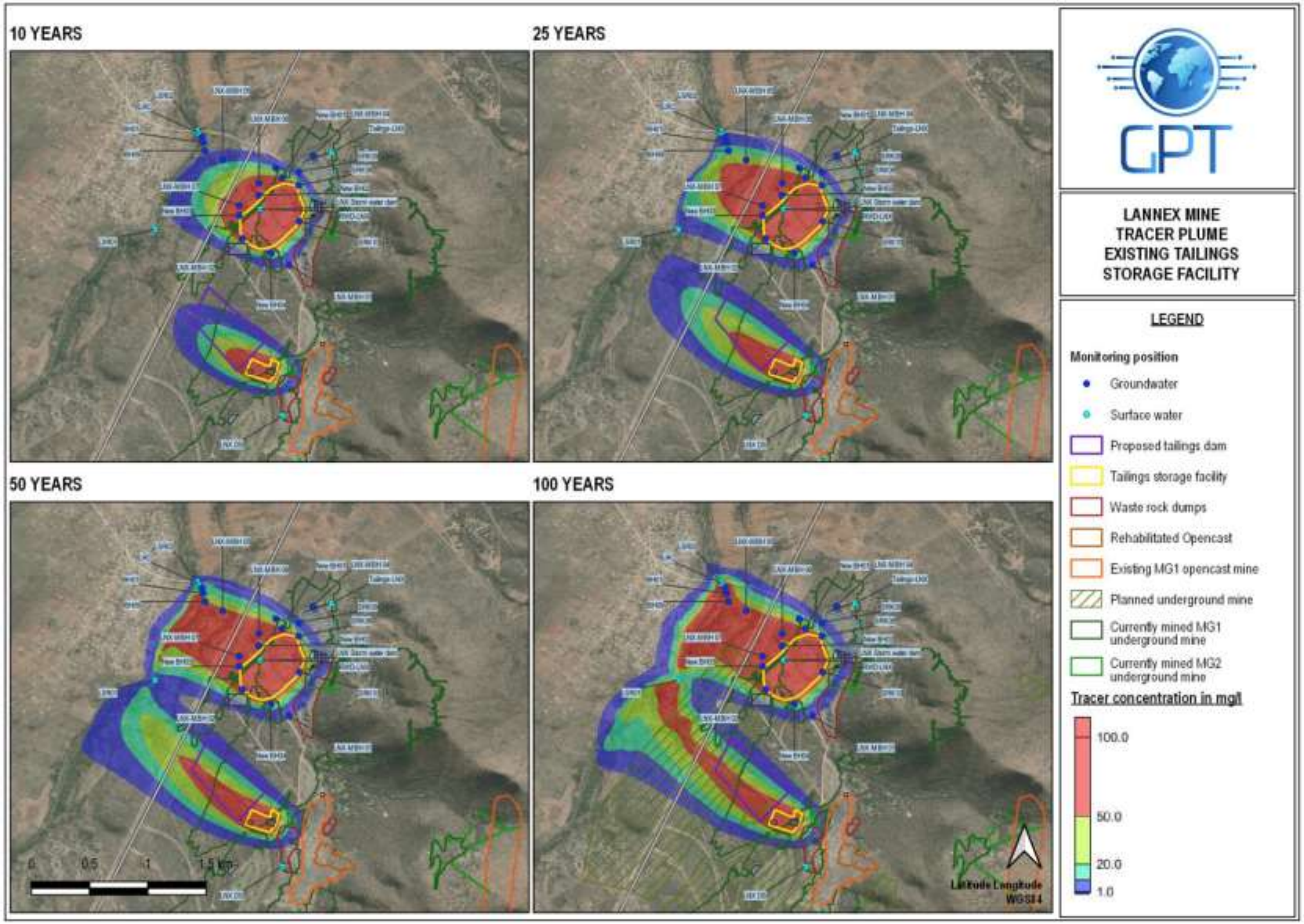

Figure 10-4: Predicted spread of pollution post- closure mining (Existing TSF`s)

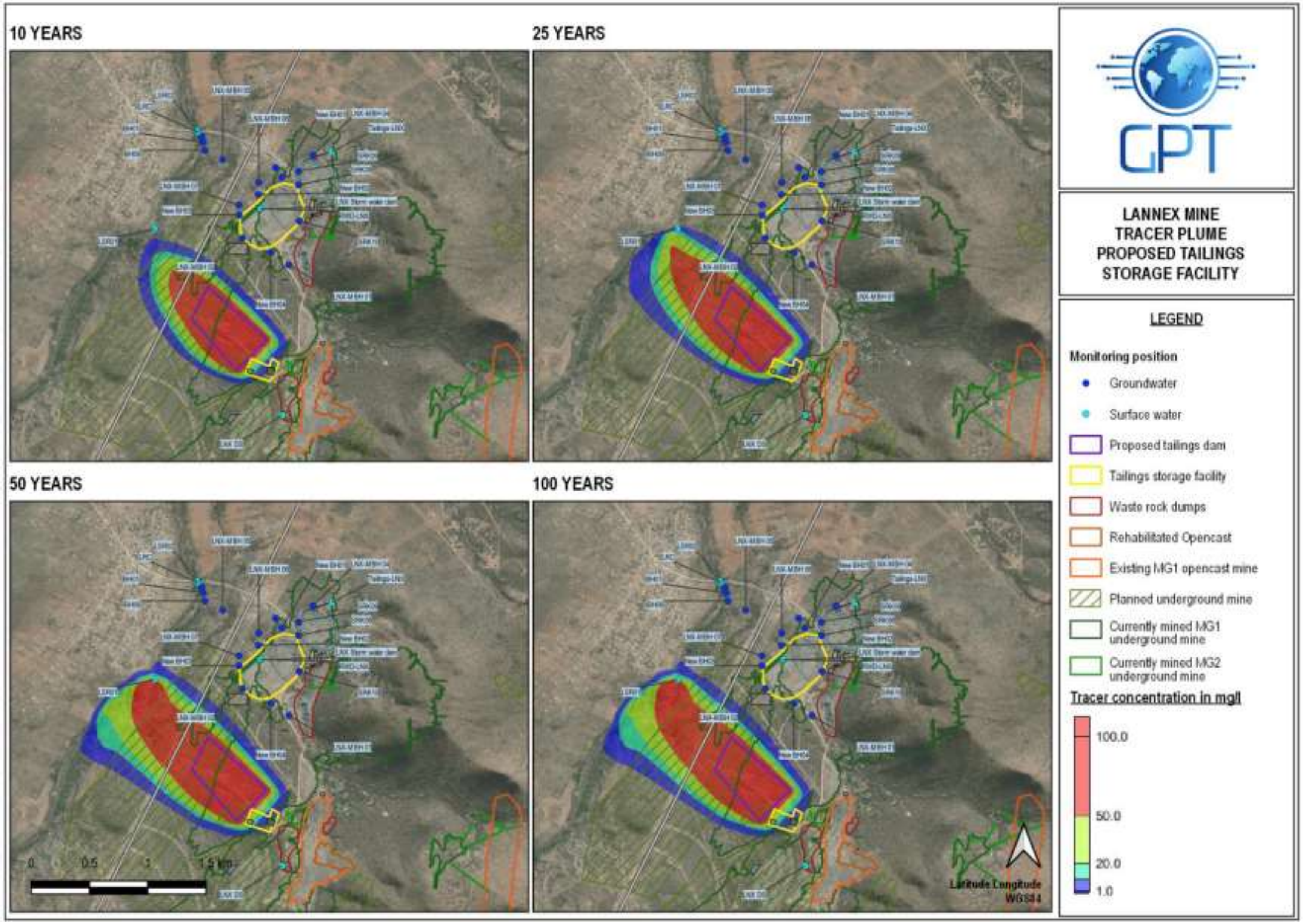

Figure 10-5: Predicted spread of pollution post- closure mining (Proposed TSF1)

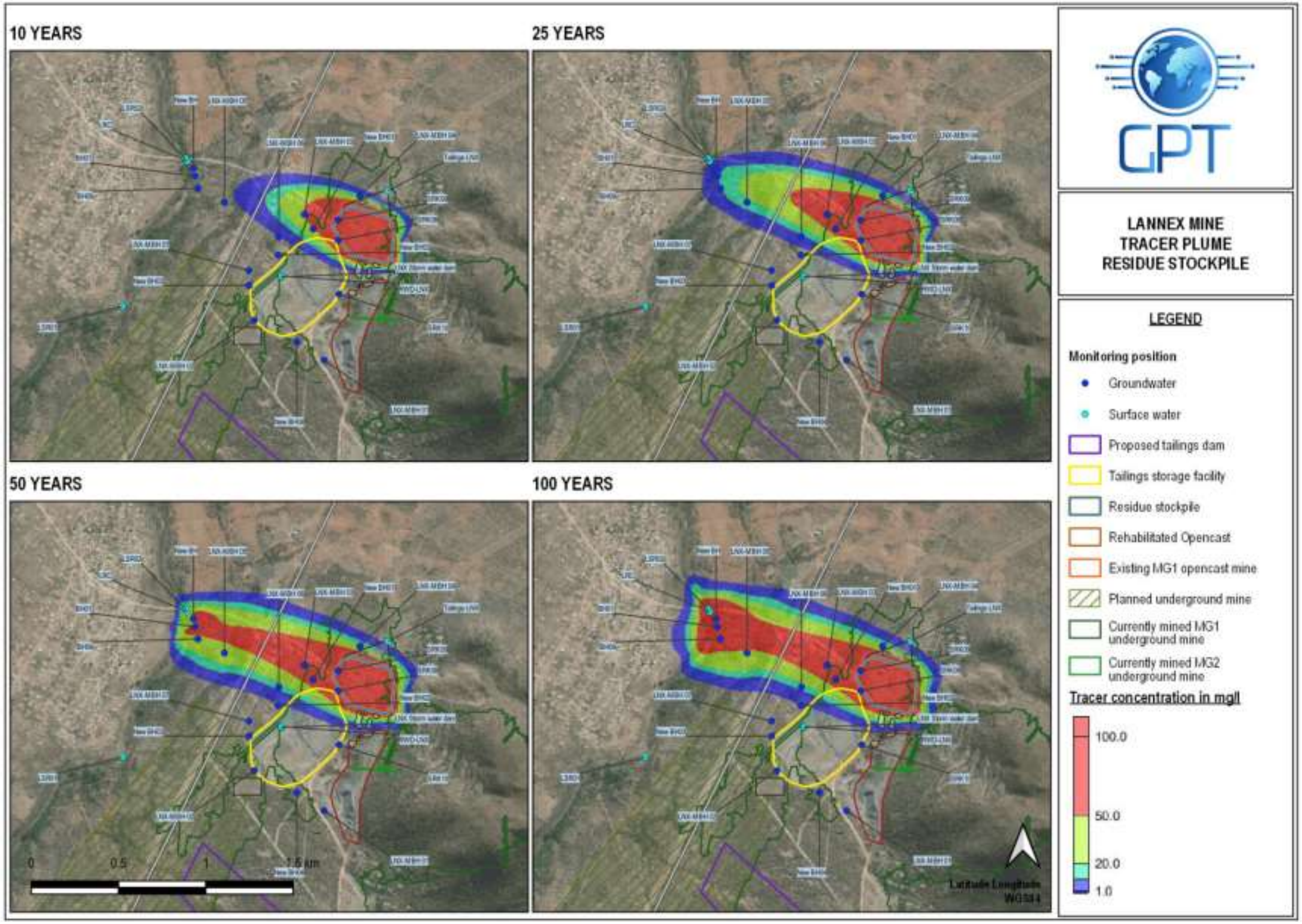

Figure 10-6: Predicted spread of pollution post, mining (residue stockpile)

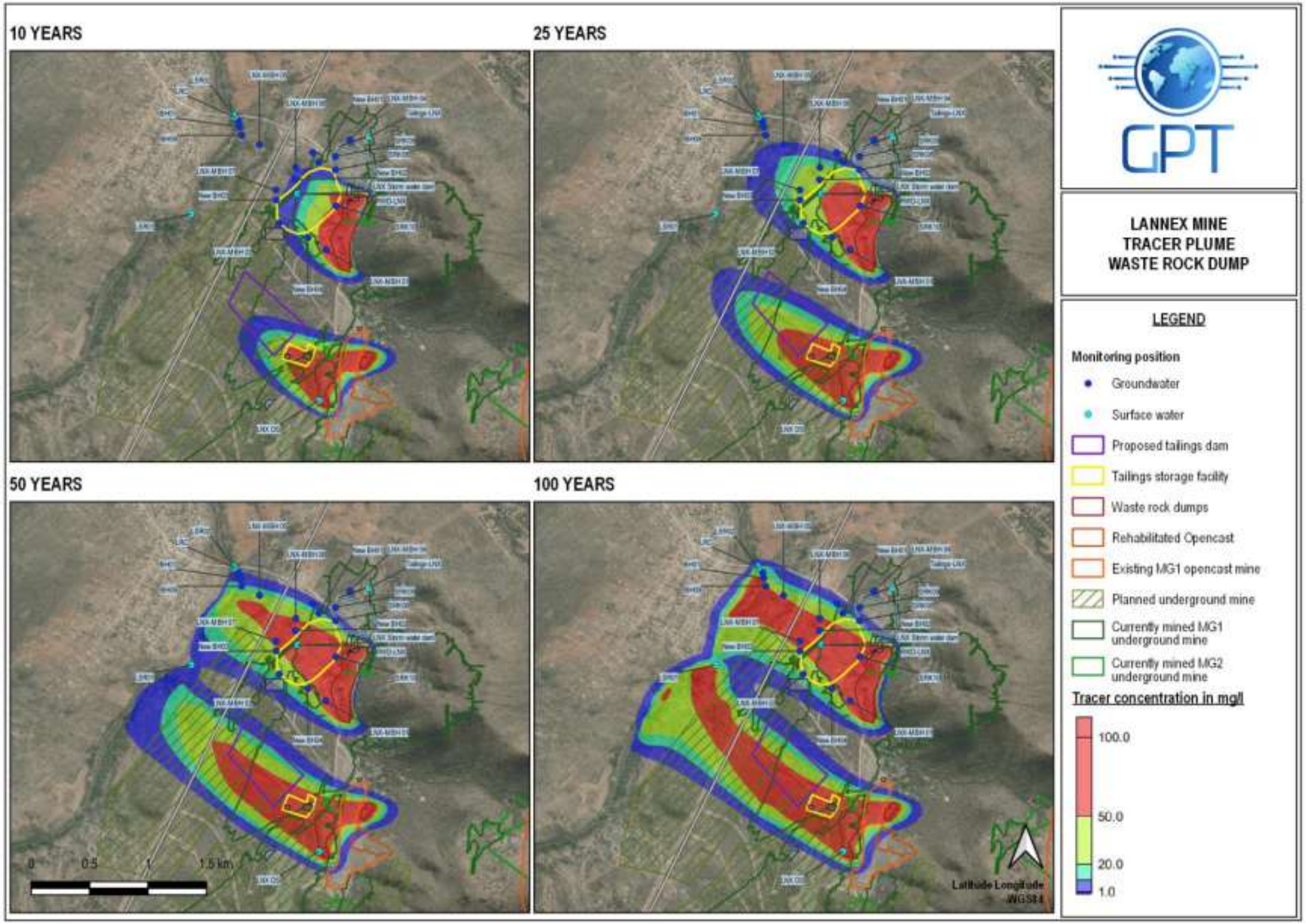

Figure 10-7: Predicted spread of pollution post-closure mining (WRD)

10.5.3.4. Air Quality

- Demolition and removal of all infrastructure (including transportation off site); and
- Rehabilitation (spreading of soils, revegetation & profiling/contouring).

10.5.3.5. Socio- Economy

- Noise;
- Air Pollution;
- Lights and Visual Impacts;
- Landuse and Land capacity;
- Cultural and Heritage;
- Crime, HIV and Covid-19; and
- Economic Opportunities, Infrastructure Development and Employment.

10.5.3.6. Soil, Landuse and Land Capability

New tailings deposit area, new crushing and screening plant, TSF reclamation and WRD	
Soils	
Disturbance/loses of soil due to erosion as well as contamination of soils	Construction and Closure Phase
Cumulative: Increased/Decrease sediment loads downstream system	Closure
Land capability and Landuse	
Cumulative: Loss of land, services, ecosystem support and services	Decommissioning
OC 1,2,3	
Additional Disturbances/ loses of Soil Due to Erosion as well as Contamination	Closure
Cumulative Disturbance, Loss and Degradation of Soils	Planning Post closure phase
Land capability and Landuse	
Cumulative: Loss of land services, ecosystem support and services	Planning and Post closure
Access Roads, Opencast, Tubatse Village and stream diversion	
Soils	
Additional Disturbances/ loses of Soil Due to Erosion as well as Contamination	Planning and Closure
Cumulative: Disturbance, loss and degradation of soils	Planning and Closure
Cumulative: Increased/decreased sediment loads on downstream systems	Closure
Land capability and Landuse	
Cumulative: Loss of land services, Ecosystem, support and services	Post closure

10.5.3.7. Climate Change

Increased greenhouse gases from all the vehicles, plants and other earth moving equipment.

10.5.4 CUMULATIVE IMPACTS

10.5.4.1. Surface Water

The cumulative impacts of the existing and historical mining and support infrastructures and activities at Lannex have already impacted on the watercourses.

10.5.4.2. Groundwater

The cumulative pollution impacts of all current and planned mining in addition to the proposed development have been modelled. The cumulative impacts on groundwater drawdown during mining and groundwater pollution post mining will be presented below.

a) Groundwater Drawdown During Mining

The drawdown during mining of all current opencasts and underground mining, as well as proposed future underground mining, have been modelled and depicted as Figure 10-1 and Figure 10-2. The first figure shows the drawdown that can be expected at surface level (corresponding to surface water structures such as streams and dams), while the next figure indicates the impact expected at the typical borehole depth of 30 to 5 metres below surface.

The expected cumulative impacts are:

- No surface water structures are predicted to be affected. The modelled drawdown does not extend to the Steelpoort River, even though mining will progress to close to the river; the reason being that the depth of mining is very deep closer to the river and de-pressurising does not extend to surface. Other non-perennial streams in the area serve only as stormwater draining channels following heavy rainfall events. Since flow is then a short-term feature, no decrease in flow due to mining is likely.
- The groundwater drawdown at the level of boreholes will most likely affect the yield of boreholes in the areas coloured red and could affect boreholes in yellow areas. However, these impacted areas are mostly close to the mining plant areas and no known privately owned boreholes exist there. In the green areas further to the southwest of the plant areas, groundwater levels in boreholes could decrease by 5 metres or less, which is typical of seasonal variations and should thus not impact significantly on borehole yields.

b) <u>Groundwater Contamination Post Mining</u>

The expected cumulative impact of groundwater contamination is depicted in Figure 10-8 and Figure 10-9 in terms of a hypothetical tracer. The reason for introducing a tracer with a maximum starting concentration of 100 is that any pollutant which is measured at the mine can be related and calculated for any position on this figure. The most likely pollutant is sulphate with a typical concentration of 1 000 mg/L at the sources. If this is applied to the modelling results, a tracer concentration of 50% relate to a sulphate concentration of 500 mg/L, etc. It follows from these figures that:

- Contamination will flow slowly from the shallow mining areas downstream to the Steelpoort River. The migration velocity is slow due to the low hydraulic conductivity of the bedrock and the low hydraulic gradients in the valley.
- The contamination could reach the river at a period of 50 to 100 years after mining has terminated and groundwater levels have returned to a new equilibrium. However, the predicted concentrations will be low, typically about 10% or less of the initial source concentration. In the example of sulphate contamination with a source concentration of 1 000 mg/L, this relate to a concentration of 100 mg/L or less at the river, which is within the limits for human consumption.
- Whether any contamination will impact on the river is uncertain, as the connectivity between the river and groundwater is unknown. This connectivity could only be established by a separate detailed study of the river and surrounding groundwater levels.
- No known privately boreholes exist in potential affected areas, and no impact on current groundwater users is thus predicted.

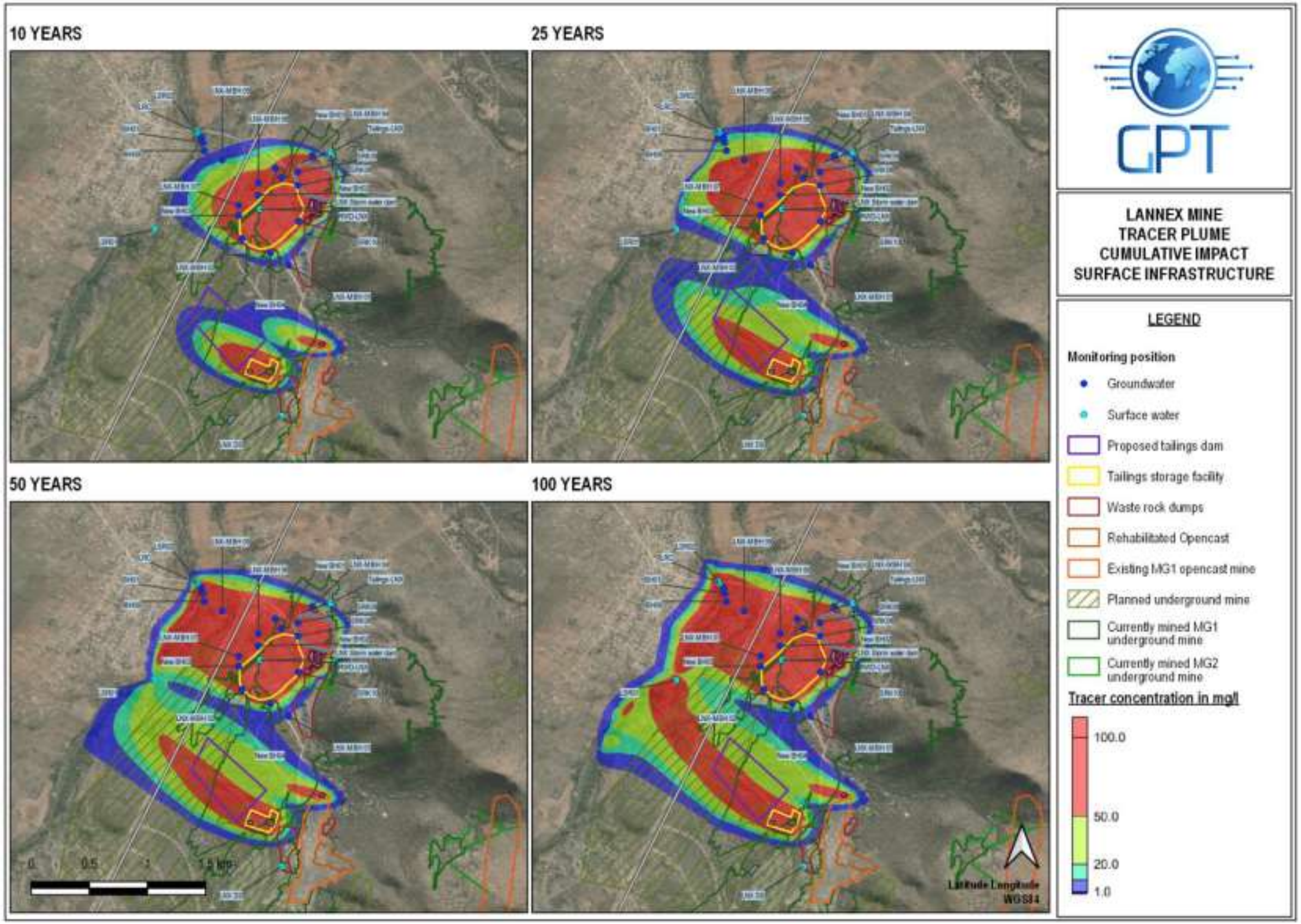

Figure 10-8: Predicted Cumulative spread of pollution post-closure of mining (At Surface Level)

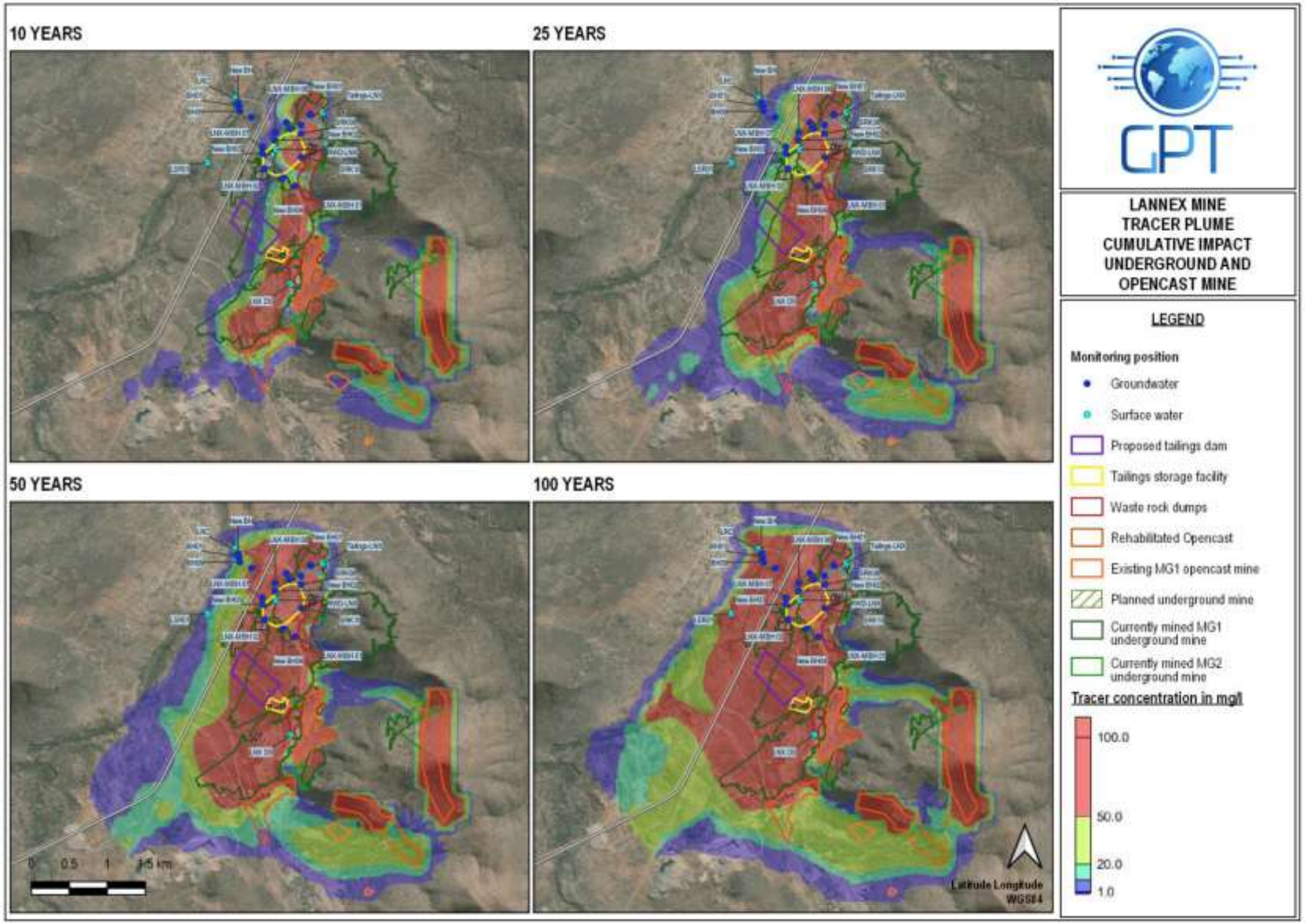

Figure 10-9: Predicted cumulative spread of pollution post mining (At borehole level)

10.5.4.3. Visual

Cumulative effects can also arise from the inter-visibility (visibility) of a range of developments and / or the combined effects of individual components of the proposed development occurring in different locations or over a period of time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effects on visual receptors within their combined visual envelopes. Inter-visibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation and distance, as this affects visual acuity, which is also influenced by weather and light conditions. (Institute of Environmental Assessment and The Landscape Institute, 1996).

10.5.4.4. Air Quality

a) Project Site cumulative impacts

These are the cumulative impacts that result from mining operations in the immediate vicinity of the project site. Project site localised cumulative impacts include the cumulative effects from operations that are close enough to potentially cause additive effects on the environment or sensitive receivers. These include mainly dust deposition.

b) Regional cumulative impacts

Regional cumulative impacts include the project's contribution to impacts that are caused by mining operations throughout the region. Each mining operation in itself may not represent a substantial impact, however the cumulative effect on air quality in the region may warrant consideration. The mining sector in South Africa is growing steadily and therefore this project will also contribute to the larger regional impact that will be experienced.

c) Global cumulative impacts

The only impact from the project that is potentially global is the generation of potential greenhouse gas emissions. However, the level of emissions from the project represents a very minor and insignificant contribution at this scale.

10.5.4.5. Socio- economy

- The noise impacts of the proposed Lannex Project and Tukakgomo village andretail/commercial activities in the area do not overlap, therefore the cumulative impacts to noise sensitive areas are negligible, and remain of low negative significance as per the current ambient noise levels.
- Lannex Project construction activities may add to the annual PM10 concentrations in the area. Sensitive receptors for PM10 will be the residential houses at Tukakgomo village. However, the said village is at least 5 km away from Lannex project. This aspect was addressed in more detail by the Air Quality Impact Assessment conducted in 2020.
- Predicted dust fall-out impacts will be below the residential standard of 600 mg/m^2/day,therefore no significant impacts are anticipated in the sensitive receptors.
- The proposed additional mining infrastructure at Lannex Mine may form part of the "sense of place" in the long term, even after operations cease.
- Possible further changes in landuse due to secondary industries that may be developed around the areas to provide support services and material to the mine. Urbanization andmodern residential developments also likely.
- Possible further changes in landuse due to secondary industries that may be developed around the areas to provide support services and material to the mine. Urbanization andmodern residential developments also likely.
- Possible loss of life and Covid-19 pandemic spread and new cases.
- Cumulative impacts of socio-economic change include increase in crime, alcohol abuse, prostitutions, HIV and AIDS, Covid-19 and other transmitted diseases, influx of foreign people and change in social fabric of the community. Improved way of life due to jobcreation.

10.5.4.6. Soil, Landuse and Land Capability

New tailings deposit area, new crushing and screening plant, TSF reclamation and WRD	
Cumulative: Disturbance, loss and degradation of soils	Construction and Operational
Cumulative: Increased/Decrease sediment loads downstream system	Closure
Land capability and Landuse	
Cumulative: Loss of land, services, ecosystem support and services	Decommissioning
OC 1,2,3	
Cumulative Disturbance, Loss and Degradation of Soils	Planning Post closure phase
Cumulative: Increased/ Decreased Sediment Loads On Downstream Systems	Construction
Land capability and Landuse	
Cumulative: Loss of land services, ecosystem support and services	Planning and Post closure
Access Roads, Opencast, Tubatse Village and stream diversion	
Soils	
Cumulative: Disturbance, loss and degradation of soils	Planning and Closure
Cumulative: Increased/decreased sediment loads on downstream systems	Closure
Land capability and Landuse	
Cumulative: Loss of land services, Ecosystem, support and services	Post closure

10.5.5 CUMULATIVE IMPACTS ASSOCIATED WITH CURRENT MINING OPERATIONS (2013 EMPR)

- **Topography:** as development in the area increase the topography of a wider area may be affected by surface infrastructure development.
- **Land use and land capability**: as more and more mining activities and residential development occur in the area less space will be available for agricultural purposes.
- **Soil:** as a result of increased topsoil removal to allow for the development of housing infrastructure, field establishment and mining activities the soil resource in the area may become less and as a result of the impact on the viability of soils due to stockpiling and potential erosion the impact will increase.
- **Fauna and Flora:** as development increase less natural area (wilderness) will be available resulting in greater impoverished natural environment.
- **Surface water:** Deterioration in water quality as a result of discharges (mining areas) and the potential increased erosion as a result of erosion from agriculture areas that is not managed correctly could impact on downstream water users.
- **Ground water**: Deterioration in Water Quality as a Result of Seepage (mining waste areas) pit latrines from residential areas and fertilisers in agriculture areas will lead to increase groundwater quality deterioration.
- **Air Quality**: No additional impacts expected.
- **Noise:** No additional impacts expected.
- **Visual aspects:** The visibility of the mining infrastructure cumulative with the visuals of residential areas creates a cumulative impression of the area for visitors.
- **Socio-economic:** Cumulative impacts due to multiple mining developments and resulting commercial areas for residential areas could have a positive effect in terms of employment opportunities
- **Archaeological and cultural**: as more development occurs the potential to relocate graves are increased. In addition more archaeological findings may be made and where possible identified for conservation.

11. *IMPACTS AND RISKS IDENTIFIED INCLUDING THE NATURE, SIGNIFICANCE, CONSEQUENCE, EXTENT, DURATION AND PROBABILITY OF THE IMPACTS, INCLUDING THE DEGREE TO WHICH THESE IMPACTS*

(Provide a list of the potential impacts identified of the activities described in the initial site layout that will be undertaken, as informed by both the typical known impacts of such activities, and as informed by the consultations with affected parties together with the significance, probability, and duration of the impacts. Please indicate the extent to which they can be reversed, the extent to which they may cause irreplaceable loss of resources, and can be avoided, managed or mitigated)

Table 11-1: Impacts and Risk Identified including extent, intensity, duration, probability, mitigation efficiency, weighting factor

Nr	Potential Impacts	Aspects affected	Significance before mitigation							ME	Significance after mitigation	
			I / M	D	E	P	W F	SR	Rating		Rating	
1	Loss of chrome and other by product resources		5	4	2	5	5	80	High	0,6	Medium	48
2	Voids left as a result of chrome and other by products removal as the opencast area.	Geology	3	5	1	3	4	48	Medium	0,6	Low to Medium	28,8
3	Impact on pre-mining and operational topography	Topography	3	3	2	5	4	52	Medium	0,4	Low to Medium	20,8
4	As a result of the construction activities fragmentation, degradation or compression may occur if heavy construction vehicles are not kept to the demarcated roads.		5	4	3	5	5	85	High	0,8	Medium to High	68
5	Construction, human and vehicle movement and introduction of foreign material e.g. soils may lead to the introduction of alien invader species, impacting on the floral characteristics of the project site and adjacent natural areas.		3	4	2	3	3	36	Low to medium	0,4	Low	14,4
6	Development related activities may lead to the loss of floral species of conservation concern.		3	4	3	4	4	56	Medium	0,6	Medium	33,6
7	Development and related activities are likely to impact on the sensitive habitats related to the watercourses situated in and around the development footprint.		3	4	3	4	4	56	Medium to High	0,6	Low to Medium	33,6
8	As a result of the construction activities fragmentation, degradation or compression may occur if heavy construction vehicles are not kept to the demarcated roads.		3	4	2	5	3	42	Medium	0,8	Low to Medium	33,6
9	Construction, human and vehicle movement and introduction of foreign material e.g. soils may lead to the introduction of alien invader species, impacting on the floral characteristics of the project site and adjacent natural areas.	Flora	1	4	2	3	2	20	Low to Medium	0,4	Low	8
10	Development related activities may lead to the loss of floral species of conservation concern.		3	4	3	3	3	39	Low to Medium	0,6	Low to Medium	23,4
11	Development and related activities are likely to impact on the sensitive habitats related to the watercourses situated in and around the development footprint.		3	4	3	3	3	39	Low to Medium	0,6	Low to Medium	23,4
12	Construction, human and vehicle movement and introduction of foreign material e.g. soils may lead to the introduction of alien invader species, impacting on the floral characteristics of the project site and adjacent natural areas.		1	4	2	3	2	20	Low to Medium	0,4	Low	8
13	Rehabilitation could be ineffective if measures are not appropriately complied to or rehabilitation is not planned well in advance. Without the necessary mitigation	Flora	3	3	2	3	4	44	Medium	0,6	Low to Medium	26,4

Nr	Potential Impacts	Aspects affected	Significance before mitigation							ME	Significance after mitigation	
			I / M	D	E	P	W F	SR	Rating		Rating	
	measures, rehabilitation will be unsuccessful and the environment will not be self-sustaining.											
14	The construction activities might result in impacts on the mountainous animals due to increased movement, traffic and construction personnel to the area.		3	4	3	5	4	60	Medium to High	0,8	Medium	48
15	Storing of foreign materials, such as construction material, mixing of concrete or collection and delivering could result in pollution.		3	4	3	5	4	60	Medium to High	0,8	Medium	48
16	Constructing activities and heavy construction vehicles might result in compaction of the soil and destruction of vegetation habitat which will impact on the animals that use the area as habitat.		3	4	3	5	4	60	Medium to High	0,8	Medium	48
17	A remaining ventilation shaft or adit entrance have been observed in the mountain and this may signal the occurrence and usage of bats in these abandoned tunnels (OC2). Destruction of these artificial caves created, should be avoided if possible.		1	4	2	2	2	18	Low	0,8	Low	14,4
18	The drainage of the surface water areas or sources (such as diversion of the drainage lines or changes to the beds and banks) that feed the drainage system found within the development site may be impacted or may be interfered with due to construction activities and may result in the destruction of riparian habitat for the sensitive species.	Fauna	3	3	3	5	3	42	Medium	0,6	Medium	25,2
19	Artificial lighting may also impact the surrounding natural environment and animals tend to move away from light, while others may be drawn towards it.		3	3	2	5	4	52	Medium	0,4	Low to Medium	20,8
20	The operational activities might result in impacts to the natural environment due to prolonged activity and movement to and from the area.		3	3	3	5	4	56	Medium	0,4	Low to Medium	22,4
21	The construction activities might result in impacts on the new TSF footprints proposed due to increased movement, traffic and construction personnel to the area. Construction will result in increase of potentially destructive movement within the designated area.		3	3	3	5	4	56	Medium	0,8	Medium	44,8
22	Storing of foreign materials, such as construction material, mixing of concrete or collection and delivering could result in pollution		3	3	2	4	4	48	Medium	0,6	Medium	28,8
23	Constructing activities and heavy construction vehicles might result in compaction of the soil and destruction of vegetation habitat which will impact on the animals that use the area as habitat.		3	3	2	5	4	52	Medium	0,6	Medium	31,2
24	The operational activities might result in impacts to the natural environment due to prolonged activity and movement to and from the area.		3	3	3	5	4	56	Medium	0,4	Medium	22,4
25	Movement, noise and waste management is the main impacts that should be managed within this phase. The impacts are foreseen to be less severe than Construction phase, although the threat of this stage is not the magnitude of the impact, rather the duration.	Fauna	3	3	3	5	3	42	Medium	0,4	Medium	16,8
26	The construction activities might result in impacts on the natural environment, however, the footprint proposed for the WRD has already been developed and fall within a designated fenced area.		1	4	1	5	3	33	Medium	0,8	Low to Medium	26,4

Nr	Potential Impacts	Aspects affected	Significance before mitigation							ME	Significance after mitigation	
			I / M	D	E	P	W F	SR	Rating		Rating	
27	Traffic and constant usage of heavy vehicles might result in compaction of the soil and destruction of vegetation habitat which will impact on the animals that use the area as habitat.		1	4	1	2	3	24	Low to medium	0,8	Low	19,2
28	The operational activities might result in impacts to the natural environment due to prolonged activity and movement to and from the area.		1	4	1	2	3	24	Low to medium	0,8	Low	19,2
29	Increased activity and traffic within a shorter timeframe (closure phase) may degrade the area if adherence is not inline with the Environmental Management Plan (EMP) and Final Rehabilitation programme compiled for the specific Lannex area.		1	3	3	2	3	27	Low to medium	0,8	Low to Medium	21,6
30	Proposed LNX TSF 1 Pollution Plume		3	3	3	5	3	42	Medium	0,6	Low to Medium	25,2
31	Existing TSF Pollution Plume		3	3	3	5	3	42	Medium	0,6	Low to Medium	25,2
32	WRD Pollution Plume		3	3	3	4	2	26	Low to Medium	0,4	Low	10,4
33	Residue Stockpile Area		3	3	3	4	2	26	Low to Medium	0,4	Low	10,4
34	Existing MG1 Opencast Pollution Plume	Groundwater	4	4	3	5	4	64	Medium to High	0,6	Low to Medium	38,4
35	Proposed Opencast 1 Pollution Plume		4	4	3	5	4	64	Medium to High	0,6	Low to Medium	38,4
36	Proposed Opencast 2 Pollution Plume		4	4	3	5	4	64	Medium to High	0,6	Low to Medium	38,4
37	Proposed Opencast 3 Pollution Plume		4	4	3	5	4	64	Medium to High	0,6	Low to Medium	38,4
38	Proposed Opencast 1 Decant		2	1	1	1	1	5	Low	0,2	Low	1
39	Proposed Opencast 2 Decant		2	1	1	1	1	5	Low	0,2	Low	1
40	Proposed Opencast 3 Decant		2	1	1	1	1	5	Low	0,2	Low	1
41	Planned Underground Mine Pollution Plume		4	5	4	5	5	90	High	1	High	90
42	Currently Mined MG1 Underground Mine Pollution Plume		4	5	4	5	5	90	High	1	High	90
43	Currently Mined MG2 Underground Mine Pollution Plume		4	5	4	5	5	90	High	1	High	90
44	Planned Underground Mine Dewatering	Groundwater	4	4	4	5	4	68	Medium to High	1	Medium to High	68
45	Currently Mined MG1 Underground Mine Dewatering		4	4	4	5	4	68	Medium to High	1	Medium to High	68
46	Currently Mined MG2 Underground Mine Dewatering		4	4	4	5	4	68	Medium to High	1	Medium to High	68
47	Cumulative Plume Impact of Lannex Mine		5	5	4	5	5	95	High	1	High	95
48	Cumulative: Clearing or removal of vegetation leaves the soils prone to erosion during rainfall events, and as a result runoff from these areas which will be high		3	3	3	5	4	56	High	0,6	Low to Medium	33,6

Nr	Potential Impacts	Aspects affected	Significance before mitigation							ME	Significance after mitigation	
			I / M	D	E	P	W F	SR	Rating		Rating	
	in suspended solids and will cause an increase in turbidity in the natural water resources.											
49	Cumulative: A High volume of traffic by vehicles will occur due to the transport of equipment/material to site, together with removal of material from the opencast areas to the WRD area.		3	4	3	4	4	56	Medium to High	0,6	Medium	33,6
50	These impacts will lead to the deterioration of the water quality and hence impact the downstream water users, as well as the aquatic life.	Floodline/ Surfacewater	3	3	2	4	4	48	Medium	0,8	Low to Medium	38,4
51	The footprint areas of the TSF and associated infrastructures will no longer form part of the natural downstream catchment thereby potentially resulting in a decrease of runoff downstream		3	4	3	5	5	75	High	0,2	15	15
52	Flooding of the proposed TSF, WRD expansion and opencast areas may result in a significant water pollution impacts on the natural streams, hence impact on the downstream users as well as the aquatic life.		5	4	3	4	5	80	High	0,6	Medium to High	48
53	The flooding of the opencast areas may also result in extended downtime for the mining operation, whilst flood damages are being repaired	Floodline/ Surfacewater	5	4	3	4	4	64	Medium to High	0,8	Medium	51,2
54	All runoff emanating from upstream of the TSF, WRD, opencast and associated infrastructures are considered dirty and need to be managed so as to prevent the mixing of clean and dirty water.		5	4	3	4	5	80	High	0,6	Medium	48
55	Potential visual impact on the viewpoints that had a visual exposure.	Visual	1	2	3	3	2	18	Low	0,8	Low	14,4
56	Potential permanent visual impact on the viewpoints		1	3	3	3	2	20	Low to Medium	0,6	Low	12
	Fugitive dust (containing TSP (total suspended particulate, will give rise to nuisance impacts as fallout dust), as well as PM10 and PM2.5 (dust with a size less than 10 microns, and dust with a size less than 2.5 microns giving rise to health impacts)).		1	2	2	4	2	18	Low	0,4	Low	7,2
57	The proposed mining activities will result in fugitive dust emissions containing TSP (total suspended particulate, giving rise to nuisance impacts as fallout dust).		1	2	2	3	2	16	Low	0,8	Low	12,8
58	Transportation of the workers and materials in and out of mine site will be a constant feature during the construction phase.	Air Quality	1	2	2	3	3	24	Low to Medium	0,4	Low	9,6
59	The impacts on the atmospheric environment during the decommissioning phase will be similar to the impacts during the construction phase. The process includes dismantling and demolition of existing infrastructure, transporting and handling of topsoil on unpaved roads in order to bring the site to its initial/rehabilitated state.		1	1	2	3	2	14	Low	0,8	Low	11,2
60	The reshaping and restructuring of the landscape. Topsoil can be imported to reconstruct the soil structure. Profiling of dumps and waste rock dump to enhance vegetation cover and reduce wind erosion from such surfaces post mining.		3	2	2	4	3	33	Low to Medium	0,6	Low	19,8
61	Numerous simultaneous future construction activities during the day at LNX 1		1	2	2	1	2	12	Low	1	Low	12
62	Numerous simultaneous future construction activities during the night at LNX 1		1	2	3	1	2	14	Low	1	Low	14

Nr	Potential Impacts	Aspects affected	Significance before mitigation							ME	Significance after mitigation	
			I / M	D	E	P	W F	SR	Rating		Rating	
63	Numerous simultaneous future construction activities during the day at LNX 3	Noise	1	2	2	1	2	12	Low	1	Low	12
64	Numerous simultaneous future construction activities during the night at LNX 3		1	2	3	1	2	14	Low	1	Low	14
65	Potential future construction at opencast area 1- Day		1	2	2	1	2	12	Low	1	Low	12
66	Potential future construction at opencast area 1- Night		1	2	3	1	2	14	Low	1	Low	14
67	Potential future construction at opencast area 2- Day		1	2	2	1	2	12	Low	1	Low	12
68	Potential future construction at opencast area 2- Night		1	2	3	1	2	14	Low	1	Low	14
69	Future operational activities at Opencast Area 1- Day		1	4	2	1	2	16	Low	1	Low	16
70	Future operational activities at Opencast Area 2- Day		3	4	3	1	2	22	Low to Medium	1	Low to Medium	22
71	Future operational activities at Opencast Area 2- Night		1	4	2	1	2	16	Low	1	Low	16
72	Noise levels will revert to pre-mining ambient levels when the construction activities and mining activities come to an end. Depending of the volumes of available waste rock, the crushing operations may continue even after Lannex Project closure.	Noixe	5	4	2	4	3	45	Medium	0,6	Low to Medium	27
73	The noise impacts of the proposed Lannex Project and exiting Tukakgomo village and retail/commercial activities in the area do not overlap, therefore the cumulative impacts to noise sensitive areas are negligible, and remain of low negative significance as per the current ambient noise levels.		1	4	2	3	3	30	Low to Medium	0,6	Low	18
74	Lannex Project construction activities may add to the annual PM_{10} concentrations in the area. Sensitive receptors for PM_{10} will be the residential houses at Tukakgomo village. However, the said village is at least 5km away from Lannex project. Predicted dust fall-out impacts will be below the residential standard of 600mg/m2/day, therefore no significant impacts are anticipated in the sensitive receptors	Air Pollution	3	4	2	2	3	33	Low to Medium	0,6	Low	19,8
75	The new mine opencast areas and surface infrastructures will be visible to the surrounding village and from the R555 national road for the entire life of mine. Further loss to the scenic values of the Tukakgomo community, compounded by the existing Lannex mine infrastructure.		3	5	2	5	3	45	Medium	0,8	Low to Medium	36
76	The proposed additional mining infrastructure at Lannex Mine may form part of the “sense of place” in the long term, even after operations cease.		3	4	2	3	3	36	Low to Medium	0,8	Low to Medium	28,8
77	The positive impact of mining in the project area include increased business opportunities, greater demand for goods and services, pressures for housing (ability to own houses), etc.	Landuse and Capacity	4	5	2	4	3	45	Medium	0,6	Low to Medium	27
78	The Lannex mine construction and mining operational activities will add to the existing negative impacts of air pollution due to dust, visual impacts due to mining, restricted access, loss of grazing land, and loss of land for cultural or traditional practices.		3	3	2	3	2	22	Low to Medium	0,6	Low	13,2
79	Cumulative: Possible further changes in landuse due to secondary industries that may be developed around the areas to provide support services and material to the mine. Urbanization and modern residential developments also likely	Landuse and Capacity	3	4	2	3	3	36	Low to Medium	0,6	Low to Medium	21,6

Nr	Potential Impacts	Aspects affected	Significance before mitigation							ME	Significance after mitigation	
			I / M	D	E	P	W F	SR	Rating		Rating	
80	The cultural and historic remains are area specific and very important to the cultural and values of the area. In the unlikely event that some resources are encountered during operations of the mining activities, the impact will become of moderate negative significance since the earth moving equipment will destroy such resources to the detriment of the local people or inhabitants.	Cultural and Heritage Aspects	3	5	2	3	3	39	Low to Medium	0,6	Low to Medium	23,4
81	Cumulative: Any further mining development will form part of the history of the local area.	Social	3	4	2	3	3	36	Low to Medium	0,6	Low to Medium	21,6
82	Influx of foreigners and job seekers and increase in disposable income for local people may create negative social impacts such as crime, alcoholism and prostitution in and around the project area.	Safety	3	4	3	4	3	42	Medium	0,5	Low to Medium	21
83	Cumulative: Possible loss of life and Covid-19 pandemic spread and new cases.	Social	3	4	2	3	3	36	Low to Medium	0,6	Low to Medium	21,6
84	Skilling and training of local people will make them more marketable to other industries in the region. LED projects will continue to sustain economic activity post Lannex Project.	Employment	3	4	2	4		36	Low to Medium	0,6	Low to Medium	21,6
85	Cumulative impacts of socio-economic change include increase in crime, alcohol abuse, prostitutions, HIV and AIDS, Covid-19 and other transmitted diseases, influx of foreign people and change in social fabric of the community.	Crime									Low to Medium	
86	Cumulative impacts of socio-economic change include increase in crime, alcohol abuse, prostitutions, HIV and AIDS, Covid-19 and other transmitted diseases, influx of foreign people and change in social fabric of the community. Improved way of life due to job creation	Jobs	5	4	3	5		60	Medium	0,6	Low to Medium	36
87	Disturbance/loss of soil resources		5	4	2	5	5	80	High	0,8	Medium	64
88	Disturbance/loses of soil due to erosion as well as contamination of soils	Soils	4	3	1	4	5	60	Medium to High	0,6	Low to Medium	36
89	Continued activities including mining and transportation		3	4	2	5	5	70	Medium to High	0,6	Medium	42
90	Disturbance/loss/sterilisation of inherent land capability and land use	Land capability and Land use	3	3	2	3	4	44	Medium	0,6	Low to Medium	26,4
91	Disturbance/loss of soil resources	Soils	5	4	2	5	5	80	High	0,8	Medium	64
92	Cumulative: Loss of land services, Ecosystem, support and services	Land capability and landuse	3	4	1	4	4	48	Low to Medium	0,6	Low to Medium	28,8
93	Disturbance/loss of soil resources		5	4	2	5	5	80	High	0,8	Medium	64
94	Additional disturbances/losses of soil due to erosion as well as contamination		3	3	2	5	5	65	Medium to High	0,4	Low to Medium	26
95	Cumulative: Disturbance, loss and degradation of soils	Soils	3	3	3	5	5	70	Medium to High	0,6	Medium	42
96	Cumulative: Increased/decreased sediment loads on downstream systems		5	3	2	5	5	75	Medium to High	0,6	Medium	45
97	Disturbance/loss/sterilisation of inherent land capability and land use	Land capability and landuse	3	4	2	5	5	70	Medium to High	0,4	Low to Medium	28

Nr	Potential Impacts	Aspects affected	Significance before mitigation							ME	Significance after mitigation	
			I / M	D	E	P	W F	SR	Rating		Rating	
98	Loss of land services, ecosystem support and services		3	4	2	5	5	70	Medium to High	0,4	Low to Medium	28
99	Disturbance/loss of soil resources	Soils	3	3	2	5	4	52	Medium	0,6	Low to Medium	31,2
100	Additional Disturbances/ loses of Soil Due to Erosion as well as Contamination		3	3	1	4	4	44	Medium	0,4	Low	17,6
101	Cumulative: Disturbance, loss and degradation of soils		3	3	1	4	4	44	Medium	0,6	Low to Medium	26,4
102	Cumulative: Increased/decreased sediment loads on downstream systems		3	3	2	5	4	52	Medium	0,6	Low to Medium	31,2
103	Disturbance/loss/sterilisation of inherent land capability and land use	Land capability and landuse	3	4	1	4	4	48	Low to Medium	0,4	Low	19,2
104	Cumulative: Loss of land services, Ecosystem, support and services		3	4	1	4	4	48	Low to Medium	0,4	Low	19,2
105	Ground Vibrations	Subsurface/ Geology	3	4	3	3	3	39	Low to Medium	0,6	Low to Medium	23,4
106	Ground Vibrations		3	4	3	3	3	39	Low to Medium	0,6	Low to Medium	23,4
107	Ground Vibrations		3	4	3	3	3	39	Low to Medium	0,6	Low to Medium	23,4
108	Air Blast		3	4	3	3	4	52	Medium	0,6	Low to Medium	31,2
109	Fly rock		3	4	3	4	3	42	Medium	0,6	Low to Medium	25,2
111	Increased greenhouse gases	Local Climate	3	5	3	2	3	39	Low to Medium	0,6	Low to Medium	23,4
112	Removal of vegetation within a watercourse will impact on the habitat that has established which in turn will impact on the biota using these habitats.	Surface water	3	2	2	5	4	48	Medium	0,6	Low to Medium	28,8
113	The removal of vegetation will result in physical changes to the beds and banks that will impact on the water quality and result in increased potential for siltation and erosion.		3	2	2	5	4	48	Medium	0,6	Low to Medium	28,8
114	The movement of machinery could also result in compaction and hydrocarbons spills that could impact on water quality, vegetation and biota.		3	2	2	5	4	48	Medium	0,6	Low to Medium	28,8
115	Removal of vegetation within a watercourse will impact on the habitat that has established which in turn will impact on the biota using these habitats.		3	2	2	4	4	44	Medium	0,6	Low to Medium	26,4
116	The removal of vegetation will result in physical changes to the beds and banks that will impact on the water quality and result in increased potential for siltation and erosion.		3	2	2	4	3	33	Medium	0,6	Low	19,8
117	The movement of machinery could also result in compaction and hydrocarbons spills that could impact on water quality, vegetation and biota.		3	2	2	4	3	33	Medium	0,6	Low	19,8
118	Removal of vegetation could result in increased siltation of watercourses and increase erosion potential.		3	1	1	4	5	45	Medium	0,4	Low	18

Nr	Potential Impacts	Aspects affected	Significance before mitigation							ME	Significance after mitigation	
			I / M	D	E	P	W F	SR	Rating		Rating	
119	Loosening of material as part of the construction of the identified infrastructures would result in additional damage to habitat and biota while increasing impacts on the stability of the watercourse resulting in increased potential for erosion and siltation.		3	2	1	3	3	27	Low to Medium	0,6	Low	16,2
120	In addition, the movement of machinery within the watercourse or within 32 m could result in increased potential for hydrocarbon spills that will impact on water quality and in turn biota and vegetation.		3	2	1	3	3	27	Low to Medium	0,6	Low	16,2
121	The potential for increase erosion that could increase siltation of watercourses exists.		3	2	1	2	3	24	Low to Medium	0,6	Low	14,4
122	The movement of machinery could result in hydrocarbons spills that could impact on water quality, vegetation and biota.		3	3	1	3	3	30	Low to Medium	0,4	Low	12
123	Damming of water upstream of the opencast sections and allowing the water to be diverted around the opencast will alter the flow regime, habitat and biota composition of the downstream watercourse as no water will be flowing in the original course.		5	5	3	5	4	72	Medium to High	0,6	Medium	43,2
124	The containment of dirty storm water will effectively remove water from the natural water resource, this in turn will impact on the habitat and biota of the impacted watercourses.		3	3	3	3	4	48	Medium	0,4	Low	19,2
125	The containment of rainwater in the opencast pit will effectively remove water from the natural water resource, this in turn will impact on the habitat and biota of the impacted watercourses.		3	3	3	3	4	48	Medium	0,6	Low to Medium	28,8
126	Opencast pits located within a watercourse will alter the flow regime, habitat and biota composition of the watercourse completely.		5	5	2	5	5	85	High	0,6	Medium	51
127	Spills from the tailings pipeline could impact on the water quality should it occur during the rainy season and the watercourse is flowing. This in turn could impact on the habitat and biota of the receiving water resources.		3	2	2	3	3	30	Low to Medium	0,6	Low	18
128	Spills from the return water pipeline could impact on the water quality should it occur during the rainy season and the watercourse is flowing. This in turn could impact on the habitat and biota of the receiving water resources.		3	2	2	3	3	30	Low to Medium	0,6	Low	18
129	Increased dust generation could impact on water quality and habitat should the windblown dust from these two infrastructures be deposited in a watercourse.		1	4	2	4	3	33	Low to Medium	0,6	Low	19,8
130	Should there be a problem with the liner system leachate from these could impact on groundwater which in turn could impact on the base flow water quality of watercourses.	Surface water	3	4	3	2	5	60	Medium	0,6	Low to Medium	36
131	Overburden storage within the watercourse / within 32 m from the watercourse will alter the flow regime of the water courses and could result in increased siltation to downstream areas.		5	4	2	4	3	45	Medium	0,4	Low	18
132	Backfilling of the opencast with overburden could impact on subsurface water flow quality due to the leachate potential from the material.		3	3	2	3	4	44	Medium	0,6	Low to Medium	26,4
133	This is a positive aspect and will result in slowing down surface run-off flow thus decreasing the potential for erosion.		3	3	2	3	3	33	Low to Medium	1	Low to Medium	33

Nr	Potential Impacts	Aspects affected	Significance before mitigation							ME	Significance after mitigation	
			I / M	D	E	P	W F	SR	Rating		Rating	
134	Leachate from these areas could negative impact on baseflow water; If not rehabilitated correctly increased windblown dust from these could impact on vegetation and biota of watercourses.		3	3	2	2	2	20	Low to Medium	0,4	Low	8
135	Removal of the overburden will be a positive as it reduces the potential for siltation from these and will re-establish continuity of the watercourse.		3	2	1	5	4	44	Medium	1	Medium	44
136	The removal of the river diversion, containment dams, access roads and culverts will result in loosening of material that could increase erosion risk and siltation.		5	3	3	4	5	75	Medium to High	0,6	Medium	45
137	The movement of machinery increase the potential for hydrocarbon spills.		3	2	3	3	4	44	Medium	0,6	Low to Medium	26,4
138	The historical and existing operations at Lannex have already impacted significantly on several watercourses. The impact relates to the connectivity of watercourses (upstream to downstream) and impact on subsurface water flow quality and quantity.	Surface Water	3	4	3	3	3	39	Low to Medium	0,6	Low to Medium	23,4
139	By rehabilitating and closure of areas that are no longer needed for support or mining, the dirty footprint area of the mine is reduced and this in turn will increase the water that is released to baseflow and to downstream areas.		3	2	3	4	3	36	Low to Medium	0,4	Low	14,4

Table 11-2: Impact Rating without mitigation and with mitigation- 2013 EMPr

ASPECT	IMPACT	I/M	D	S	P	SR	Rating	M	D	S	P	S R	Rating
Geology	Loss of chrome resource	6	5	5	5	80	High	6	5	5	5	80	High
	Voids left as a result of chrome removal at Opencast areas	10	4	2	5	80	High	6	3	2	2	22	Low
Topography	Impact on pre-mining and operational topography	8	4	2	5	70	High	4	3	2	3	27	Low
Soil	Loss of topsoil during stripping, handling and placement on rehabilitated areas	6	4	1	3	33	Medium	4	4	1	3	27	Low
	Loss of topsoil fertility as a result of changes to the physical, chemical and biological soil properties which could affect the potential land use	6	5	2	4	52	Medium	6	5	1	2	24	Low
	Contamination of soils by fuels and lubricants from mining equipment	4	4	1	2	18	Low						
	Change to physical, chemical and biological soil properties by diesel spilt, thereby affecting potential land use	6	4	1	4	44	Medium	4	4	1	4	36	Medium
	Change to physical, chemical and biological soil properties by pumping tailings underground, thereby affecting potential land use	8	5	1	3	42	Medium					0	Low
	Loss of topsoil through stripping, handling and stockpiling of soils	6	4	1	3	33	Medium	4	4	1	3	27	Low
	Change to physical, chemical and biological soil properties thereby affecting potential land use	4	5	1	1	10	Low	4	3	2	5	45	Medium
	Contamination by fuels and lubricants from mining equipment	4	4	1	2	18	Low						
Landuse	Change of land use from wilderness to mining and back to wilderness	8	4	2	5	70	High						
	Impact on wilderness land used for mining activities	10	4	2	5	80	High	4	4	1	3	27	Low
	Management of un-mined land at Lannex	4	2	3	2	18	Low						
Soil	Change to physical, chemical and biological soil properties by diesel spilt, thereby affecting potential land use	6	4	1	4	44	Medium	4	4	1	4	36	Medium

ASPECT	IMPACT	I/M	D	S	P	SR	Rating	M	D	S	P	S R	Rating
	Change to physical, chemical and biological soil properties by pumping tailings underground, thereby affecting potential land use	8	5	1	3	42	Medium					0	Low
	Loss of topsoil through stripping, handling and stockpiling of soils	6	4	1	3	33	Medium	4	4	1	3	27	Low
Soil	Change to physical, chemical and biological soil properties thereby affecting potential land use	4	5	1	1	10	Low						
	Contamination by fuels and lubricants from mining equipment	4	4	1	2	18	Low						
Flora	Loss of rare plant species that occur on site	8	5	1	5	70	High	6	3	1	3	30	Low
	Growth of alien invasive plant species on site	6	4	1	4	44	Medium	4	4	1	3	27	Low
Fauna	Loss of species diversity and habitat characteristics due to mining	8	4	2	5	70	High	6	3	1	4	40	Medium
	Loss of indigenous animals	8	5	1	5	70	High	6	3	1	3	30	Low
Surface Water	Reduction in surface water quantity (volume of water to the receiving environment)	7	4	3	5	70	High	4	4	2	3	30	Low
	Impact on surface water quality	8	4	3	4	60	Medium	5	3	2	2	20	Low
	Alteration of the natural river / water courses	5	5	2	5	60	Medium	3	3	1	5	35	Medium
	Contamination of surface water by diesel	4	4	2	4	40	Medium	6	4	2	4	48	Medium
	Surface water contamination during re-treatment and pumping	7	4	2	4	52	Medium	5	4	1	3	30	Low
	Impact on catchment yield through water extraction for washing plant and processing	8	4	2	4	56	Medium	4	4	2	4	40	Medium
	Pollution of surface water by contamination with plant process water	8	4	2	4	56	Medium	6	4	2	4	48	Medium
	Loss of catchment yield through disturbance of the catchment area	8	4	2	4	56	Medium	6	4	2	4	48	Medium
	Erosion of mined areas	8	4	1	4	52	Medium	4	4	1	4	36	Medium
Groundwater	Impact of dewatered water being discharged into natural water system	8	4	2	4	56	Medium	4	4	2	4	40	Medium
	Lowering of groundwater levels due to mining related activities	8	4	3	4	60	Medium	6	2	2	3	30	Low
	Negative impact on groundwater quality as a result of mining activities and tailings dams	8	4	3	4	60	Medium	6	4	2	4	48	Medium
	Elevated water levels due to recharge from tailings dams	2	3	1	5	30	Low						
	Impact on groundwater yield and quality as a result of vent shafts	4	4	1	4	36	Medium					0	Low
	Localized elevation of water table by return water dam	6	4	1	3	33	Medium					0	Low
	Impact on groundwater aquifer through accumulation of diesel spill	6	4	2	4	48	Medium	4	4	1	4	36	Medium
	Effect of the groundwater system by pumping tailings underground	4	4	1	2	18	Low						
	Impact of mechanised mining on fresh bedrock and impact on yield	4	4	1	3	27	Low						
	Quantity of groundwater inflows into opencast	8	4	1	5	65	High	4	4	1	5	45	Medium
	Impact on groundwater quality by explosives	4	4	1	4	36	Medium	4	4	1	3	27	Low
Air Quality	Impact on air quality as a result of operation dust and gaseous emissions	8	4	2	4	56	Medium	4	4	2	4	40	Medium
	Mining operations within open pit area will impact on Dust fallout (nuisance dust)					0	Low	4	4	2	5	50	Medium
	Material handling operations will impact on Dust fallout (nuisance dust)	6	4	2	5	60	Medium	4	4	2	5	50	Medium
	Crushing will impact on Dust fallout (nuisance dust)	6	4	2	5	60	Medium	4	4	2	5	50	Medium
	Vehicle entrainment on unpaved roads will impact on Dust fallout (nuisance dust)					0	Low	6	4	2	5	60	Medium
	Vehicle entrainment on paved roads will impact on Dust fallout (nuisance dust)					0	Low	6	4	2	5	60	Medium
	Continuous rehabilitation activities will impact on Dust fallout (nuisance dust)	6	4	2	5	60	Medium	6	4	2	5	60	Medium
	Wind erosion from tailings dam will impact on Dust fallout (nuisance dust)					0	Low	6	4	2	5	60	Medium
Air Quality	Wind erosion from topsoil stockpile will impact on Dust fallout (nuisance dust)	6	4	2	5	60	Medium	4	4	2	5	50	Medium
	Wind erosion from overburden/ waste rock storage pile will impact on Dust fallout (nuisance dust)	4	4	2	5	50	Medium	2	4	2	5	40	Medium

ASPECT	IMPACT	I/M	D	S	P	SR	Rating	M	D	S	P	SR	Rating
	Wind erosion from ROM storage piles will impact on Dust fallout (nuisance dust)	4	4	2	5	50	Medium	2	4	2	5	40	Medium
	Drilling and blasting activities – opencast will impact on Dust fallout (nuisance dust)	8	1	2	5	55	Medium	6	1	2	5	45	Medium
	Mining operations within open pit area will impact on Respirable dust (PM10)	6	4	2	5	60	Medium	4	4	2	5	50	Medium
	Material handling operations will impact on Respirable dust (PM10)	6	4	2	5	60	Medium	4	4	2	5	50	Medium
	Crushing will impact on Respirable dust (PM10)	6	4	2	5	60	Medium	4	4	2	5	50	Medium
	Vehicle entrainment on unpaved roads will impact on Respirable dust (PM10)	8	4	2	5	70	High	6	4	2	5	60	Medium
	Vehicle entrainment on paved roads will impact on Respirable dust (PM10)	6	4	2	5	60	Medium	6	4	2	5	60	Medium
	Continuous rehabilitation activities will impact on Respirable dust (PM10)	6	4	2	5	60	Medium	6	4	2	5	60	Medium
	Wind erosion from tailings dam will impact on Respirable dust (PM10)	8	4	2	5	70	High	6	4	2	5	60	Medium
	Wind erosion from topsoil stockpile will impact on Respirable dust (PM10)	6	4	2	5	60	Medium	4	4	2	5	50	Medium
	Wind erosion from overburden/ waste rock storage pile will impact on Respirable dust (PM10)	4	4	2	5	50	Medium	2	4	2	5	40	Medium
	Wind erosion from ROM storage piles will impact on Respirable dust (PM10)	4	4	2	5	50	Medium	2	4	2	5	40	Medium
	Drilling and blasting activities – opencast will impact on Respirable dust (PM10)	8	1	2	5	55	Medium	6	1	2	5	45	Medium
	Blasting of overburden and reef will impact on Gaseous emissions	4	1	2	5	35	Medium	4	1	2	5	35	Medium
	Release of underground emissions due to diesel operating machinery will impact on Gaseous emissions	2	1	2	5	25	Low						
	Gaseous emissions from operating diesel machinery	2	1	2	5	25	Low						
	Increased levels of dust and air borne particles from tailings retreatment	4	4	2	3	30	Low						
	Increased levels of dust and air particulates from crushing and vehicle entrainment	8	4	2	4	56	Medium					0	Low
	Dust fallout & Respirable dust	6	4	2	5	60	Medium	4	4	2	5	50	Medium
	Dust fallout & Respirable dust	8	4	2	5	70	High	6	4	2	5	60	Medium
	Dust fallout & Respirable dust	4	4	2	5	50	Medium	2	4	2	5	40	Medium
	Gaseous emissions	2	1	2	5	25	Low						
Noise & vibration	Increased noise levels as a result of the mining activities above acceptable levels	6	4	3	4	52	Medium	4	3	2	4	36	Medium
	Risk to humans and equipment as a result of fly rock	10	4	2	4	64	High	6	3	2	2	22	Low
	Noise impacts of extraction fans within vent holes	6	4	1	5	55	Medium	0	0	0	0	0	Low
	Operation noise of re- treatment plant	4	4	1	3	27	Low						
	Noise impacts of plant activities on residential areas in case of upgrade	6	4	1	4	44	Medium					0	Low
	Noise impacts of opencast extension on residential areas	6	4	1	4	44	Medium					0	Low
Visual	The only sensitive landscapes present in the vicinity of Lannex are the Steelpoort River floodplains and riparian zones.	N/A				N/A							
Visual	Visibility of the mining activities may impact on the sense of place, visual quality	6	4	2	5	60	Medium	6	4	2	4	48	Medium
	Visual impacts of vent holes on nearby roads	4	4	1	4	36	Medium	0	0	0	0	0	Low
	Visual impacts on Annex club and road to Steelpoort	8	4	2	5	70	High					0	Low
Cultural &Heritage	Damage to postherds near Lannex opencast	8	4	1	2	26	Low						
	Graveyard GY01 will be destroyed by mining operations on Lannex	10	5	1	5	80	High	4	5	1	5	50	Medium
	Destruction of scattered stone tools by mining activities on Lannex	8	5	1	5	70	High	4	5	1	5	50	Medium
Socio-Economic	Influx of job seekers into the area	8	4	3	5	75	High	4	3	3	3	30	Low
	Impact on community safety as a result of mining activities	8	4	3	4	60	Medium	6	3	2	3	33	Medium
	Increase in Social pathologies due to influx of job seekers	1	4	2	1	7	Low						
	Accommodation and social services limitations	3	2	2	2	14	Low						

ASPECT	IMPACT	I/M	D	S	P	SR	Rating	M	D	S	P	SR	Rating
	Road maintenance and safety	8	4	3	4	60	Medium	4	3	3	3	30	Low
	Safety of Children	8	4	2	3	42	Medium	4	3	2	3	27	Low
	Aesthetics and impacts on sense of place	4	4	2	5	50	Medium	2	3	2	4	28	Low
	Influx of job seekers into the area	1	4	2	1	7	Low						
	Employment and income generation	8	4	3	3	45	Medium						
	The use of current employees as construction workers	8	2	4	4	56	Medium						
	Increase in indirect employment opportunities and local expenditure	8	4	3	3	45	Medium						
	local and regional economic benefits and multipliers	6	4	4	4	56	Medium						
	Growth in the local housing sector	3	2	2	2	14	Low						
	Development of BEE and SMME opportunities	4	4	3	3	33	Medium						
	Corporate and social investment	4	4	3	3	33	Medium						
	Loss of jobs through conversion to mechanised mining	2	4	1	3	21	Low						
Rehabilitation, Closure and post closure phase (1953-1963): management and operation of:													
Geology	No additional impacts expected	N/A	Rehabilitation will have a positive effect										
Topography	No additional impacts expected	N/A	Rehabilitation will have a positive effect										
Soils	No additional impacts expected	N/A	Rehabilitation will have a positive effect										
Land capability	No additional impacts expected	N/A	Rehabilitation will have a positive effect										
Land use	No additional impacts expected	N/A	Rehabilitation will have a positive effect										
Vegetation / plant life	No additional impacts expected	N/A	Rehabilitation will have a positive effect										
Animals	No additional impacts expected	N/A	Rehabilitation will have a positive effect										
Surface Water	Effect of final void on catchment yield	6	5	2	4	52	Medium	4	5	1	4	40	Medium
	Effect on surface water quality	N/A	Rehabilitation will have a positive effect										
Groundwater	Possibility for Decant from mining operations	6	5	2	3	39	Medium						
	Elevated water levels due to recharge from the tailings dam	2	2	1	2	10	Low						
Groundwater	Nitrate pollution from migration from tailings am	4	4	2	2	20	Low						
	Impact of runoff into aquifer	4	5	1	3	30	Low						
Air Quality	Topsoil utilised for rehabilitation and revegetation will impact on dust fallout (nuisance dust)	4	2	2	5	40	Medium	4	2	2	3	24	Low
	Demolition, stripping and sealing of mine shafts will impact on dust fallout (nuisance dust)	4	2	2	5	40	Medium	4	2	2	3	24	Low
	Infrastructure removal will impact on dust fallout (nuisance dust)	4	2	2	5	40	Medium	4	2	2	3	24	Low
	Vehicle entrainment on unpaved roads will impact on dust fallout (nuisance dust)	4	2	2	5	40	Medium	4	2	2	3	24	Low
	Vehicle entrainment on paved roads will impact on dust fallout (nuisance dust)	4	2	2	5	40	Medium	4	2	2	3	24	Low
	Topsoil utilised for rehabilitation and revegetation will impact on Respirable dust (PM10)	4	2	2	5	40	Medium	4	2	2	3	24	Low
	Demolition, stripping and sealing of mine shafts will impact on Respirable dust (PM10)	4	2	2	5	40	Medium	4	2	2	3	24	Low
	Infrastructure removal will impact on Respirable dust (PM10)	4	2	2	5	40	Medium	4	2	2	3	24	Low
	will impact on Respirable dust (PM10)	4	2	2	5	40	Medium	4	2	2	3	24	Low
	Vehicle entrainment on paved roads will impact on Respirable dust (PM10)	4	2	2	5	40	Medium	4	2	2	3	24	Low
	Demolition of infrastructure – blasting will impact on Gaseous emissions	8	1	2	5	55	Medium	8	1	2	3	33	Medium
	Tailpipe emissions from vehicles will impact on Gaseous emissions	2	2	2	5	30	Low					0	

ASPECT	IMPACT	I/M	D	S	P	SR	Rating	M	D	S	P	SR	Rating
	Generation of Respirable dust	5	2	2	5	45	Medium					0	Low
	Dust fallout & Respirable dust	4	2	2	5	40	Medium					0	Low
	Dust fallout & Respirable dust	4	2	2	5	40	Medium					0	Low
	Dust fallout & Respirable dust	4	2	2	5	40	Medium					0	Low
	Gaseous emissions	2	2	2	5	30	Low	6	5	2	4	52	Medium
Noise & vibration	Increase in noise levels as a result of demolition of infrastructure	6	4	1	4	44	Medium					0	
Sensitive landscapes	No additional impacts expected	N/A	Rehabilitation will have a positive effect										
Visual aspects	No additional impacts expected	N/A	Rehabilitation will have a positive effect										
Archaeological and cultural interest	No additional impacts expected	N/A	Rehabilitation will have a positive effect										
Socio-Economic	Cessation of employment	8	3	2	5	65	High	4	3	2	3	27	Low
	Reduced economic activity	8	3	3	4	56	Medium	4	3	2	3	27	Low
	Potential re-employment of employees	2	4	3	2	18	Low						
	Changed land-use after rehabilitation	4	5	2	2	22	Low						
	Loss of employment through retrenchment	8	5	2	4	60	Medium	6	5	2	4	52	Medium

11.1. The Possible Mitigation Measures That Could Be Applied And The Level Of Risk

(With regard to the issues and concerns raised by affected parties provide a list of the issues raised and an assessment/ dis cussion of the mitigations or site layout alternatives available to accommodate or address their concerns, together with an assessment of the impacts or risks associated with the mitigation or alternatives considered).

Table 11-3: Mitigation measures

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
Opencast mining operations	Loss of chrome and other by product resources	Geology	No mitigation is possible as there is no way that the resource could be replaced	Cannot be reversed
	Voids left as a result of chrome and other by products removal as the opencast area.		Backfill voids	Can be managed
			Rehabilitate disturbances caused by	Can be managed
			Level trenches and boreholes and cover with topsoil	Can be managed
			Seed and vegetate area disturbed by mining	Can be controlled
			Should erosion occur suitable alternatives such as mulching and shelter beds for wind erosions should be investigated	May cause irreversible damage
Opencast mining operations	Impact on pre-mining and operational topography	Topography	The hard and soft material place in mined out areas must be reprofiled in keeping with the adjacent un-mined areas	Can be avoided, managed or mitigated
			At the contact between the pit and the un-mined land the slope of the ground must not exceed 5%	Can be avoided, managed or mitigated
			Shape the topography so that it is free draining and reshape areas of arable land capability so that it does not have a slope greater than 4%.	May cause irreversible damage
			Replace topsoil to achieve required pre-mining land capability	May cause irreversible damage
			Re-vegetate rehabilitated areas	May cause irreversible damage
Opencast	As a result of the construction activities fragmentation, degradation or compression may occur if heavy construction vehicles are not kept to the demarcated roads.	Flora	A control of access should be implemented for all remaining natural areas to prevent unnecessary destruction of habitats or disturbance of species. It is also vital that no additional fragmentation occurs and that all roads are clearly demarcated and kept to without any exceptions	Can be avoided, managed or mitigated
			The operational area should be fenced-in in order to reduce human and vehicle traffic to areas outside of the demarcated mining area.	Can be controlled
			The vegetation removal during the construction phase should be controlled and very specific.	May cause irreplaceable loss of resources
			Continuous rehabilitation of the area should occur during construction, where re-vegetation practices should be prioritised.	Can be avoided, managed or mitigated
	Dust deposition on leaf lamina may result in the decline of rate of photosynthesis which leads to retarded plant growth.		Rainwater accumulated in the mine pit, if any, can be collected in the quarry sump will be used for dust suppression.	Can be managed
	Construction, human and vehicle movement and introduction of foreign material.	Flora	A management plan for the control of invasive and exotic plant species needs to be implemented. Specialist advice should be used in this regard. This plan should include pre-treatment, initial treatment and follow-up treatment and should be planned and budgeted for in advance.	Can be managed
			All footprint areas should remain as small as possible. This can be achieved by fencing footprint areas to contain all activities within designated areas.	Can be avoided, managed or mitigated

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
	Development related activities may lead to the loss of floral species of conservation concern.		If any SCC are encountered within the subject property in the future, the following should be ensured:	Can be avoided, managed or mitigated
			Mark all trees and clumps that must be protected and fence them off.	Can be avoided, managed or mitigated
	Development and related activities are likely to impact on the sensitive habitats related to the watercourses situated in and around the development footprint.		If any threatened species will be disturbed, ensure effective relocation of individuals to suitable offset areas or within designated open space on the subject property.	May cause irreplaceable loss of resources
			All rescue and relocation plans should be overseen by a suitably qualified specialist.	Can be avoided, managed or mitigated
			Human and vehicle movement should be restricted from taking place in sensitive habitats. Areas to be fenced if necessary.	Can be avoided, managed or mitigated
TSF Footprint	As a result of the construction activities fragmentation, degradation or compression may occur if heavy construction vehicles are not kept to the demarcated roads.		A control of access should be implemented for all remaining natural areas to prevent unnecessary destruction of habitats or disturbance of species. It is also vital that no additional fragmentation occurs and that all roads are clearly demarcated and kept to without any exceptions.	Can be controlled
			The operational area should be fenced in in order to reduce human and vehicle traffic to areas outside of the demarcated operational area.	May cause irreplaceable loss of resources
	Construction, human and vehicle movement and introduction of foreign material.		A management plan for the control of invasive and exotic plant species needs to be implemented. Specialist advice should be used in this regard. This plan should include pre-treatment, initial treatment and follow-up treatment and should be planned and budgeted for in advance.	Can be managed
	Development related activities may lead to the loss of floral species of conservation concern.		All footprint areas should remain as small as possible. This can be achieved by fencing footprint areas to contain all activities within designated areas.	Can be managed
	Development and related activities are likely to impact on the sensitive habitats related to the watercourses situated in and around the development footprint.		Survey for SCC species on the project footprint area should be undertaken by a suitably qualified specialist prior to the start of construction.	Can be avoided, managed or mitigated
			If any SCC are encountered within the subject property in the future, the following should be ensured:	Can be avoided, managed or mitigated
			If any threatened species will be disturbed, ensure effective relocation of individuals to suitable offset areas or within designated open space on the subject property.	Can be avoided, managed or mitigated
			All rescue and relocation plans should be overseen by a suitably qualified specialist.	Can be avoided, managed or mitigated
		Flora	Human and vehicle movement should be restricted from taking place in sensitive habitats. Areas to be fenced if necessary.	Can be avoided, managed or mitigated
Waste Rock Dump Extension	Construction, human and vehicle movement and introduction of foreign material e.g. soils may lead to the introduction of alien invader species, impacting on the floral characteristics of		A control of access should be implemented for all remaining natural areas to prevent unnecessary destruction of habitats or disturbance of species. It is also vital that no additional fragmentation occurs and that all roads are clearly demarcated and kept to without any exceptions	Can be avoided, managed or mitigated
			The operational area should be fenced in in order to reduce human and vehicle traffic to areas outside of the demarcated operational area.	Can be avoided, managed or mitigated

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
	the project site and adjacent natural areas.		The vegetation removal during the construction phase should be controlled and very specific.	Can be controlled
	Rehabilitation could be ineffective if measures are not appropriately complied to or rehabilitation is not planned well in advance.		A management plan for control of invasive/exotic plant species needs to be implemented. This will be ongoing until the end of the mining closure phase.	Can be avoided, managed or mitigated
	Without mitigation the alien invasive species will increase and result in a degraded veld condition making the property less viable for post-closure land use activities such as wilderness, grazing and agriculture.		Rehabilitation plans should be planned long before the closure phase is due. Continuous rehabilitation should also take place during the operational phase.	Can be managed
			Rehabilitation plan should be implemented. This includes the process of replanting the vegetation. Rehabilitation plans should be compiled with the use of a specialist and the correct seeding techniques and mixtures should be applied.	Can be managed
			Close monitoring of plant communities to ensure that ecology is restored and self-sustaining. The monitoring of the flora should be conducted annually by the environmental practitioner, until a suitably qualified specialist deems the monitoring to no longer be necessary. A report should be written and stored and should be available at all times.	Can be avoided, managed or mitigated
Opencast	The construction activities might result in impacts on the mountainous animals due to increased movement, traffic and construction personnel to the area.	Fauna	The construction area should be well demarcated and construction workers should not enter adjacent areas.	Can be avoided, managed or mitigated
	Specifically, OC1 and OC2 and their extended footprints (the natural areas) will be more intensely affected in terms of activities since they are in better condition than OC3 and further away from constant movement.		All opencast sections should be mined and rehabilitated before moving on to the adjacent section as to ensure enough range and forage opportunities remain available to the wildlife present at Tubatse.	Can be avoided, managed or mitigated
			Any nests encountered should be avoided at all stages if encountered.	Can be avoided, managed or mitigated
			Passage to the opencast footprints should follow a route that preferably moves along the proposed opencast footprints to prevent additional fragmentation which could occur if access is taken from the other side of the mountain.	May cause irreplaceable loss of resources
			To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.	Can be avoided, managed or mitigated
			Continuous rehabilitation of the area should occur during construction, where re-vegetation practices should enjoy priority.	Can be avoided, managed or mitigated
	Storing of foreign materials, such as construction material, mixing of concrete or collection and delivering could result in pollution.	Fauna	The caves created near OC2 should not be destroyed if possible as bats that may have established within these structures have valuable contributions to pollination and possibly predatory niches.	Can be avoided, managed or mitigated
	Constructing activities and heavy construction vehicles might result in compaction of the soil and destruction of vegetation habitat.		To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.	Can be controlled

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
			Continuous rehabilitation of the area should occur during construction, where re-vegetation practices should enjoy priority.	May cause irreplaceable loss of resources
			Prevent impacts from impacting on the multiple drainage lines identified during the field visit.	Can be managed
			Placement of the OC footprints along the stretches surveyed should ideally be placed close to the Lannex or Tubatse Chrome Club footprints to minimise impacts to green fields and to avoid the more natural drainage features where possible.	Can be managed
	The drainage of the surface water areas or sources (such as diversion of the drainage lines or changes to the beds and banks) that feed the drainage system found within the development site may be impacted due to construction activities and may result in the destruction of riparian habitat for the sensitive species.		To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.	Can be avoided, managed or mitigated
			Corridors between the drainage channels and river systems should always be maintained during construction and operational phases.	Can be avoided, managed or mitigated
			Fencing the footprint area will prevent movement into the natural veld areas and keep the impacts regulated within a controlled environment. Animals may get used to movement by people in designated areas if it is a predictable situation.	May cause irreplaceable loss of resources
	Artificial lighting may also impact the surrounding natural environment.		Continuous rehabilitation of the area should occur to ensure all impacts identified during operational phase is speedily managed and restored.	Can be avoided, managed or mitigated
	The operational activities might result in impacts to the natural environment due to prolonged activity and movement to and from the area.	Fauna	Noise impacts should be monitored and kept in accordance with the regulated standard prescribed for the zoning of the area.	Can be avoided, managed or mitigated
			Special lighting in the evenings should be considered to limit disturbance of animals (especially since most of these animals are deemed nocturnal) and the attraction of insects to these lights that often lead to their death	Can be avoided, managed or mitigated
			Prevent impacts and waste from reaching the various drainage areas and areas outside the dirty footprint areas.	Can be controlled
			Strict rules and punishment should be adhered to offenders entering the natural environment outside of the footprint.	May cause irreplaceable loss of resources
			Workers should not be housed or allowed free access around the mountainous areas.	Can be avoided, managed or mitigated
			The only threatening impact anticipated will be the result of long-term activity and associated disturbance brought on by the humans that penetrate the natural environment surrounding the actual footprint areas. This will lead to systematic degradation of areas, creating a larger footprint that was anticipated from the original development site.	Can be managed
			The construction area should be well demarcated and construction workers should not enter adjacent areas;	Can be managed
			The TSF footprints should be also considered for remining and reclamation after it is established. This will aid with rehabilitation, improve financial turnout and decrease the waste remaining to be removed or capped (depending on final landform).	Can be avoided, managed or mitigated
TSF (LNX Footprints)	The construction activities might result in impacts on the new TSF footprints		Any nests encountered during the establishment of the TSF should be avoided at all stages. Flat boulders and rocky outcrops have been sighted during the	Can be avoided, managed or mitigated

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
	proposed due to increased movement, traffic and construction personnel to the area. Construction will result in increase of potentially destructive movement within the designated area.	Fauna	field assessment of the footprints and these will likely need to be removed or moved to establish the dam.	
			To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.	Can be avoided, managed or mitigated
			Continuous rehabilitation of the area should occur during construction, where re-vegetation practices should enjoy priority.	Can be avoided, managed or mitigated
			Adequate landscaping will result in bird species returning to the site. Therefore, the planting of indigenous trees and shrubs should be encouraged.	May cause irreplaceable loss of resources
			To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.	Can be avoided, managed or mitigated
			Continuous rehabilitation of the area should occur during construction, where re-vegetation practices should enjoy priority.	Can be avoided, managed or mitigated
	Storing of foreign materials, such as construction material, mixing of concrete or collection and delivering could result in pollution		Seed mixes should match the surrounding vegetation structures and those specifically found in the Sekhukhune Plains Bushveld and Sekhukhune Mountain Bushveld vegetation types.	Can be avoided, managed or mitigated
	Constructing activities and heavy construction vehicles might result in compaction of the soil and destruction of vegetation habitat which will impact on the animals that use the area as habitat.		Prevent impacts from impacting on the multiple drainage lines identified during the field visit. These were dry channels but will facilitate the movement of water during rainfall events.	Can be controlled
			Corridors between the drainage channels and river systems should always be maintained during construction and operational phases.	May cause irreplaceable loss of resources
			Fencing the footprint area will prevent movement into the natural veld areas and keep the impacts regulated within a controlled environment. Animals may get used to movement by people in designated areas if it is a predictable situation. If movement is allowed into natural areas on a regular basis and the smell and sound of humans are found outside the demarcated development zones, it may result in animals moving away from the area and those that have specialised niches may flee and starve due to limited range and adaptability.	Can be managed
			Continuous rehabilitation of the area should occur to ensure all impacts identified during operational phase is speedily managed and restored. This included erosion and the management of Invasive plant species that may decrease the integrity of the Sekhukhune vegetation types as a specialised habitat for animals.	Can be managed
			Noise impacts should be monitored and kept in accordance to the regulated standard prescribed for the zoning of the area.	Can be avoided, managed or mitigated
	The operational activities might result in impacts to the natural environment due to prolonged activity and movement to and from the area.		Special lighting in the evenings should be considered to limit disturbance of animals (especially since most of sensitive animals are deemed nocturnal) and the attraction of insects to these lights that often lead to their death	Can be avoided, managed or mitigated
			Prevent impacts and waste from reaching the various drainage areas and areas outside the dirty footprint areas.	

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
			Strict rules and punishment should be adhered to offenders entering the natural environment outside of the footprint.	Can be avoided, managed or mitigated
			Workers should not be housed or allowed free access around the mountainous areas.	May cause irreplaceable loss of resources
			The construction area should be well demarcated and construction workers should not enter adjacent areas;	Can be avoided, managed or mitigated
			Any nests encountered should be avoided at all stages if encountered.	Can be avoided, managed or mitigated
			To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.	Can be avoided, managed or mitigated
	Movement, noise and waste management is the main impacts that should be managed within this phase	Fauna	Continuous rehabilitation of the area should occur during construction, where re-vegetation practices should enjoy priority.	Can be controlled
Waste Rock Dump Extension	The construction activities might result in impacts on the natural environment, however, the footprint proposed for the WRD has already been developed and fall within a designated fenced area.		Implement all other mitigation measures prescribed and manage the expansion as per current WRD area to prevent any new impacts stemming from the expansion.	May cause irreplaceable loss of resources
			Ensure that the stormwater management features of the WRD area (and possibly OC 1 extended footprint area) include the additional areas before the development thereof	Can be avoided, managed or mitigated
			Fencing the footprint area will prevent movement into the natural veld areas and keep the impacts regulated within a controlled environment.	Can be managed
			Continuous rehabilitation of the area should occur to ensure all impacts identified during operational phase is speedily managed and restored. This included erosion and the management of Invasive plant species.	Can be managed
	Traffic and constant usage of heavy vehicles might result in compaction of the soil and destruction of vegetation habitat which will impact on the animals that use the area as habitat.		Noise impacts should be monitored and kept in accordance to the regulated standard prescribed for the zoning of the area.	Can be avoided, managed or mitigated
			Strict rules and punishment should be adhered to offenders entering the natural environment outside of the footprint.	Can be avoided, managed or mitigated
	The operational activities might result in impacts to the natural environment due to prolonged activity and movement to and from the area.		Implement all the EMP requirements as prescribed for the WRD footprint area (since this is only an extension).	Can be avoided, managed or mitigated
			Positive impacts will start outweighing any negative impacts after initial rehabilitation and re-vegetation has occurred. Rehabilitation is a long-term process and the success will be a product of the planning and adherence to the designed final landform and measures initiated to ensure success	Can be avoided, managed or mitigated
			Active rehabilitation of degraded landscapes should commence.	May cause irreplaceable loss of resources
			To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.	Can be avoided, managed or mitigated

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
		Fauna	Ensure that an acceptable aesthetic scenario is created post closure. This will be reached through adequate rehabilitation practices by restoring damaged and degraded habitat areas.	Can be avoided, managed or mitigated
Closure and Post-Closure phase for all developments	Increased activity and traffic within a shorter timeframe (closure phase) may degrade the area if adherence is not in line with the Environmental Management Plan (EMP) and Final Rehabilitation programme compiled for the specific Lannex area.		When closure is considered successful and rehabilitation complete, unnecessary fences should be lifted to restore larger foraging areas, especially for larger mammalian species within the area.	Can be avoided, managed or mitigated
			Impacts will begin to subside and move towards a positive scale (ideally)	Can be controlled
Mining operations	Proposed LNX TSF 1 Pollution Plume	Groundwater	• Before operation, a plan that includes explicit consideration of closure and rehabilitation issues must be prepared and approved. • Water management facilities should be designed to intercept and contain as much contaminated runoff and/or seepage as possible.	May cause irreplaceable loss of resources
	Existing TSF Pollution Plume		• Pollution prevention consideration. Deterioration of water quality must be prevented wherever possible and minimised where complete prevention is not possible.	Can be avoided, managed or mitigated
	WRD Pollution Plume		• Identify and where possible, maximise areas of the mine that will result in clean storm water runoff • Ensure that clean storm water is only contained if the volume of the runoff poses a risk, if the water cannot be discharged to watercourses by gravitation, for attenuation purposes, or when the clean area is small and located within a large dirty area. . • Ensure that seepage losses from storage facilities (such as polluted dams) are minimised and overflows are prevented. • The size of unrehabilitated areas (pit, spoils, and unvegetated areas) that produce contaminated runoff should be minimised.	Can be managed
	Residue Stockpile Area		• Monitoring of water storage facilities, particularly pollution control dams, is imperative to manage the risk of spillage from the dams. Stage-storage (elevation-capacity) curves are useful tools to monitor the remaining capacity within a water storage facility. • Prevent the erosion or leaching of materials from any residue deposit or stockpile from any area and contain material or substances so eroded or leached in such area by providing suitable barrier dams, evaporation dams or any other effective measures to prevent this material or substance from entering and polluting any water resources. • Water quantity and quality data should be collected on a regular, ongoing basis during mine operations. • The depth of the trench should be at least 4 mbgl (or 2 m below the groundwater level) to intercept polluted seepage that resulted from the WRD; • The design of the trench gradient must be such that the water is free flowing without eroding the channel; • The water from the trench must be captured, retained and managed within the mine water systems.	Can be avoided, managed or mitigated

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
	Existing MG1 Opencast Pollution Plume	Groundwater	• Should privately owned boreholes decrease in yield due to mining drawdown, the mine should supply the owners with a volume of water as agreed upon between the parties involved. • The capacity to rapidly pump water out of the pit into storage dams should be maintained. This will assist in minimising water quality deterioration due to long-term retention of storm water in contact with materials that may cause water quality deterioration. • Berms should be constructed around the opencast pits to minimise the flow of any surface water or floodwater into mine workings. These berms should be constructed to allow free drainage away from the pits.	Can be avoided, managed or mitigated
	Proposed Opencast 1,2,3 Pollution Plume			Can be avoided, managed or mitigated
	Proposed Opencast 1,2,3 Decant			May cause irreplaceable loss of resources
	Planned Underground Mine Pollution Plume		• All openings to the mine need to be sealed or have adequate berms surrounding the openings to prevent surface water entering. • All boreholes should be sealed from the bottom to the top to prevent groundwater entering the hole and feeding into the mine workings. • All depressions created by mining need to be profiled for self-drainage of surface water away from the workings. • Should depressions created by mining not be able to be filled, then the areas need to be surrounded by berms to prevent surface water ingress to the mine workings. • Water quantity and quality data should be collected on a regular, ongoing basis during mine operations.. • Areas that may have subsided or areas of depressions and/or sinkholes should be filled to create free draining surfaces.	Can be avoided, managed or mitigated
	Currently Mined MG1 and MG2 Underground Mine Pollution Plume			Can be controlled
	Planned Underground Mine Dewatering			Can be avoided, managed or mitigated
	Currently Mined MG1 and MG2 Underground Mine Dewatering			Can be managed
Siltation of surface water resources	Cumulative: Clearing or removal of vegetation leaves the soils prone to erosion during rainfall events, and as a result runoff from these areas which will be high in suspended solids and will cause an increase in turbidity in the natural water resources.	Floodline/ Surface water	Clearing of vegetation must be limited to the development footprint area and the use of existing access roads must be prioritized to minimise construction of new access roads in the areas;	Can be avoided, managed or mitigated
			Re-vegetate all open and unprotected areas where no activity is taking place. - Reduce speed of run-off water.	Can be avoided, managed or mitigated
			Fine products must be covered by tarpaulin during transport, where possible, which will help to reduce dust accumulation. Reduce speed on gravel roads to reduce dust kick up. Roads can be sprayed with water collected in quarry sump (reduce dust kick-up). Costs can be saved by using hygroscopic material such as calcium chloride. Dust collectors and filters can be placed on all drill rigs.	Can be avoided, managed or mitigated
	Dust generated during the construction activities and increased vehicular movements can also be deposited into the nearby natural streams during rainfall events thereby contributing to the accumulation of suspended solids in these water resources leading to the siltation of the water bodies.		If possible, construction should be undertaken during the dry season (April to September) to minimise erosion and sedimentation/siltation of the river/drainage;	May cause irreplaceable loss of resources

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
	The proposed TSF options, WRD expansion and the proposed opencast areas are located a minimum of 20 to 200 m between the river/drainages which form tributaries of the Steelpoort River and the Steelpoort River itself.		Any construction work that involves site clearance, digging, excavation during construction services should be suspended during heavy rains to avoid erosion and sedimentation of the water course;	Can be avoided, managed or mitigated
			When wet season construction cannot be avoided, sedimentation control measures, such as hay bales, sedimentation basins or any silt traps should be in place during the construction phase; and	Can be avoided, managed or mitigated
			Dust suppression measures must be undertaken on the cleared areas during construction.	Can be avoided, managed or mitigated
			Dispose of contaminated soil as if it is hazardous waste at the appropriate location on the site.	Can be controlled
Hydrocarbon spillages	Cumulative: A High volume of traffic by vehicles will occur due to the transport of equipment/material to site, together with removal of material from the opencast areas to the WRD area.		Oil spillages must be contained to the smallest possible area and must be cleaned immediately;	May cause irreplaceable loss of resources
			Maintenance/servicing of vehicles should only take place in designated service areas on site. Refuelling may only take place on a bund and by means of a pump.	Can be avoided, managed or mitigated
	These impacts will lead to the deterioration of the water quality and hence impact the downstream water users, as well as the aquatic life.		All construction equipment shall be put onto a maintenance program, including daily inspection of the equipment. Vehicles maintenance must only be conducted within designated service bays.	Can be managed
Alteration of surface water drainage patterns and river banks	The proposed TSF options, WRD expansion and the proposed opencast areas fall within close proximity to the tributaries of the Steelpoort River and the Steelpoort River itself. Increased vehicular movements and other construction activities may alter or disturb these drainage lines, thereby altering the morphological patterns of the stream as well as impact on the normal drainage flow		If possible, only the demarcated footprint of the TSF, WRD and opencast areas should be disturbed to avoid additional footprint areas which may lead to disturbance of the drainage lines	Can be managed
			Construction work closer to the streams should be suspended during heavy rains to avoid erosion and sedimentation of the streams and unnecessary vehicle movement should be avoided;	Can be avoided, managed or mitigated
			Use of existing access roads must be prioritized so as to minimise construction of new access roads crossing the stream.	Can be avoided, managed or mitigated
Reduction of catchment yield	The footprint areas of the TSF and associated infrastructures will no longer form part of the natural downstream catchment thereby potentially resulting in a decrease of runoff downstream		This impact is unavoidable for this nature of project, however, to try and manage this impact, it is recommended to only restrict the proposed TSF, WRD and opencast development to the exact footprint to avoid unnecessary loss of runoff.	Can be avoided, managed or mitigated
Floodline of the proposed TSF, WRD, opencast and associated infrastructures	Flooding of the proposed TSF, WRD expansion and opencast areas may result in a significant water pollution impacts on the natural streams, hence impact on the downstream users as well as the aquatic life.		Floodlines will be required on all major watercourses within close proximity to the TSF options, WRD expansion and opencast areas. Based on government notice (GN) 704, the mine infrastructure in question should fall outside of the 1:100 year floodline or the 100 m away from the river/drainage, whichever is greater.	May cause irreplaceable loss of resources
			The downstream river/drainage section which is responsible for draining Catchment 5 and 6 bisects the planned opencast area. These opencast areas fall within the 1:100-year floodline and the 100 m river/drainage buffer. The	Can be avoided, managed or mitigated

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
			proposed footprint should also be adjusted to ensure it falls outside of the 1:100 year floodline or 100 m river/drainage buffer, whichever is greater.	
	The flooding of the opencast areas may also result in extended downtime for the mining operation, whilst flood damages are being repaired		Based on GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated. Therefore clean water emanating from upstream of the TSF and RWD, WRD expansion and opencast areas will be diverted away and discharged to the nearby watercourse or environment..	Can be controlled
Mixing of clean and dirty water	All runoff emanating from upstream of the TSF, WRD, opencast and associated infrastructures are considered dirty and need to be managed so as to prevent the mixing of clean and dirty water.		To size the required capacity of the RWD a conceptual water balance is to be developed which will take into consideration the 1:50 year storm event, the operating volume, and the external catchments if any. The RWD will also have a minimum freeboard from spillway to crest of 0.8 m as per GN 704 requirements.	May cause irreplaceable loss of resources
Mining operations	Potential visual impact on the viewpoints that had a visual exposure.	Visual	The visual impact can be minimized by creating visual barriers. The construction area will be cleared as soon as construction of the infrastructure is finished.	Can be avoided, managed or mitigated
	Potential permanent visual impact on the viewpoints		The visual impact can be minimized by the creation of visual barriers. Planting indigenous vegetation. Clearing only vegetation as required. Rehabilitating any disturbed areas as soon as possible.	Can be avoided, managed or mitigated
			Fencing types can also be considered to ensure that it blends with the surrounding environment.	Can be avoided, managed or mitigated
Site clearing, removal of topsoil and vegetation	Fugitive dust (containing TSP (total suspended particulate, will give rise to nuisance impacts as fallout dust), as well as PM10 and PM2.5 (dust with a size less than 10 microns, and dust with a size less than 2.5 microns giving rise to health impacts)).	Air Quality	Topsoil should not be removed during windy months (August to January) due to associated wind erosion heightening dust levels in the atmosphere.	Can be managed
			Area of disturbance to be kept to a minimum and no unnecessary clearing of vegetation to occur.	Can be avoided, managed or mitigated
			Topsoil should be re-vegetated to reduce exposure areas.	Can be managed
			All stockpiles to be damped down, especially during dry weather or re-vegetated (hydro seeding is a good option for slope revegetation).	Can be avoided, managed or mitigated
			Sprayers can be attached to conveyor belts and crushers/screen equipment to reduce dust at the source.	Can be avoided, managed or mitigated
Construction of surface infrastructure (e.g. access roads, pipes, storm water diversion berms, drilling, blasting)	The proposed mining activities will result in fugitive dust emissions containing TSP (total suspended particulate, giving rise to nuisance impacts as fallout dust).		Dust emitted during bulldozing activity can be reduced by increasing soil dampness by watering the material being removed thus increasing the moisture content.	Can be managed
			Another option would be to time the blasting with wind to ensure the dust will not be blown to the sensitive receptors or especially the community.	Can be managed
			Constricting the areas and time of exposure of pre-strip clearing in advance of construction to limit exposed soil surfaces.	May cause irreplaceable loss of resources
General transportation, hauling and vehicle movement on site	Transportation of the workers and materials in and out of mine site will be a constant feature during the construction phase.		Hauling of materials and transportation of people should take place on roads which is being watered and/or sprayed with dust suppressant.	Can be avoided, managed or mitigated
			To reduce the amount of dust being blown from the load bin in the haul roads, the material being transported can be watered or the back of the vehicles can be covered with plastic tarpaulin covers.	Can be avoided, managed or mitigated
			The drop heights should be minimised when depositing materials to the ground.	May cause irreplaceable loss of resources

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
	Use and maintenance of access road	Air Quality	Encourage car-pool and bulk delivery of materials in order to reduce the number of trips generated daily.	Can be avoided, managed or mitigated
	Dust from material handling- inside and outside the pit area		Use wetting agents to ensure dust suspension.	Can be managed
	Haul roads for transporting RoM to the offsite processing plant		Dust suppression of roads being used during rehabilitation should be enforced	Can be managed
	Wind erosion		Re-vegetate where possible and use water for dust suspension.	Can be avoided, managed or mitigated
Demolition and removal of all infrastructure (incl. transportation off site)	The process includes dismantling and demolition of existing infrastructure, transporting and handling of topsoil on unpaved roads in order to bring the site to its initial/rehabilitated state.		Demolition should not be performed during windy periods (August, September and October), as dust levels and the area affected by dust fallout will increase.	Can be avoided, managed or mitigated
			Cabs of machines should be swept or vacuumed regularly to remove accumulated dust.	May cause irreplaceable loss of resources
			Dust suppression of roads being used during rehabilitation should be enforced	Can be controlled
	Rehabilitation (spreading of soil, revegetation &profiling/contouring)		Revegetation of exposed areas for long-term dust and water erosion control is commonly used and is the most cost-effective option.	May cause irreplaceable loss of resources
			The reshaping and restructuring of the landscape. Topsoil can be imported to reconstruct the soil structure. Profiling of dumps and waste rock dump to enhance vegetation cover and reduce wind erosion from such surfaces post mining.	Can be avoided, managed or mitigated
Noise increase	Numerous simultaneous future construction activities during the day and night at TSF	Noise	No night-time mining (construction and operational) activities should be allowed within 500 m from residential dwellings at night without a noise study with a detailed management plant;	May cause irreplaceable loss of resources
	Numerous simultaneous future construction activities during the day and night at TSF		All employees and contractors should receive induction that includes an environmental awareness component (noise).	Can be avoided, managed or mitigated
	Potential future construction at opencast area 1,2,3- Day		Development of a noise measurement programme (if required, depending on recommendation from the noise measurement specialist) once mining activities are to take place within 1,000 m from residential houses in the Tubatse Village;	Can be controlled
	Potential future construction at opencast area 1,2,3- Night		Compliance with the Noise conditions of the Environmental Management Plan that covers:	May cause irreplaceable loss of resources
			Blasting should be avoided during overcast condition, if possible, as this increases noise and vibration. Impact from blasting can be reduced through the selection of explosives, sequencing of blast, deflection equipment and timing. Use blasting mats. Notify I&AP of any blasts.	Can be managed
	Future operational activities at Opencast Area 1,2,3 – Day		Impact from blasting can be reduced through the selection of explosives, sequencing of blast, deflection equipment and timing. Use blasting mats. Notify I&AP of any blasts	Can be avoided, managed or mitigated
	Future operational activities at Opencast Area 1,2,3- Night		Impact from blasting can be reduced through the selection of explosives, sequencing of blast, deflection equipment and timing. Use blasting mats. Notify I&AP of any blasts	Can be avoided, managed or mitigated

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
The natural ambient noise levels	The earth moving equipment and blasting together with grinding and stone crushing activities will generate noise above ambient noise levels in the surrounding areas	Noise	Measures such as ensuring all vehicles and equipment are in good working order, and that any faulty exhaust- and/or intake silencers are replaced timorously, will reduce the severity and significance of the impact. Drilling and blasting is generally intermittent and should be limited to daylight hours when ambient noise levels are highest.	Can be avoided, managed or mitigated
Complaints	Increased noise levels from construction and mining operations		Operators must wear ear protection at all times when operating the earth moving equipment and machinery to prevent noise induced hearing loss. Noise pollution must be monitored monthly, and recorded throughout the life of mine.	May cause irreplaceable loss of resources
Dust will also be generated from the opencast pits, tailings storage facility, access roads to and from the waste rock dump sites.	The dust generated during the construction phase and operational phase of the surface mine infrastructure and mining of the opencast pits will reduce the air quality of the local area immediately adjacent to the mining works. The ore crushing and waste rock disposal activities will also generate dust.	Air Pollution	Wetting of the access roads with water periodically to suppress the dust will greatly reduce the impact of dust. This wetting with water must be done daily during dry and windy seasons. Dust and smoke monitoring will be conducted during the life of mine to determine the prominent wind directions and dust / smoke levels at various points around the mining site. Concurrent rehabilitation and re-vegetation of the project sites will also reduce surfaces that are exposed to wind generated dust	Can be avoided, managed or mitigated
Controlled movement of haul trucks and light delivery vehicles (LDVs)	Dust will be generated from the existing gravel access road if used for other purposes subsequent to mining access		Dust and smoke monitoring will be conducted during the life of mine to determine the prominent wind directions and dust / smoke levels at various points around the mining site.	Can be controlled
The crushing and screening activities create a High visual contrast with the surrounding areas, which are greener and less uniform.	The proposed SECM Lannex opencast, waste dumps activities and surface infrastructure will further change the aesthetic character of surrounding area by permanently changed landscape and the development associated with the mining operation.	Light and visual impacts	Progressive rehabilitation will be implemented throughout the life of mine, such that as closure approaches a significant portion of the mining site would have been rehabilitated to conform to surrounding environmental characteristics and topographic features. This is subject to strict implementation and compliance with this environmental management programme report. Over time and towards closure the visual impact should gradually change from moderate to low after final rehabilitation is complete.	Can be avoided, managed or mitigated
The inherent land capability will be permanently lost below the footprint of these mining entities	The positive impact of mining in the project area includes increased business opportunities, greater demand for goods and services, pressures for housing.	Landuse and Capacity	Rehabilitate the land to as close as possible to its wilderness and grazing land state during and after the mining activities are concluded. Re-vegetation should be with indigenous plant species that are able to sustain the regional climate and soil conditions.	Can be managed
			The farm where the current mining activities are taking place, is already a restricted/controlled access, therefore the larger SECM Lannex mining proposed activities will not reduce availability of natural resources and land to local communities.	
Culture and Heritage	The cultural and historic remains are area specific and very important to the cultural and values of the area	Cultural and Heritage Aspects	All Archaeological, palaeontological and heritage sites and resources must be preserved if they are of cultural, historic or pre-historic significance. This must be done in conjunction with an expert or competent person:	Can be avoided
			Monitoring for chance finds (e.g. burial sites, old waste disposal sites, ruins, foundations etc.) must be done continuously during operations	
	SECM, Lannex mine will form part of the history of the local area. Some mine		Findings, if encountered during mining activities, must be reported to the LIHRA Office, Limpopo and Fetakgomo Tubatse Municipality who will decide, after consultation with other relevant authorities, company representatives and local	May cause irreplaceable loss of resources

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
	infrastructure may be preserved as local heritage resources.		communities whether work may go ahead. Special precautions may be instituted to enable the mining work to proceed.	
Crime, HIV and Covi-19	Influx of foreigners and job seekers and increase in disposable income for local people may create negative social impacts such as crime, alcoholism and prostitution in and around the project area.	Soicio- Eonomic	Labour should be sort from the local settlement areas to prevent influx of foreigners who are likely to disrupt the social fabric, values and norms of the village people.	Can be avoided, managed or mitigated
			Through the SLP and day-to-day training and awareness programmes pandemics such as HIV and Covid-19 can be managed and minimized. The Lannex mine must also have an HIV and Covid-19 awareness outreach programme in conjunction with local health centres and clinics to extend awareness and knowledge about the diseases to the broader communities affected by the proposed mine activities.	
	Cumulative: Possible loss of life and Covid-19 pandemic spread and new cases.		Visible policing and community policing forums must be established to curb incidents of crime in the communities. This option must be implemented in conjunction with existing tribal authority processes to manage crime and illegal activities.	Can be avoided, managed or mitigated
Economic Opportunities, Infrastructure development and Employment	A high percentage of residents in the local village of Tukakgomo are unemployed. The continuation of mining activities at Lannex Mine will alleviate this unemployment problem, though it will not eradicate it completely.		Promotion of chrome beneficiation within the Limpopo to improve the quality and value of the product being mined, and create further economic activity. Samancor Chrome Limited already has chrome concentrator plants in the Steelpoort valley. Subject to economic modelling and feasibility study, another concentrator plant in the vicinity of Lannex can further stimulate significantly the economic activity in Fetakgomo-Tubatse Municipality, Burgersfort, Steelpoort and the surrounding region.	Positive, cannot be mitigated
	Local business will also benefit by providing supplies and services to the mine. Secondary industries are also likely to develop.		Labour should be sort from the local settlement areas to prevent influx of foreign people.	Positive, cannot be mitigated
	The social and labour plan (SLP) to be implemented by the SECM Lannex Project will contribute to the development of the adjacent community in terms of skills training, local economic development projects, and improved infrastructure.		Labour should be sort from the local settlement areas to prevent influx of foreign people	Positive, cannot be mitigated
	Skilling and training of local people will make them more marketable to other industries in the region. LED projects will continue to sustain economic activity post Lannex Project.	Employment	Job seekers who are likely to disrupt the social fabric, values and norms of the village people.	Positive, cannot be mitigated
New tailings deposit area, new crushing and screening plant, TSF reclamation and WRD	Disturbance/loss of soil resources	Soils	See Section 13.1.1-10 and Section 13.4-5 It is recommended to restrict the number of roads, and limit the number of passes on the roads in construction areas to control the possibility of compaction by heavy vehicles and erosion, but also to control the possibility of dust. If necessary, special measurements should be taken to control dust, especially on unpaved roads.	Can be avoided, managed or mitigated

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
	Additional disturbance/loses of soil due to erosion as well as contamination of soils		See Section 13.1 1,3-5 and Section 13.4-5 Erosion must be controlled in run off areas especially in specific positions where donga erosion is present such as between Lannex 1 and 2 as well as south of Lannex 2. During all new development care should be taken not to enhance erosion and it should be controlled as soon as erosion is observed. Surface areas should not be left bare for extended periods of time, but should always be vegetated or covered with suitable coverage to prevent dust Contamination of presently undisturbed top soils should be prevented as far as possible. Since large areas on this site have already been disturbed all waste products should be dumped on previously disturbed sites of the prospecting rights areas, even though the soils on this site are of low potential.	Can be avoided, managed or mitigated
	Cumulative disturbances, loss and degradation of soils		See Section 13.2 1-10 and Section 13.4-13.5 In case of any new development, all usable soil (where present) should be stockpiled and used for rehabilitation. Vegetation of these stockpiles will be needed on the long term. Site all soil stockpiles upslope from any mining / development activities.	Can be avoided, managed or mitigated
	Increased/Decreased sediment loads on downstream systems		See Section 13.2 1-10 and Section 13.4-13.5 Water runoff must be controlled on the entire site to prevent any further disturbance of the site. The water runoff between Lannex 1 and 2 as well as south of Lannex 2 needs attention. It is foreseen that the development at the planned opencast areas 1 and 2 may pose serious runoff problems due to the topography. Early management to prevent water runoff is needed	Can be avoided, managed or mitigated
	Disturbance/loss/sterilisation of inherent land capability and land use	Land capability and Land use	See Section 13.1.1-10 and Section 13.4-5 All stockpiles should also be protected to prevent erosion of stockpiled material and deflect water runoff. The duration of the stockpiles phase should be limited to a minimum period of time. Stockpiles should not exceed a maximum height of 6 m and it is recommended that the side slopes and surface areas be vegetated in order to prevent water and wind erosion and to keep the soils biologically active. The top fertile 30 cm soil layer should be stockpiled separately and should be used for seeding and revegetation purposes.	Can be controlled
	Loss of land services, ecosystem support and services		See Section 13.1.1-10 and Section 13.4-5 See above	May cause irreplaceable loss of resources
Impact assessment ratings for the opencast areas 1,2,3	Disturbance/loss of soil resources	Soils	See Section 13.1.1-10 and Section 13.4-5 See above	Can be avoided, managed or mitigated
	Additional disturbance/losses of soil due to erosion as well as contamination		Section 13.1 1,3-5, 7-10 and Section 13.4-5 Erosion must be controlled in run off areas especially in specific positions where donga erosion is present such as between Lannex 1 and 2 as well as south of Lannex 2. During all new development care should be taken not to enhance erosion and it should be controlled as soon as erosion is observed. Surface areas should not be left bare for extended periods of time, but should always be vegetated or covered with suitable coverage to prevent dust Contamination of presently undisturbed top soils should be prevented as far as possible. Since large areas on this site have already been disturbed all waste products should be dumped on previously disturbed sites of the prospecting rights areas, even though the soils on this site are of low potential. formation	Can be managed

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
	Cumulative disturbance, loss and degradation of soils		See Section 13.2 1-10 and Section 13.4-13.5	Can be managed
	Increased/Decreased sediment loads on downstream systems		See section 13.3 1-10 and Section 13.4- 13.5	Can be avoided, managed or mitigated
	Disturbance/loss/sterilization of inherent land capability and land use	Land capability and landuse	See Section 13.1 1-10 and Section 13.4-5 All stockpiles should also be protected to prevent erosion of stockpiled material and deflect water runoff. The duration of the stockpiles phase should be limited to a minimum period of time. Stockpiles should not exceed a maximum height of 6 m and it is recommended that the side slopes and surface areas be vegetated in order to prevent water and wind erosion and to keep the soils biologically active. The top fertile 30 cm soil layer should be stockpiled separately and should be used for seeding and revegetation purposes.	Can be avoided, managed or mitigated
	Loss of land services, ecosystem support and services		See Section 13.1 1-10 and Section 13.4-5	Can be avoided, managed or mitigated
Access road to opencast areas, Tubatse village and the stream diversion	Disturbance/loss of soil resources	Soils	See Section 13.1.1-10 and Section 13.4-5 See above	Can be avoided, managed or mitigated
	Additional disturbance/losses of soil due to erosion as well as contamination		See Section 13.1.1-10 and Section 13.4-5 Erosion must be controlled in run off areas especially in specific positions where donga erosion is present such as between Lannex 1 and 2 as well as south of Lannex 2. Contamination of presently undisturbed top soils should be prevented as far as possible. Since large areas on this site have already been disturbed all waste products should be dumped on previously disturbed sites of the prospecting rights areas, even though the soils on this site are of low potential. formation	May cause irreplaceable loss of resources
	Cumulative disturbance, loss and degradation of soils		See Section 13.2 1-10 and Section 13.4-13.5 See above	Can be avoided, managed or mitigated
	Increased/Decreased sediment loads on downstream systems		See section 13.3 1-10 and Section 13.4- 13.5 See above	Can be avoided, managed or mitigated
	Disturbance/loss/sterilisation of inherent land capability and land use	Land capability and landuse	See Section 13.1.1-10 and Section 13.4-5 See above	Can be avoided, managed or mitigated
	Loss of land services, ecosystem support and services		See Section 13.1.1-10 and Section 13.4-5 See above	Can be controlled
Tubatse Community Houses	Ground Vibrations	Subsurface/ Geology	Specific blast design to be done, shorter blast holes, smaller diameter blast hole, using electronic initiation instead of shock tube systems to obtain single hole firing. Sequencing of blast can be kept in mind to help reduce vibrations caused by blasts.	May cause irreplaceable loss of resources
Informal housing	Ground Vibrations		Do blast design that considers the actual blasting and the ground vibration levels to be adhered too. Only apply electronic initiation systems to facilitate single hole firing. Do design for smaller diameter blast holes that will use fewer explosives per blast hole. Relocate the POI / acquire the POI of concern – mined owned.	Can be avoided, managed or mitigated
Buildings/structure	Ground Vibrations		See above	Can be managed

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
Buildings/structure	Air Blast		Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Used of specific stemming to manage fly rock - crushed aggregate of specific size. Re-design with increased stemming lengths.	Can be managed
Road	Fly rock		Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Used of specific stemming to manage fly rock - crushed aggregate of specific size. Re-design with increased stemming lengths.	Can be avoided, managed or mitigated
			The road that has to be rerouted will require rerouting far enough away from the blasting area to ensure that feasible blasting operations will be possible.	Can be avoided, managed or mitigated
			During the closure phase no mining, drilling and blasting operations are expected. It is uncertain if any blasting will be done for demolition. If any demolition blasting will be required it will be reviewed as civil blasting and addressed accordingly.	Can be avoided, managed or mitigated
Greenhouse gases	Increased greenhouse gases	Local Climate	• Reducing fuel consumption – this can be achieved by ensuring the vehicles and equipment are maintained through an effective inspection and maintenance program. • Reducing electricity consumption from fossil fuel – • Limiting the removal of vegetation and ensuring that revegetation occurs as much as possible (vegetation use up CO2 in the atmosphere).	May cause irreplaceable loss of resources
Clearing of vegetation within a watercourse	Removal of vegetation within a watercourse will impact on the habitat that has established which in turn will impact on the biota using these habitats. The removal of vegetation will result in physical changes to the beds and banks that will impact on the water quality and result in increased potential for siltation and erosion. The movement of machinery could also result in compaction and hydrocarbons spills that could impact on water quality, vegetation and biota.	Surface Water	Conduct vegetation removal in the dry season. Start vegetation removal upstream and move downstream. Implement the construction of the proposed river diversion in the dry season. Delineate areas where vegetation is to be cleared and restrict activities to within this area. Red data species that will need to be removed needs a permit. Refer to measures for vegetation clearance within 32 m of a watercourse as well. Comply with the requirements of the Water use licence.	Can be avoided, managed or mitigated
Clearing of vegetation within 32 m of a watercourse	Removal of vegetation within 32 m of a watercourse will impact on the habitat that has established which in turn will impact on the biota using these habitats. The removal of vegetation will result in physical changes to the beds and banks that will impact on the water quality and result in increased potential for siltation and erosion. The movement of machinery could also result in		Refer to measures for the removal of vegetation within a watercourse as well. Ensure that vehicles are properly maintained and that the do not leak oil / grease / diesel. Vehicles will not the allowed to overnight at the construction site. Any vehicles that breakdown on site will have a drip tray placed underneath them and will be removed from site as soon as possible. Drip trays are not to be cleaned at the incident site. Any soils contaminated by hydrocarbon will be collected using the correct manner and disposed to a suitable site.	Can be avoided, managed or mitigated

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
	compaction, hydrocarbons spills that could impact on water quality, vegetation and biota.	Surface Water		
Clearing of vegetation - general	Removal of vegetation could result in increased siltation of watercourses and increase erosion potential.		Refer to the measures for vegetation removal within a watercourse and within 32 m of a watercourse.	Can be avoided, managed or mitigated
Construction of infrastructure within a watercourse and within 32 m from a watercourse	Loosening of material as part of the construction of the identified infrastructures would result in additional damage to habitat and biota while increasing impacts on the stability of the watercourse resulting in increased potential for erosion and siltation. In addition, the movement of machinery within the watercourse or within 32 m could result in increased potential for hydrocarbon spills that will impact on water quality and in turn biota and vegetation.		Refer to the measures for vegetation removal within a watercourse and within 32 m of a watercourse. Ensure that all designs are signed off by an engineer and that the as build drawings as drawn up, signed and submitted to the DWS. Stabilise the banks immediately upstream and downstream of the infrastructure.	Can be controlled
Construction of infrastructure - General	The potential for increase erosion that could increase siltation of watercourses exists.		Refer to the measures for vegetation removal within a watercourse and within 32 m of a watercourse. Ensure that all designs are signed off by an engineer and that the as build drawings as drawn up, signed and submitted to the DWS.	May cause irreplaceable loss of resources
Using access roads, culverts	The movement of machinery could result in hydrocarbons spills that could impact on water quality, vegetation and biota.		Ensure that vehicles are maintained. Remove any hydrocarbon spills immediately and dispose contaminated soil in the correct manner. Inspect culverts before the rainy season and remove any debris that could damage the infrastructure. Inspect after heavy rainfall and remove debris as needed.	Can be avoided, managed or mitigated
Diverting clean storm water and containing clean water into containment dams above operational opencast pit	Damming of water upstream of the opencast sections and allowing the water to be diverted around the opencast will alter the flow regime, habitat and biota composition of the downstream watercourse as no water will be flowing in the original course. In addition, the damming will alter the habitat in the immediate area of the dam as more water would be available for vegetation establishment. Unless the diversion banks are stabilised, the potential for erosion and increases siltation in the diversion and the watercourse to which it will join is increased.		All storm water management infrastructure must be designed by a suitable qualified engineer. All storm water infrastructure should be compliant with Legislation and suitably sized to cater for the 1 in 50 year flood. Comply with the requirements of the water use licence. Stabilise the banks of the clean storm water channels and the river diversion using suitable material and vegetation. Implement end of line infrastructure to dissipate water and prevent erosion at discharge points.	Can be managed

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
Containment of dirty storm water	The containment of dirty storm water will effectively remove water from the natural water resource, this in turn will impact on the habitat and biota of the impacted watercourses. In addition, spills from these infrastructures could negative impact on the downstream water quality which in turn could affect vegetation and biota negatively.	Surface Water	Refer to measures above for the clean storm water management infrastructure and river diversion. Report any spills from the dirty storm water infrastructures and monitor for quality.	Can be managed
Mining of opencast pit - all active pit areas	The containment of rainwater in the opencast pit will effectively remove water from the natural water resource, this in turn will impact on the habitat and biota of the impacted watercourses.		Implement upstream clean storm water diversion around operational opencast areas. Test water quality in the opencast pit, if suitable quality, apply for licence and discharge to downstream watercourses. If not of suitable quality investigate options for re-use.	Can be avoided, managed or mitigated
Mining of opencast pit within a watercourse and within 32 m from a watercourse.	Opencast pits located within a watercourse will alter the flow regime, habitat and biota composition of the watercourse completely.		Implement upstream containment dams as approved and licenced. Implement river diversions as approved and licenced. Plan opencast mining within 32 m and within the watercourse to occur within the dry seasons (March to September), this must include the vegetation removal, mining and backfilling. Seeding of the backfilled area to take place during spring (September - November).	Can be avoided, managed or mitigated
Pumping Tailings to the TSF	Spills from the tailings pipeline could impact on the water quality should it occur during the rainy season and the watercourse is flowing. This in turn could impact on the habitat and biota of the receiving water resources.		Inspect the pipeline on a daily basis. Repair immediately. Remove spilled material from the watercourse and dispose to the TSF.	May cause irreplaceable loss of resources
Pumping return water to the plant	Spills from the return water pipeline could impact on the water quality should it occur during the rainy season and the watercourse is flowing. This in turn could impact on the habitat and biota of the receiving water resources.		Refer to measures for pumping of tailings to TSF.	Can be avoided, managed or mitigated
Establishing the TSF and WRD by depositing of material	Increased dust generation could impact on water quality and habitat should the windblown dust from these two infrastructures be deposited in a watercourse. In addition, should there be a problem with the liner system leachate from these could impact on groundwater which in turn could impact on the base flow water quality of watercourses.	Surface Water	Implement dust suppression at the WRD and TSF. The construction of the liner system needs to be supervised by a suitably qualified engineer and once finished the as build drawings need to be submitted to the DWS. Comply with the requirements of the water use licence.	May cause irreplaceable loss of resources

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
Stockpiling overburden at opencast sections within a watercourse and within 32m from a watercourse	Overburden storage within the watercourse / within 32 m from the watercourse will alter the flow regime of the water courses and could result in increased siltation to downstream areas. In addition, this will also impact on the habitat and biota making use of the watercourses. In addition, leachate from the material could impact on subsurface flow water quality.	Surface Water	Refer to the measures for opencast within a watercourse and within 32 m of a watercourse.	Can be avoided, managed or mitigated
Backfilling of opencast sections within a watercourse or within 32m of a watercourse	Backfilling of the opencast with overburden could impact on subsurface water flow quality due to the leachate potential from the material. Though backfilled, the pit will still capture run-off due to greater interstitial spaces in the backfilled material resulting in less water reaching the downstream watercourses. If unvegetated, the backfilled material could loosen and during heavy rainfall events result in erosion of the backfilled material and increased siltation to downstream areas.		Refer to measures as outlined under operation of the opencast pit. Try to compact material that is used for backfilling to reduce interstitial spaces.	Can be avoided, managed or mitigated
Vegetation of the backfilled opencast areas	This is a positive aspect and will result in slowing down surface run-off flow thus decreasing the potential for erosion.		Refer to the measures for vegetation removal within a watercourse and within 32 m of a watercourse. Conduct annual assessment of vegetation establishment for 2 years after construction has been finalised. Re-vegetate areas as needed based on the annual assessments for the first 2 years. If the second assessment indicate that vegetation establishment has not been successful a further 2 annual assessment should be conducted.	Can be avoided, managed or mitigated
Removal of certain infrastructures within a watercourse or within 32 m of a watercourse	Removal of the overburden will be a positive. The removal of the river diversion, containment dams, access roads and culverts. The movement of machinery increase the potential for hydrocarbon spills.		As above	May cause irreplaceable loss of resources
Closure of certain infrastructure areas	Leachate from these areas could negative impact on baseflow water; If not rehabilitated correctly increased windblown dust from these could impact on vegetation and biota of watercourses.		Soil should be brought in as needed and dispersed immediately in areas where there is poor soil layers. Rehabilitate TSF and WRD with the approved procedure, as well as backfilled opencast sites must be vegetated as soon as possible. Monitor vegetation for at least 2 years on annual basis to determine vegetation establishment. If unsuccessful vegetation establishment is noted, re-seed the area and monitor on an annual basis for another 2 years.	Can be controlled

Activity/Receptor	Potential Impacts	Aspects affected	Mitigation Measures	Mitigation Effect
Mining operations with support activities	Connectivity of watercourses (upstream to downstream) and impact on subsurface water flow quality and quantity.		Implement EMPr	Can be avoided, managed or mitigated
Rehabilitation and Closure of areas that are no longer needed for support infrastructures or mining.	By rehabilitating and closure of areas that are no longer needed for support or mining, the dirty footprint area of the mine is reduced and this in turn will increase the water that is released to baseflow and to downstream areas.		Implement EMPr	Can be managed

12. SUMMARY OF SPECIALIST REPORTS

(This summary must be completed if any specialist reports informed the impact assessment and final site layout process and must be in the following tabular form):

Table 12-1: Summary of Specialist Reports

SPECIALIST	RECOMMENDATIONS AND CONCLUSIONS	SPECIALIST INCLUSION IN THE EIA REPORT	REFERENCE APPLICABLE SECTIONS OF THE REPORT WHERE RECOMMENDATIONS HAVE BEEN INCLUDED
Terrestrial Ecology Assessment	According to the National Vegetation Map (2018) the project site falls within the Sekhukhune Mountain Bushveld, Sekhukhune Plains Bushveld, with a small section representative of the Sekhukhune Montane Grassland. The desktop flora assessment indicates that approximately 416 plant species occur within the QDS. Fifty-two (52) endemic species and eleven exotic plant species were found to possibly occur in the area. Sixty-one (61) plant species listed for the area are classified as species of conservation concern (SCC) according to the IUCN Red List status, the ToPS list, their endemism, the NFA and the LEMA. Based on the desktop information gathered for the specific area, only mammalian and reptilian species with a red listed status are known to occur where the new Lannex expansions are proposed. Two (2) mammal species were found to possibly occur within the QDS, one (1) has been included within the National Red Data List, however this species is not likely expected on the specific footprint, but could possibly utilise the wider region as part of their range, since it has fairly large range requirements: • *Panthera pardus* – Leopard - Vulnerable (2016) – Not expected on site during mining activities, but rather may occur as part of larger range requirement. • Thirty-three (33) reptile species are recorded for the QDS. One of the species have a red listed status: *Platysaurus orientalis Fitzsimons* - FitzSimons' Flat Lizard - Near Threatened (SARCA 2014) According to data collected, ninety-four (94) bird species listed for this area. Thirty-three (33) butterfly species were found for the 2430CC. Nineteen (19) species of Dung beetles were recorded. Three (3) Odonata species are known to occur within the area. Two (2) species of Lacewing are known to occur within the region. Eight (8) amphibian species have been recorded within the region. None of these species are red listed on the SANBI Database. Field assessments were conducted on the 18th of March 2020 and the 23rd of June 2020. The proposed opencast areas and access roads are largely situated on mountainous areas and associated slopes, with a number of watercourses occurring on the proposed opencast areas. The proposed TSF alternatives are located on the plains down gradient of the mountain slopes. Vegetation units were identified according to plant species composition, previous land use and topography. The state of the vegetation of the proposed mining area varies from being natural to completely degraded. The following broad classification of Vegetation Units (VU) was found to occur on the proposed project footprint: 1. Mountain slopes bushveld (VU1); 2. Plains bushveld (VU2); 3. Watercourses and riparian bushveld (VU3); and 4. Degraded and transformed areas (VU4).	X	See Appendix 5.1: Terrestrial Ecology Assessment

SPECIALIST	RECOMMENDATIONS AND CONCLUSIONS	SPECIALIST INCLUSION IN THE EIA REPORT	REFERENCE APPLICABLE SECTIONS OF THE REPORT WHERE RECOMMENDATIONS HAVE BEEN INCLUDED
	Of the 113 plant species identified during the site assessment, eight species not indigenous to South Africa were identified of which two are listed as alien and invasive plant (AIP) species in NEMBA. Twenty-nine (29) species that were found to occur on site have medicinal uses. Thirteen mammalian species listed either provincially or nationally as Species of Conservation Concern (SCC) were verified on-site. No other faunal species recorded during the site survey are listed as SCC. None of the three vegetation types are listed in the National List of Threatened Ecosystems. However, the Sekhukhune Mountain Bushveld and Sekhukhune Montane Grassland form part of the Sekhukhune Mountainlands (MP3) which is listed as Endangered in the National List of Threatened Ecosystems. The closest area protected in terms of NEMPAA is the Apiesboomen Private Nature Reserve, which is 9 km to the northeast of the project area. Sites OC1, OC2, LNX1, LNX2 and the WRD area are located / partially located on areas earmarked in terms of the National Protected Areas Expansion Strategy – Focus Areas, namely Mpumalanga Mesic Grasslands. In terms of the Limpopo Conservation Plan, LNX1, LNX2 and LNX4 are located on areas classified as Critical Biodiversity Areas (CBA2) and LNX3, OC1, OC2 and OC3 are all situated on an area classified as Ecological Support Area (ESA1). The most southern parts of OC1 and OC2 fall within CBA 1. The crests of VU1 and a 100 m buffer was rated as No-go areas, based on the undisturbed condition of the vegetation, the presence of endemic species and species of conservation concern and the irreplaceable value of the crests as habitat for faunal SCC. • The mountainous areas and slopes bushveld vegetation unit (VU1) was rated as having a High sensitivity, based on the undisturbed condition of the vegetation, the presence of endemic species and species of conservation concern and that the vegetation unit is situated in the Sekhukhune Mountainlands (MP 9) which is classified as vulnerable. • The plains bushveld vegetation unit (VU2) was rated as having a Medium sensitivity, based on the moderately disturbed state of the vegetation in this unit and that sections of this nit is categorised as Critical Biodiversity Areas (CBA) in the Limpopo Conservation Plan. • Watercourses (VU3): According to the National Water Act, 1998 (Act No. 36 of 1998), riparian areas are classified as a water resource and are therefore considered to be sensitive. The riparian areas on site are denoted as having High sensitivity. • Transformed areas (VU4) are totally disturbed and cannot be considered sensitive. Therefore, a low sensitivity was assigned to this vegetation unit. It is the opinion of the specialist that the development may continue without severe ecological impacts in terms of the faunal and floral species identified in the framework of the study. Development and OC footprints should be kept as close as possible to the existing Tubatse Chrome and existing Lannex operations and avoid largescale developments along the predominantly natural mountainous habitat (especially areas indicated as No-go Areas). Management of impacts should be initiated from the onset of the project.		
Invasive Alien Plant Assessment	Invasive alien plants pose a direct threat not only to South Africa's biological diversity, but also to water security, the ecological functioning of natural systems and the productive use of land. They intensify the impact of fires and floods and increase soil erosion. IAPs can divert enormous amounts of water from more productive uses, therefore their control and management is of utmost importance.	X	See Appendix 5.2: Invasive Alien Plants

SPECIALIST	RECOMMENDATIONS AND CONCLUSIONS	SPECIALIST INCLUSION IN THE EIA REPORT	REFERENCE APPLICABLE SECTIONS OF THE REPORT WHERE RECOMMENDATIONS HAVE BEEN INCLUDED
	A site inspection was conducted during the dry season in June 2017, and IAP species occurring within the property boundaries were recorded. Several IAP species were identified within the Lannex Mine area. It is difficult to add coordinates to all the plant species as most of the areas have an excessive amount of plants. IAP species were mapped by indicating the general areas of concern where invasive plants occur on the study area. The ideal aim of control is to reach a point where: • The plants concerned no longer occur in that particular area; • The plants can no longer grow, produce viable seeds or spores, coppice, sprout or produce root suckers reproduce vegetatively; and • Propagate themselves in any other way, or spread into other areas. If this is not possible, the plants must be contained and their multiplication limited as far as possible. The use of grass at the onset of rehabilitation is very important as it allows soil stabilisation and further succession of desired plant species in the area. In conclusion, it should be reiterated that this should be a dynamic document, especially regarding the Tables which describe current control measures against IAP species. If new, more effective methods arise then these should replace the existing measures currently in the document. If new species infest areas within the Lannex Mine area, then these should be added to the list in Table 2. The control and eradication measures should be documented for each species and frequent photographs taken of the sites (taken at similar angles and distances each time). Rehabilitation efforts should also be included in this process. All records should be filled in on the relevant information sheets attached with each species and kept in an open file. This will create a working document and provide evidence of control measures undertaken for auditing purposes.		
Surface Water Assessment	Various watercourses within the Lannex section boundaries have already been impacted by the existing operations. The proposed expansion activities, especially the proposed opencast section will have a significant impact on the surface water resource especially the activities taking place within the 32 m buffer and this impact cannot be fully mitigated due to the invasive nature of the activity. Management measures are however proposed and these should be implemented. Recommendations are the following: • UT5 will be diverted to allow the expansion into Opencast 3 area as delineated, it is recommended that the volume of outflow from this dam be measured. • From the flood determination and the riparian assessment conducted, as well as the erosion potential of the area it is recommended that a 32 m buffer be implemented from the edge of all watercourses. This buffer will cater in most areas for the 1 in 100-year flood as well as any riparian vegetation. In addition, the vegetation will continue to stabilise the banks of the watercourses and reduce the potential for siltation to downstream areas. • A detailed mine works plan for the opencast area needs to be developed to ensure that active pit areas start upstream and move downstream to assist with rehabilitation. In addition, the time frame allocated to active pits and the sequence of active pits should be developed. • The management measures as outlined in this report must be implemented. • A river diversion and storm water management infrastructure must be implemented as needed at the opencast areas.	X	See Appendix 5.3: Surface Water Assessment

SPECIALIST	RECOMMENDATIONS AND CONCLUSIONS	SPECIALIST INCLUSION IN THE EIA REPORT	REFERENCE APPLICABLE SECTIONS OF THE REPORT WHERE RECOMMENDATIONS HAVE BEEN INCLUDED
	• The correct liner system for the waste to be disposed together with a leakage detection system must be implemented. • Monitoring as proposed must be implemented. • Before opencast sections expand into the 32 m buffer, a detailed riparian assessment needs to be done to ensure that red data plant species are removed as per the permit. If the management measures and recommendation as outlined in this report is implemented it is recommended that the proposed expansion activities be implemented.		
Floodline Assessment	Summary of conclusions are listed below. • The primary impacts identified for the proposed project include the mixing of clean and dirty water and the impact of flooding to the TSF, WRD expansion and opencast areas together with the associated infrastructures. To ensure that the mixing of clean and dirty water is mitigated/alleviated, a stormwater management plan is required as per GN 704 requirements. • The floodline assessment indicate that TSF option LNX1 Alt, LNX2 and LNX4 all fall outside of the 1:100 year floodline, however the mentioned footprint areas fall within the 100 m river/drainage buffer. Therefore the TSF footprint area to be selected is to be adjusted so that it falls outside both the 1:100 year floodline and the 100 m river/drainage buffer. • The opencast areas OC2 and OC3 fall within the 1:100 year floodline and 100 m river/drainage buffer. The mentioned footprint areas are to be adjusted to ensure that they fall outside of the 1:100 year floodline and 100 m river/drainage buffer. The following is recommended: • The floodline information should be updated whenever more detailed survey data becomes available or when a new hydraulic structure has to be constructed across the river/drainage.	X	See Appendix 5.4: Floodline Impact Assessment
Hydrogeological	Conclusions and Recommendations (Cumulative Impacts): It is thus concluded that cumulative mining in the area will have limited impact on the groundwater users in the immediate vicinity. To further quantify and limit impacts to groundwater users, the following is recommended: • An extended hydrocensus must be conducted in the areas that could be impacted every five years to update the groundwater status and provide proof that the mine dies not impact on the groundwater. • Users within areas that could be affected, should be monitored at least on an annual basis to establish a baseline against which future impacts can be compared, and protect the mine against unwarranted claims. • The water in the Steelpoort River must be measured monthly upstream and downstream of the mining area to be able to prove no negative impact from mining on river water quality. • Assessment of groundwater impacts and update of the model must be conducted on a five-year interval to incorporate latest groundwater measurements and future mining plans. Groundwater Monitoring: • Currently a monitoring network does exist for the mine. Additional boreholes should be drilled which can be utilized for water level monitoring during operations, as well as groundwater quality monitoring after decommissioning of the site. These boreholes should be sited by means of a geophysical survey and drilled to the depth of first water strike, but at least 30 meters deep to ensure that deeper circulation groundwater is sampled. The softs must be sealed off by solid casing which must be raised above surface to prevent	X	See Appendix 5.5: Geohydrological Impact Assessment

SPECIALIST	RECOMMENDATIONS AND CONCLUSIONS	SPECIALIST INCLUSION IN THE EIA REPORT	REFERENCE APPLICABLE SECTIONS OF THE REPORT WHERE RECOMMENDATIONS HAVE BEEN INCLUDED
	surface runoff to enter the borehole. In the operational phase and closure phase, monthly monitoring of groundwater quality and groundwater levels is recommended. Quality monitoring should take place before after and during the wet season, i.e. during September and March. It is important to note that a groundwater-monitoring network should also be dynamic. This means that the network should be extended over time to accommodate the migration of contaminants through the aquifer as well as the expansion of infrastructure and/or addition of possible pollution sources. An audit on the monitoring network should be conducted annually. The following recommendations are put forward: • The Proposed TSF LNX1 and Residue Stockpile should be lined with the appropriate liner material as dictated by the waste classification of the tailing's material. • A system of storm water drains must be designed and constructed to ensure that all water that falls outside the area of the TSF's, waste rock dump and residue stockpile area is diverted clear of the deposit. • The proposed monitoring boreholes should be added to current monitoring network before the proposed LNX TSF 1, extension of the waste rock dump, proposed residue stockpile area, opencast options 1 to 3 and planned underground is operational. These should be monitored on a monthly basis prior to construction, during and operational for the parameters analysed in this report. • The monitoring boreholes should be sited using geophysical methods in order to identify geological structures that may act as preferential flow paths for contaminant transport. • Monitoring boreholes drilling should be supervised by a qualified hydrogeologist and care should be taken to accurately log the geology during drilling and construct the boreholes appropriately • The aquifer parameters should be measured by conducting an aquifer test (pump test, slug test etc.) on each of the newly drilled boreholes (24-Hour pumping tests are recommended). This information can be used to update the numerical with accurately measured parameters. A hydrocensus within a radius of 2 km around the boundary of the site should be conducted every 2 years. • A re-evaluation of the risk to the aquifer should be conducted every 2 years.		

Visual Impact Assessment	The construction and operation phase of the proposed Lannex project related activities and its associated infrastructure will have a LOW- MEDIUM visual impact on the natural scenic resources and topography. However, with the correct mitigation measures the impact might decrease to a point where the visual impact can be seen as less significant. The moderating factors of the visual impact of the proposed mining operations in close range are the following:
	• Number of human inhabitants located in the area;
	• Natural topography and vegetation;
	• Mitigation measures that will be implemented such as the establishment of barriers or screens;
	  o The size of the operation;
	  o High absorption capacity of the landscape; and
	  o Previously mined area.
	The Visual Impact due to mining activities and associated infrastructure can be seen as having a LOW-MEDIUM impact on the surrounding environment and inhabitants before mitigation measures are implemented. After mitigation, the visual impact can be seen as LOW. The visual impact from the mining activities can be sufficiently
		X	See Appendix 5.7: Visual Impact Assessment

SPECIALIST	RECOMMENDATIONS AND CONCLUSIONS	SPECIALIST INCLUSION IN THE EIA REPORT	REFERENCE APPLICABLE SECTIONS OF THE REPORT WHERE RECOMMENDATIONS HAVE BEEN INCLUDED
	mitigated to a point where it can be seen as insignificant. Thus, mitigation measures are very important and one of the most significant mitigation measures are the rehabilitation of the area after mining has been concluded. If the rehabilitation of the impact is not done correctly and the final landform does not fit into the surrounding area then the visual impact will remain high and become a concern. However, with correct rehabilitation, the impact will be minimal and might even increase the aesthetics of the operational area, since it is a previously mined area, after the landform has been restored.		

Air Quality	Based on the results presented the following further recommendations are outlined:
	• It is recommended that ambient air quality monitoring be expanded get a baseline condition prior to the onset of the expansion operations and in order to establish the level at which the proposed operations are noted to impact on the ambient air quality;
	• Fallout monitoring should be continued for the life of mine to better assess the level of nuisance dust associated with both mining and process related operations. Sampling of fallout should be undertaken within the neighbouring areas as well as on-site. Dust fallout monitoring is recommended at the locations;PM10 and PM2.5 dust monitoring must also be undertaken at the same sites as mentioned under the previous bullet but also in and around potential fugitive emission sources to determine mitigation measures and focus management efforts. PM10 monitoring will however only be conducted if it becomes a requirement in terms of the environmental auhtorisation.
	• Further measures that should be applied, if it is found that dust and PM10 levels are measured to be exceeding limits are:
	  o Fully sealed Pit and Access Haul Road to achieve 100% mitigation on these roads.
	  o Realtime monitoring of the get quantitative data as to the source of the emissions.
	The impacts from dust fallout and Particulate matter can be reduced by implementing dust control measures. The highest intensity of the construction work should be carried out during the summer months and not over the harsh winter months as can result in increased dispersion of fugitive dust. The mine should ensure that unpaved roads are continuously watered and treated with dust binding additive products to reduce the volume of fugitive dust emitted from unpaved roads.
	Mitigation and management measures for mining operation as discussed in this report should be sufficient to ensure the mining operation can be conducted with minimal impact on the receiving environment and therefore not have a detrimental effect and can go ahead.
		X	See Appendix 5.8: Air Quality Impact Assessment

Noise Impact Assessment	It is concluded that the proposed activities will have no significant impact on the surrounding ambient sound levels. It is therefore the recommendation that the proposed activities at Lannex be authorized (from a noise impact perspective). However, considering the potential noise levels, the significance could increase as mining activities take place closer than 600 m from the houses and it is recommended that the mine review the noise study. This should be a detailed review, with noise modelling considering: • Actual mining equipment used at the section as well as their sound power emission levels; and • Actual mining layout, berms and mining activities. While the significance of the noise impact is low (as conceptualized), active noise monitoring is recommended if mining takes place within 1,000 m from residential houses in the Tubatse Village.	X	See Appendix 5.9: Noise Impact Assessment

SPECIALIST	RECOMMENDATIONS AND CONCLUSIONS	SPECIALIST INCLUSION IN THE EIA REPORT	REFERENCE APPLICABLE SECTIONS OF THE REPORT WHERE RECOMMENDATIONS HAVE BEEN INCLUDED
Paleontological Assessment	In the unlikely event that fossils are found in the soil cover in the study area the ECO should take the following steps: ***Procedure For Chance Palaeontological Finds*** (Extracted and adapted from the National Heritage Resources Act, 1999 Regulations Reg No. 6820, GN: 548). The following procedure must be considered in the event that previously unknown fossils or fossil sites are exposed or found during the life of the project: I. Surface excavations should continuously be monitored by the ECO and any fossil material be unearthed the excavation must be halted. II. If fossiliferous material has been disturbed during the excavation process it should be put aside to prevent it from being destroyed. III. The ECO then has to take a GPS reading of the site and take digital pictures of the fossil material and the site from which it came. IV. The ECO then should contact a palaeontologist and supply the palaeontologist with the information (locality and pictures) so that the palaeontologist can assess the importance of the find and make recommendations. V. If the palaeontologist is convinced that this is a major find an inspection of the site must be scheduled as soon as possible in order to minimise delays to the development. From the photographs and/or the site visit the palaeontologist will make one of the following recommendations: • The material is of no value so development can proceed, or: • Fossil material is of some interest and a representative sample should be collected and put aside for further study and to be incorporated into a recognised fossil repository after a permit was obtained from SAHRA for the removal of the fossils, after which the development may proceed, or: • The fossils are scientifically important and the palaeontologist must obtain a SAHRA permit to excavate the fossils and take them to a recognised fossil repository, after which the development may proceed. VI. If any fossils are found then a schedule of monitoring will be set up between the developer and palaeontologist in case of further discoveries.	X	See Appendix 5.10: Paleontological Impact Assessment
Phase I Archaeological Impact Assessment	With only a section of the erosion donga located in the OC3 pit area assessed in any detail, it is highly likely that other similar sites occur in the development area. Some sites and finds are possibly also still covered by topsoil in un-eroded sections, preserving them fairly in-tact. It is therefore imperative that the OC3 area be studied in more detail as part of Phase 2 Archaeological Mitigation before mining activities commence here. This will entail the following: I. Detailed mapping of the OC3 area and erosion donga system in order to determine the extent of the archaeological deposit and sites located here II. The sampling of surface material dating to the Stone Age and Iron Age. For this an archaeological permit will be required from SAHRA III. The excavation of surface features dating to the Iron Age (such as Site 3) in order to determine the age of and extent of the Iron Age in the study area. A permit from SAHRA will have to be obtained for this purpose as well. From an Archaeological point of view it is recommended that the proposed development actions can be allowed to continue, but that the recommended mitigation measures for the archaeological sites in the OC3 area be undertaken	X	See Appendix 5.11: Heritage Impact Assessment

SPECIALIST	RECOMMENDATIONS AND CONCLUSIONS	SPECIALIST INCLUSION IN THE EIA REPORT	REFERENCE APPLICABLE SECTIONS OF THE REPORT WHERE RECOMMENDATIONS HAVE BEEN INCLUDED
	before any work here is undertaken. Once the Phase 2 Archaeological work has been finalized work in the OC3 area can continue. Finally, it should be noted that although all efforts are made to locate, identify and record all possible cultural heritage sites and features (including archaeological remains) there is always a possibility that some might have been missed as a result of grass cover and other factors. The subterranean nature of these resources (including low stone-packed or unmarked graves) should also be taken into consideration. Should any previously unknown or invisible sites, features or material be uncovered during any development actions then an expert should be contacted to investigate and provide recommendations on the way forward.		
Socio Economic Assessment	The Socio-Economic Impact Assessment on Tukakgomo village has focused strongly on the demographic profile, the settlement and infrastructure, economics activities, employment status as well as the educational background of the households in the village. The study indicates that a majority of the households are comprised of core family and extended family- although it may be a custom for the majority of rural villages to live as single family units with parents and their children and grandparents. Even with this evidence it has come to light that some households are headed by children or grandparents. Communal are a standard practise. Even though large margins of the household members are unemployed, most of them bring income through social grants and the rest of the unemployed individuals are either trading or receive cash gifts. Agricultural activities are very minimal in the village. Amongst the employed, a small number has received formal education therefore bring in minimal wages. Almost all households have made their residences permanent and more than half of them live in brick houses that they own although some may be inherited or family homes. Based on the analysed data and site investigations, it is evident that most of these households depend on public taps to get water. Only a small amount has piped water in their households. Almost all the households make use of natural resources for survival on a daily basis. The Tukakgomo village falls outside the Fetakgomo Tubatse Municipal boundary for services, therefore do not have services such as rubbish removal, sewage reticulation, and access roads/streets. Sanitation facilities are pit or septic tank methods. This poses further risk of underground water pollution which is the main source of potable water for the communities. There is a very high unemployment rate – especially amongst young people who have completed matric certificate. These young people can be further trained in various skills that may be required by the proposed SECM Lannex project. The mine will alleviate the unemployment problem, though it will not eradicate it completely. Social unrest and crime are expected to be relatively low in the village due to its rural nature. This is likely to change due to the Lannex proposed activities and result in influx of foreigners in the village, therefore policing plans must be developed in conjunction with the respective village. The proposed Lannex project will add to the economic development of Fetakgomo Tubatse Local Municipality in terms of capital investment, job creation, infrastructure development, services and foreign exchange. Local business will also benefit by providing supplies and services to the mine. Secondary industries are also likely to develop due the proposed Lannex activities. The Environmental Authorisation (EA) is expected to be for 20 years, which translate to 20 years of economic activity in the region. The construction phase is expected to be for a period of 2 years.	X	See Appendix 5.12: Socio-Economic Impact Assessment
	Recommendations for rehabilitation of soils used as top-soil seeding layer over the discard dump. The following recommendations are made:	X	See Appendix 5.6: Agricultural potential, Soil

SPECIALIST	RECOMMENDATIONS AND CONCLUSIONS	SPECIALIST INCLUSION IN THE EIA REPORT	REFERENCE APPLICABLE SECTIONS OF THE REPORT WHERE RECOMMENDATIONS HAVE BEEN INCLUDED
Soils, Land Capability and Agricultural Potential	• Strip the topsoil to depth of 50-60cm and stockpile on the closest allocated area for the stockpiles • Utilize the latest freshly disturbed soils immediately on the discard dump as rehabilitation material. In that way the effect of long fallow syndrome (loss of soil microbial activity and organic carbon) is negated • The top soils must not be stockpiled higher than 6m to alleviate natural compaction and the creation of anaerobic conditions in the topsoil. • The sub-soil can be stripped to a depth above the solid, ferricrete layer, or weathered saprolite material. The sub-soil must be stripped and stockpiled separately from the top-soil. Rehabilitation soil fertility and nutrition: • An integrated biological and chemical approach is recommended to improve the fertility status and ensure a proper growth medium is created for the grass species to germinate and establish in the covering layer. • The soil chemical analysis must be taken before using in rehabilitation activities • 30-50t/ha of well composted kraal manure and 3-4t/ha of dolomitic lime well incorporated is recommended as a starter to initiate biological activity in the soil 6-8 weeks before seeding • This kraal manure will provide sufficient nutrients for germination and root development • The kraal manure has the added advantage that it contains vital broadleaf and grass species to get a fairly quick basal cover • Other humic and fulvic acids as well as growth stimulants (various products on the market) can also be used to enhance microbial activity with the seeding process • It is recommended that soils recovered from stockpiles for use in rehabilitation and vegetation establishment be sampled and tested to confirm their soil chemistry and fertility status and the need for addition of fertilisers and ameliorants. At Lannex Section the dominant soil forms, according to the Taxonomical Soil Classification System of South Africa, are Mispah (Sites 1, 2 and 4), Glenrosa (Sites 1, 2 and 4) and Witbank (Sites 1 and 3) These forms are constituted of an orthic A-horizon overlaying rock, lithocutanic rock (weathered rock) or man-made materials respectively. The effective depth of the soils is between 0 and 300 mm and the clay content is 18 to 20% in the top soil. The agricultural potential under dryland and irrigation conditions of the Mispah and Glenrosa soil forms are considered low under dryland (<300 mm/y rainfall) and irrigation conditions (>1015 mm/week). The Witbank soil form has no agricultural value. Taking the soil, climate and topography into account the area therefore has no dominant agricultural value. Severe concerns exist regarding the condition of the soils and the presence of soil erosion (sheet, rill and donga) on almost the entire site. Serious attention will be needed to combat further soil deterioration. Contamination of presently undisturbed top soils should be prevented as far as possible. Since large areas on this site have already been disturbed all waste products should be dumped on previously disturbed sites of the prospecting rights areas, even though the soils on this site are of low potential. The number of roads and trips on the roads should be restricted in order to prevent wind and/or water erosion. Soils are shallow and any operations regarding road construction will most probably end up on rock on most places. Position of access roads is therefore not restricted by soil properties, as long as disturbance regarding roads are kept to a minimum. Soil samples and soil observations are needed to be done as soon as an access road to opencast 1 and 2 is completed.		and Land Capability Assessment

SPECIALIST	RECOMMENDATIONS AND CONCLUSIONS	SPECIALIST INCLUSION IN THE EIA REPORT	REFERENCE APPLICABLE SECTIONS OF THE REPORT WHERE RECOMMENDATIONS HAVE BEEN INCLUDED
	Monitoring of the soil stripping and placement of the stockpiles need to be a continuous action during the construction phase. From an agricultural and soil potential viewpoint there are no objections against the use and development for mining purposes of the selected sites at the Lannex. It is recommended that the EMPr amendment and Listed activities (i.e. Environmental Authorisation) be approved, as long as the recommendations and mitigation regarding the measurements to limit erosion are implemented in the report. Based on site evaluation, the agricultural potential and land capability of Lannex Section is not suitable for arable agriculture, but suitable for grazing and natural veld. From the Klingebiel and Montgomery, the screening tool as prescribed by the National Environmental Management Act (1998) Government Gazette, 20 March 2020, it can be deducted that the soils of the entire site is of low to marginally low suitability for agriculture. It is recommended from a soils and land capability perspective to continue with the project.		
Blasting Impact Assessment	Regulatory requirements indicate specific requirements for all non-mining structures and installations within 500 m from the mining operation. Various POI's are observed within the pit that needs consideration as well within 500 m from the mining area. The mine will have to apply for the necessary authorisations as prescribed in the various acts, and specifically Mine Health and Safety Act Reg 4.16 as well as recommendations regarding infrastructure within the pit areas. Figure 31 below shows the 500 m boundary around the opencast pit area. The location of non-mining installations is clearly observed. The report shows 500 m boundary for the complete planned opencast area. No specific detail points were identified (tabled) other than only those in relation to the evaluated OC 1, 2 and 3. Sufficient detail was only available for OC1, 2 and 3. Detail for the full extent of the complete planned opencast is not currently available and thus not modelled. Regulatory requirements indicate specific requirements for all non-mining structures and installations within 500 m from the mining operation. Various POI's are observed within the pit that needs consideration as well within 500 m from the mining area. The mine will have to apply for the necessary authorisations as prescribed in the various acts, and specifically Mine Health and Safety Act Reg 4.16 as well as recommendations regarding infrastructure within the pit areas. Figure 31 below shows the 500 m boundary around the opencast pit area. The location of non-mining installations is clearly observed. The report shows 500 m boundary for the complete planned opencast area. No specific detail points were identified (tabled) other than only those in relation to the evaluated OC 1, 2 and 3. Sufficient detail was only available for OC1, 2 and 3. Detail for the full extent of the complete planned opencast is not currently available and thus not modelled.	X	See Appendix 5.13: Blasting Impact Assessment
Climate Change Assessment	It is recommended that the mitigation, adaptation, and resiliency measures recommended in this study be considered. Specialist opinion for authorization of the application for the Project is premised on the implementation of recommendations in this study.	X	See Appendix 5.14: Climate Change Assessment
Geotechnical Report	No recommendations or conclusions. General discussion of the report are: • The geotechnical information shows that the bedrock is mantled by transported, pedogenic and residual soils. The soils are primarily granular with sub-ordinate fine-grained portions. Due to the shallow soil profile, no shear testing was conducted on the soil materials. Hence for the soils, strength parameters were chosen using past experience. Using the formulations of Vesic (1975) and the general Mohr-Coulomb drained shear strength parameters, the allowable bearing capacities for the different soil types were calculated. • For the rock strata, utilising the Rock Mass Rating (RMR) parameters of Bieniawski (1989), combined with the Hoek-Brown Failure Criterion formulations (Hoek and Diederichs, 2006) and Vesic (1975), the shear	X	See Appendix 5.15: Geotechnical Investigation Report

SPECIALIST	RECOMMENDATIONS AND CONCLUSIONS	SPECIALIST INCLUSION IN THE EIA REPORT	REFERENCE APPLICABLE SECTIONS OF THE REPORT WHERE RECOMMENDATIONS HAVE BEEN INCLUDED
	strength parameters for the R-VS and R-SM strata are calculated. Note that due to the dominant presence of norite across both sites, this is the rock type chosen for the parametric calculations. • Note that the above calculations are based on a factor of safety FOS = 2.5 and assume vertical, non-eccentric loads.		
Design Report for the new TSF and WRD extension	The Mine requires the addition of a new tailings storagefacility (TSF) to ensure sufficient deposition space for the coming years. The TSF for the tailings and the WRD for the waste rock are to be constructed to allow for the necessary deposition space for mining activities to continue since the existing TSF and WRD are reaching their end of serviceability life. The design was guided by the applicable regulations, SANS codes and best practice guidelines but there are challenges that influence the risk of the new TSF construction, operation, and closure. These known risks have been identified, noted in this report, and mitigated as far as reasonably possible. Some areas can however be further improved, and this is to be addressed as part of the detail design process for construction. To comply with Regulation GN704 and the Waste Act, the stormwater management infrastructure has been designed to ensure separation of clean and dirty water. The system will ensure that dirty water is contained within the dirty water system, and the clean water, generated from the catchment upstream of the dirty areas will be diverted past the dirty water areas and released into the environment. The dirty water containment system, and clean water diversion system have been designed for a fifty-year (1:50) reoccurrence period. To adhere with regulation GN704 and successfully manage the surface water on site, the following surface water infrastructure will be required: • WRD (Class-D) with surface area of 2.3 ha; • TSF (Class-C) with a surface area of 14.9 ha; • RWD (Class-C) with a capacity of 20 000 m^3; • DWD (Class-C) with a capacity of 38 000 m^3; • 2 silt-traps; • Lined (Class-C) dirty water collection channels (2 310 m); and • Earth-lined clean water channels and energy dissipating structures at point of discharge (1 265 m). Once constructed; it is imperative that the above-mentioned infrastructure be operated and maintained within the design parameters and the operating and maintenance manual guidelines. This will assist with compliance to regulations including the appropriate storage of mine residue, the separation of clean water and dirty water collected and releasing or re-use of water in a controlled manner. The civil designs have been based on the survey information and existing stormwater management plans provided by the client. The civil designs are to be further optimised during the detail design period before final implementation and construction. To ensure strict quality assurance is maintained during construction and installation of the lining system, the design engineer along with an external CQA will be appointed for full time construction monitoring as defined in the Guidelines for Services and Processes for Estimating Fees for Persons Registered in terms of the Engineering Profession Act, 2000. The barrierand installation thereof, will adhere to the construction phase of the project included in SANS 1200, 1526, 10409, with all relevant GRI and ASTM requirements for MQC, MQA to CQC and CQA.	X	See Appendix 7: Design Report for Lannex TSF and WRD

12.1. Environmental impact statement

12.1.1 Summary of the key findings of the environmental impact assessment;

The findings of the specialist studies undertaken within this EIA&EMPR provide an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed project. The findings conclude that, provided that the recommended mitigation and management measures are implemented, there are no environmental fatal flaws that should prevent the proposed project from proceeding.

In order to achieve appropriate environmental management standards and ensure that the findings of the environmental studies are implemented through practical measures, the recommendations from this EIA&EMPR will form part of the contract with the contractors appointed to construct and maintain the proposed mine and associated infrastructure. The EIA&EMPR would be used to ensure compliance with environmental specifications and management measures. The implementation of this EIA&EMPR for key cycle phases (i.e. construction, operation and closure/decommissioning) of the proposed project is considered to be fundamental in achieving the appropriate environmental management standards as detailed for this project.

12.2. Final Site Map

Provide a map at an appropriate scale which superimposes the proposed overall activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers. Attach as Appendix.

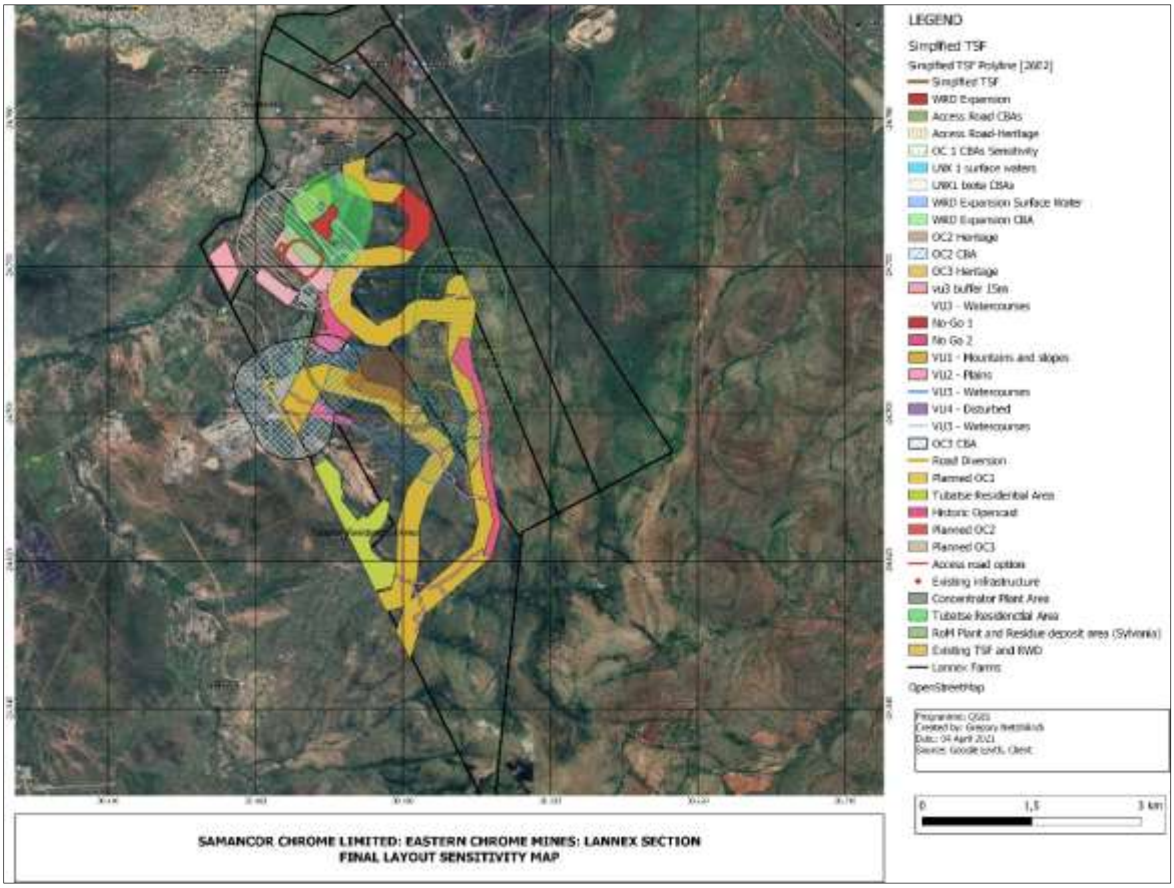

Figure 12-1: Final Site Layout Map showing all the sensitive areas within the mining area and proposed infrastructure area

See Appendix 4 for a clearer figure.

12.3. SUMMARY OF THE POSITIVE AND NEGATIVE IMPLICATIONS AND RISKS OF THE PROPOSED ACTIVITY AND IDENTIFIED ALTERNATIVES

Refer to Table 11-1.

12.4. PROPOSED IMPACT MANAGEMENT OBJECTIVES AND THE IMPACT MANAGEMENT OUTCOMES FOR INCLUSION IN THE EMPR

Based on the assessment and where applicable the recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorization.

Specialist recommendations which could be included as conditions have been discussed in Table 12-1.

13. *SPECIALIST MANAGEMENT MEASURES AS WELL AS THE SIGNIFICANCE OF THE IMPACTS PRIOR AND POST MITIGATION ARE PROVIDED IN IMPACTS AND RISKS IDENTIFIED INCLUDING THE NATURE, SIGNIFICANCE, CONSEQUENCE, EXTENT, DURATION AND PROBABILITY OF THE IMPACTS, INCLUDING THE DEGREE TO WHICH THESE IMPACTS*

(Provide a list of the potential impacts identified of the activities described in the initial site layout that will be undertaken, as informed by both the typical known impacts of such activities, and as informed by the consultations with affected parties together with the significance, probability, and duration of the impacts. Please indicate the extent to which they can be reversed, the extent to which they may cause irreplaceable loss of resources, and can be avoided, managed or mitigated)

Table 11-1 and contained in the respective studies.

13.1. FINAL PROPOSED ALTERNATIVES

(Provide an explanation for the final layout of the infrastructure and activities on the overall site as shown on the final site map together with the reasons why they are the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment)

Refer to Section 5.2.1.

14. *ASPECTS FOR INCLUSION AS CONDITIONS OF AUTHORIZATION*

Any aspects which have not formed part of the EMPr that must be made conditions of the Environmental Authorization.

Refer to Table 12-1 for conditions which could possibly be included in the Environmental Authorisation.

15. *DESCRIPTION OF ANY ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE.*

(Which relate to the assessment and mitigation measures proposed?)

Please refer to Section 10.4.

16. *REASONED OPINION AS TO WHETHER THE PROPOSED ACTIVITY SHOULD OR SHOULD NOT BE AUTHORIZED*

16.1. REASONS WHY THE ACTIVITY SHOULD BE AUTHORIZED OR NOT

Please refer to Section Table 12-1. The findings of the specialist studies undertaken within this EIA&EMPR provide an assessment of both the benefits and potential negative impacts anticipated as a result of the proposed project. The findings conclude that, provided that the recommended mitigation and management measures are implemented, there are no environmental fatal flaws that post the provided mitigation, should prevent the proposed project from proceeding.

16.2. Conditions that must be included in the authorization

16.2.1 Specific conditions to be included into the compilation and approval of EMPr

Please refer to Section Table 12-1.

16.2.2 Rehabilitation requirements

For the mining operations, the following closure objectives and goals are proposed:

- To rehabilitate all disturbed land to a state that is suitable for its post closure use;
- To ensure that affected areas are safe and secure for both human and animal activities;
- The physical and chemical stability of the remaining structures should be such that risk to the environment through naturally occurring forces is eliminated;
- To rehabilitate all disturbed land to a state where limited or preferably no post closure management is required;
- To rehabilitate all disturbed land to a state that facilitates compliance with current environmental quality objectives (air and water quality); and
- To limit the impact on personnel whose positions may become redundant on decommissioning of the mine.

16.3. Period for which the Environmental Authorisation is required

The environmental authorisation is required for 20 years.

For the activities to which a construction phase only is applicable e.g. roads, pipeline, TSF a timeframe of 2 years is proposed.

16.4. Undertaking

Confirm that the undertaking required to meet the requirements of this section is provided at the end of the EMPr and is applicable to both the Environmental Impact Assessment Report and the Environmental Management Programme report.

The signed undertaking is included in Section 30 of Part B.

17. *FINANCIAL PROVISION*

Environmental management infrastructure that is required at the outset will be financed out of the project capital. On-going environmental management and rehabilitation as identified in this document and as set out in the EMP will be funded from working costs during the life of the project.

The provision for closure required for the proposed open pit extension and the existing mining activities combined will create a shortfall of **R194 328 327** in the provision that will be provided Appendix 10.

17.1. 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

The post closure land use proposed for the project area is to return the area to wilderness/natural area or area suitable for game and or grazing land. This excludes the portions of the pits which will only be partially backfilled.

The following general closure objectives and goals are proposed:

1. To rehabilitate all disturbed land to a state that is suitable for its post closure use;
2. To ensure that affected areas are safe and secure for both human and animal activities;
3. The physical and chemical stability of the remaining structures should be such that risk to the environment through naturally occurring forces is eliminated;

4. To rehabilitate all disturbed land to a state where limited or preferably no post closure management is required;
5. To rehabilitate all disturbed land to state that facilitates compliance with current environmental quality objectives (air and water quality); and
6. To limit the impact on personnel whose positions may become redundant on decommissioning of the mine.

17.1.1 Closure objectives for the TSF

17.1.1.1. Seepage and stormwater

Both the TSF and RWD are identified as sources of possible seepage that can infiltrate the underground sources and contribute to surface runoff. Seepage is to be managed through the installation and maintenance of surface stormwater infrastructure, seepage drainage collection network, monitoring boreholes and the progressive and ultimate engineered capping to disconnect the infiltration of precipitation and thereby the recharging of the in-situ phreatic regions.

17.1.1.2. Erosion and slope stability

From site observations the local materials are prone to erosion if not stabilised by, for example vegetation. This places arisk on sediment generation and the mobilization of fine tailings. Erosion is to be managed by limiting the surface runoff length through step-ins and berm structures where possible, vegetation establishment should be encouraged as far as possible. This may be a more challenging scenario against the slopes where coal discard is in the vicinity and therefore a proper establishment and maintenance plan needs to be compiled to address the various stages, including shaping, amelioration, vegetation types and establishment.

17.1.1.3. Social impact

A national tar road and community establishment are located close by and the risk of ground water contamination must be considered and mitigated as far as reasonably possible. The implementation and monitoring of a proper operations and closure execution plan are imperative and it would be advisable to include the proactive interaction of IAPs where identified.

17.1.1.4. Progressive closure

The progressive implementation of the TSF closure would be possible and was considered as part of this feasibility concept. As the TSF continues to rise from the deposition of discard, the slopes of the inter benches can be ameliorated and vegetation establishment be done to improve the stability and limiting of erosion.

17.1.1.5. Implementation and monitoring

The above discusses the suggested interventions and methodology to consider as part of the closure plan. It is howeverenvisaged that the TSF and RWD will remain active for an extended period after closure. It is therefore imperative that amonitoring plan be in place and continued after closure to observe any variations, risk, deterioration and success of the interventions. Maintenance is likely to be required for some of the infrastructure and needs to be planned.

17.1.2 POST CLOSURE LANDUSE FOR THE TSF

The defined land use after closure has not been indicated yet. The TSF has a significant profile with mildly steep side slopes and would therefore not be ideal surface for farming activities, including livestock and preparing for crops. The foreseeable use could be for locating farming or industrial structures on engineered and profiled surfaces.

It is therefore also viewed that the area would be identified as access controlled to prevent livestock entering the area.

17.2. CONFIRM SPECIFICALLY THAT THE ENVIRONMENTAL OBJECTIVES IN RELATION TO CLOSURE HAVE BEEN CONSULTED WITH LANDOWNER AND INTERESTED AND AFFECTED PARTIES

The environmental objective in relation to closure was reported in the Draft Scoping Report which was made available to all registered I&AP's for comment for a period of 30 days. All comments received and the relevant meeting minutes are appended to this report. The closure end land-use will stay unchanged from that approved in the mine's current EMPR (Lannex, 2013).

17.3. 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.

Please refer to the attached Appendix 9

17.4. EXPLAIN WHY IT CAN BE CONFIRMED THAT THE REHABILITATION PLAN IS COMPATIBLE WITH THE CLOSURE OBJECTIVES.

The closure and rehabilitation of the TSF,WRD, OC 1,2,3 and other associated infrastructure need to be considered and included from the design, operational and ultimate closure phase. Considerations for closure would include:

- Post-closure land use.
- Risk identification and addressing / mitigating the risks.
- Progressive closure.
- Implementation and monitoring.
- Social transition.

17.5. CALCULATE AND STATE THE QUANTUM OF THE FINANCIAL PROVISION REQUIRED TO MANAGE AND REHABILITATE THE ENVIRONMENT IN ACCORDANCE WITH THE APPLICABLE GUIDELINE.

The evaluation has been undertaken according to the DMR's Guideline (DMR, 2005).

			CALCULATION OF THE QUANTUM				
Applicant:	SAMANCOR CHROME LIMITED- EASTERN CHROME- LANNEX SECTION				Ref No.:	MP 30/5/1/2/2/420 MR AND MP	
EAPs:	PRESCALI ENVIRONMENTAL CONSULTANTS (PTY) LTD				Date:	Apr-21	
			A	B	C	D	E=A*B*C*D
No.	**Description**	**Unit**	**Quantity**	**Master Rate**	**Multiplication factor**	**Weighting factor 1**	**Amount (Rands)**
1	Processing plant and related structures including overland conveyors and power lines)	**m3**	**0**	**16,14**	**1**	**1**	**0**
2 (A)	Steel buildings and structures (including floor slabs)	**m2**	**0**	**224,76**	**1**	**1**	**0**
2(B)	Reinforced concrete buildings and structures	**m2**	**0**	**331,22**	**1**	**1**	**0**
3	Acces roads	**m2**	**100000**	**40,22**	**1**	**1**	**4022000**
4 (A)	Demolition and rehabilitation of electrified railway lines	m	0	390,37	1	1	**0**
4 (A)	Demolition and rehabilitation of non-electrified railway lines	m	0	212,92	1	1	**0**
5	**Demolition of housing and/or administration facilities**	**m2**	**0**	**449,51**	**1**	**1**	**0**
6	**Opencast rehabilitation including final voids and ramps**	**ha**	**528**	**228777,57**	**1**	**1**	**120794557**
7	**Sealing of shafts adits and inclines**	**m3**	**0**	**120,66**	**1**	**1**	**0**
8 (A)	**Rehabilitation of overburden and spoils**	**ha**	**0**	**152098,35**	**1**	**1**	**0**
8 (B)	Rehabilitation of processing waste deposits and evaporation ponds (non-polluting potential)	ha	23	195655,69	1	1	4500080,87
8 (C)	Rehabilitation of processing waste deposits and evaporation ponds (polluting potential)	ha	10	568276,85	1	1	**5682768,5**
9	Rehabilitation of subsided areas	ha	0	121541,19	1	1	**0**
10	**General surface rehabilitation**	**ha**	**5**	**124443,64**	**1**	**1**	**622218,2**
11	River diversions	ha	0	**124443,64**	1	1	**0**
12	**Fencing**	**m**	**0**	141,95	**1**	**1**	**0**
13	**Water management**	**ha**	**0**	**47316,97**	**1**	**1**	**0**
14	**2 to 3 years of maintenance and aftercare**	**ha**	**0**	**16560,94**	**1**	**1**	**0**
15 (A)	**Specialist study**	**Sum**	**0**	**65000**	**1**	**1**	**0**
15 (B)	Specialist study	Sum	0	0	1	1	**0**
					Sub Total 1		**135621624,5**
1	Preliminary and General		16274594,94		**weighting factor 2** 1		**16274594,94**
2	Contingencies		13562162,45				**13562162,45**
					Subtotal 2		**165458381,93**
					VAT (15%)		**24818757,29**
					Grand Total		**R190 277 139,22**

Figure 17-1: Financial Quantum provisioning calculated by Prescali

The financial provisioning to be update the accordingly during the operational phases of the project on a year-on-year basis.

17.6. CONFIRM THAT THE FINANCIAL PROVISION WILL BE PROVIDED AS DETERMINED.

Samancor Chrome Limited (Pty) Ltd will provide the funds for rehabilitation. The total rehabilitation cost for the proposed development is **R190 277 139,22.**

18. *DEVIATIONS FROM THE APPROVED SCOPING REPORT AND PLAN OF STUDY*

18.1. DEVIATIONS FROM THE METHODOLOGY USED IN DETERMINING THE SIGNIFICANCE OF POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS.

(Provide a list of activities in respect of which the approved scoping report was deviated from, the reference in this report identifying where the deviation was made, and a brief description of the extent of the deviation).

No deviations were made to the methodology used and as outlined in Section 10.

18.1.1 MOTIVATION FOR THE DEVIATION

Not applicable.

19. *OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY*

A Record of Decision (RoD) from the Department of Water and Sanitation will be required in order to provide the necessary information related to the Waste Licence of the proposed TSF as well as the instream water uses as per Section 21 of the NWA Section 21(c) and (i).

19.1. COMPLIANCE WITH THE PROVISIONS OF SECTIONS 24(4)(A) AND (B) READ WITH SECTION 24 (3) (A) AND (7) OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107 OF 1998) THE EIA REPORT MUST INCLUDE THE:

19.1.1 IMPACT ON THE SOCIO-ECONOMIC CONDITIONS OF ANY DIRECTLY AFFECTED PERSON

(Provide the results of Investigation, assessment, and evaluation of the impact of the mining, bulk sampling or alluvial diamond prospecting on any directly affected person including the landowner, lawful occupier, or, where applicable, potential beneficiaries of any land restitution claim, attach the investigation report as Appendix 2.19.1 and confirm that the applicable mitigation is reflected in 2.5.3; 2.11.6.and 2.12.herein).

A socio-Economic Assessment study has been conducted to assess any socio-economic impact that may be caused by the proposed expansion project See Appendix 5.12.

Employment security, Positive economic benefits for local communities, increase in crime, HIV and Covid-19 infections are some of the impacts identified in the Socio-economic assessment.

19.1.2 IMPACT ON ANY NATIONAL ESTATE REFERRED TO IN SECTION 3(2) OF THE NATIONAL HERITAGE RESOURCES ACT

(Provide the results of Investigation, assessment, and evaluation of the impact of the mining, bulk sampling or alluvial diamond prospecting on any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) with the exception of the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act, attach the investigation report as Appendix 2.19.2 and confirm that the applicable mitigation is reflected in 2.5.3; 2.11.6.and 2.12.herein).

An Archaeological Impact Assessment and Paleontological studies have been conducted to assess any impact on the cultural and heritage resources and how it might be impacted by the proposed expansion project. See Appendix 5.10 and Appendix 5.11. Impacts on Heritage resources have been summarized in Table 11-1.

19.2. OTHER MATTERS REQUIRED IN TERMS OF SECTIONS 24(4)(A) AND (B) OF THE ACT.

(the EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in sub-regulation 22(2)(h), exist.).

None.

PART B ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT

20. DETAILS OF THE EAP:

(Confirm that the requirement for the provision of the details and expertise of the EAP are already included in PART A, section 1(a) herein as required).

The information can be found in Section 1.1.

21. DESCRIPTION OF THE ASPECTS OF THE ACTIVITY

(Confirm that the requirement to describe the aspects of the activity that are covered by the draft environmental management programme is already included in PART A, section (1)(h) herein as required).

Please refer to Section 3 of Part A of this report.

21.1. COMPOSITE MAP

(Provide a map (Attached as an Appendix) 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 any areas that should be avoided, including buffers)

Refer to Appendix 4.

21.2. DETERMINATION OF CLOSURE OBJECTIVES

(ensure that the closure objectives are informed by the type of environment described in 2.4 herein)

- To rehabilitate all disturbed land to a state that is suitable for its post closure use;
- To ensure that affected areas are safe and secure for both human and animal activities;
- The physical and chemical stability of the remaining structures should be such that risk to the environment through naturally occurring forces is eliminated;
- To rehabilitate all disturbed land to a state where limited or preferably no post closure management is required;
- To rehabilitate all disturbed land to a state that facilitates compliance with current environmental quality objectives (air and water quality); and
- To limit the impact on personnel whose positions may become redundant on decommissioning of the mine.

21.3. THE PROCESS FOR MANAGING ANY ENVIRONMENTAL DAMAGE, POLLUTION, PUMPING AND TREATMENT OF EXTRANEOUS WATER OR ECOLOGICAL DEGRADATION AS A RESULT OF UNDERTAKING A LISTED ACTIVITY

Refer to Table 11-3 for the proposed mitigation measures.

22. ACID MINE DRAINAGE

22.1. POTENTIAL RISK OF ACID MINE DRAINAGE

A waste classification for the overburden was conducted for the proposed development, See Appendix 5.16.

The samples of the overburden were collected by Prescali and submitted to a SANAS accredited laboratory for analysis. The following waste characterisation is based on the analytical results received from the laboratory. All laboratory certificates are provided in the appendix section of the Waste Classification Report (Appendix 5.16).

22.1.1 MINERALOGY

The overburden sample was prepared for X-ray Diffraction analysis according to standard analytical methods. The XRD analysis indicates that the following mineral phases and relative phase amounts were detected in the sample:

- Plagioclase (65.1 wt%) - $(Na,Ca)(Si,Al)_4O_8$;
- Enstatite (22.5 wt%) - $(Mg,Fe)SiO_3$;
- Chromite (4.6 wt%) - $Fe^{++}Cr_2O_4$;
- Smectite (4 %wt) - $(Na,Ca)_{0},3(Al,Mg)_2Si_4O_{10}(OH)_2 \bullet n(H_2O)$;
- Talc (2.6 %wt) - $Mg_3Si_4O_{10}(OH)_2$; and
- Kaolinite (1.2 wt%) - $Al_2 Si_2 O_5 (OH)_4$.

22.2. TOTAL ELEMENT CONCENTRATIONS

The total element concentrations were determined by XRF and acid digestion. The major element concentration, determined with XRF, is presented in Table 22-1. These results show that the overburden consist mainly of silica (quartz), aluminium oxide, iron oxide, calcium oxide and chromium oxide.

Table 22-1: Major element concentration

Major Elements		Major Element Concentration (%)
		Overburden soil from Lannex section
Silica	**SiO_2**	16.2
Titanium	**TiO_2**	0.38
Aluminium	**Al_2O_3**	5.31
Iron	**Fe_2O_3**	6.6
Manganese	**MnO**	0.1
Magnesium	**MgO**	1.56
Calcium	**CaO**	4.69
Sodium	**Na_2O**	0.03
Potassium	**K_2O**	0.11
Phosphorous	**P_2O_5**	0.03
Chromium	**Cr_2O_3**	3.43
Sulphur	**SO_3**	0.02

The geochemical enrichment of the heavy metals (Table 22-2) was determined by calculating the geochemical abundance index (GAI). The GAI compares the actual concentration of an element in a sample with the median abundance for that element in the most relevant media and is calculated as follows:

$$GAI = \log2 [C / (1.5*S)]$$

where C is the concentration of the element in the sample and S is the median content for that element in the reference material.

The GAI values range from 0 to 6, where a GAI of 0 indicates the element is present at a concentration similar to, or less than, median abundance and a GAI of 6 indicates approximately a 100-fold, or greater, enrichment above median abundance (GARD Guide, 2009). The geochemical abundance indices for the analysed constituents of concern are presented in Table 22-2. The GAI value of 6 for total chromium shows the enrichment of total chromium in the overburden sample, i.e., more than 100 times the median crustal content. Since the geology of the area is characterised by chromite ($FeCr_2O_4$), this Cr enrichment in the overburden is to be expected.

Table 22-2: Geochemical abundance indices for total elements of concern analysed

Constituent of concern	Total concentration in Overburden sample	Median Crustal abundance (Fortescue, 1992 and Price, 1997)	Geochemical Abundance Indices (GAI)
Units	**mg/kg**	**mg/kg**	**unit-less**
As, Arsenic	0.2*	1.8	0
B, Boron	6.8	9	0
Ba, Barium	33.2	390	0
Cd, Cadmium	0.4*	0.16	0
Co, Cobalt	40	29	0
Cr Total, Chromium Total	13200	122	6
Cu, Copper	55.6	68	0
Hg, Mercury	0.2*	0.086	0
Mn, Manganese	780	1060	0
Mo, Molybdenum	5*	1.2	1
Ni, Nickel	301.2	99	1
Pb, Lead	3.2	13	0
Sb, Antimony	0.2*	0.2	0
Se, Selenium	0.2*	0.05	1
V, Vanadium	252.8	136	0
Zn, Zinc	94.4	76	0
Total Fluoride [o]	0.25	544	0

Notes: * Half the detection limit used in calculation. GAI of 1 corresponds to a 3 to 6-fold; GAI of 2 corresponds to a 6 to 12-fold; GAI of 3 corresponds to a 12 to 24-fold; GAI of 4 corresponds to a 24 to 48-fold; GAI of 6 indicates a 96-fold or greater

22.2.1 ACID BASE ACCOUNTING

The results of acid base accounting (ABA) are aimed at indicating the relative proportions of acid generating and neutralizing elements within a specific sample. The ABA is static test which does not consider long term mineral kinetics (MEND, 2009; Price et al., 2007). The ABA results of the overburden from Lannex Section are presented in Table 22-3.

The acid rock drainage (ARD) classification of the material is presented on Figure 22-1 and Figure 22-2. The paste pH of the overburden is alkaline (8.20). The total sulphide-S (0.004%) is significantly below the 0.3% threshold to be considered acid generating. The potential for acid generation of the material was evaluated from sulphide-S and the acid generating potential of the overburden was found to be low (Table 22-4).

The neutralization potential ratio (TNPR or SNPR) refers to the ratio of neutralizing potential (NP) and acid generating potential (TAP or SAP). The calculations considered the bulk NP since it considers a combination of more reactive carbonate minerals and less reactive silicate minerals. The dissolution of silicate minerals provides effective acid buffering capacity at pH conditions of less than 4. The effect will therefore not be observed in this case since the paste pH of the overburden is 8.5.

Table 22-3: Summary of ABA results

Sample ID	Paste pH	Total-S	Sulphide-S	S-Other	S-Organic	C-Total	Bulk-NP[1]	SAP[2]	TAP[2]	SNPR[4]	TNPR[4]	Classification based on SNPR	Classification based on TNPR
	s.u	**%**					**kg $CaCO_3$eq/t**					**No units**	
Overburden	8.20	0.04	0.04	0.00	na	na	3.36	1.25	1.25	2.69	2.69	None	Non-PAG
Overburden-D	8.20	0.04	0.04	0.00	na	na	3.40	1.25	1.25	2.72	2.72	None	Non-PAG

Notes: **S-Other (italics) calculated from the difference between Total S and Sulphide. S-Other includes Sulphate (SO_4) and Organic Sulphate

*Negative NP values are obtained when the volume of NaOH(0.1N) titrated (pH:8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0-2.5. Any negative NP values are corrected to 0.00 and a value of 0.001 has been used to compute ABA graphs.

[1]Bulk NP is Np measured by Sobek titration. CaNP is NP calculated on the basis of carbonate percentage from LECO analysis. Measured NP is used for NPR calculation.

[2]SAP – acidic potential based on sulphide sulphur; TAP – acid potential based on the total sulphur content.

[3]SNNP – the difference between bulk NP and SAP; TNNP – the difference between bulk NP and SAP; TNNP – the difference between bulk NP and TAP; SNPR – Ratio of SAP and bulk NP; TNPR – Ratio of TAP and bulk NP

The net neutralization potential (TNPR) of the overburden was 2.7 kg $CaCO_3$ eqv/t whilst the sulphur neutralization potential (SNPR) was also 2.7 kg $CaCO_3$ eqv/t since the total sulphur of the overburden is sulphide as shown in Figure 22-1. The calculated TNPR and SNPR of the material indicate non-acid generating potential (Figure 22-2). The sulphide-S (0.04%) of the overburden indicates the absence of acid generating potential.

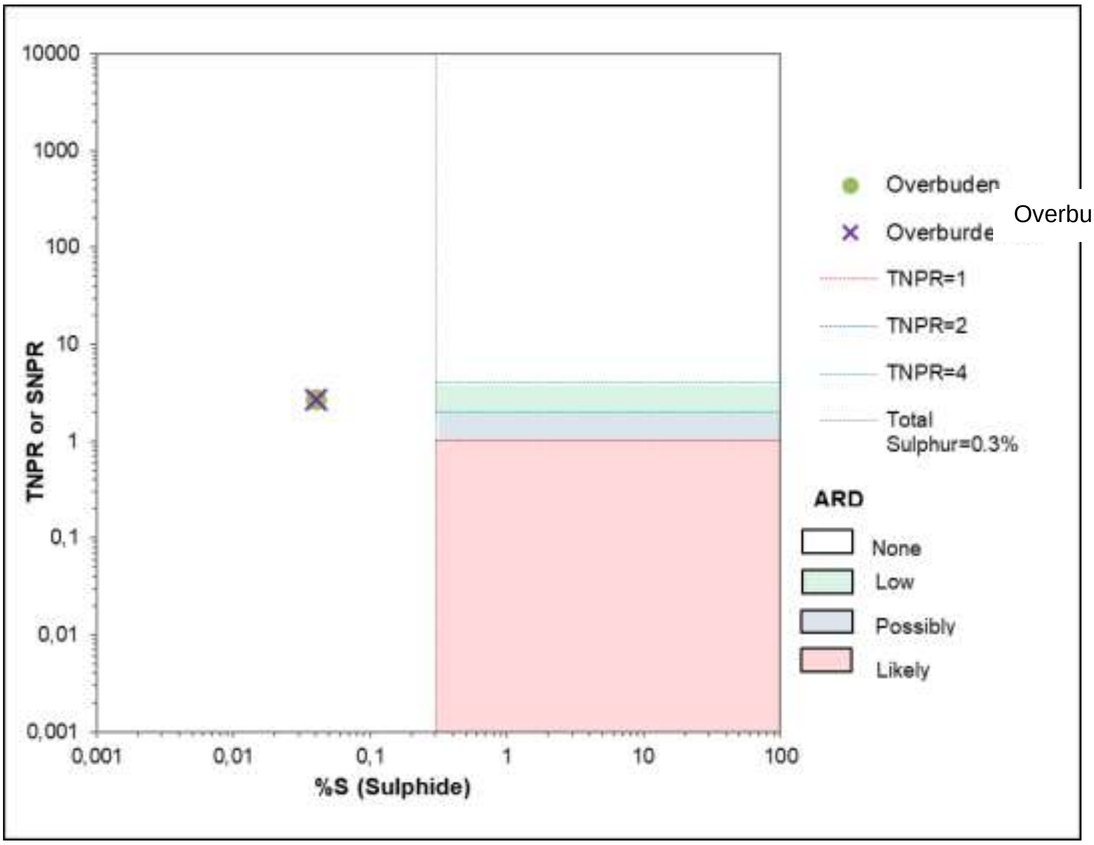

Figure 22-1. Net potential ratio (TNPR) vs sulphide-S of the Overburden

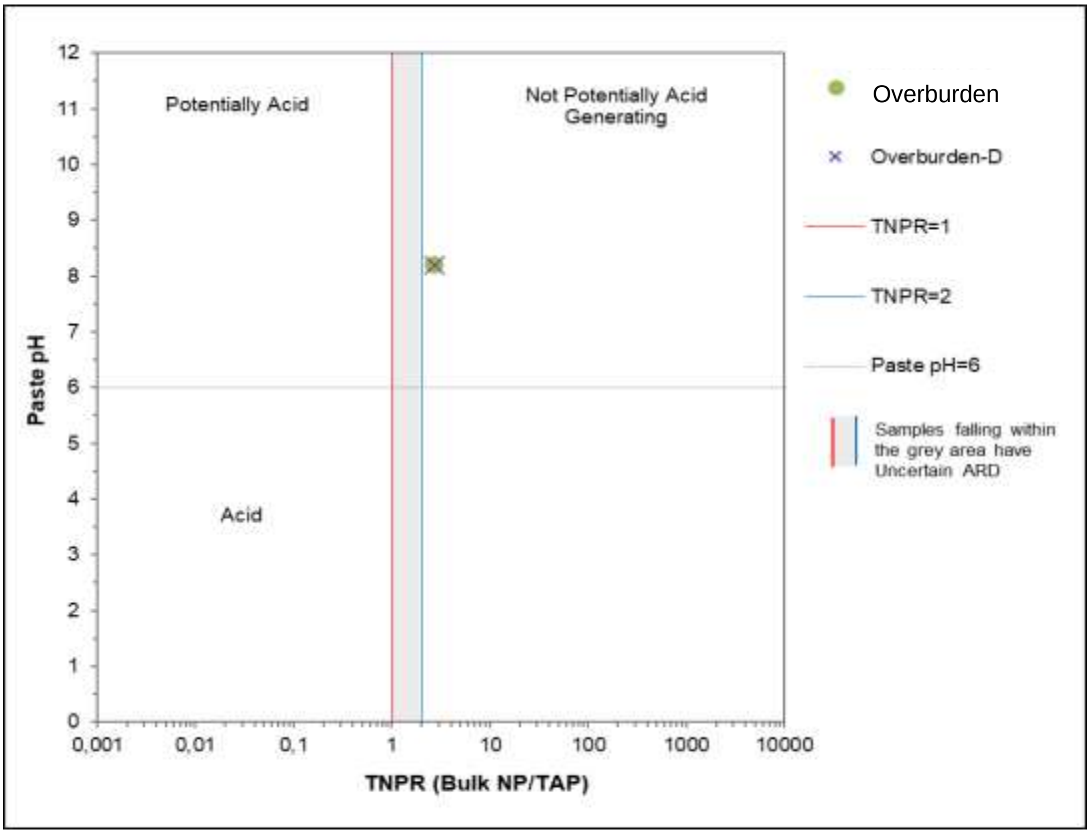

Figure 22-2. Paste pH vs sulphide neutralization potential (SNPR) of the Overburden

22.2.2 NET ACID GENERATION

The net acid generation (NAG) test indicates the potential drainage quality of the waste material. A titration value at pH 4.5 indicates acidity due to free acid (i.e. H2SO4) as well as soluble Fe and Al. A titration value at pH 7 includes metallic ions that precipitate as hydroxides at pH 4.5-7 (AMIRA, 2002).

The NAG results of the waste material are presented in Table 22-4. The results indicate that under complete oxidation, the water quality interacting with the overburden will have a neutral pH of 7.3.

Table 22-4: NAG results of the overburden material

Sample ID	NAG pH (H_2O_2)	NAG at pH 4.5	NAG at pH 7.0
	Units (s.u)	Kg H_2SO_4/t	Kg H_2SO_4/t
Overburden	7.3	<0.01	<0.01
Overburden-D	7.3	<0.01	<0.01

The results therefore indicate that the overburden material from Lannex Section is non-acid generating and will result in a water quality with a pH of 7.3 under maximum oxidation.

22.3. SHORT TERM LEACH TESTS

Included in the analytical suite was the determination of the leachable fraction of the constituents of concern. The Australian Standard leaching procedure (ASLP) with deionised water extract was conducted on the overburden sample in order to assess the potential drainage quality of the material. The results of ASLP test work were compared to the South African Water Quality Guidelines (DWAF, 1996) in order to assess the quality of the leachate. Guidelines for domestic use, agricultural use (irrigation and livestock) and aquatic ecosystems were considered.

The constituents of concern leachate concentrations were generally low, in most cases below detection. Low concentrations of boron, sulphate and nitrate were detected, but these are all below the water quality guideline threshold values. None of the water quality threshold values were exceeded as shown in Table 22-5.

Table 22-5: Overburden leachate quality compared to South African Water Quality Guidelines

Constituents of concern	South African Water Quality Guidelines (DWAF, 1996)				Overburden
	Domestic Use	Livestock	Irrigation	Aquatic Ecosystems	
Units	**mg/ℓ**	**mg/ℓ**	**mg/ℓ**	**mg/ℓ**	**mg/ℓ**
As, Arsenic	0.01	1	0.1	≤ 0.01	<0.001
B, Boron	ng	5	0.5	ng	0.029
Ba, Barium	ng	ng	ng	ng	<0.025
Cd, Cadmium	0.005	0.01	0.01	≤ 0.00025	<0.001
Co, Cobalt	ng	1	0.05	ng	<0.025
$Cr_{Total,}$ Chromium Total	ng	ng	ng	ng	<0.025
Cr(VI), Chromium (VI)	0.05	1	0.1	≤ 0.007	<0.010
Cu, Copper	1.0	0.5	0.2	≤ 0.0008**	<0.010
Hg, Mercury	0.001	0.001	ng	≤ 0.00004	<0.001
Mn, Manganese	0.05	10	0.02	0.18	<0.025
Mo, Molybdenum	ng	0.01	0.01	ng	<0.025
Ni, Nickel	ng	1	0.2	ng	<0.025
Pb, Lead	0.01	0.1	0.2	≤ 0.0005	<0.001
Sb, Antimony	ng	ng	ng	ng	<0.001
Se, Selenium	0.02	50	0.02	0.002	<0.001
V, Vanadium	0.1	1	0.1	ng	<0.025
Zn, Zinc	3.0	20.0	1.0	≤ 0.002	<0.025
Inorganic Anions					
Total Dissolved Solids*	450	1000	ng	ng	90
Chloride as Cl	100	1500	ng	ng	<2
Sulphate as SO4	200	1000	ng	ng	5
Nitrate as N	ng	100	ng	ng	0.1
Fluoride as F	1	2	2	≤ 0.75	<0.2
Total Cyanide as CN	ng	ng	ng	0.001	<0.07
pH	6 - 9	ng	6.5-8.4	variation of 0.5 or by 5% from background values allowed	8.1

A summary of the analytical results of the overburden sample are presented in Table 22-6 - Table 22-7 below. These results show the following:

- The total concentrations of copper (Cu), nickel (Ni) and vanadium (V) exceed the TCT0 threshold and is considered to be inherent to the geology.
- The majority of the analysed constituents of concern's leachable concentration is below the detection limit, including that of Cu, Ni and V.

Given the TCT0 exceedances for Cu, Ni and V, the overburden classifies as Type 3 Waste according to GN R. 635. However, due to the low leachable concentrations of constituents (< LCT0), the waste does not completely fall within the Type 3 assessment of TC ≤ TCT1 **and** LCT0 < LC ≤ LCT1. But it is also not Type 4 waste due to the TC > TCT0.

Due to the low leachability of constituents in the overburden it is expected to react more like Type 4 waste than Type 3 waste and therefore the impact on the receiving environment is considered to be insignificant.

Table 22-6: Total concentration of constituents of concern compared to GN R. 635 TCT thresholds

Constituent of concern	TCT0	TCT1	TCT2	Overburden
Units	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
As, Arsenic	5.8	500	2000	<0.400
B, Boron	150	15000	6000	6.80
Ba, Barium	62.5	6250	25000	33
Cd, Cadmium	7.5	260	1040	<0.400
Co, Cobalt	50	5000	20000	40

Constituent of concern	TCT0	TCT1	TCT2	Overburden
Cr_{Total}, Chromium Total	46000	800000	N/A	13200
Cu, Copper	16	19500	78000	56
Hg, Mercury	0.93	160	640	<0.400
Mn, Manganese	1000	25000	100000	780
Mo, Molybdenum	40	1000	4000	<10
Ni, Nickel	91	10600	42400	301
Pb, Lead	20	1900	7600	3.20
Sb, Antimony	10	75	300	<0.400
Se, Selenium	10	50	200	<0.400
V, Vanadium	150	2680	10720	253
Zn, Zinc	240	160000	640000	94
Inorganic Anions				
Cr(VI), Chromium (VI) Total	6.5	500	2000	<2
Total Fluoride	100	10000	40000	<0.5
Total Cyanide as CN	14	10500	42000	<1.55

Notes *Grey: TC >TCT0 but < TCT1; Yellow: TC >TCT1 but < TCT2; Red: TC >TCT2*

Table 22-7: Leachable (1:20 deionised water ASLP) concentration of constituents of concern compared to GN R. 635 LCT thresholds

Constituents of concern	LCT0	LCT1	LCT2	LCT3	Overburden
Units	**mg/ℓ**	**mg/ℓ**	**mg/ℓ**	**mg/ℓ**	**mg/ℓ**
As, Arsenic	0.01	0.5	1	4	<0.001
B, Boron	0.5	25	50	200	0.029
Ba, Barium	0.7	35	70	280	<0.025
Cd, Cadmium	0.003	0.15	0.3	1.2	<0.001
Co, Cobalt	0.5	25	50	200	<0.025
Cr_{Total}, Chromium Total	0.1	5	10	40	<0.025
Cr(VI), Chromium (VI)	0.05	2.5	5	20	<0.010
Cu, Copper	2.0	100	200	800	<0.010
Hg, Mercury	0.006	0.3	0.6	2.4	<0.001
Mn, Manganese	0.5	25	50	200	<0.025
Mo, Molybdenum	0.07	3.5	7	28	<0.025
Ni, Nickel	0.07	3.5	7	28	<0.025
Pb, Lead	0.01	0.5	1	4	<0.001
Sb, Antimony	0.02	1.0	2	8	<0.001
Se, Selenium	0.01	0.5	1	4	<0.001
V, Vanadium	0.2	10	20	80	<0.025
Zn, Zinc	5.0	250	500	2000	<0.025
Inorganic Anions					
Total Dissolved Solids*	1000	12 500	25 000	100 000	90
Chloride as Cl	300	15 000	30 000	120 000	<2
Sulphate as SO4	250	12 500	25 000	100 000	5
Nitrate as N	11	550	1100	4400	0.1
Fluoride as F	1.5	75	150	600	<0.2
Total Cyanide as CN	0.07	3.5	7	28	<0.07
pH					8.1

Notes: *Grey: LC >LCT0 but <LCT1; Yellow: LC >LCT1 but <LCT2; Orange: LC >LCT2 but <LCT3; Red: LC>LCT3*

Table 22-8: Overburden risk assessment summary

Aspect		Lannex Section Overburden
Chemical	Acid-base accounting	Not acid-generating
	Chemical composition of leachate (short-term)	No exceedances of water quality guidelines
	Propensity for spontaneous combustion	Not observed
	Propensity to oxidise and decompose, stability and reactivity	Not containing minerals that will react with oxygen and water to produce ARD
	Concentration of volatile organics	Not applicable
Mineralogy	Acid-forming minerals	None
Waste	Physical hazards	Not hazardous
	Health hazards	Not hazardous
	Environmental hazard	Not hazardous

Aspect		Lannex Section Overburden
	Classification	Not hazardous in terms of SANS10234
	Total concentrations	TC > TCT0 (Cu, Ni, V)
	Leachable concentrations	LC < LCT0 `
	Assessment	Not Type 4 waste but does not meet the full definition of Type 3 waste, due to low leachable concentrations (LC< LCT0) The geochemical enrichment of Cr(III) is due to the presence of chromite in the geology.
Toxicity	Ecotoxicology	Not ecotoxic (low leachability)
Vulnerability of the aquifer		Local aquifers are not vulnerable to contamination from overburden
Presence of vulnerable ecosystems		None at risk from groundwater contamination due to this activity
Mitigation measures to manage the impact on receiving environment		• Continuous surface- and groundwater monitoring • Include Cr(VI) and NO_3-N in analytical suite for groundwater

22.3.1 STEPS TAKEN TO INVESTIGATE, ASSESS, AND EVALUATE THE IMPACT OF ACID MINE DRAINAGE

The tailings, Waste rock and overbuden generated by Lannex are not acid forming. In addition to the description provided in the Section above, SRK also conducted Waste classification which confirmed the non-acid forming nature.

22.3.2 ENGINEERING OR MINE DESIGN SOLUTIONS TO BE IMPLEMENTED TO AVOID OR REMEDY ACID MINE DRAINAGE

Not applicable.

22.3.3 MEASURES THAT WILL BE PUT IN PLACE TO REMEDY ANY RESIDUAL OR CUMULATIVE IMPACT THAT MAY RESULT FROM ACID MINE DRAINAGE

Acid mine drainage is not anticipated, however in the unlikely event that AMD occurs in the future, the responsibility will be with Lannex to implement management measures and these will include:

- The construction and operation of a water treatment plant to treat the effected water; and
- Sealing of or resealing of leachate sources.

23. WATER

23.1. VOLUMES AND RATE OF WATER USE REQUIRED FOR THE MINING, TRENCHING OR BULK SAMPLING OPERATION

A water use licence application for Lannex has been submitted to DWS, Final volumes required has not been determined at this stage. Based on preliminary investigations it is anticipated that the following “clean water” volumes will be required / abstracted:

- Borehole water: 307 703,00 m^3/a;
- Water pumped from Underground: 357 700,00m^3/a; and
- Water removed from Opencast sections: 105 851,00 m^3/a

23.2. HAS A WATER USE LICENCE HAS BEEN APPLIED FOR?

An Integrated Water Use Licence Application is in process of being submitted to the Department of Water and Sanitation (DWS).

24. IMPACTS TO BE MITIGATED IN THEIR RESPECTIVE PHASES

Measures to rehabilitate the environment affected by the undertaking of any listed activity
See attached Management outcomes

Table 24-1: Management measures, mitigaction effect, compliance with standards, implementation time, responsibility and monitoring frequency

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
Opencast mining operations	Loss of chrome and other by product resources	No mitigation is possible as there is no way that the resource could be replaced	Cannot be reversed	MPRDA,NEMA, MHS	Immediately		Continuous
	Voids left as a result of chrome and other by products removal as the opencast area.	Backfill voids	Can be managed	MPRDA,NEMA, MHS	End of mining activities	Mine Manager	Once-off
		Rehabilitate disturbances caused by mining	Can be managed	MPRDA,NEMA, MHS	Immediately	Mine Manager	Continuous
		Level trenches and boreholes and cover with topsoil	Can be managed	MPRDA,NEMA, MHS	When not in use	Mine Manager	Once-off
		Seed and vegetate area disturbed by mining	Can be controlled	MPRDA,NEMA, MHS	Immediately	Mine Manager	Continuous
		Should erosion occur suitable alternatives such as mulching and shelter beds for wind erosions should be investigated	May cause irreversible damage	MPRDA,NEMA, MHS	Immediately	Mine Manager, SHEQ Manager	Monthly
Opencast mining operations	Impact on pre-mining and operational topography	The hard and soft material place in mined out areas must be reprofiled in keeping with the adjacent un-mined areas	Can be avoided, managed or mitigated	MPRDA,NEMA, MHS	End of mining activities	Mine Manager	Continuous
		At the contact between the pit and the un-mined land the slope of the ground must not exceed 5%	Can be avoided, managed or mitigated	MPRDA,NEMA, MHS	End of mining activities	Mine Manager,SHEQ Manager	Once-off
		Shape the topography so that it is free draining and reshape areas of arable land capability so that it does not have a slope greater than 4%.	May cause irreversible damage	MPRDA,NEMA, MHS	End of mining activities	Mine Manager,SHEQ Manager	Continuous
		Replace topsoil to achieve required pre-mining land capability	May cause irreversible damage	MPRDA,NEMA, MHS	End of mining activities	Mine Manager,SHEQ Manager	Continuous
		re-vegetate rehabilitated areas	May cause irreversible damage	MPRDA,NEMA, MHS	Immediately	Mine Manager,SHEQ Manager	When necessary
Opencast	As a result of the construction activities fragmentation, degradation or compression may occur if heavy construction vehicles are not kept to the demarcated roads.	A control of access should be implemented for all remaining natural areas to prevent unnecessary destruction of habitats or disturbance of species.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	SHEQ Manager	Quarterly
		It is also vital that no additional fragmentation occurs and that all roads are clearly demarcated and kept to without any exceptions	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	SHEQ Manager	Once-off
		The operational area should be fenced-in in order to reduce human and vehicle traffic to areas outside of the demarcated mining area.	Can be controlled	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	Once-off
		The vegetation removal during the construction phase should be controlled and very specific.	May cause irreplaceable loss of resources	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	Continuous
		Continuous rehabilitation of the area should occur during construction, where re-vegetation practices should be prioritised.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	Continuous
	Dust deposition on leaf lamina may result in the decline of rate of photosynthesis which leads to retarded plant growth.	Rainwater accumulated in the mine pit, if any, can be collected in the quarry sump will be used for dust suppression.	Can be managed	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	Weekly

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
	Construction, human and vehicle movement and introduction of foreign material.	A management plan for the control of invasive and exotic plant species needs to be implemented. Specialist advice should be used in this regard. This plan should include pre-treatment, initial treatment and follow-up treatment and should be planned and budgeted for in advance.	Can be managed	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	Annually
	Development related activities may lead to the loss of floral species of conservation concern.	All footprint areas should remain as small as possible. This can be achieved by fencing footprint areas to contain all activities within designated areas.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	Continuous
		If any SCC are encountered within the subject property in the future, the following should be ensured:	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	Monthly
		Mark all trees and clumps that must be protected and fence them off.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	When necessary
	Development and related activities are likely to impact on the sensitive habitats related to the watercourses situated in and around the development footprint.	If any threatened species will be disturbed, ensure effective relocation of individuals to suitable offset areas or within designated open space on the subject property.	May cause irreplaceable loss of resources	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	When necessary
		All rescue and relocation plans should be overseen by a suitably qualified specialist.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	When necessary
		Human and vehicle movement should be restricted from taking place in sensitive habitats. Areas to be fenced if necessary.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	Always
TSF Footprint	As a result of the construction activities fragmentation, degradation or compression may occur if heavy construction vehicles are not kept to the demarcated roads.	A control of access should be implemented for all remaining natural areas to prevent unnecessary destruction of habitats or disturbance of species. It is also vital that no additional fragmentation occurs and that all roads are clearly demarcated and kept to without any exceptions.	Can be controlled	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	When necessary
		The operational area should be fenced in in order to reduce human and vehicle traffic to areas outside of the demarcated operational area.	May cause irreplaceable loss of resources	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	Once-off
	Construction, human and vehicle movement and introduction of foreign material..	A management plan for the control of invasive and exotic plant species needs to be implemented. Specialist advice should be used in this regard. This plan should include pre-treatment, initial treatment and follow-up treatment and should be planned and budgeted for in advance.	Can be managed	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	Annually
	Development related activities may lead to the loss of floral species of conservation concern.	All footprint areas should remain as small as possible. This can be achieved by fencing footprint areas to contain all activities within designated areas.	Can be managed	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	Always
	Development and related activities are likely to impact on the sensitive habitats related to the watercourses situated in and around the development footprint.	survey for SCC species on the project footprint area should be undertaken by a suitably qualified specialist prior to the start of construction.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager, SHEQ Manager	When necessary
		If any SCC are encountered within the subject property in the future, the following should be ensured:	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	When necessary
		If any threatened species will be disturbed, ensure effective relocation of individuals to suitable offset areas or within designated open space on the subject property.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	When necessary
		All rescue and relocation plans should be overseen by a suitably qualified specialist.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	When necessary

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementa tion time	Responsibility	Monitoring frequency
		Human and vehicle movement should be restricted from taking place in sensitive habitats. Areas to be fenced if necessary.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Always
Waste Rock Dump Extension	Construction, human and vehicle movement and introduction of foreign material e.g. soils may lead to the introduction of alien invader species, impacting on the floral characteristics of the project site and adjacent natural areas.	A control of access should be implemented for all remaining natural areas to prevent unnecessary destruction of habitats or disturbance of species. It is also vital that no additional fragmentation occurs and that all roads are clearly demarcated and kept to without any exceptions	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	When necessary
		The operational area should be fenced in in order to reduce human and vehicle traffic to areas outside of the demarcated operational area.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Always
		The vegetation removal during the construction phase should be controlled and very specific.	Can be controlled	NEMBA,NEMA	Immediately	Mine Manager	Once-off
	Rehabilitation could be ineffective if measures are not appropriately complied to or rehabilitation is not planned well in advance.	A management plan for control of invasive/exotic plant species needs to be implemented. This will be ongoing until the end of the mining closure phase.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Annually
	Without mitigation the alien invasive species will increase and result in a degraded veld condition making the property less viable for post-closure land use activities such as wilderness, grazing and agriculture.	Rehabilitation plans should be planned long before the closure phase is due. Continuous rehabilitation should also take place during the operational phase.	Can be managed	NEMBA,NEMA	Immediately	Mine Manager	Annually
		Rehabilitation plan should be implemented. This includes the process of replanting the vegetation. Rehabilitation plans should be compiled with the use of a specialist and the correct seeding techniques and mixtures should be applied.	Can be managed	NEMBA,NEMA	Immediately	Mine Manager	Continuous
		Close monitoring of plant communities to ensure that ecology is restored and self-sustaining. The monitoring of the flora should be conducted annually by the environmental practitioner, until a suitably qualified specialist deems the monitoring to no longer be necessary. A report should be written and stored and should be available at all times.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Annually
Opencast	The construction activities might result in impacts on the mountainous animals due to increased movement, traffic and construction personnel to the area.	The construction area should be well demarcated and construction workers should not enter adjacent areas.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Always
	Specifically, OC1 and OC2 and their extended footprints (the natural areas) will be more intensely affected in terms of activities since they are in better condition than OC3 and further away from constant movement.	All opencast sections should be mined and rehabilitated before moving on to the adjacent section as to ensure enough range and forage opportunities remain available to the wildlife present at Tubatse.	May cause irreplaceable loss of resources	NEMBA,NEMA	Immediately	Mine Manager	Continuous
		Any nests encountered should be avoided at all stages if encountered.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	When necessary
		Passage to the opencast footprints should follow a route that preferably moves along the proposed opencast footprints to prevent additional fragmentation which could occur if access is taken from the other side of the mountain.	May cause irreplaceable loss of resources	NEMBA,NEMA	Immediately	Mine Manager	Once-off
		To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Always

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
		Continuous rehabilitation of the area should occur during construction, where re-vegetation practices should enjoy priority.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Continuous
	Storing of foreign materials, such as construction material, mixing of concrete or collection and delivering could result in pollution.	The caves created near OC2 should not be destroyed if possible as bats that may have established within these structures have valuable contributions to pollination and possibly predatory niches.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Once-off
	Constructing activities and heavy construction vehicles might result in compaction of the soil and destruction of vegetation habitat.	To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.	Can be controlled	NEMBA,NEMA	Immediately	Mine Manager	Always
		Continuous rehabilitation of the area should occur during construction, where re-vegetation practices should enjoy priority.	May cause irreplaceable loss of resources	NEMBA,NEMA	Immediately	Mine Manager	Continuous
		Prevent impacts from impacting on the multiple drainage lines identified during the field visit.	Can be managed	NEMBA,NEMA	Immediately	Mine Manager	Once-off
		Placement of the OC footprints along the stretches surveyed should ideally be placed close to the Lannex or Tubatse Chrome Club footprints to minimise impacts to green fields and to avoid the more natural drainage features where possible.	Can be managed	NEMBA,NEMA	Immediately	Mine Manager	Once-off
	The drainage of the surface water areas or sources (such as diversion of the drainage lines or changes to the beds and banks) that feed the drainage system found within the development site may be impacted due to construction activities and may result in the destruction of riparian habitat for the sensitive species.	To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Always
		Corridors between the drainage channels and river systems should always be maintained during construction and operational phases.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Continuous
		Fencing the footprint area will prevent movement into the natural veld areas and keep the impacts regulated within a controlled environment. Animals may get used to movement by people in designated areas if it is a predictable situation.	May cause irreplaceable loss of resources	NEMBA,NEMA	Immediately	Mine Manager	Once-off
	Artificial lighting may also impact the surrounding natural environment.	Continuous rehabilitation of the area should occur to ensure all impacts identified during operational phase is speedily managed and restored.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Continuous
	The operational activities might result in impacts to the natural environment due to prolonged activity and movement to and from the area.	Noise impacts should be monitored and kept in accordance with the regulated standard prescribed for the zoning of the area.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Always
		Special lighting in the evenings should be considered to limit disturbance of animals (especially since most of these animals are deemed nocturnal) and the attraction of insects to these lights that often lead to their death	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Always
		Prevent impacts and waste from reaching the various drainage areas and areas outside the dirty footprint areas.	Can be controlled	NEMBA,NEMA	Immediately	Mine Manager	Always
		Strict rules and punishment should be adhered to offenders entering the natural environment outside of the footprint.	May cause irreplaceable loss of resources	NEMBA,NEMA	Immediately	Mine Manager	Always

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
		Workers should not be housed or allowed free access around the mountainous areas.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Always
		The construction area should be well demarcated and construction workers should not enter adjacent areas;	Can be managed	NEMBA,NEMA	Immediately	Mine Manager	Always
		The TSF footprints should be also considered for remining and reclamation after it is established. This will aid with rehabilitation, improve financial turnout and decrease the waste remaining to be removed or capped (depending on final landform).	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Once-off
TSF (LNX Footprints)	The construction activities might result in impacts on the new TSF footprints proposed due to increased movement, traffic and construction personnel to the area. Construction will result in increase of potentially destructive movement within the designated area.	Any nests encountered during the establishment of the TSF should be avoided at all stages. Flat boulders and rocky outcrops have been sighted during the field assessment of the footprints and these will likely need to be removed or moved to establish the dam.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Always
		To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Continuous
		Continuous rehabilitation of the area should occur during construction, where re-vegetation practices should enjoy priority.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Continuous
		Adequate landscaping will result in bird species returning to the site. Therefore, the planting of indigenous trees and shrubs should be encouraged.	May cause irreplaceable loss of resources	NEMBA,NEMA	Immediately	Mine Manager	Once-off
		To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Continuous
		Continuous rehabilitation of the area should occur during construction, where re-vegetation practices should enjoy priority.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Continuous
	Storing of foreign materials, such as construction material, mixing of concrete or collection and delivering could result in pollution	Seed mixes should match the surrounding vegetation structures and those specifically found in the Sekhukhune Plains Bushveld and Sekhukhune Mountain Bushveld vegetation types.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Rehabilitation phase
	Constructing activities and heavy construction vehicles might result in compaction of the soil and destruction of vegetation habitat which will impact on the animals that use the area as habitat.	Prevent impacts from impacting on the multiple drainage lines identified during the field visit. These were dry channels but will facilitate the movement of water during rainfall events.	Can be controlled	NEMBA,NEMA	Immediately	Mine Manager	Once-off
		Corridors between the drainage channels and river systems should always be maintained during construction and operational phases.	May cause irreplaceable loss of resources	NEMBA,NEMA	Immediately	Mine Manager	Once-off
		Fencing the footprint area will prevent movement into the natural veld areas and keep the impacts regulated within a controlled environment. Animals may get used to movement by people in designated areas if it is a predictable situation. If movement is allowed into natural areas on a regular basis and the smell and sound of humans are found outside the demarcated development zones, it may result in animals moving away from the area and those that have specialised niches may flee and starve due to limited range and adaptability.	Can be managed	NEMBA,NEMA	Immediately	Mine Manager	Once-off

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementa tion time	Responsibility	Monitoring frequency
		Continuous rehabilitation of the area should occur to ensure all impacts identified during operational phase is speedily managed and restored. This included erosion and the management of Invasive plant species that may decrease the integrity of the Sekhukhune vegetation types as a specialised habitat for animals.	Can be managed	NEMBA,NEMA	Immediately	Mine Manager	Continuous
		Noise impacts should be monitored and kept in accordance to the regulated standard prescribed for the zoning of the area.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Continuous
	The operational activities might result in impacts to the natural environment due to prolonged activity and movement to and from the area.	Special lighting in the evenings should be considered to limit disturbance of animals (especially since most of sensitive animals are deemed nocturnal) and the attraction of insects to these lights that often lead to their death	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Continuous
		Prevent impacts and waste from reaching the various drainage areas and areas outside the dirty footprint areas..	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Hourly
		Strict rules and punishment should be adhered to offenders entering the natural environment outside of the footprint.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Once-off
		Workers should not be housed or allowed free access around the mountainous areas.	May cause irreplaceable loss of resources	NEMBA,NEMA	Immediately	Mine Manager	Continuous
		The construction area should be well demarcated and construction workers should not enter adjacent areas;	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Once-off
		Any nests encountered should be avoided at all stages if encountered.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	When necessary
		To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Continuous
	Movement, noise and waste management is the main impacts that should be managed within this phase	Continuous rehabilitation of the area should occur during construction, where re-vegetation practices should enjoy priority.	Can be controlled	NEMBA,NEMA	Immediately	Mine Manager	Continuous
Waste Rock Dump Extension	The construction activities might result in impacts on the natural environment, however, the footprint proposed for the WRD has already been developed and fall within a designated fenced area.	Implement all other mitigation measures prescribed and manage the expansion as per current WRD area to prevent any new impacts stemming from the expansion.	May cause irreplaceable loss of resources	NEMBA,NEMA	Immediately	Mine Manager	Monthly
		Ensure that the stormwater management features of the WRD area (and possibly OC 1 extended footprint area) include the additional areas before the development thereof	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Monthly
		Fencing the footprint area will prevent movement into the natural veld areas and keep the impacts regulated within a controlled environment.	Can be managed	NEMBA,NEMA	Immediately	Mine Manager	Once-off
		Continuous rehabilitation of the area should occur to ensure all impacts identified during operational phase is speedily managed and restored. This included erosion and the management of Invasive plant species.	Can be managed	NEMBA,NEMA	Immediately	Mine Manager	Continuous
	Traffic and constant usage of heavy vehicles might result in compaction of the soil and destruction of vegetation	Noise impacts should be monitored and kept in accordance to the regulated standard prescribed for the zoning of the area.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Monthly

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
	habitat which will impact on the animals that use the area as habitat.						
		Strict rules and punishment should be adhered to offenders entering the natural environment outside of the footprint.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Continuous
	The operational activities might result in impacts to the natural environment due to prolonged activity and movement to and from the area.	Implement all the EMP requirements as prescribed for the WRD footprint area (since this is only an extension).	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Monthly
		Positive impacts will start outweighing any negative impacts after initial rehabilitation and re-vegetation has occurred. Rehabilitation is a long-term process and the success will be a product of the planning and adherence to the designed final landform and measures initiated to ensure success	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Continuous
		Active rehabilitation of degraded landscapes should commence.	May cause irreplaceable loss of resources	NEMBA,NEMA	Immediately	Mine Manager	Continuous
		To minimize potential impacts to animal species, animals (wildlife and domestic animals) may under no circumstances be handled, removed, killed or interfered with by the Contractor, his employees, his Sub-Contractors or his Sub-Contractors' employees.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Monthly
		Ensure that an acceptable aesthetic scenario is created post closure. This will be reached through adequate rehabilitation practices by restoring damaged and degraded habitat areas.	Can be avoided, managed or mitigated	NEMBA,NEMA	Immediately	Mine Manager	Continuous
Closure and Post-Closure phase for all developments	Increased activity and traffic within a shorter timeframe (closure phase) may degrade the area if adherence is not inline with the Environmental Management Plan (EMP) and Final Rehabilitation programme compiled for the specific Lannex area.	When closure is considered successful and rehabilitation complete, unnecessary fences should be lifted to restore larger foraging areas, especially for larger mammalian species within the area.	Can be avoided, managed or mitigated	NEMBA,NEMA	End of mining activities	SHEQ Manager	Continuous
		Impacts will begin to subside and move towards a positive scale (ideally)	Can be controlled	NEMBA,NEMA	End of mining activities	SHEQ Manager	Annually
Mining operations (Groundwater)	Proposed LNX TSF 1 Pollution Plume	Before operation, a plan that includes explicit consideration of closure and rehabilitation issues must be prepared and approved..	May cause irreplaceable loss of resources	NEMA,NEMWA, NWA	Planning	SHEQ Manager,	Quarterly
		Water management facilities should be designed to intercept and contain as much contaminated runoff and/or seepage as possible.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Planning and operational phase	Mine Manager, Engineer	Quarterly
	Existing TSF Pollution Plume	Pollution prevention consideration. Deterioration of water quality must be prevented wherever possible and minimised where complete prevention is not possible.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Operational	Mine Manager	Quarterly
	WRD Pollution Plume	Identify and where possible, maximise areas of the mine that will result in clean storm water runoff	Can be managed	NEMA,NEMWA, NWA	Throughout mining operation	Mine Manager	Quarterly
		Ensure that clean storm water is only contained if the volume of the runoff poses a risk, if the water cannot be discharged to watercourses by gravitation, for attenuation purposes, or when the clean area is small and located within a large dirty area. .		NEMA,NEMWA, NWA	Throughout mining operation	Mine Manager	Quarterly

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementa tion time	Responsibility	Monitoring frequency
		Ensure that seepage losses from storage facilities (such as polluted dams) are minimised and overflows are prevented.		NEMA,NEMWA, NWA	Throughout mining operation	Mine Manager	Quarterly
		The size of unrehabilitated areas (pit, spoils, unvegetated areas) that produce contaminated runoff should be minimised.		NEMA,NEMWA, NWA	Throughout mining operation	Mine Manager	Quarterly
	Residue Stockpile Area	Monitoring of water storage facilities, particularly pollution control dams, is imperative to manage the risk of spillage from the dams. Stage-storage (elevation-capacity) curves are useful tools to monitor the remaining capacity within a water storage facility.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Throughout mining operation and post closure	Mine Manager, SHEQ Manager	Quarterly
		Prevent the erosion or leaching of materials from any residue deposit or stockpile from any area and contain material or substances so eroded or leached in such area by providing suitable barrier dams, evaporation dams or any other effective measures to prevent this material or substance from entering and polluting any water resources.		NEMA,NEMWA, NWA	Throughout mining operation	Engineer, Mine Manager	Quarterly
		Water quantity and quality data should be collected on a regular, ongoing basis during mine operations.		NEMA,NEMWA, NWA	Mining operation	SHEQ Manager	Quarterly
		The depth of the trench should be at least 4 mbgl (or 2 m below the groundwater level) to intercept polluted seepage that resulted from the WRD;		NEMA,NEMWA, NWA	Planning and construction period	Mine Engineer	Quarterly
		The design of the trench gradient must be such that the water is free flowing without eroding the channel;		NEMA,NEMWA, NWA	Planning and construction period	Mine Engineer	Quarterly
		The water from the trench must be captured, retained and managed within the mine water systems.		NEMA,NEMWA, NWA	Mining operation	SHEQ Manager, Mine Manager, Engineer	Quarterly
	Existing MG1 Opencast Pollution Plume	Should privately owned boreholes decrease in yield due to mining drawdown, the mine should supply the owners with a volume of water as agreed upon between the parties involved.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Mining operation	Mine Manager	Quarterly
	Proposed Opencast 1,2,3 Pollution Plume	The capacity to rapidly pump water out of the pit into storage dams should be maintained. This will assist in minimising water quality deterioration due to long-term retention of storm water in contact with materials that may cause water quality deterioration.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Throughout mining operation	Mine Manager, Engineer, SHEQ Manager	Quarterly
	Proposed Opencast 1,2,3 Decant	Berms should be constructed around the opencast pits to minimise the flow of any surface water or floodwater into mine workings. These berms should be constructed to allow free drainage away from the pits.	May cause irreplaceable loss of resources	NEMA,NEMWA, NWA	Planning and mine operational period	Engineer, Mine Manager	Quarterly
	Planned Underground Mine Pollution Plume	All openings to the mine need to be sealed or have adequate berms surrounding the openings to prevent surface water entering.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Operational and end of mining activities	SHEQ Manager, Mine Manager	Quarterly
		All boreholes should be sealed from the bottom to the top to prevent groundwater entering the hole and feeding into the mine workings.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Operational and end of mining activities	SHEQ Manager, Mine Manager	Quarterly

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementa tion time	Responsibility	Monitoring frequency
		All depressions created by mining need to be profiled for self-drainage of surface water away from the workings.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Operational and end of mining activities	SHEQ Manager, Mine Manager	Quarterly
	Currently Mined MG1 and MG2 Underground Mine Pollution Plume	Should depressions created by mining not be able to be filled, then the areas need to be surrounded by berms to prevent surface water ingress to the mine workings.	Can be controlled	NEMA,NEMWA, NWA	Operational and end of mining activities	SHEQ Manager, Mine Manager	Quarterly
	Planned Underground Mine Dewatering	Water quantity and quality data should be collected on a regular, ongoing basis during mine operations.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Operational and end of mining activities	SHEQ Manager, Mine Manager	Quarterly
	Currently Mined MG1 and MG2 Underground Mine Dewatering	Areas that may have subsided or areas of depressions and/or sinkholes should be filled to create free draining surfaces.	Can be managed	NEMA,NEMWA, NWA	Operational and end of mining activities	SHEQ Manager, Mine Manager	Quarterly
Siltation of surface water resources	Cumulative: Clearing or removal of vegetation leaves the soils prone to erosion during rainfall events, and as a result runoff from these areas which will be high in suspended solids and will cause an increase in turbidity in the natural water resources.	Clearing of vegetation must be limited to the development footprint area and the use of existing access roads must be prioritized to minimise construction of new access roads in the areas;	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Operational and end of mining activities	SHEQ Manager, Mine Manager	Monthly
		Re-vegetate all open and unprotected areas where no activity is taking place.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	End of mining activities	SHEQ Manager	Rehabilitation phase
		- Reduce speed of run-off water.		NEMA,NEMWA, NWA	Mining operation	SHEQ Manager	Monthly
		Fine products must be covered by tarpaulin during transport, where possible, which will help to reduce dust accumulation.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Mining operation	SHEQ Manager	Weekly
		Reduce speed on gravel roads to reduce dust kick up.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Mining operation	SHEQ Manager	Weekly
		Roads can be sprayed with water collected in quarry sump (reduce dust kick-up).	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Mining operation	SHEQ Manager	Weekly
		Costs can be saved by using hygroscopic material such as calcium chloride.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Mining operation	SHEQ Manager	Weekly
Hydrocarbon spillages (Surface Water)		Dust collectors and filters can be placed on all drill rigs.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Mining operation	SHEQ Manager	Weekly
	Dust generated during the construction activities and increased vehicular movements can also be deposited into the nearby natural streams during rainfall events thereby contributing to the accumulation of suspended solids in these water resources leading to the siltation of the water bodies.	If possible, construction should be undertaken during the dry season (April to September) to minimise erosion and sedimentation/siltation of the river/drainage;	May cause irreplaceable loss of resources	NEMA,NEMWA, NWA	Planning and Mining operation	Mine Manager, SHEQ Manager	Seaonally

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
	The proposed TSF options, WRD expansion and the proposed opencast areas are located a minimum of 20 to 200 m between the river/drainages which form tributaries of the Steelpoort River and the Steelpoort River itself.	Any construction work that involves site clearance, digging, excavation during construction services should be suspended during heavy rains to avoid erosion and sedimentation of the water course;	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Planning and Mining operation	Mine Manager, SHEQ Manager	Continuous
		When wet season construction cannot be avoided, sedimentation control measures, such as hay bales, sedimentation basins or any silt traps should be in place during the construction phase; and	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Planning and Mining operation	Mine Manager, SHEQ Manager	Quarterly
		Dust suppression measures must be undertaken on the cleared areas during construction.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Planning and Mining operation	Mine Manager, SHEQ Manager	Daily
		Dispose of contaminated soil as if it is hazardous waste at the appropriate location on the site.	Can be controlled	NEMA,NEMWA, NWA	Planning and Mining operation	Mine Manager, SHEQ Manager	Quarterly
	Cumulative: A High volume of traffic by vehicles will occur due to the transport of equipment/material to site, together with removal of material from the opencast areas to the WRD area.	Oil spillages must be contained to the smallest possible area and must be cleaned immediately;	May cause irreplaceable loss of resources	NEMA,NEMWA, NWA	Planning and Mining operation	Mine Manager, SHEQ Manager	Quarterly
		Maintenance/servicing of vehicles should only take place in designated service areas on site.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Mining operation	Mine Manager	Quarterly
		Refuelling may only take place on a bund and by means of a pump.		NEMA,NEMWA, NWA	Mining operation	Mine Manager	Quarterly
	These impacts will lead to the deterioration of the water quality and hence impact the downstream water users, as well as the aquatic life.	All construction equipment shall be put onto a maintenance program, including daily inspection of the equipment. Vehicles maintenance must only be conducted within designated service bays.	Can be managed	NEMA,NEMWA, NWA	Mining operation	Mine Manager	Annually
Alteration of surface water drainage patterns and river banks	The proposed TSF options, WRD expansion and the proposed opencast areas fall within close proximity to the tributaries of the Steelpoort River and the Steelpoort River itself. Increased vehicular movements and other construction activities may alter or disturb these drainage lines, thereby altering the morphological patterns of the stream as well as impact on the normal drainage flow	If possible, only the demarcated footprint of the TSF, WRD and opencast areas should be disturbed to avoid additional footprint areas which may lead to disturbance of the drainage lines	Can be managed	NEMA,NEMWA, NWA	Mining operation	Mine Manager	Quarterly
		Construction work closer to the streams should be suspended during heavy rains to avoid erosion and sedimentation of the streams and unnecessary vehicle movement should be avoided;	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Mining operation	Mine Manager	Quarterly
		Use of existing access roads must be prioritized so as to minimise construction of new access roads crossing the stream.	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Mining operation	Mine Manager	When necessary
Reduction of catchment yield	The footprint areas of the TSF and associated infrastructures will no longer form part of the natural downstream catchment thereby potentially resulting in a decrease of runoff downstream	This impact is unavoidable for this nature of project, however, to try and manage this impact, it is recommended to only restrict the proposed TSF, WRD and opencast development to the exact footprint to avoid unnecessary loss of runoff.	May cause irreplaceable loss of resources	NEMA,NEMWA, NWA	Mining operation	Mine Manager	Always
Floodline of the proposed TSF, WRD, opencast and associated infrastructures	Flooding of the proposed TSF, WRD expansion and opencast areas may result in a significant water pollution impacts on the natural streams, hence impact on the downstream users as well as the aquatic life.	Floodlines will be required on all major watercourses within close proximity to the TSF options, WRD expansion and opencast areas. Based on government notice (GN) 704, the mine infrastructure in question should fall outside of the 1:100 year floodline or the 100 m away from the river/drainage, whichever is greater.	May cause irreplaceable loss of resources	NEMA,NEMWA, NWA	Mining operation	Mine Manager	Monthly
		The downstream river/drainage section which is responsible for draining Catchment 5 and 6 bisects the planned opencast area. These opencast areas fall within the 1:100-year floodline and the 100 m river/drainage buffer. The proposed footprint should also be adjusted to ensure it falls	Can be avoided, managed or mitigated	NEMA,NEMWA, NWA	Mining operation	Mine Manager	Monthly

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
		outside of the 1:100 year floodline or 100 m river/drainage buffer, whichever is greater.					
	The flooding of the opencast areas may also result in extended downtime for the mining operation, whilst flood damages are being repaired	Based on GN 704 requirements regarding stormwater management for mining activities it is noted that all clean and dirty water must be separated. Therefore clean water emanating from upstream of the TSF and RWD, WRD expansion and opencast areas will be diverted away and discharged to the nearby watercourse or environment..	Can be controlled	NEMA,NEMWA, NWA	Mining operation	SHEQ Manager	Monthly
Mixing of clean and dirty water	All runoff emanating from upstream of the TSF, WRD, opencast and associated infrastructures are considered dirty and need to be managed so as to prevent the mixing of clean and dirty water.	To size the required capacity of the RWD a conceptual water balance is to be developed which will take into consideration the 1:50 year storm event, the operating volume, and the external catchments if any. The RWD will also have a minimum freeboard from spillway to crest of 0.8 m as per GN 704 requirements.	May cause irreplaceable loss of resources	NEMA,NEMWA, NWA	Mining operation	SHEQ Manager	When necessary
Mining operations	Potential visual impact on the viewpoints that had a visual exposure.	The visual impact can be minimized by creating visual barriers. The construction area will be cleared as soon as construction of the infrastructure is finished.	Can be avoided, managed or mitigated	NEMA	Mining operation	SHEQ Manager	Continuous
	Potential permanent visual impact on the viewpoints	The visual impact can be minimized by the creation of visual barriers. Planting indigenous vegetation. Clearing only vegetation as required. Rehabilitating any disturbed areas as soon as possible.	Can be avoided, managed or mitigated	NEMA	Mining operation	SHEQ Manager	Monthly
		Fencing types can also be considered to ensure that it blends with the surrounding environment.	Can be avoided, managed or mitigated	NEMA	Planning and Mining operation	SHEQ Manager, Mine Manager	Once-off
Site clearing, removal of topsoil and vegetation	Fugitive dust (containing TSP (total suspended particulate, will give rise to nuisance impacts as fallout dust), as well as PM10 and PM2.5 (dust with a size less than 10 microns, and dust with a size less than 2.5 microns giving rise to health impacts)).	Topsoil should not be removed during windy months (August to January) due to associated wind erosion heightening dust levels in the atmosphere.	Can be managed	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Monthly
		Area of disturbance to be kept to a minimum and no unnecessary clearing of vegetation to occur.	Can be avoided, managed or mitigated	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Monthly
		Topsoil should be re-vegetated to reduce exposure areas.	Can be managed	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Bi-annually
		All stockpiles to be damped down, especially during dry weather or re-vegetated (hydro seeding is a good option for slope revegetation).	Can be avoided, managed or mitigated	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Seaonally
		Sprayers can be attached to conveyor belts and crushers/screen equipment to reduce dust at the source.	Can be avoided, managed or mitigated	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Daily
Construction of surface infrastructure (e.g access roads, pipes, storm water diversion berms, drilling, blasting)	The proposed mining activities will result in fugitive dust emissions containing TSP (total suspended particulate, giving rise to nuisance impacts as fallout dust).	Dust emitted during bulldozing activity can be reduced by increasing soil dampness by watering the material being removed thus increasing the moisture content.	Can be managed	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Daily
		Another option would be to time the blasting with wind to ensure the dust will not be blown to the sensitive receptors or especially the community.	Can be managed	NEMA, NEM:AQA	Mining operation	SHEQ Manager	When necessary
		Constricting the areas and time of exposure of pre-strip clearing in advance of construction to limit exposed soil surfaces.	May cause irreplaceable loss of resources	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Always
General transportation, hauling and	Transportation of the workers and materials in and out of mine site will be	Hauling of materials and transportation of people should take place on roads which is being watered and/or sprayed with dust suppressant.	Can be avoided, managed or mitigated	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Daily

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
vehicle movement on site	a constant feature during the construction phase.	To reduce the amount of dust being blown from the load bin in the haul roads, the material being transported can be watered or the back of the vehicles can be covered with plastic tarpaulin covers.	Can be avoided, managed or mitigated	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Daily
		The drop heights should be minimised when depositing materials to the ground.	May cause irreplaceable loss of resources	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Once-off
	Use and maintenance of access road	Encourage car-pool and bulk delivery of materials in order to reduce the number of trips generated daily.	Can be avoided, managed or mitigated	NEMA, NEM:AQA	Mining operation	SHEQ Manager	When necessary
	Dust from material handling- inside and outside the pit area	Use wetting agents to ensure dust suspension.	Can be managed	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Daily
	Haul roads for transporting RoM to the offsite processing plant	Dust suppression of roads being used during rehabilitation should be enforced	Can be managed	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Continuous
	Wind erosion	Re-vegetate where possible and use water for dust suspension.	Can be avoided, managed or mitigated	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Daily
Demolition and removal of all infrastructure (incl. transportation off site)	The process includes dismantling and demolition of existing infrastructure, transporting and handling of topsoil on unpaved roads in order to bring the site to its initial/rehabilitated state.	Demolition should not be performed during windy periods (August, September and October), as dust levels and the area affected by dust fallout will increase.	Can be avoided, managed or mitigated	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Daily
		Cabs of machines should be swept or vacuumed regularly to remove accumulated dust.	May cause irreplaceable loss of resources	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Daily
		Dust suppression of roads being used during rehabilitation should be enforced	Can be controlled	NEMA, NEM:AQA	Mining operation	SHEQ Manager	Continuous
	Rehabilitation (spreading of soil, revegetation &profiling/contouring)	Revegetation of exposed areas for long-term dust and water erosion control is commonly used and is the most cost-effective option.	May cause irreplaceable loss of resources	NEMA, NEM:AQA	End of mining activities	SHEQ Manager, Mine Manager	Seaonally
		The reshaping and restructuring of the landscape. Topsoil can be imported to reconstruct the soil structure. Profiling of dumps and waste rock dump to enhance vegetation cover and reduce wind erosion from such surfaces post mining.	Can be avoided, managed or mitigated	NEMA, NEM:AQA	End of mining activities	SHEQ Manager, Mine Manager	Once-off
Noise increase	Numerous simultaneous future construction activities during the day and night at TSF	No night-time mining (construction and operational) activities should be allowed within 500 m from residential dwellings at night without a noise study with a detailed management plant;	May cause irreplaceable loss of resources	NEMA	Mining operations	SHEQ Manager, Mine Manger	Continuous
	Numerous simultaneous future construction activities during the day and night at TSF	All employees and contractors should receive induction that includes an environmental awareness component (noise).	Can be avoided, managed or mitigated	NEMA	Mining operations	SHEQ Manager, Mine Manger	Annually
	Potential future construction at opencast area 1,2,3- Day	Development of a noise measurement programme (if required, depending on recommendation from the noise measurement specialist) once mining activities are to take place within 1,000 m from residential houses in the Tubatse Village;	Can be controlled	NEMA	Mining operations	SHEQ Manager, Mine Manger	Monthly
	Potential future construction at opencast area 1,2,3- Night	Compliance with the Noise conditions of the Environmental Management Plan that covers:	May cause irreplaceable loss of resources	NEMA	Mining operations	SHEQ Manager, Mine Manger	Monthly
		Blasting should be avoided during overcast condition, if possible, as this increases noise and vibration.	Can be managed	NEMA	Mining operations	SHEQ Manager, Mine Manger	When necessary

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
		Impact from blasting can be reduced through the selection of explosives, sequencing of blast, deflection equipment and timing.	Can be avoided, managed or mitigated	NEMA	Mining operations	SHEQ Manager, Mine Manger	When necessary
		Use blasting mats.	Can be avoided, managed or mitigated	NEMA	Mining operations	SHEQ Manager, Mine Manger	When necessary
		Notify I&AP of any blasts.	Can be avoided, managed or mitigated	NEMA	Mining operations	SHEQ Manager, Mine Manger, Explosive specialist	When necessary
	Future operational activities at Opencast Area 1,2,3 - Day	Impact from blasting can be reduced through the selection of explosives, sequencing of blast, deflection equipment and timing.	Can be avoided, managed or mitigated	NEMA	Mining operations	SHEQ Manager, Mine Manger, Explosive specialist	When necessary
		Use blasting mats.	Can be avoided, managed or mitigated	NEMA	Mining operations	SHEQ Manager, Mine Manger, Explosive specialist	When necessary
		Notify I&AP of any blasts	Can be avoided, managed or mitigated	NEMA	Mining operations	SHEQ Manager, Mine Manger, Explosive specialist	When necessary
	Future operational activities at Opencast Area 1,2,3- Night	Impact from blasting can be reduced through the selection of explosives, sequencing of blast, deflection equipment and timing.	Can be avoided, managed or mitigated	NEMA	Mining operations	SHEQ Manager, Mine Manger, Explosive specialist	When necessary
		Use blasting mats.	Can be avoided, managed or mitigated	NEMA	Mining operations	SHEQ Manager, Mine Manger, Explosive specialist	When necessary
		Notify I&AP of any blasts	Can be avoided, managed or mitigated	NEMA	Mining operations	SHEQ Manager, Mine Manger, Explosive specialist	When necessary
The natural ambient noise levels	The earth moving equipment and blasting together with grinding and stone crushing activities will generate noise above ambient noise levels in the surrounding areas	Measures such as ensuring all vehicles and equipment are in good working order, and that any faulty exhaust- and/or intake silencers are replaced timorously, will reduce the severity and significance of the impact.	Can be avoided, managed or mitigated	NEMA	Mining operation	SHEQ Manager, Engineer, Mine Manager	Monthly
		Drilling and blasting is generally intermittent and should be limited to daylight hours when ambient noise levels are highest.	Can be avoided, managed or mitigated	NEMA	Mining operation	SHEQ Manager	When necessary
Complaints	Increased noise levels from construction and mining operations	Operators must wear ear protection at all times when operating the earth moving equipment and machinery to prevent noise induced hearing loss. Noise pollution must be monitored monthly, and recorded throughout the life of mine.	May cause irreplaceable loss of resources	NEMA	Mining operation	SHEQ Manager	Monthly
Dust will also be generated from the opencast	The dust generated during the construction phase and operational phase of the surface mine infrastructure	Wetting of the access roads with water periodically to suppress the dust will greatly reduce the impact of dust. This wetting with water must be done daily during dry and windy seasons.	Can be avoided, managed or mitigated	NEMA	Mining operation	SHEQ Manager	Daily

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementa tion time	Responsibility	Monitoring frequency
pits, tailings storage facility, access roads to and from the waste rock dump sites.	and mining of the opencast pits will reduce the air quality of the local area immediately adjacent to the mining works. The ore crushing and waste rock disposal activities will also generate dust.	Dust and smoke monitoring will be conducted during the life of mine to determine the prominent wind directions and dust / smoke levels at various points around the mining site.	Can be avoided, managed or mitigated	NEMA	Mining operation	SHEQ Manager	Daily
		Concurrent rehabilitation and re-vegetation of the project sites will also reduce surfaces that are exposed to wind generated dust	Can be avoided, managed or mitigated	NEMA	Mining operation	SHEQ Manager	Continuous
Controlled movement of haul trucks and light delivery vehicles (LDVs)	Dust will be generated from the existing gravel access road if used for other purposes subsequent to mining access	Dust and smoke monitoring will be conducted during the life of mine to determine the prominent wind directions and dust / smoke levels at various points around the mining site.	Can be avoided, managed or mitigated	NEMA	Mining operation	SHEQ Manager	Daily
The crushing and screening activities create a High visual contrast with the surrounding areas, which are greener and less uniform.	The proposed SECM Lannex opencast, waste dumps activities and surface infrastructure will further change the aesthetic character of surrounding area by permanently changed landscape and the development associated with the mining operation.	Progressive rehabilitation will be implemented throughout the life of mine, such that as closure approaches a significant portion of the mining site would have been rehabilitated to conform to surrounding environmental characteristics and topographic features. This is subject to strict implementation and compliance with this environmental management programme report. Over time and towards closure the visual impact should gradually change from moderate to low after final rehabilitation is complete.	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	SHEQ Manager, Engineer, Mine Manager	Always
The inherent land capability will be permanently lost below the footprint of these mining entities	The positive impact of mining in the project area include increased business opportunities, greater demand for goods and services, pressures for housing.	Rehabilitate the land to as close as possible to its wilderness and grazing land state during and after the mining activities are concluded. Re-vegetation should be with indigenous plant species that are able to sustain the regional climate and soil conditions.	Can be avoided, managed or mitigated	NEMA	End of mining activities	SHEQ Manager	Monthly
		The farm where the current mining activities are taking place, is already a restricted/controlled access, therefore the larger SECM Lannex mining proposed activities will not reduce availability of natural resources and land to local communities.	Can be avoided, managed or mitigated	NEMA	End of mining activities	Mine Manager	Always
Culture and Heritage	The cultural and historic remains are area specific and very important to the cultural and values of the area		Can be avoided, managed or mitigated				When necessary
		All Archaeological, palaeontological and heritage sites and resources must be preserved if they are of cultural, historic or pre-historic significance. This must be done in conjunction with an expert or competent person:	Can be avoided, managed or mitigated	NEMA, NHRA	Throughout mining operation	SHEQ Manager	When necessary
		Monitoring for chance finds (e.g. burial sites, old waste disposal sites, ruins, foundations etc) must be done continuously during operations	Can be avoided, managed or mitigated	NEMA, NHRA	Throughout mining operation	SHEQ Manager	Continuous
	SECM, Lannex mine will form part of the history of the local area. Some mine infrastructure may be preserved as local heritage resources.	Findings, if encountered during mining activities, must be reported to the LIHRA Office, Limpopo and Fetakgomo Tubatase Municipality who will decide, after consultation with other relevant authorities, company representatives and local communities whether work may go ahead. Special precautions may be instituted to enable the mining work to proceed.	May cause irreplaceable loss of resources	NEMA, NHRA	Throughout mining operation	SHEQ Manager	When necessary
Crime, HIV and Covi-19	Influx of foreigners and job seekers and increase in disposable income for local people may create negative social	Labour should be sort from the local settlement areas to prevent influx of foreign who are likely to disrupt the social fabric, values and norms of the village people.	Can be avoided, managed or mitigated	NEMA, MPRDA	Throughout mining operation	Mine Manager	When necessary

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
	impacts such as crime, alcoholism and prostitution in and around the project area.	Through the SLP and day-to-day training and awareness programmes pandemics such as HIV and Covid-19 can be managed and minimized. The Lannex mine must also have an HIV and Covid-19 awareness outreach programme in conjunction with local health centres and clinics to extend awareness and knowledge about the diseases to the broader communities affected by the proposed mine activities.	Can be avoided, managed or mitigated	NEMA, MPRDA	Throughout mining operation	Mine Manager,SHEQ Manager	When necessary
	Cumulative: Possible loss of life and Covid-19 pandemic spread and new cases.	Visible policing and community policing forums must be established to curb incidents of crime in the communities. This option must be implemented in conjunction with existing tribal authority processes to manage crime and illegal activities.	Can be avoided, managed or mitigated	NEMA, MPRDA	Throughout mining operation	Mine Manager,SHEQ Manager	Continuous
Economic Opportunities, Infrastructure development and Employment	A high percentage of residents in the local village of Tukakgomo are unemployed. The continuation of mining activities at Lannex Mine will alleviate this unemployment problem, though it will not eradicate it completely.		Positive, cannot be mitigated	NEMA, MPRDA			N.A
		Promotion of chrome beneficiation within the Limpopo to improve the quality and value of the product being mined, and create further economic activity. Samancor Chrome Limited already has chrome concentrator plants in the Steelpoort valley. Subject to economic modelling and feasibility study, another concentrator plant in the vicinity of Lannex can further stimulate significantly the economic activity in Fetakgomo-Tubatse Municipality, Burgersfort, Steelpoort and the surrounding region.	Positive, cannot be mitigated	NEMA, MPRDA	Throughout mining operation	Mine Manager,SHEQ Manager	When necessary
	Local business will also benefit by providing supplies and services to the mine. Secondary industries are also likely to develop.	Labour should be sort from the local settlement areas to prevent influx of foreign people.	Positive, cannot be mitigated	NEMA, MPRDA	Throughout mining operation	Mine Manager,SHEQ Manager	When necessary
	The social and labour plan (SLP) to be implemented by the SECM Lannex Project will contribute to the development of the adjacent community in terms of skills training, local economic development projects, and improved infrastructure.	Labour should be sort from the local settlement areas to prevent influx of foreign people	Positive, cannot be mitigated	NEMA, MPRDA	Throughout mining operation	Mine Manager,SHEQ Manager	When necessary
	Skilling and training of local people will make them more marketable to other industries in the region. LED projects will continue to sustain economic activity post Lannex Project.	Job seekers who are likely to disrupt the social fabric, values and norms of the village people.	Positive, cannot be mitigated	NEMA, MPRDA	Throughout mining operation	Mine Manager,SHEQ Manager	When necessary
New tailings deposit area, new crushing and screening plant, TSF reclamation and WRD	Disturbance/loss of soil resources	See Section 13.1.1-10 and Section 13.4-5	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager,SHEQ Manager	When necessary
		It is recommended to restrict the number of roads, and limit the number of passes on the roads in construction areas to control the possibility of compaction by heavy vehicles and erosion, but also to control the possibility of dust. If necessary, special measurements should be taken to control dust, especially on unpaved roads.	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager	Always

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
	Additional disturbance/loses of soil due to erosion as well as contamination of soils	See Section 13.1 1,3-5 and Section 13.4-5	Can be avoided, managed or mitigated	NEMA			When necessary
		Erosion must be controlled in run off areas especially in specific positions where donga erosion is present such as between Lannex 1 and 2 as well as south of Lannex 2. During all new development care should be taken not to enhance erosion and it should be controlled as soon as erosion is observed. Surface areas should not be left bare for extended periods of time, but should always be vegetated or covered with suitable coverage to prevent dust	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
		Contamination of presently undisturbed top soils should be prevented as far as possible. Since large areas on this site have already been disturbed all waste products should be dumped on previously disturbed sites of the prospecting rights areas, even though the soils on this site are of low potential. formation.	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Continuous
	Cumulative disturbances, loss and degradation of soils	See Section 13.2 1-10 and Section 13.4-13.5	Can be avoided, managed or mitigated	NEMA			When necessary
		In case of any new development, all usable soil (where present) should be stockpiled and used for rehabilitation. Vegetation of these stockpiles will be needed on the long term. Site all soil stockpiles upslope from any mining / development activities.		NEMA	Throughout mining operation	Mine Manager	Continuous
	Increased/Decreased sediment loads on downstream systems	See Section 13.2 1-10 and Section 13.4-13.5	Can be avoided, managed or mitigated	NEMA			When necessary
		Water runoff must be controlled on the entire site to prevent any further disturbance of the site. The water runoff between Lannex 1 and 2 as well as south of Lannex 2 needs attention. It is foreseen that the development at the planned opencast areas 1 and 2 may pose serious runoff problems due to the topography. Early management to prevent water runoff is needed		NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Continuous
	Disturbance/loss/sterilisation of inherent land capability and land use	See Section 13.1.1-10 and Section 13.4-5	Can be controlled	NEMA			When necessary
		All stockpiles should also be protected to prevent erosion of stockpiled material and deflect water runoff. The duration of the stockpiles phase should be limited to a minimum period of time. Stockpiles should not exceed a maximum height of 6 m and it is recommended that the side slopes and surface areas be vegetated in order to prevent water and wind erosion and to keep the soils biologically active. The top fertile 30 cm soil layer should be stockpiled separately and should be used for seeding and revegetation purposes.	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
	Loss of land services, ecosystem support and services	See Section 13.1.1-10 and Section 13.4-5	May cause irreplaceable loss of resources	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
		See above	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
Impact assessment ratings for the	Disturbance/loss of soil resources	See Section 13.1.1-10 and Section 13.4-5	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementa tion time	Responsibility	Monitoring frequency
opencast areas 1,2,3		See above		NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
	Additional disturbance/losses of soil due to erosion as well as contamination	Section 13.1 1,3-5, 7-10 and Section 13.4-5	Can be managed	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
		Erosion must be controlled in run off areas especially in specific positions where donga erosion is present such as between Lannex 1 and 2 as well as south of Lannex 2. During all new development care should be taken not to enhance erosion and it should be controlled as soon as erosion is observed. Surface areas should not be left bare for extended periods of time, but should always be vegetated or covered with suitable coverage to prevent dust	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
		Contamination of presently undisturbed top soils should be prevented as far as possible. Since large areas on this site have already been disturbed all waste products should be dumped on previously disturbed sites of the prospecting rights areas, even though the soils on this site are of low potential. formation	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
	Cumulative disturbance, loss and degradation of soils	See Section 13.2 1-10 and Section 13.4-13.5	Can be managed	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
	Increased/Decreased sediment loads on downstream systems	See section 13.3 1-10 and Section 13.4- 13.5	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
	Disturbance/loss/sterilization of inherent land capability and land use	See Section 13.1 1-10 and Section 13.4-5	Can be avoided, managed or mitigated	NEMA			Monthly
		All stockpiles should also be protected to prevent erosion of stockpiled material and deflect water runoff. The duration of the stockpiles phase should be limited to a minimum period of time. Stockpiles should not exceed a maximum height of 6 m and it is recommended that the side slopes and surface areas be vegetated in order to prevent water and wind erosion and to keep the soils biologically active. The top fertile 30 cm soil layer should be stockpiled separately and should be used for seeding and revegetation purposes.	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
	Loss of land services, ecosystem support and services	See Section 13.1 1-10 and Section 13.4-5	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
Access road to opencast areas, Tubatse village and the stream diversion	Disturbance/loss of soil resources	See Section 13.1.1-10 and Section 13.4-5	Can be avoided, managed or mitigated	NEMA			Monthly
		See above		NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
	Additional disturbance/losses of soil due to erosion as well as contamination	See Section 13.1.1-10 and Section 13.4-5	May cause irreplaceable loss of resources	NEMA			Monthly

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
		Erosion must be controlled in run off areas especially in specific positions where donga erosion is present such as between Lannex 1 and 2 as well as south of Lannex 2.	May cause irreplaceable loss of resources	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
		Contamination of presently undisturbed top soils should be prevented as far as possible. Since large areas on this site have already been disturbed all waste products should be dumped on previously disturbed sites of the prospecting rights areas, even though the soils on this site are of low potential. formation	May cause irreplaceable loss of resources	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
	Cumulative disturbance, loss and degradation of soils	See Section 13.2 1-10 and Section 13.4-13.5	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
		See above		NEMA			Monthly
	Increased/Decreased sediment loads on downstream systems	See section 13.3 1-10 and Section 13.4- 13.5	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
		See above		NEMA			Monthly
	Disturbance/loss/sterilisation of inherent land capability and land use	See Section 13.1.1-10 and Section 13.4-5	Can be avoided, managed or mitigated	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
		See above		NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
	Loss of land services, ecosystem support and services	See Section 13.1.1-10 and Section 13.4-5	Can be controlled	NEMA	Throughout mining operation	Mine Manager, SHEQ Manager, ECO	Monthly
Tubatse Community Houses	Ground Vibrations	Specific blast design to be done, shorter blast holes, smaller diameter blast hole, using electronic initiation instead of shock tube systems to obtain single hole firing. Sequencing of blast can be kept in mind to help reduce vibrations caused by blasts.	May cause irreplaceable loss of resources	NEMA,MHS,MP RDA	Planning and operational phase	Mine Manager, SHEQ Manager	When necessary
Informal housing	Ground Vibrations	Do blast design that considers the actual blasting and the ground vibration levels to be adhered too.	Can be avoided, managed or mitigated	NEMA,MHS,MP RDA	Mining operation	Mine Manager, SHEQ Manager	When necessary
		Only apply electronic initiation systems to facilitate single hole firing.	Can be avoided, managed or mitigated	NEMA,MHS,MP RDA	Planning and operational phase	Mine Manager, SHEQ Manager	When necessary
		Do design for smaller diameter blast holes that will use fewer explosives per blast hole.	Can be avoided, managed or mitigated	NEMA,MHS,MP RDA	Planning and operational phase	Mine Manager, SHEQ Manager	When necessary
		Relocate the POI / acquire the POI of concern – mined owned.	Can be avoided, managed or mitigated	NEMA,MHS,MP RDA	Planning and operational phase	Mine Manager, SHEQ Manager	Once-off
Buildings/structure	Ground Vibrations	See above	Can be managed	NEMA,MHS,MP RDA	Planning and operational phase	Mine Manager, SHEQ Manager	When necessary
Buildings/structure	Air Blast	Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Used of specific	Can be managed	NEMA,MHS,MP RDA	Planning and operational phase	Mine Manager, SHEQ Manager	When necessary

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementa tion time	Responsibility	Monitoring frequency
		stemming to manage fly rock - crushed aggregate of specific size. Re-design with increased stemming lengths.					
Road	Fly rock	Specific blast design to be done, shorter blast holes, smaller diameter blast hole, use of specific stemming materials to manage air blast, increased stemming lengths to reduce air blast effect. Used of specific stemming to manage fly rock - crushed aggregate of specific size. Re-design with increased stemming lengths.	Can be avoided, managed or mitigated	NEMA,MHS,MPRDA	Planning and operational phase	Mine Manager, SHEQ Manager	When necessary
		The road that has to be rerouted will require rerouting far enough away from the blasting area to ensure that feasible blasting operations will be possible.	Can be avoided, managed or mitigated	NEMA,MHS,MPRDA	Planning and operational phase	Mine Manager, SHEQ Manager	When necessary
		During the closure phase no mining, drilling and blasting operations are expected. It is uncertain if any blasting will be done for demolition. If any demolition blasting will be required it will be reviewed as civil blasting and addressed accordingly.	Can be avoided, managed or mitigated	NEMA,MHS,MPRDA	End of mining activities	Mine Manager, SHEQ Manager	When necessary
Greenhouse gases	Increased greenhouse gases	• Reducing fuel consumption – this can be achieved by ensuring the vehicles and equipment are maintained through an effective inspection and maintenance program.	May cause irreplaceable loss of resources	Climate Change Bill, NEMA	Mining operation	SHEQ	Monthly
		• Reducing electricity consumption from fossil fuel –	Can be avoided, managed or mitigated	Climate Change Bill, NEMA	Mining operation	SHEQ	Monthly
		• Limiting the removal of vegetation and ensuring that revegetation occurs as much as possible (vegetation use up CO2 in the atmosphere).		Climate Change Bill, NEMA	Mining operation	SHEQ	Continuous
Clearing of vegetation within a watercourse	Removal of vegetation within a watercourse will impact on the habitat that has established which in turn will impact on the biota using these habitats. The removal of vegetation will result in physical changes to the beds and banks that will impact on the water quality and result in increased potential for siltation and erosion. The movement of machinery could also result in compaction and hydrocarbons spills that could impact on water quality, vegetation and biota.	Conduct vegetation removal in the dry season.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Monthly
		Start vegetation removal upstream and move downstream.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Monthly
		Implement the construction of the proposed river diversion in the dry season.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Continuous
		Delineate areas where vegetation are to be cleared and restrict activities to within this area.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Always
		Red data species that will need to be removed needs a permit.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Once-off
		Refer to measures for vegetation clearance within 32 m of a watercourse as well.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Monthly
		Comply with the requirements of the Water use licence.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	When necessary
Clearing of vegetation within	Removal of vegetation within 32 m of a watercourse will impact on the habitat that has established which in turn will	Refer to measures for the removal of vegetation within a watercourse as well.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Monthly

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementa tion time	Responsibility	Monitoring frequency
32 m of a watercourse	impact on the biota using these habitats. The removal of vegetation will result in physical changes to the beds and banks that will impact on the water quality and result in increased potential for siltation and erosion. The movement of machinery could also result in compaction, hydrocarbons spills that could impact on water quality, vegetation and biota.	Ensure that vehicles are properly maintained and that the do not leak oil / grease / diesel.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	Mine Manager, Foreman	Monthly
		Vehicles will not the allowed to overnight at the construction site.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	Mine Manager, Foreman	Continuous
		Any vehicles that breakdown on site will have a drip tray placed underneath them and will be removed from site as soon as possible.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	Mine Manager, Foreman	Monthly
		Drip trays are not to be cleaned at the incident site.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	Mine Manager, Foreman	When necessary
		Any soils contaminated by hydrocarbon will be collected using the correct manner and disposed to a suitable site.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	Mine Manager, Foreman	When necessary
Clearing of vegetation - general	Removal of vegetation could result in increased siltation of watercourses and increase erosion potential.	Refer to the measures for vegetation removal within a watercourse and within 32 m of a watercourse.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Monthly
Construction of infrastructure within a watercourse and within 32 m from a watercourse	Loosening of material as part of the construction of the identified infrastructures would result in additional damage to habitat and biota while increasing impacts on the stability of the watercourse resulting in increased potential for erosion and siltation. In addition, the movement of machinery within the watercourse or within 32 m could result in increased potential for hydrocarbon spills that will impact on water quality and in turn biota and vegetation.	Refer to the measures for vegetation removal within a watercourse and within 32 m of a watercourse.	Can be controlled	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Monthly
		Ensure that all designs are signed off by an engineer and that the as build drawings as drawn up, signed and submitted to the DHSWS.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Planning and licence application phase	Engineer, Mine Manager	When necessary
		Stabilise the banks immediately upstream and downstream of the infrastructure.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	Engineer, Mine Manager	When necessary
Construction of infrastructure - General	The potential for increase erosion that could increase siltation of watercourses exists.	Refer to the measures for vegetation removal within a watercourse and within 32 m of a watercourse.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA		SHEQ Manager	Monthly
		Ensure that all designs are signed off by an engineer and that the as build drawings as drawn up, signed and submitted to the DHSWS.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Planning and licence application phase	Engineer, Mine Manager	When necessary
Using access roads, culverts	The movement of machinery could result in hydrocarbons spills that could impact on water quality, vegetation and biota.	Ensure that vehicles are maintained.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	Engineer, Mine Manager	Monthly
		Remove any hydrocarbon spills immediately and dispose contaminated soil in the correct manner.		NEMA,NWA,NEMWA	Mining operation	Engineer, Mine Manager	When necessary
		Inspect culverts before the rainy season and remove any debris that could damage the infrastructure.		NEMA,NWA,NEMWA	Mining operation	Engineer, Mine Manager	Monthly
		Inspect after heavy rainfall and remove debris as needed.		NEMA,NWA,NEMWA	Mining operation	Engineer, Mine Manager	Monthly

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
Diverting clean storm water and containing clean water into containment dams above operational opencast pit	Damming of water upstream of the opencast sections and allowing the water to be diverted around the opencast will alter the flow regime, habitat and biota composition of the downstream watercourse as no water will be flowing in the original course. In addition, the damming will alter the habitat in the immediate area of the dam as more water would be available for vegetation establishment. Unless the diversion banks are stabilised, the potential for erosion and increases siltation in the diversion and the watercourse to which it will join is increased.	All storm water management infrastructure must be designed by a suitable qualified engineer.	Can be managed	NEMA,NWA,NEMWA	Planning and operational phase	Mine Manager, SHEQ Manager	Once-off
		All storm water infrastructure should be compliant with Legislation and suitably sized to cater for the 1 in 50 year flood.		NEMA,NWA,NEMWA	Planning and operational phase	Engineer, Mine Manager	Once-off
		Comply with the requirements of the water use licence.		NEMA,NWA,NEMWA	Mining operation	Mine Manager,SHEQ Manager	When necessary
		Stabilise the banks of the clean storm water channels and the river diversion using suitable material and vegetation.		NEMA,NWA,NEMWA	Mining operation	Engineer, Mine Manager	Once-off
		Implement end of line infrastructure to dissipate water and prevent erosion at discharge points.		NEMA,NWA,NEMWA	Mining operation	Mine Manager, SHEQ Manager	When necessary
Containment of dirty storm water	The containment of dirty storm water will effectively remove water from the natural water resource, this in turn will impact on the habitat and biota of the impacted watercourses. In addition, spills from these infrastructures could negative impact on the downstream water quality which in turn could affect vegetation and biota negatively.	Refer to measures above for the clean storm water management infrastructure and river diversion.	Can be managed	NEMA,NWA,NEMWA	Mining operation	Mine Manager, SHEQ Manager	Continuous
		Report any spills from the dirty storm water infrastructures and monitor for quality.		NEMA,NWA,NEMWA	Mining operation	Mine manager, SHEQ Manager	When necessary
Mining of opencast pit - all active pit areas	The containment of rainwater in the opencast pit will effectively remove water from the natural water resource, this in turn will impact on the habitat and biota of the impacted watercourses.	Implement upstream clean storm water diversion around operational opencast areas.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Once-off
		Test water quality in the opencast pit, if suitable quality, apply for licence and discharge to downstream watercourses. If not of suitable quality investigate options for re-use.		NEMA,NWA,NEMWA	Mining operation and End of mining	SHEQ Manager	Monthly
Mining of opencast pit within a watercourse and within 32 m from a watercourse.	Opencast pits located within a watercourse will alter the flow regime, habitat and biota composition of the watercourse completely.	Implement upstream containment dams as approved and licenced.	Can be avoided, managed or mitigated	NEMA,NWA,NEMWA	Mining operation and End of mining	Mine Manager, Engineer, SHEQ Manager	Once-off
		Implement river diversions as approved and licenced.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	Planning and mining phase	Engineer, Mine Manager	Once-off
		Plan opencast mining within 32 m and within the watercourse to occur within the dry seasons (March to September), this must include the vegetation removal, mining and backfilling. Seeding of the backfilled area to take place during spring (September - November).	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	Planning phase	Engineer, Mine Manager	Monthly
Pumping Tailings to the TSF	Spills from the tailings pipeline could impact on the water quality should it occur during the rainy season and the watercourse is flowing. This in turn could impact on the habitat and biota of the receiving water resources.	Inspect the pipeline on a daily basis.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	Mining phase	Engineer, Mine Manager	Daily
		Remove spilled material from the watercourse and dispose to the TSF.		NEMA,NWA,NEMWA	Mining operation	Mine Manager, SHEQ Manager	Monthly

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
Pumping return water to the plant	Spills from the return water pipeline could impact on the water quality should it occur during the rainy season and the watercourse is flowing. This in turn could impact on the habitat and biota of the receiving water resources.	Refer to measures for pumping of tailings to TSF.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	Mining operation	Mine Manager, SHEQ Manager	Daily
Establishing the TSF and WRD by depositing of material	Increased dust generation could impact on water quality and habitat should the windblown dust from these two infrastructures be deposited in a watercourse. In addition, should there be a problem with the liner system leachate from these could impact on groundwater which in turn could impact on the base flow water quality of watercourses.	Implement dust suppression at the WRD and TSF.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	Mining operation	Mine Manager, SHEQ Manager	Daily
		The construction of the liner system needs to be supervised by a suitably qualified engineer and once finished the as build drawings need to be submitted to the DHSWS.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	Planning and operational phase	Engineer, Mine Manager	Continuous
		Comply with the requirements of the water use licence.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	When necessary
Stockpiling overburden at opencast sections within a watercourse and within 32m from a watercourse	Overburden storage within the watercourse / within 32 m from the watercourse will alter the flow regime of the water courses and could result in increased siltation to downstream areas. In addition, this will also impact on the habitat and biota making use of the watercourses. In addition, leachate from the material could impact on subsurface flow water quality.	Refer to the measures for opencast within a watercourse and within 32 m of a watercourse.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager, Engineer, Mine Manager	Monthly
Backfilling of opencast sections within a watercourse or within 32m of a watercourse	Backfilling of the opencast with overburden could impact on subsurface water flow quality due to the leachate potential from the material. Though backfilled, the pit will still capture run-off due to greater interstitial spaces in the backfilled material resulting in less water reaching the downstream watercourses. If unvegetated, the backfilled material could loosen and during heavy rainfall events result in erosion of the backfilled material and increased siltation to downstream areas.	Refer to measures as outlined under operation of the opencast pit.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	Operational	Mine Manager, SHEQ	Continuous
		Try to compact material that is used for backfilling to reduce interstitial spaces.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA			Continuous
Vegetation of the backfilled opencast areas	This is a positive aspect and will result in slowing down surface run-off flow	Refer to the measures for vegetation removal within a watercourse and within 32 m of a watercourse.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Monthly

Actiivity	Potential Impacts	Mitigation Measures	Mitigation Effect	Complaince	Implementation time	Responsibility	Monitoring frequency
	thus decreasing the potential for erosion.	Conduct annual assessment of vegetation establishment for 2 years after construction has been finalised.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Annually
		Re-vegetate areas as needed based on the annual assessments for the first 2 years. If the second assessment indicate that vegetation establishment has not been successful a further 2 annual assessment should be conducted.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	End of mining activities	SHEQ Manager	Annually
Closure of certain infrastructure areas	Leachate from these areas could negative impact on baseflow water; If not rehabilitated correctly increased windblown dust from these could impact on vegetation and biota of watercourses.	Soil should be brought in as needed and dispersed immediately in areas where there is poor soil layers.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	End of mining activities	SHEQ Manager	When necessary
		Rehabilitate TSF and WRD with the approved procedure, as well as backfilled opencast sites must be vegetated as soon as possible.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	End of mining activities	SHEQ Manager	Continuous
		Monitor vegetation for at least 2 years on annual basis to determine vegetation establishment. If unsuccessful vegetation establishment is noted, re-seed the area and monitor on an annual basis for another 2 years.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	End of mining activities	SHEQ Manager	Annually
Removal of certain infrastructures within a watercourse or within 32 m of a watercourse	Removal of the overburden will be a positive. The removal of the river diversion, containment dams, access roads and culverts. The movement of machinery increase the potential for hydrocarbon spills.	Refer to the measures for vegetation removal within a watercourse and within 32 m of a watercourse.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Monthly
		Conduct annual assessment of vegetation establishment for 2 years after construction has been finalised.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	End of mining activities	SHEQ Manager	Annually
		Re-vegetate areas as needed based on the annual assessments for the first 2 years. If the second assessment indicate that vegetation establishment has not been successful a further 2 annual assessment should be conducted.	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	End of mining activities	SHEQ Manager	Annually
Mining operations with support activities	Connectivity of watercourses (upstream to downstream) and impact on subsurface water flow quality and quantity.	Implement EMPr	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Continuous
Rehabilitation and Closure of areas that are no longer needed for support infrastructures or mining.	By rehabilitating and closure of areas that are no longer needed for support or mining, the dirty footprint area of the mine is reduced and this in turn will increase the water that is released to baseflow and to downstream areas.	Implement EMPr	May cause irreplaceable loss of resources	NEMA,NWA,NEMWA	Mining operation	SHEQ Manager	Continuous

25. *FINANCIAL PROVISION*

25.1. DETERMINATION OF THE AMOUNT OF FINANCIAL PROVISION

25.1.1 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 17.

25.1.1.1. Confirm specifically that the environmental objectives in relation to closure have been consulted with landowner and interested and affected parties.

Refer to Section 17.2

25.1.1.2. 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 17.3

25.1.1.3. Explain why it can be confirmed that the rehabilitation plan is compatible with the closure objectives.

Please refer to Section 17

25.2. CONFIRM THAT THIS AMOUNT CAN BE PROVIDED FOR FROM OPERATING EXPENDITURE

(Confirm that the amount, is anticipated to be an operating cost and is provided for as such in the Mining work programme, Financial and Technical Competence Report or Prospecting Work Programme as the case may be).

The amount is anticipated to be covered as part or during the operating cost and will be provided through operating costs.

26. *MECHANISMS FOR MONITORING COMPLIANCE WITH AND PERFORMANCE ASSESSMENT AGAINST THE ENVIRONMENTAL MANAGEMENT PROGRAMME AND REPORTING THEREON*

Including:
a) Monitoring of Impact Management Actions
b) Monitoring and reporting frequency
c) Responsible persons
d) Time period for implementing impact management action
e) Mechanisms for monitoring compliance

26.1. ENVIRONMENTAL MONITORING AND AUDITING

DEAT (2004) defines environmental auditing as “a process whereby an organisation’s environmental performance is tested against its environmental policies and objectives.” Monitoring and auditing is an essential environmental management tool which is used to assess, evaluate and manage environmental and sustainability issues.

In order to ensure that the objectives of sustainable development and integrated environmental management are met and in order to obtain data which can inform continuous improvement of environmental practices at the site (adaptive management), monitoring and reporting will be an essential component of the proposed operations.

Monitoring and management actions associated with the project are contained in Section 26 of this report as well as in the various specialist reports associated with this project. This section provides a summary of the critical monitoring aspects per specific environmental field.

26.2. General Monitoring and Management

Lannex is an operational mine with existing monitoring programmes, all monitoring programmes must continue with revised scope to accommodate for new development. The appointment of a suitably qualified on-site Environmental Control Officer (ECO) is essential to the successful implementation of this project, although this role can be fulfilled by the SHE Representative. The ECO will be responsible for the implementation of the EMP, applicable environmental legislation and any stipulations/conditions set by the relevant competent authorities (including but not limited to the DMRE and DWS). The Environmental officer will conduct formal monthly site inspections and conduct an internal annual audit during the construction and operational phase.

An independent Environmental Control Officer (ECO) should also be appointed to conduct bi-annual (6 monthly) audits for the duration of the construction phase. The Independent ECO should monitor the success and effective implementation of the environmental management measures stipulated by applicable legislation, the EIA&EMPR, and any conditions set by the competent authorities. The ECO audit reports will be submitted to the SHEQ office and the relevant contractors. Submission of audit reports to the DWS and DMRE will be done in accordance with the applicable licences and authorisations. It should be indicated that the ECO can be an existing Samancor employee suitably qualified for the work to be done. The ECO should however not be involved in the day to day management of the site / activity being audited.

26.2.1 SPECIFIC MONITORING REQUIREMENTS

Monitoring of the proposed development (both on site and where appropriate in the surrounding environments) should be considered a high priority and should be conducted in accordance with the relevant specialist monitoring recommendations as summarized below in Section 26.3:

26.2.2 MONITORING PROTOCOL

It is essential that during the construction and operational phase of the proposed development that the monitoring of certain elements is carried out to ensure compliance with regulatory bodies. A monitoring protocol for both the construction phase and the operational phase will be required. The monitoring only includes those activities identified in the EMPR and excludes any monitoring that should take place according to the water use license if and when it will be authorized.

26.2.3 MONITORING REQUIREMENTS AND RECORD KEEPING

To ensure that the procedures outlined throughout the EMPR are implemented effectively it will be necessary to monitor the implementation of the EMPR and evaluate the success of achieving the objectives listed in the EMPR. To ensure that all personnel on site are aware of their obligation to protect the environment, induction training will also include environmental awareness.

The audit procedure will include a Compliance audit, conducted by the Environmental Control Officer. Where the objectives of the EMPR are not being met the reasons will be determined and remedial action or variation to the tasks will be recommended. Major residual effects shall be documented in a Non-Conformance Report, during the construction and operational phases. Follow-up audits will be conducted as per the audit protocol in the EMPR or as prescribed within legislation.

26.3. PROPOSED MONITORING PROGRAMME

26.3.1 Fauna and Flora

26.3.1.1. Monitoring

An ECO or appropriately appointed person must ensure that all impacts remain within the approved footprint and remains in compliance with the approved EMPr.

Monitoring of the terrestrial ecology should be done on an annual basis to assess whether there are any concerns regarding the flora. Monitoring of the flora should start as soon as the construction phase of the development commences. The monitoring should include the following:

- Annual terrestrial ecology monitoring of surrounding areas to determine if vegetation in undisturbed areas is being impacted. Photographic record of monitoring sites should be kept for comparison between monitoring events.
- Annual alien invasive plant monitoring, eradication and control programme.
- Implement an Observe and Report approach which will enable employees to report any disturbance of fauna or degradation that they encounter during the operational phase.

Monitor the ecological characteristics, rehabilitation and recovery after decommissioning until it is self-sustaining and a closure certificate is obtained.

26.3.2 SURFACE WATER MONITORING

The Table below indicate the proposed Water quality monitoring parameters to be monitored on a monthly frequency during the various phases of the mine, however Lannex Section will only implement monitoring of the parameters required by the DWS and included in the new Water Use Licence (WUL) once it is received based on the 2021 WUL application. In addition, the Water use licence will specify the frequency of the monitoring to be conducted and this will be implemented by Lannex Section.

Variable	Unit
Aluminium as Al	mg/l
Calcium as Ca	mg/l
Chloride as Cl	mg/l
Chromium 3^+	mg/l
Chromium 6^+	mg/l
Electrical Conductivity as EC	mS/m
Fluoride as F	mg/l
Iron as Fe	mg/l
Magnesium as Mg	mg/l
Manganese as Mn	mg/l
Nitrate as NO_3	mg/l
pH	pH Units
Potassium as K	mg/l
Phosphate as P	mg/l
Sodium as Na	mg/l
Sulphate as SO_4	mg/l
Suspended solids as SS	mg/l
Total alkalinity	mg/l
Total Dissolved Solids as TDS	mg/l
Total hardness as $CaCO_3$	mg/l

The existing surface water monitoring points are and these are monitored on a Quarterly basis:

Site name	Coordinate (° WGS84)		Type	Description
	Ycoord	Xcoord		
LNX Storm water dam	-24,7707	30,166943	Dam	Lannex Storm Water Dam
LRA	24,71974	30,197	River or stream	Last point at river
LRB	24,73023	30,185	River or stream	Water extraction for Smelter
LRC	24,76414	30,16161	River or stream	Under Samancor Eastern Chrome Mines

LRD	24,80862	30,10469	River or stream	Below extraction
LSR01	-24,772362	30,157948	River or stream	Lannex Mine Upper Steelpoort River
LSR02	-24,763977	30,1615	River or stream	Lannex Mine Lower Steelpoort River
RWD-LNX	-24,770653	30,16695	Return water dam	Lannex Return Water Dam
Tailings-LNX	-24,765818	30,172993	Dam	Lannex Tailings Dam
RWD OF-LNX			Overflow	Lannex Return Water Dam Overflow

As a result of the proposed new activities the following additional site have been identifie. Coordinates have not been identified due to the phased nature of the opencast activities and that due to the phased approach the monitoring location will change as the opencast progress. Lannex Section is committed to monitor the affected water resources as per the frequency that will be included in the Water Use Licence.

Table 26-1: Proposed additional Surface Water monitoring programme

Location	Aspect	Parameters	Frequency
River diversions	Vegetation establishment and alien invasive plant determination and removal	Vegetation cover and vegetation species	Annually
Upstream of Opencasts in watercourses	Groundwater quality	Electrical conductivity	Quarterly
		Sodium	
		Sulphate	
		Chemical oxygen Demand	
	Surface water quality when flowing	Chloride	Monthly
Downstream of opencast in watercourses	Groundwater quality	Nitrate	Quarterly
		Ammonia	
	Surface water quality when flowing		Monthly
Backfilled opencast in watercourses	Connectivity if upstream and downstream	Is a river bed and banks formed?	Annually
	Erosion	Has the material that was backfilled moved and is it resulting in siltation downstream?	Annually
	Vegetation establishment	Vegetation cover and species composition	Annually
Storm water dam /	Overflow water quality	Electrical conductivity	Daily (for discharges to the environment during incidents of extreme rainfall)
Return water dam		Sodium	
		Sulphate	
		Chemical oxygen Demand	
		Chloride	
		Nitrate	
		Ammonia	
	Water levels	Free board	Daily
	Overflow volume	Volume	Daily
All TSFs and associated infrastructure	Rainfall	One location at Site only	Daily
	Water balance	For the complete Lannex Site	Monthly
	Toe seepage Quality	Electrical conductivity	Monthly

Location	Aspect	Parameters	Frequency
		Sodium	
		Sulphate	
		Chloride	
		Nitrate	
		Ammonia	
	Toe seepage volume	Volume	Monthly
	Water infiltration of waste	Volume	Monthly

26.3.3 GROUNDWATER MONITORING SYSTEM

A groundwater monitoring system has to adhere to the criteria mentioned below. As a result, the system should be developed accordingly.

26.3.3.1. Source, plume, impact and background monitoring

A groundwater monitoring network should contain monitoring positions which can assess the groundwater status at certain areas. The boreholes can be grouped classification according to the following purposes:

- **Source monitoring:** Monitoring boreholes are placed close to or in the source of contamination to evaluate the impact thereof on the groundwater chemistry.
- **Plume monitoring:** Monitoring boreholes are placed in the primary groundwater plume's migration path to evaluate the migration rates and chemical changes along the pathway.
- **Impact monitoring:** Monitoring of possible impacts of contaminated groundwater on sensitive ecosystems or other receptors. These monitoring points are also installed as early warning systems for contamination break-through at areas of concern.
- **Background monitoring:** Background groundwater quality is essential to evaluate the impact of a specific action/pollution source on the groundwater chemistry.

26.3.3.2. System Response Monitoring Network

Groundwater levels: The response of water levels to abstraction is monitored. Static water levels are also used to determine the flow direction and hydraulic gradient within an aquifer. Where possible all of the above-mentioned borehole's water levels need to be recorded during each monitoring event.

26.3.3.3. Monitoring Frequency

In the operational phase and closure phase, Quarterly monitoring of groundwater quality and groundwater levels is recommended. Quality monitoring should take place before after and during the wet season, i.e. during September and March. It is important to note that a groundwater monitoring network should also be dynamic. This means that the network should be extended over time to accommodate the migration of contaminants through the aquifer as well as the expansion of infrastructure and/or addition of possible pollution sources. An audit on the monitoring network should be conducted annually.

Additional boreholes should be drilled () for calibration and background monitoring. These boreholes should be sited by means of a geophysical survey.

26.3.3.4. Monitoring Parameters

The identification of the monitoring parameters is crucial and depends on the chemistry of possible pollution sources. They comprise a set of physical and/or chemical parameters (e.g. groundwater levels and predetermined organic and inorganic chemical constituents). Once a pollution indicator has been identified it can be used as a substitute to full analysis and therefore save costs. The use of pollution indicators should be validated on a regular basis in the different sampling positions. The parameters should be revised after each sampling event; some metals may be added to the analyses during the operational phase, especially if the pH drops. The paramaters for analysing groundwater will be provided in the water use license that is being applied for by Lannex.

26.3.3.5. Monitoring Boreholes

DWAF (1998) states that "A monitoring hole must be such that the section of the groundwater most likely to be polluted first, is suitably penetrated to ensure the most realistic monitoring result."

Currently a monitoring network does exist for the mine. The recommended boreholes for the new proposed LNX TSF1 are listed in Table 26-2 and the areas to site these monitoring boreholes are shown in Figure 26-1. These boreholes can be utilised for water level monitoring during operations, as well as groundwater quality monitoring after decommissioning of the site. Additional monitoring borehole positions were also listed around the planned opencast options.

In addition, monitoring boreholes are recommended in the areas to where underground mining will be extended to (Figure 26-2), and listed in Table 26-2. These boreholes should be drilled to the depth of first water strike, but at least 30 meters deep to ensure that deeper circulation groundwater is sampled. The softs must be sealed off by solid casing which must be raised above surface to prevent surface runoff to enter the borehole.

Table 26-2: Revised monitoring position for Lannex Mine

Borehole No	Description	Frequency	WUL	Coordinates		Comments
				South	North	
SRK 08	Borehole	Quarterly	Yes	-24.7606	30.1702	Monitoring
SRK09	Borehole	Quarterly	Yes	-24.7675	30.1701	Monitoring
SRK10	Borehole	Quarterly	Yes	-24.7716	30.1702	Monitoring
New BH01	Borehole	Quarterly	No	-24.7685	30.1675	Monitoring
New BH02	Borehole	Quarterly	No	-24.7694	30.1667	Monitoring
New BH03	Borehole	Quarterly	No	-24.7714	30.1651	Monitoring
New BH04	Borehole	Quarterly	No	-24.7744	30.1679	Monitoring
New BH	Borehole	Quarterly	Yes	-24.7657	30.1623	In use
BH 01	Borehole	Quarterly	Yes	-24.4591	30.0973	In use
BH 05	Borehole	Quarterly	Yes	-24.7169	30.2029	Monitoring
BH 09	Borehole	Quarterly	Yes	-24.7646	30.162	In use
LNX MBH 01	Borehole	Quarterly	No	-24.7882	30.1694	Monitoring
LNX MBH 02	Borehole	Quarterly	No	-24.7731	30.1654	Monitoring
LNX MBH 03	Borehole	Quarterly	No	-24.1671	30.1683	Monitoring
LNX MBH 04	Borehole	Quarterly	No	-24.7661	30.1713	Monitoring
LNX MBH 05	Borehole	Quarterly	No	-24.7665	30.16376	Monitoring
LNX MBH 06	Borehole	Quarterly	No	-24.76842	30.16682	Monitoring
LNX MBH 07	Borehole	Quarterly	No	-24.77033	30.16512	Monitoring

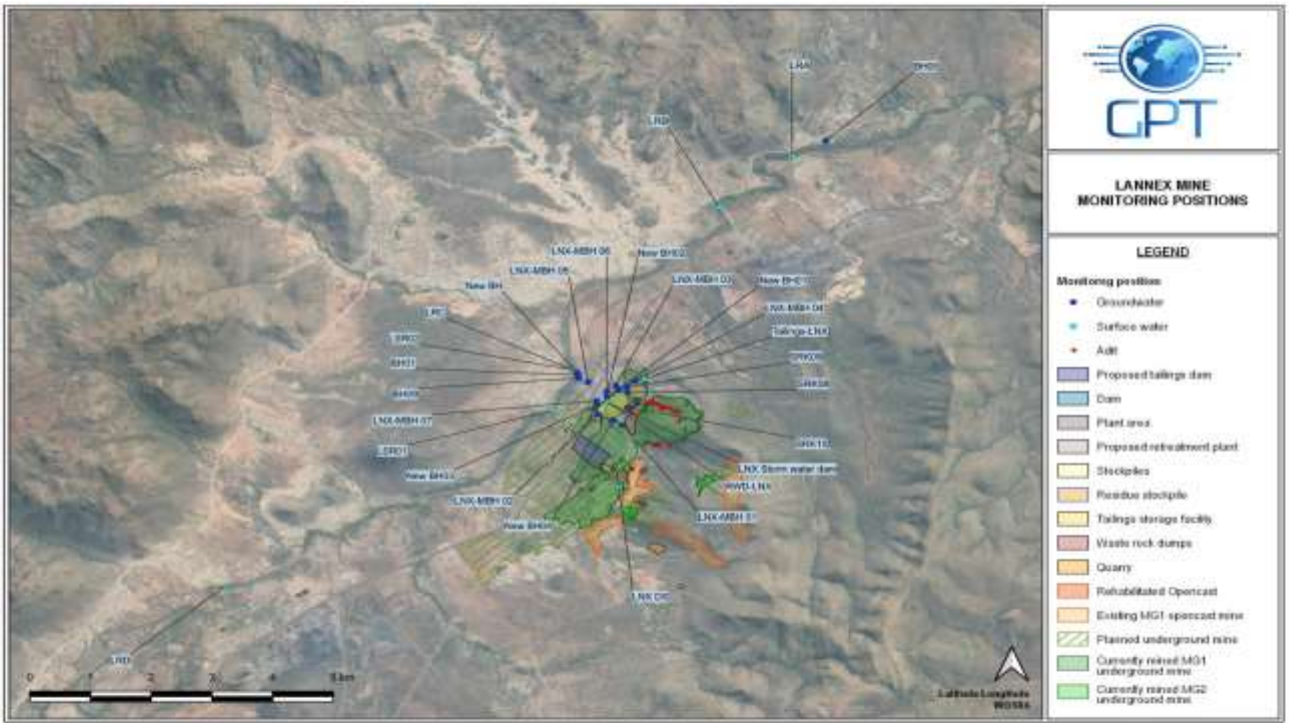

Figure 26-1: Proposed monitoring positions for surface infrastructure (new boreholes to be sited by geophysics)

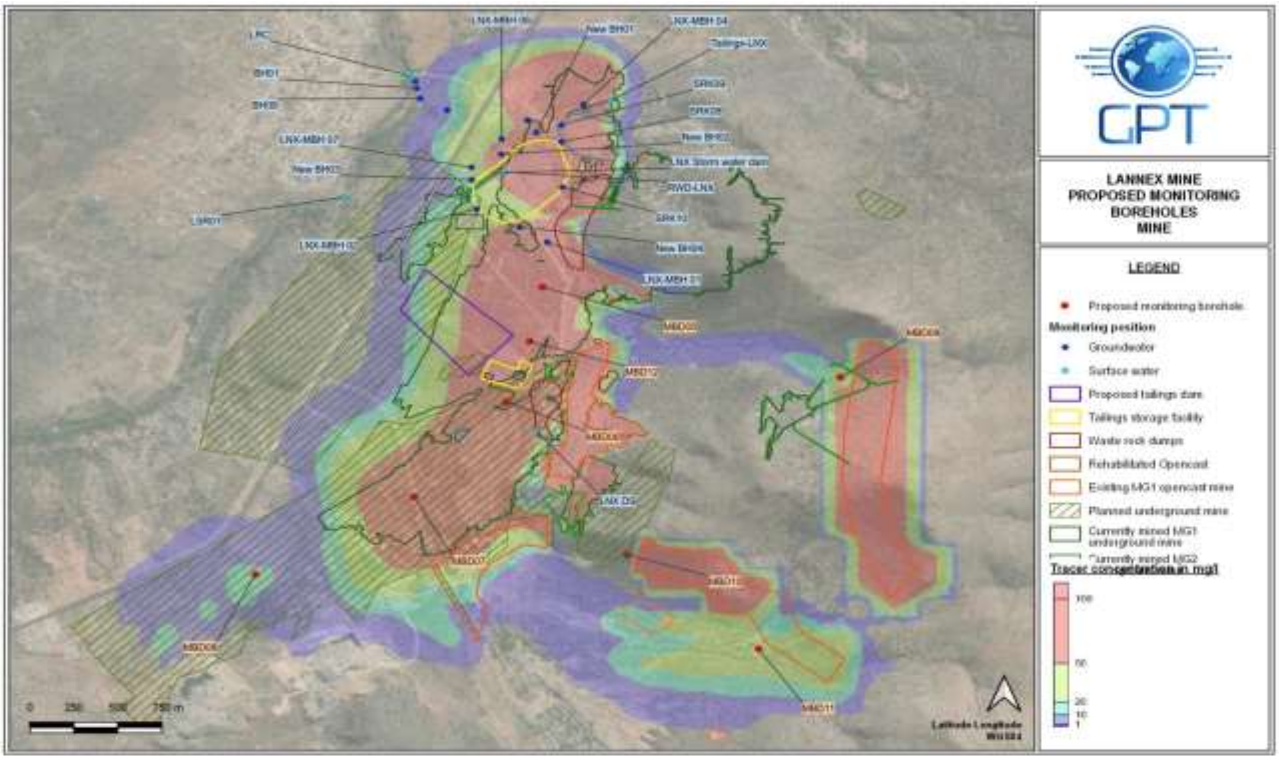

Figure 26-2: Proposed monitoring positions for mining activity (new boreholes to be sited by geophysics)

26.3.4 AIR QUALITY MONITORING

A monitoring program does exist for the current Lannex operations. Details of this can be found below in Table 26-3 and Figure 26-3.

Table 26-3: Current monitoring campaign dust fallout results for 2019

Coordinate (° WGS84)			mg/m²/day					
Name	**X**	**Y**	**Jan-19**	**Feb-19**	**Mar-19**	**Apr-19**	**May-19**	**Jun-19**
North	30.17489	-24.7659	621	356	337	326	271	466
North West	30.16949	-24.768	699	464	579	465	218	746
West	30.17015	-24.7731	282	355	451	462	277	358
South West	30.17041	-24.7834	296	292	385	336	278	307
South	30.17026	-24.7866	272	183	127	154	112	153
South East	30.17161	-24.7786	269	241	269	284	258	243
East	30.17015	-24.7731	234	261	309	236	133	170
North East	30.17299	-24.7693	507	336	246	0	140	NA

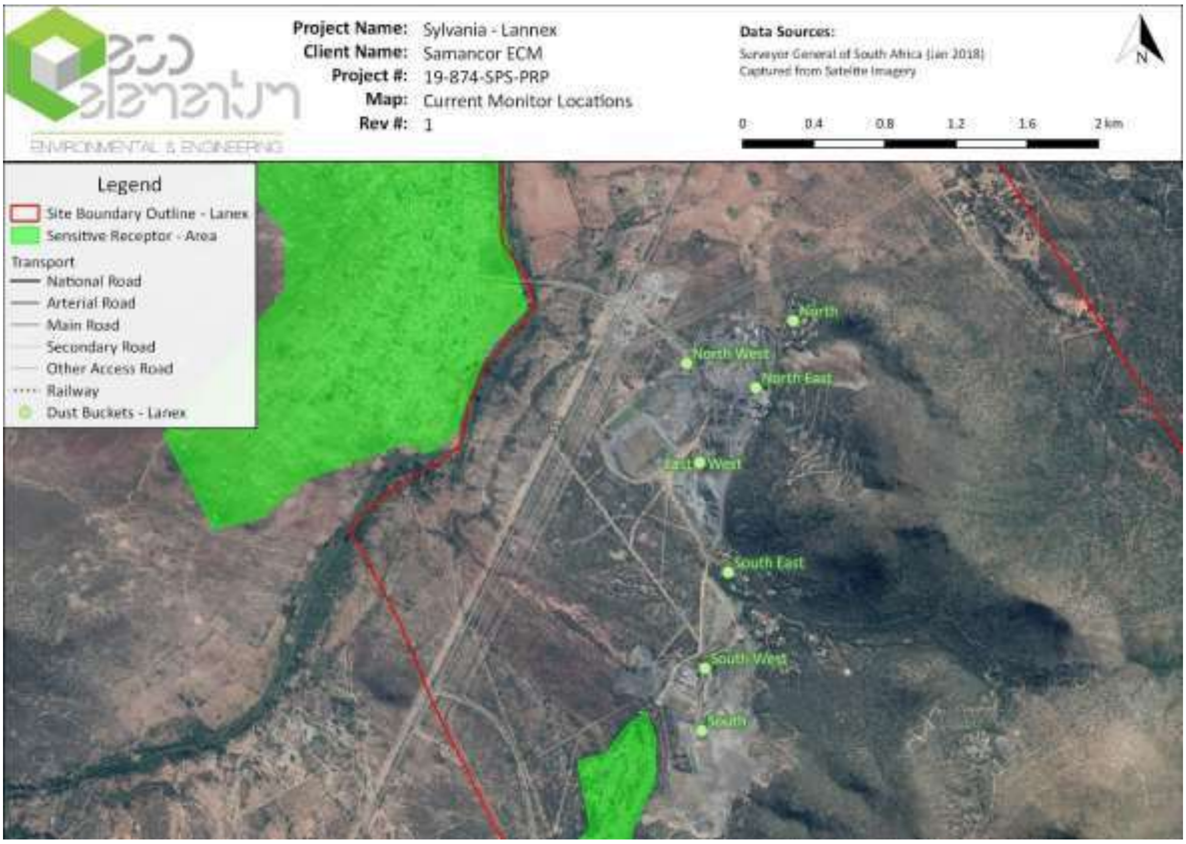

Figure 26-3: Current Air Quality Monitoring Locations

26.3.4.1. Gravimetrical Dust Fallout

Although a monitoring campaign does exist, it is recommended to expand the monitoring campaign to cover the expansion of the Lannex project area. Proposed new locations for the expansion project can be found below in Figure 26-4. The expanded monitoring campaign should be combined with the current monitoring campaign to cover both the current and expansion operations.

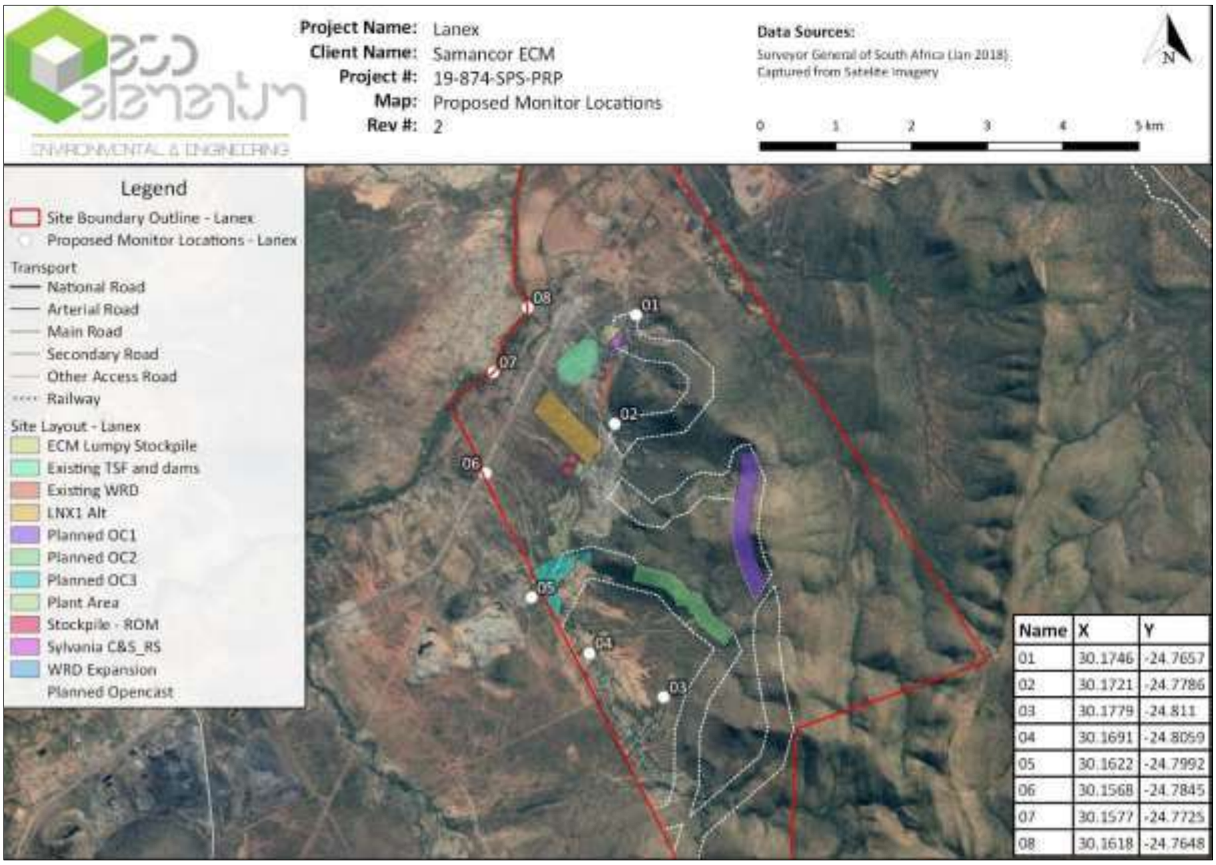

Figure 26-4: Proposed Additional Air Quality Monitoring Locations

Site layout for sampling points must be carried out according to the eight main compass directions; the site layout and equipment placement must be done in accordance with the ASTM standard, D 1739 – 2010, thereafter relevant sampling reference numbers willbe allocated to the receptors accordingly. At each gravimetric dust fallout gauge/receptor point there is a stand built according to specification containing the dust sample collection bucket. Samples will be collected after a 1 month running period (+-30 day's exposure). After sample collection, the samples are taken to a SANAS accredited laboratory as required. A visual site investigation isdone where after correlations are drawn and findings are identified and reported on.

Dust buckets of a standard size and shape are prepared and set up at locations related to the eight main compass points on the borders of the property so that dust can settle in them for periods of 30+/-2 days. The dust buckets are then sealed and replaced with new empty ones and send away to the SANAS accredited laboratory for analysis. The masses of the water-soluble and –insoluble components of the material collected are then determined and results are reported as mg/m²/day. This methodology is described according to SouthAfrican National Standards 1929:2004 and the American Society for Testing and Materials (ASTM) Designation: D 1739-98 (2010). The results for this method of testing are obtained by gravimetrical weighing. The apparatus required include open top buckets/containersnot less than 150 mm in diameter with a height not less than twice its diameter. The buckets must be placed on a stand at a height of2 +/-0.2 m above the ground.

26.3.4.2. Particulate Matter (PM10)

It is recommended that the client should establish a fine particulate monitoring programme, which should include one particulate instrument to monitor PM10 and preferably PM2.5 specifically at the problem areas shown by the passive sampling campaign at the residential areas. Handheld sampling instruments not only allows for sampling in the 8 main wind directions, but also on-site sampling down-wind of potential dust sources to quantify and determine impacts that need to be managed. It is advised to conduct this sampling on a monthly basis but also when the need arise during periods of elevated dust

concentrations being emanated from the site. Based on the recommendation made by the Air Quality Specialst, ECM propose to conduct handheld sampling for 12 months following the approval of the amended EIA/EMPr on a monthly basis using handheld instruments.
Air quality (PM10) monitoring will be discussed with the appointed specialist and a programme developed at the following locations:

- North Village;
- South Village; and
- Tubatse Village.
- This will allow a trend / baseline to be conducted that could be used in future assessments. Should the monitoring indicated elevated PM10 Levels Lannex will assess the possibility to extend the monitoring programme for a longer period.

26.3.4.3. Remote Active Indicative Real-time ambient Particulate Dust Monitoring

New technology to perform cost effective real-time dust and particulate matter is currently becoming a cost-effective option. This type of technology can record real-time wind speed and direction together with particulate concentrations. It can thus be used more effectively for management purposes. Actionable intelligence is generated on dust and particulate matter emissions, which in turn can then be used to determine the origin of the particulate emissions. In a scenario where mining operations are situated in close proximity to each other and residential areas, this type of technology can become instrumental in decision making on the management of dust for a mining operation

- **EcoElementum** is currently at a very advanced stage of developing a cost effective, certified, Remote Active Indicative Real-Time Particulate Matter Dust Monitoring solution;
- This particular service offering is backed up and supported by a team of experienced Environmental Scientists, Electronic and Information Technology Engineers.
- Our dust monitoring stations are proudly manufactured in-house in South Africa.
- The design allows to have full remote telemetry with real-time live feed alerts for corrective actions.
- Stations incorporate sensors for single or simultaneously Particulate Matter fraction measurements ranging from Pm_1 to Pm_{10}
- In addition to this the stations also include weather sensors to ensure ease of integrated data interpretation, analysis and future predictive modelling.
- Units are wireless, mobile and solar powered with built in battery banks, to allow the stations to run for up to 10 days during inclement weather.
- Data is pushed via FTP to our secure cloud-based server, or can be viewed/accessed via any web-enabled device on our remote monitoring data portal.

26.3.5 Noise Monitoring

Measurements to be made using the equivalent continuous A-weighted sound pressure level, LAEQ,I, in accordance with the South African Bureau of Standards (SABS) code of practice for noise measurement and assessment, SANS 10103:2008.

The number of complaints with regards to noise must be logged, including the name of the receptor, the location, nature of sound and the time when the noise were experienced.

Bi-annual noise monitoring should take place over a 24 hour period at the location of the two closest receptors.

26.3.6 Waste Monitoring

The following waste needs to be monitored:

- The tons and volumes of waste rock deposited and removed from the waste rock stockpile area. The totals need to be provided on a monthly basis.

- Volume of used oil removed from site. The totals need to be provided on a monthly basis
- General waste removed from the site by the appointed contractor. The totals need to be provided on a monthly basis.
- Volume of sewage removed from septic tanks by the appointed contractor.
- The volumes of tailings deposited on the operational tailings dam.
- The volume of tailings and source of tailings used by the appointed contractor as part of the re-treatment project.
- The monitoring requirements as outlined in the Water and Salt Balance report to update these balance.
- Weight / Volumes of general waste removed from site.

26.3.7 VEGETATION MONITORING

The establishment of vegetation during all mining phases needs to be investigated for the presence of alien invasive species. This assessment should be done on a yearly basis.

During continuous rehabilitation vegetation establishment on rehabilitated areas need to be monitored annually. During the post closure phase monitoring of vegetation is proposed on an annual basis and every 2 years.

26.3.8 ENVIRONMENTAL INCIDENTS

An environmental incident is defined as any unplanned event that results in actual or potential damage to the environment, whether of a serious or non-serious nature. An incident may involve non-conformance with environmental legal requirements, the requirements of the EMPR, or contravention of written or verbal orders given by the ECO or relevant authority.

In the event of any incident, an Environmental Incident Log should be completed and these reports should be kept on file by the Environmental Manager. Such reports should provide the following details:

- Date of the Incident (and time if relevant);
- Description of the nature of the incident (what happened);
- Explanation for current conditions (why it happened), responsible person, supporting photographs etc.
- Description of corrective actions taken.

Corrective action to mitigate the impact (appropriate to the nature and scale of the incident) should be conducted immediately and affected parties notified.

In the case of serious incidents or emergencies, the incident report should be sent to the relevant authority as soon as possible after the incident has been recorded.

26.3.9 WATER POLLUTION EMERGENCY INCIDENT

Water pollution emergency incident is any accident /incident in which a substance pollutes or has the potential to pollute a water resource or a substance that has or is likely to have a detrimental effect on a water resource.

The responsible person who was in control of the substance involved in the incident at the time or responsible for the section the incident occurred will immediately inform the superior of the area where the incident occurred.

The information with regard to the incident is communicated to the Business Manager, SHEQ Manager and Security Personnel immediately by the superior of the area.

The SHEQ Manager and the General Manager must, as soon as reasonably practicable after obtaining the knowledge of the incident, (i.e. within 14 days) report to:

- DWS (Regional Manager);
- South African Police Services or relevant fire department; and
- The Catchment Management Agency.

The SHEQ Manager and crisis management team must

- Take all reasonable measures to contain and minimise the effects of the incident;
- Undertake clean-up procedures;
- Remedy the effects of the incidents; and
- Sample the water together with the responsible person of the area.
-

26.3.10 AIR POLLUTION EMERGENCY INCIDENTS

The recommendation by the air quality specialist (2020) was amended to indicate that should it become a requirement ECM will comply with the requirements of any air quality registrations certificates should any be issued by the responsible authority. ECM Lannex section will comply with any reporting requirements in such a certificate / licence.

- .

26.3.11 PENALTIES AND FINES FOR NON-COMPLIANCE OR MISCONDUCT

This EMPR will form part of the contract agreement between the Client and any contractor appointed by ECM or performing operations on behalf of ECM. As such, non-compliance with conditions of the EMPR will amount to a breach of contract. ECM may issue penalties directly to the contractor in the event of non-compliance to the EMPR specifications. The issuing of a penalty will be preceded by a verbal warning by ECM, as well as strict instruction in at least one monthly ECM appointed ECO report to rectify the situation. The ECO and applicant will communicate with regards to realistic time-frames for possible rectification of the contravention, and possible consequences of continued non-compliance to the EMPR.

Penalties incurred do not preclude prosecution under any other law. Cost of rehabilitation and/or repair of environmental resources that were harmed by the actions of the contractor if such actions were in contravention of the specifications of the EMPR will be borne by the contractor himself. Penalties may be issued over and above such costs. The repair or rehabilitation of any environmental damage caused by non-compliance with the EMPR cannot be claimed in the Contract Bill, nor can any extension of time be claimed for such works. Penalty amounts shall be deducted from Certificate payments made to the Contractor.

The following categories of non-compliance are an indication of the severity of the contravention, and the fine or penalty amounts may be adjusted depending on the seriousness of the infringement.

- Category One – Acts of non-compliance that are unsightly, a nuisance or disruptive to adjacent landowners, existing communities, tourists or persons passing through the area.
- Category Two – Acts of non-compliance that cause minor environmental impact or localized disturbance.
- Category Three – Acts of non-compliance that affect significant environmental impact extending beyond point source.
- Category Four – Acts of non-compliance that result in major environmental impact affecting large areas, site character, protected species or conservation areas.

27. *INDICATE THE FREQUENCY OF THE SUBMISSION OF THE PERFORMANCE ASSESSMENT REPORT*

Yearly performance assessment reports are recommended as it is a running mine and annual performance assessment reports are complied, it is recommended that all monitoring programmes proposed in the current EMPR are upheld and included moving forward.

28. ENVIRONMENTAL AWARENESS PLAN

28.1. MANNER IN WHICH THE APPLICANT INTENDS TO INFORM HIS OR HER EMPLOYEES OF ANY ENVIRONMENTAL RISK WHICH MAY RESULT FROM THEIR WORK.

Environmental awareness training is critical for two primary reasons:

a) The workforce must understand how they can play a role in achieving the objectives specified in the EMPR; and
b) The workforce must understand their obligations in terms of the implementation of the EMPR and adherence to environmental-legislative requirements.

This environmental awareness plan is aimed at ensuring that employees, contractors, subcontractors and other relevant parties are aware of and able to meet their environmental commitments. This plan is to be updated on a yearly basis during the construction and operational phases of the project in light of operational changes, learning experiences and identified training needs.

All full time staff and contractors are required to attend an induction session when they start, which session should include environmental aspects.

It is therefore recommended that the ECO/Environmental Manager be involved in induction training. The induction sessions may be modified / adapted based on the audience attending the specific session, but it should ensure that all employees gain a suitable understanding of:

- Environmental requirements of the project, and how these will be implemented and monitored,
- including each employee's responsibilities with respect to environmental issues;
- Contents and commitments of the EMPR, including no-go areas, employee conduct, pollution prevention (prohibitions against littering, unauthorized fires, loud music, entry to adjacent properties, road conduct etc.);
- Environmentally sensitive areas on and around the proposed development sites, including why these are deemed important and how these are to be managed. Employees will also be made aware of protected species found on the site and how these are to be conserved, as well as alien invasive species potentially found on the site and how these should be managed; and
- Incident identification, remediation and reporting requirements: what constitutes an environmental incident (spillages, fire etc.) and how to react when such an incident occurs.

Environmental training will not be restricted to induction training sessions alone, but will be conducted on an on-going basis throughout the lifecycle of the project as and when required. Records are to be kept of the type of training given (matters discussed and by whom), date on which training was given and the attendees of each training session.

28.2. MANNER IN WHICH RISKS WILL BE DEALT WITH IN ORDER TO AVOID POLLUTION OR THE DEGRADATION OF THE ENVIRONMENT.

28.2.1 OBJECTIVES

The following requirements of ISO14001 are relevant to the Lannex:

- The organisation shall establish, implement and maintain a procedure(s) to identify potential emergency situations and potential accidents that can have an impact(s) on the environment and how it will respond to them.
- The organisation shall respond to actual emergency situations and accidents and prevent or mitigate associated adverse environmental impacts.
- The organisation shall periodically review and, where necessary, revise its emergency preparedness and response procedures, in particular, after the occurrence of accidents or

emergency situations.
- The organisation shall also periodically test such procedures where practicable.

28.2.2 IDENTIFICATION OF ENVIRONMENTAL RISKS

Environmental risks must be identified and procedures must be set in place by the SHPM to deal with potential environmental risks, which could include:
- Environmental emergency situations;
- Potential accidents that can have an impact on the environment; and
- General environmental ignorance that could lead to unnecessary pollution or disturbance to the environment.

Potential environmental risks identified on Lannex mine include:
- Petrochemical/chemical spillages;
- Hazardous material spillages;
- Uncontrolled emissions to the atmosphere;
- Fires;
- Tailings spillages and tailings dam failures;
- Untreated effluent spillages;
- Explosions and natural disasters;
- Disturbance of sensitive ecological environments;
- Disturbance to heritage and cultural resources;
- Uncontrolled erosion; and
- Dissatisfaction of local communities / outrage of communities.

28.2.3 RISK MATRIX

28.2.3.1. Risk Calculation

Exposure X Probability X Result (Consequence) = Risk Rating

28.2.3.2. Risk Reduction

Exposure X Probability X Result (Consequence after mitigation steps are implemented) = Risk Rating after Mitigation

28.2.3.3. Risk Level:

400 <	=	Very High risk, discontinuation considered immediate correction required
200 – 400	=	High risk, immediate correction required
70 – 200	=	Medium / Substantial risk, mitigation required
20 – 70	=	Low / Possible risk, mitigate when required
>20	=	Tolerable risk, report to Supervisor when complete

PROBABILITY OF EVENT OCCURRING	RISK	EXPOSURE TO EVENT	RISK
Almost Certain	10	Yearly	0.5
Has happened	6	Quarterly	1
Possible	3	Monthly	2
Heard of	1	Weekly	3
Unlikely	0.5	Daily	6
		Continuous	10

RESULT (CONSEQUENCE)	RISK RATING
Catastrophic Environmental Impact Irreversible / regional degradation of the biophysical environment, biodiversity compromised on regional scale, formal complaints with clear expectations of corrective actions, impact on immediate and remote neighbours	100

Major Environmental Impact. Irreversible and localized degradation of the biophysical environment, biodiversity compromised on local scale, formal complaints with clear expectations of corrective actions, impact on immediate neighbours (level 3)	40
Very Serious Environmental Impact Irreversible and localized degradation of the biophysical environment, biodiversity compromised on local scale, formal complaints with clear expectations of corrective actions, impact on immediate neighbours (level 2)	15
Serious Environmental Impact Reversible and localized degradation of the biophysical environment, biodiversity not compromised, low-level complaints, no perceived expectations of corrective action(level 1)	7
Self-reversible impact within life of business. No reasonable cause for external complaints	3
Minor environmental incident. Very low impact on biophysical environment, No reasonable cause for external complaints	1

29. *SPECIFIC INFORMATION REQUIRED BY THE COMPETENT AUTHORITY*

(among others, confirm that the financial provision will be reviewed annually).

All potential risks have been identified within this document and are to be communicated to all contractors and relevant staff. Environmental training needs for each section should be identified and addressed to ensure environmental management is part of day-to-day operations.

An environmental audit report will be submitted annually as per DMRE requirements.

The financial provision will be updated on an annual basis and submitted to the DMRE.

30. *UNDERTAKINGS*

The EAP, Prescali Environmental Consultants, herewith confirms

a) The correctness of the information provided in the reports;

b) The inclusion of comments and inputs from stakeholders and I&AP's;

c) The inclusion of inputs and recommendations from the specialist reports where relevant; and

d) The acceptability of the project in relation to the finding of the assessment and level of mitigation proposed;

Signed at..on this............................ day ....

Signature of EAP...

Designation ....

-END-

31. REFERENCES

Anon., 2008. *Mineral Council South Africa.* [Online] Available at: https://www.mineralscouncil.org.za/

Anon., 2012. *Mining Weekly.* [Online] Available at: www.miningweekly.com/

Anon., 2019. *Roskill.* [Online] Available at: https://roskill.com/market-report/chromium/

Baily, A. & Pitman, W., 2015. *Water Resources of South Africa 2012 Study (WR2012). WRC Report K5/2143/1.,* Pretoria: Water Research Commission.

Bergh, J. (., 1999. *Geskiedenisatlas van Suid-Afrika. Die vier noordelike provinsies..* Pretoria: J.L. van Schaik..

Chief Surveyor General's Database, 2017. *Documents CSG Document 10KIKQ01.,* s.l.: s.n.

CSIR, 2018. *National Wetland Map 5 and Confidence Map [Vector] 2018. Downloaded 20 August 2020.,* Pretoria: Council for Scientific and Industrial Research. B-GIS website.

CSIR, 2018. *River ecosystem threat status and protection level (Shapefile) [Vector] 2018. Available from the Biodiversity GIS website, downloaded on 20 August 2020,* Pretoria: Council for Scientific and Industrial Research.

DEAT, 1998. *Environmental Impact Assessment Guidelines.,* Pretoria: DEAT..

DEAT, 2002. *Impact Significance, Integrated Environmental Management, Information series 5.,* Pretoria: DEAT..

DME, 2005. *Guideline document for the evaluation of the quantum of closure-related financial provision provided by a mine.,* Pretoria: DME..

DWAF, 1996. *South African Water Quality Guidelines. Volume 1: Domestic use.,* Pretoria: DWAF..

DWAF, 1996. *South African Water Quality Guidelines. Volume 1: Domestic water use.,* Pretoria: DWAF.

DWAF, 1996. *South African Water Quality Guidelines. Volume 4: Agricultural Water Use: Irrigation.,* Pretoria: DWAF..

DWAF, 1996. *South African Water Quality Guidelines. Volume 5: Agricultural Use: Livestock watering.,* Pretoria: DWAF..

DWAF, 1996. *South African Water Quality Guidelines. Volume 5: Livestock watering.,* Pretoria: DWAF.

DWAF, 1996. *South African Water Quality Guidelines. Volume 7: Aquatic Ecosystems.,* Pretoria: DWAF..

DWAF, 2003. *Limpopo Water Management Area: water resources situation assessment.,* Pretoria: DWAF: Directorate: Water Resources Planning.

DWAF, 2004. *National Water Resource Strategy,* Pretoria: DWAF.

DWAF, 2004. *Olifants Water Management Area. Internal Strategic perspective.,* Pretoria: DWAF..

DWAF, 2005. *A practical field procedure for identification and delineation of wetlands and riparian areas..* Pretoria: Department of Water Affairs and Forestry.

DWAF, 2008. *Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas. Prepared by M. Rountree, A.L. Batchelor, J. MacKenzie and D. Hoare. Draft Report.,* Preotira: DWA.

Envirometrics and MetroGIS, 2009. *Environmental Management Framework for the Olifants and Letaba Rivers Catchment Areas.,* Pretoria: Department of Environmental Affairs.

Erasmus, P., 2014. *Integrated water and waste management plan for International Ferrometals (SA) Pty Ltd,* Pretoria: Prescali Environmental Consultants (Pty) Ltd.

Fenger, J., 2002. *Urban air quality, In J. Austin, P. Brimblecombe and W. Sturges (eds), Air pollution science for the 21st century.* Elsevier: Oxford.

Fetakgomo Greater Tubatse Municipality , 2016. *2016/17 Draft Consolidated IDP for Fetakgomo Greater Tubatse Municipality.,* s.l.: s.n.

Forster, N., DeMeo, T. & Ditto, N.D., 1995. Environmentally sensitive areas: a template for developing greenway corridors.. *Landscape and Urban Planning: 33,* pp. 159-177.

Fourie, W., 2008. *Archaeological Impact Assessment. Proposed Mining Development for Mooihoek Chrome Mine, Burgersfort, Limpopo Province. Unpublished Report Matakoma- ARM Heritage Contracts Unit. For: Digby Wells & Associates. January 2008.,* s.l.: s.n.

Geo Pollution Technologies – Gauteng (Pty) Ltd, 2015. *Hydrogeological Report, for the Proposed Grasvally & Zoetveld Mining Operations, Limpopo Province,* s.l.: s.n.

GTLM, 2016/17. *Final Integrated Development Plan 2016/17-2020/21,* s.l.: s.n.

Harrison, R. a. v. G. R., 1998. *Atmospheric Aerosols..* Great Britain: John Wiley.

Havenga, C. P. W. a. B. A., 2006. *Hydrological and Hydraulic modelling of the Nyl River Floodplain, Part 1: Background and Modelling.* s.l.:Department of Water Affairs and Forestry & Steward Scott International.

Huffman, T., 2007. *Handbook to the Iron Age: The Archaeology of Pre-Colonial Farming Societies in Southern Africa..* Scotsville: University of KwaZulu-Natal Press.

Hunter, L., P, H. & JC, R., 2013. *Mammals of Africa: Panthera pardus Leopard,* London: Hoffman M editors.

IPCC, 2006. *Guidelines for National Greenhouse Gas Inventories.,* Geneva, Switzerland: UNEP..

Kaonga, B. a. K. N., 2009. *Atmospherinc Particulate Matter in the Marikana Mining Area of Rusternburg.* 34, 271-279 ed. South Africa: European Journal of Scientific Research.

Kleynhans, C., Thirion, C. & Moolman, J., 2005. *A Level 1 River Ecoregion classification Sytem for South Africa, Lesotho and Swaziland. Report no. N/0000/00/REQ0104.,* Pretoria: Resource Quality Services, DWAF.

Kleynhans, M., 2004. *Hydraulic and hydrological modelling of the Nyl RIver floodplain for environmental impact assessment,* s.l.: University of Witwatersrand, Dissertation for a degree of Master of Science in Enginnering.

Krige, W., 2011. *Surface Water and Hydrological Aspects pertaining to the proposed Volspruit Platinum Mine located on the farm Volspruit 362 KR, Limpopo Province, South Africa,* Rand en Dal (Krugersdorp): African Environmental Develment.

Lambrechts, C. & Erasmus, P., 2015. *Integrated Water and waste managment plan for Sylvania Platinum LTD Volspruit PGM project: Northern and Southern Pit,* Pretoria: MENCO.

Lannex, S. C.-. E. C. M.-. L. S., 2013. *Environmental Impact Assessment and Environmental Management Program for Lannex:,* s.l.: s.n.

Letherby, G., Scott, J. & Williams, M., 2013. *Objectivity and Subjectivity in Social Research.* London: SAGE Publications.

Ltd, P. E. C. (., 2017. *EIA/EMPR for Umnotho weSizwe Resources: Black Chrome Development,* s.l.: s.n.

Marland, G., Boden, T. & Andres, R., 2006. *Global, regional, and national CO2 emissions. Trends: a Compendium of Data on Global Change, Carbon Dioxide Information Analysis Centre, Oak Ridge National Laboratory.,* Oak Ridge, Tennessee, USA: US Department of Energy..

MENCO, 2015. *Surface Water Report For Samancor Chrome Limited, Eastern Chrome Mines Lannex Section on the farms Annex Grootboom 335 KT & Grootboom 336 KT in the Greater Tubatse Local Municipality,* Pretoria: M2 Environmental Connections (Pty) Ltd.

MFE, 2004. *Good Practise Guideline for Atmospheric Dispersion Modelling.,* www.mfe.govt.nz: New Zealand Ministry for the Environment..

Mucina, L. &. R. M., 2006. *The vegetation of South Africa, Lesotho and Swaziland.* Pretoria: South African National Biodiversity Institute.

Newman, J., 1979. *Effects of industrial air pollution on wildlife. Biol. Conserv.* 15(3), 181-190 ed. s.l.:s.n.

Parsons, R., 1995. *South African aquifer system management classification. WRC report No. KV77/95.,* Pretoria: Water Research Commission..

Pelser, A., 2011. *A Heritage Impact Assessment Report for the Proposed Sylvania Resources Volspruit Mine on the farms Volspruit 326 KR and Zoetveld 294 KR, near Mokopane, Limpopo Province..* Unpublished Report Archaetnos cc AE1183P ed. s.l.:EScience Associate.

Pelser, A., 2013. *A Report on the Archaeological Investigation of Late Iron Age Stone Walled Sites Impacted on by the ESKOM Steelpoort-Tubtase Switching Station Located on Portion 5 of the farm Luipershoek 149JS, near Steelpoort, Limpopo.,* s.l.: s.n.

Pistorius, J., 2013. *A Phase I Heritage Impact Assessment (HIA) study for ESKOM'S proposed new 132kV loop-in and loop-out Power Line from the 132KV Jane Furse/Merensky Power Line to the* *proposed new Grootboom Substation in the Steelpoort Valley in the Limpopo Province of Sou,* s.l.: s.n.

Prescali Environmental Consultants (Pty) Ltd, 2017. *Basic Assessment for the Black Chrome Servitude Development,* s.l.: s.n.

Prescali Environmental Consultants (Pty) Ltd, 2017. *EIA/EMPR for Umnotho weSizwe Resources: Black Chrome Development.,* s.l.: s.n.

Scientific Terrestrial Services, 2017. *Terrestrial Ecological Assessment as part of the Environmental Assessment and Authorisation process for the proposed linear development for the Black Chrome project prepared for Prescali Environmental Consultants,* s.l.: s.n.

SRK, C., 2019. *Waste Rock and Tailings Classification and Assessment- Samancor Eastern Chrome Mines,* s.l.: s.n.

STATSSA, 2011. *Statistical release (Revised) Census 2011,* s.l.: s.n.

Stauth, R., Sowman, M. & Grindley, S., 1993. The panel evaluation method: An approach to evaluate controversial resource allocation proposals.. *Environmental Impact Review,* Volume 13, pp. 13 - 35.

Stein, A. et al., 2016. *The IUCN Red List of Threatened Species,* s.l.: s.n.

Swanepoel, L. et al., 2016. *A conservation assessemt of Panthera Pardus,* s.l.: South African Insittute of National Biodiversity and Endagered Wildlife Trust, South Africa.

Tarboton, W., 1987. *The Nyl Floodplain, Fauna and Flora..* Vol. 45 (Special issue devoted to Nylsvlei) ed. Pretoria: Transvaal Nature Conservation Division.

The MSA Group, 2016. *Environmental Impact Assessment and Environmental Management Programme for Black Chrome Project Draft EIA/EMP,* s.l.: s.n.

Tyson, P. & Preston-Whyte, R., 2000. *The weather anc climate of Southern Africa,* Cape Town: Oxford University Pres.

Urban-Econ Development Economists, 2012. *Volspruit Mine Socio-Economic Impact Assessment,* s.l.: s.n.

Van Riet, W. et al., 2001. *Environmental Potential Atlas for South Africa,* s.l.: s.n.

Van Schalkwyk, J., 2013. *Compilation of Construction Environmental Management Programmes for the Steelpoort to Marble Hall 400Kv Powerline and the Steelpoort Integration Project: Heritage Resources Assessment. Unpublished Report 2012/JvS/060. For: Iliso Consulting - Amended Janua,* s.l.: s.n.

Van Wyk, B. V. O. B. &. G. N., 2009. *Medicinal Plants of South Africa..* 2nd edition ed. Pretoria: Briza Publications.

32. *APPENDICES*

Appendix 1: Qualifications and Resume of EAP

Appendix 2: Curriculum Vitae of EAPs

Appendix 3: Locality Plans

Appendix 4: Site layout plan

Appendix 5: Specialist reports
Appendix 5.1: Terrestrial Ecology Assessment
Appendix 5.2: Invasive Alien Plants
Appendix 5.3: Surface Water Assessment
Appendix 5.4: Floodline Impact Assessment
Appendix 5.5: Geohydrological Impact Assessment
Appendix 5.6: Agricultural potential, Soil and Land Capability Assessment
Appendix 5.7: Visual Impact Assessment
Appendix 5.8: Air Quality Impact Assessment
Appendix 5.9: Noise Impact Assessment
Appendix 5.10: Paleontological Impact Assessment
Appendix 5.11: Heritage Impact Assessment
Appendix 5.12: Socio- Economic Impact Assessment
Appendix 5.13: Blasting Impact Assessment
Appendix 5.14: Climate Change Assessment
Appendix 5.15: Geotechnical Investigation Report
Appendix 5.16: Waste Classification
SRK Report
Overburden Report

Appendix 6: Public Participation Documents

Appendix 7: Design Report for Lannex TSF and WRD

Appendix 8: Tailings Storage Facility-Site Alternative Assessment

Appendix 9: Final Surface Infrastructure

Appendix 10: Quantum Calculations