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# SOIL, LAND USE AND LAND CAPABILITY SCOPING REPORT AS PART OF THE ENVIRONMENTAL AUTHORISATION PROCESS FOR THE PROPOSED DEVELOPMENT AT WONDERSTONE DRIEKUIL MINE, OTTOSDAL, NORTHWEST PROVINCE

## Prepared for

EnviroGistics
Permitting | Compliance | Consulting

## March 2022

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The table below provides the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) Regulations 2017 (as amended in 2014) for Specialist Reports and also the relevant sections in the reports where these requirements are addressed.

| NEMA Regulations (2017) - Appendix 6 | Relevant section in report |
|---|---|
| (1) A specialist report prepared in terms of these Regulations must contain - | |
| (a) details of - | |
| (i) the specialist who prepared the report; and | Appendix B |
| (ii) the expertise of that specialist to compile a specialist report, including a curriculum vitae; | Appendix B |
| (b) a declaration that the specialist is independent in a form as may be specified by the competent authority; | Appendix B |
| (c) an indication of the scope of, and the purpose for which, the report was prepared; | Section 1.2 |
| (cA) an indication of the quality and age of base data used for the specialist report; | Section 2 |
| (cB) a description of existing impacts on site, cumulative impacts of the proposed development and levels of acceptable change; | Section 5 |
| (d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment; | Section 2.3 |
| (e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used; | Section 2 |
| (f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying alternative; | Section 4 and 5 |
| (g) an identification of any areas to be avoided, including buffers; | N/A |
| (h) a map superimposing the activity, including the associated structures and infrastructure on the environmental sensitivities of the site, including areas to be avoided, including buffers; | N/A |
| (i) a description of any assumptions made and any uncertainties or gaps in knowledge; | Section 1.3 |
| (j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment or activities; | Section 4 and 5 |
| (k) any mitigation measures for inclusion in the EMPr; | Section 5 and 6 |
| (l) any conditions for inclusion in the environmental authorisation; | N/A |
| (m) any monitoring requirements for inclusion in the EMPr or environmental authorisation; | Section 6 |
| (n) a reasoned opinion - | |
| (i) as to whether the proposed activity, activities or portions thereof should be authorised; | N/A |
| (iA) regarding the acceptability of the proposed activity or activities; and | Section 7 |
| (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan; | Section 7 |
| (o) a description of any consultation process that was undertaken during the course of preparing the specialist report | Section 7 |
| (p) a summary and copies, if any, comments received during any consultation process and, where applicable all responses thereto; and | N/A |
| (q) any other information requested by the competent authority. | None |

# GLOSSARY OF TERMS

| | |
|---|---|
| **Albic** | Grey colours, apedal to weak structure, few mottles (<10 %) |
| **Alluvial soil**: | A deposit of sand, mud, etc. formed by flowing water, or the sedimentary matter deposited thus within recent times, especially in the valleys of large rivers. |
| **Catena** | A sequence of soils of similar age, derived from similar parent material, and occurring under similar macroclimatic condition, but having different characteristics due to variation in relief and drainage. |
| **Chromic:** | Having within ≤150 cm of the soil surface, a subsurface layer ≥30 cm thick, that has a Munsell colour hue redder than 7.5YR, moist. |
| **Ferralic:** | Having a ferralic horizon starting ≤150 cm of the soil surface. |
| **Ferralic horizon:** | A subsurface horizon resulting from long and intense weathering, with a clay fraction that is dominated by low-activity clays and contains various amounts of resistant minerals such as Fe, Al, and/or Mn hydroxides. |
| **Gleying:** | A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix. |
| **Hard Plinthic** | Accumulative of vesicular Fe/Mn mottles, cemented |
| **Hydrophytes:** | Plants that are adaptable to waterlogged soils |
| **Lithic** | Dominantly weathering rock material, some soil will be present. |
| **Mottles:** | Soils with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles. |
| **Plinthic Catena** | South African plinthic catena is characterised by a grading of soils from red through yellow to grey (bleached) soils down a slope. The colour sequence is ascribed to different Fe-minerals stable at increasing degrees of wetness |
| **Red Apedal** | Uniform red colouring, apedal to weak structure, no calcareous |
| **Runoff** | Surface runoff is defined as the water that finds its way into a surface stream channel without infiltration into the soil and may include overland flow, interflow and base flow. |
| **Hydraulic Conductivity** | The volume of water that would move through porous medium in unit time under unit hydraulic gradient through unit area measure perpendicular to the flow direction |
| **Orthic** | Maybe dark, chromic or bleached |
| **Salinity:** | High Sodium Adsorption Ratio (SAR) above 15% are indicative of saline soils. The dominance of Sodium (Na) cations in relation to other cations tends to cause soil dispersion (deflocculation), which increases susceptibility to erosion under intense rainfall events. |
| **Sodicity:** | High exchangeable sodium Percentage (ESP) values above 15% are indicative of sodic soils. Similarly, the soil dispersion. |
| **Soil Map Unit** | A description that defines the soil composition of a land, identified by a symbol and a boundary on a map |
| **Soft Plinthic** | Accumulation of vesicular Fe/Mn mottles (>10%), grey colours in or below horizon, apedal to weak structure |
| **Integrated Environmental Management** | Is a philosophy that is concerned with finding the right balance between development and the environment |
| **Witbank** | Man-made soil deposit with no recognisable diagnostic soil horizons, including soil materials which have not undergone paedogenesis (soil formation) to an extent that would qualify them for inclusion in another diagnostic horizon |

# ACRONYMS

| | |
|---|---|
| **AGIS** | Agricultural Geo-Referenced Information Systems |
| **°C** | Degrees Celsius. |
| **EAP** | Environmental Assessment Practitioner |
| **EIA** | Environmental Impact Assessment |
| **ET** | Evapotranspiration |
| **IUSS** | International Union of Soil Sciences |
| **FAO** | Food and Agriculture Organization |
| **GIS** | Geographic Information System |
| **GPS** | Global Positioning System |
| **m** | Meter |
| **MAP** | Mean Annual Precipitation |
| **NWA** | National Water Act |
| **PSD** | Particle Size Distribution |
| **SACNASP** | South African Council for Natural Scientific Professions |
| **SAS** | Scientific Aquatic Services |
| **SOTER** | Soil and Terrain |

# 1. INTRODUCTION

Zimpande Research Collaborative (ZRC) was appointed to conduct a scoping soil, land use and land capability assessment as part of the authorisation process for the proposed development at Wonderstone Driekuil Mine, Ottosdal, Northwest Province. Refer to Figure 1 and Figure 2.

The Wonderstone study area is located approximately 2 km northeast of the Ottosdal Town. The R507 is located approximately 2.9km south of the Wonderstone study area while the R505 traverses the northern portion of the study area.

The Assore-owned Wonderstone Mine wishes to proceed with the various specialist studies required in support of an Environmental Impact Assessment (EIA) for properties adjacent to the existing mine.

## *1.1 Project Description*

Up until recently the mine has been operating under the legal entitlement, Mining License: ML1-97, converted to Mining Right: NW 30/1/2/2/398 MR (Registered Right dated 23 December 2014). The issued mining right authorises the extraction of Pyrophyllite for a period of 30 years over the farm Gestoptefontein 349IO:

- Portion 44;
- Area measuring 135.916ha.

Mining takes place by means of open cast mining, comprising of hydraulic hammering and excavator loading with no drilling and blasting required.

In addition, WST also holds an approved New Order Mining Right (NOMR) NW30/5/1/2/2/397MR (signed 20 March 2019) over various portions of the farms Gestoptefontein and Driekuil 280IP:

- Portion 5, 7, 9, 10, 11, 24 (portion of portion 5), remainder of portion 15 (a portion of portion 1), portion 20 and portion 40 (a portion of portion 41 now known as portion 44) of the farm Gestoptefontein 349IO;
- Portions 2, 4, remainder of portion 1, portion 7 (a portion of portion A) and the remainder of farm Driekuil 280IP.
- Area measuring: 4595.4239ha

A large portion of the northern section of the WST mining area on Gestoptefontein has been rehabilitated. WST would like to combine its existing mining rights into one, consolidated right,

in an attempt to ease the administrative duties and compliance requirements associated with multiple mining authorisations per site.

At the same time, the operation would like to abandon some of the areas currently included and authorised as part of the approved NOMR area. After an extensive study, WST forecasts only using a select portion of the already approved NOMR area in its future mining endeavours. Abandonment of the remainder of the approved NOMR areas will ensure future mining in these areas and prevent the sterilisation of said areas for future mining.

During a pre-application meeting with the Department of Mineral Resources and Energy (DMRE) on 15 November 2021, the Department indicated that WST will be expected to submit a Section 102 Amendment Application. The application will include the areas of one approved mining right into the existing area of the other approved right.

WST decided to apply for the extension of the CMR (398MR) area by adding Portions of the approved NOMR (397) areas to the CMR area. At the same time the additional proposed areas of the NOMR, portions of the approved portions will be abandoned to allow for future mining.

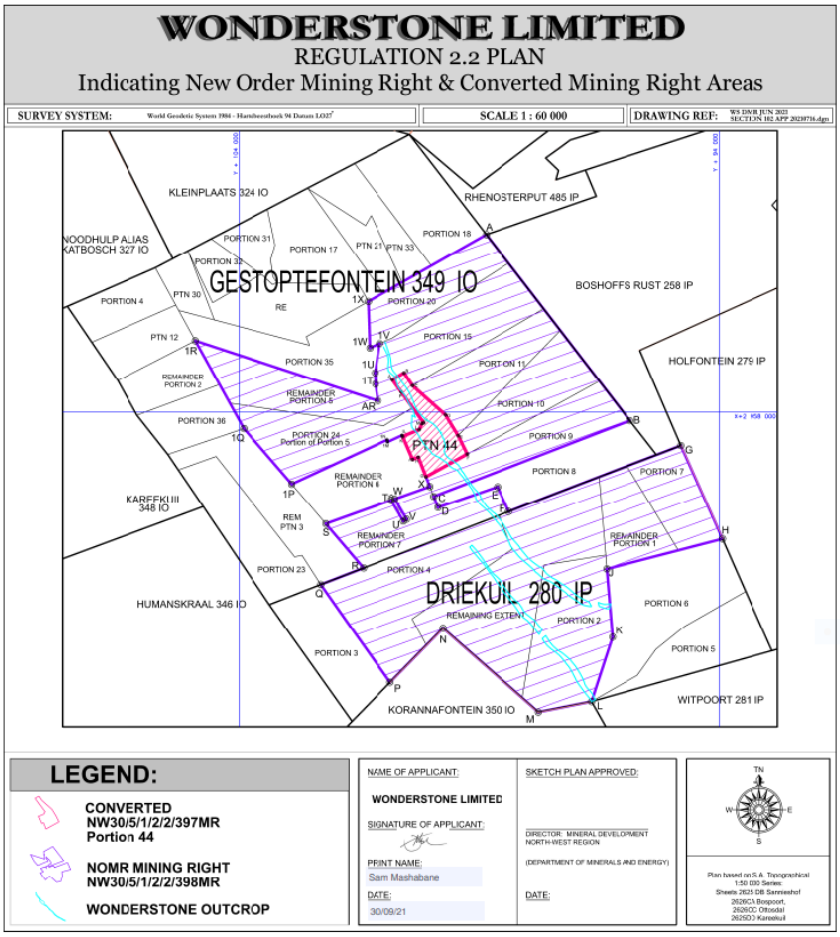


**Figure 1: Current Mining Rights held by Applicant.**

## New Project Activities

The mine will continue mining from the existing Wonderstone Opencast Pit and will include the additional five (5) mining blocks. The mineral to be mined is Pyrophyllite, an aluminium silicate of the phyllosilicate family, with the chemical formula $Al_2$ $Si_4$ O10 $(OH)_2$.

The pyrophyllite is opencast mined with a Hydraulic hammer mounted on an Excavator that loosens the stone, the loose stone is then loaded onto dump trucks that transport usable stone to the plant for further processing and un-usable stone to the low-grade stockpile. In areas where there is topsoil present, the topsoil, if any, will first be stripped to open the pyrophyllite, this topsoil will on completion of mining process be used during the rehabilitation process. Historically, there is little to no topsoil on Wonderstone deposits. The Pyrophyllite will be mined using an excavator equipped with a hydraulic hammer that will break the stone loose, an excavator with a shovel will load the usable stone on dump trucks that will transport the stone to the processing plant. Unusable stone will be transported to the low-grade stockpile (current Waste Rock Dump) for possible use in future. Mining will be done using the bench method with benches not higher than 5 meters.

It should however be noted, that two areas are demarcated for the temporary storage of overburden which will be used for backfilling of the opencast pits in the future.
Existing haul roads will be used but will have to be extended to the new mining area.
No electricity is required in new areas.
Dust control on haul roads will be done with the mine's own water bowser and water will be extracted from Driekuilspruit dam that is included in the mine's existing Water Use License. There are, however, existing boreholes that can be developed should the need arise.

The project will involve:

**Mining activities**

- Mining of existing area (Block 1N – about 15ha);
- five (5 mining blocks (2.5ha, 2.1ha, 2.1ha, 2ha, 2.9ha), which will be mined at different time intervals via opencast mining methods); and
- Area: Approx. 12ha (considering 14ha, for inclusion of the area between Block 5 and Block 5)

**Stockpiles**

- Two areas (3.4 and 3.2ha) have been identified for the temporary stockpiling of overburden (the mine will commit to ongoing rollover mining) but due to the time sequence, material will be stockpiled in these areas. For your studies, please look at these blocks and indicate whether there are any areas within these blocks which must be avoided. Important to note that the existing Waste Rock Dump will remain operational at 13.4ha;
- Provision in the two new areas must be for topsoil and overburden/waste rock (volumes is still to be finalised); and
- A new WRD of about 4ha is currently planned, which will likely comprise of a Pollution Control Dam (PCD).

## *1.2 Terms of Reference and Scope of Work*

The scoping phase of the soil, land use and land capability assessment entailed the following aspects:

- As part of the desktop study various data sets were consulted which includes but is not limited to: Soil and Terrain dataset (SOTER), land type and capability maps, to establish broad baseline conditions and sensitivity of the study area both from an environmental and agricultural perspective;

- Compile various maps depicting the on-site conditions based on desktop review of existing data;
- Classification of the climatic conditions occurring within the study area;
- Conduct a desk-based soil survey within the study area;
- Assess the spatial distribution of various soil types within the study area and classify the dominant soil types according to the South African Soil Classification System: A Natural and Anthropogenic System for South Africa (Soil Classification Working Group, 2018);
- Identify restrictive soil properties on land capability under prevailing conditions;
- Compile a report based on the desktop study;
- Identify and provide a high-level assessment of the potential impacts in relation to the proposed development using pre-defined impact assessment methodology; and
- Present the plan of study for the EIA phase of the project including the methods of assessment to be used.

## *1.3 Assumptions and Limitations*

For the purpose of this assessment, the following assumptions are applicable:

- The soil and land capability desktop assessment are confined to the study area and does not include the neighbouring and adjacent properties, and
- This study was undertaken as a desktop assessment and preliminary field observations, the information gathered during the desktop assessment must be considered with caution, as inaccuracies and data capturing errors are often present within these databases. Since this information forms part of the scoping phase, this desktop assessment and preliminary field observations are considered to provide adequate information for informed decision making to take place and in order to inform the Plan of Study for the EIA.

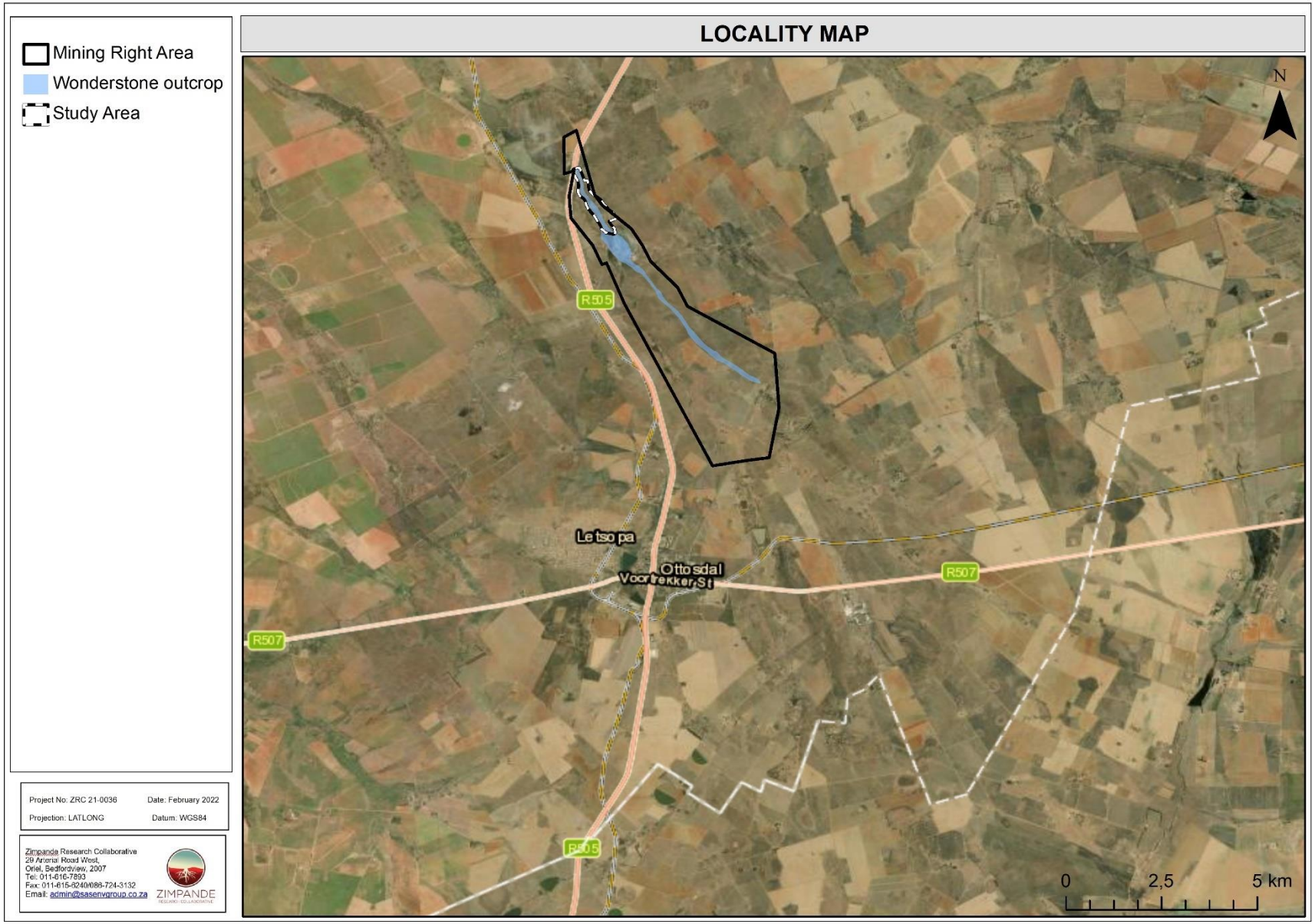


**Figure 2: Digital satellite imagery depicting the locality of the study area in relation to the surrounding areas.**

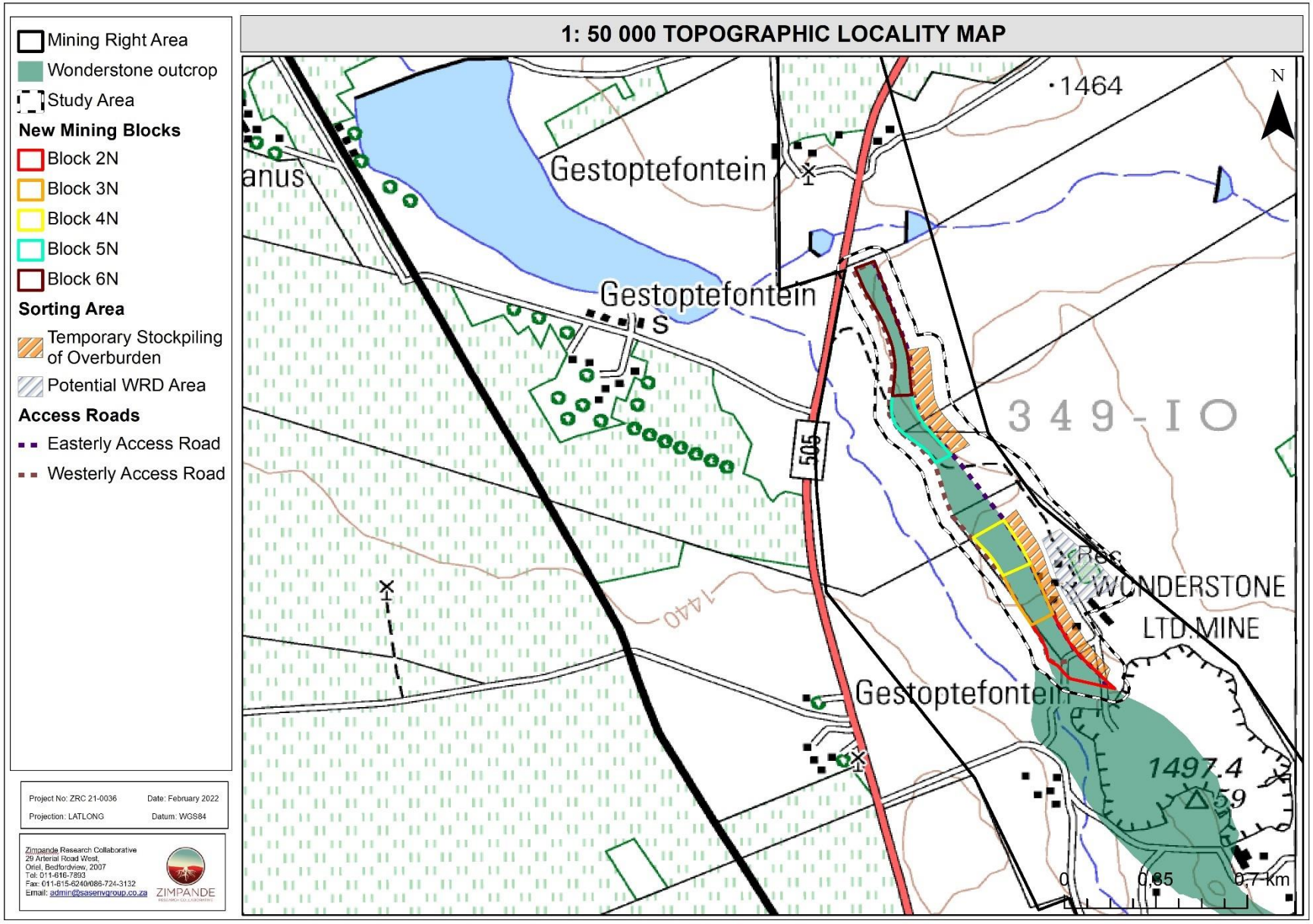


**Figure 3: Location of the study area depicted on a 1:50 000 topographical map in relation to surrounding area.**

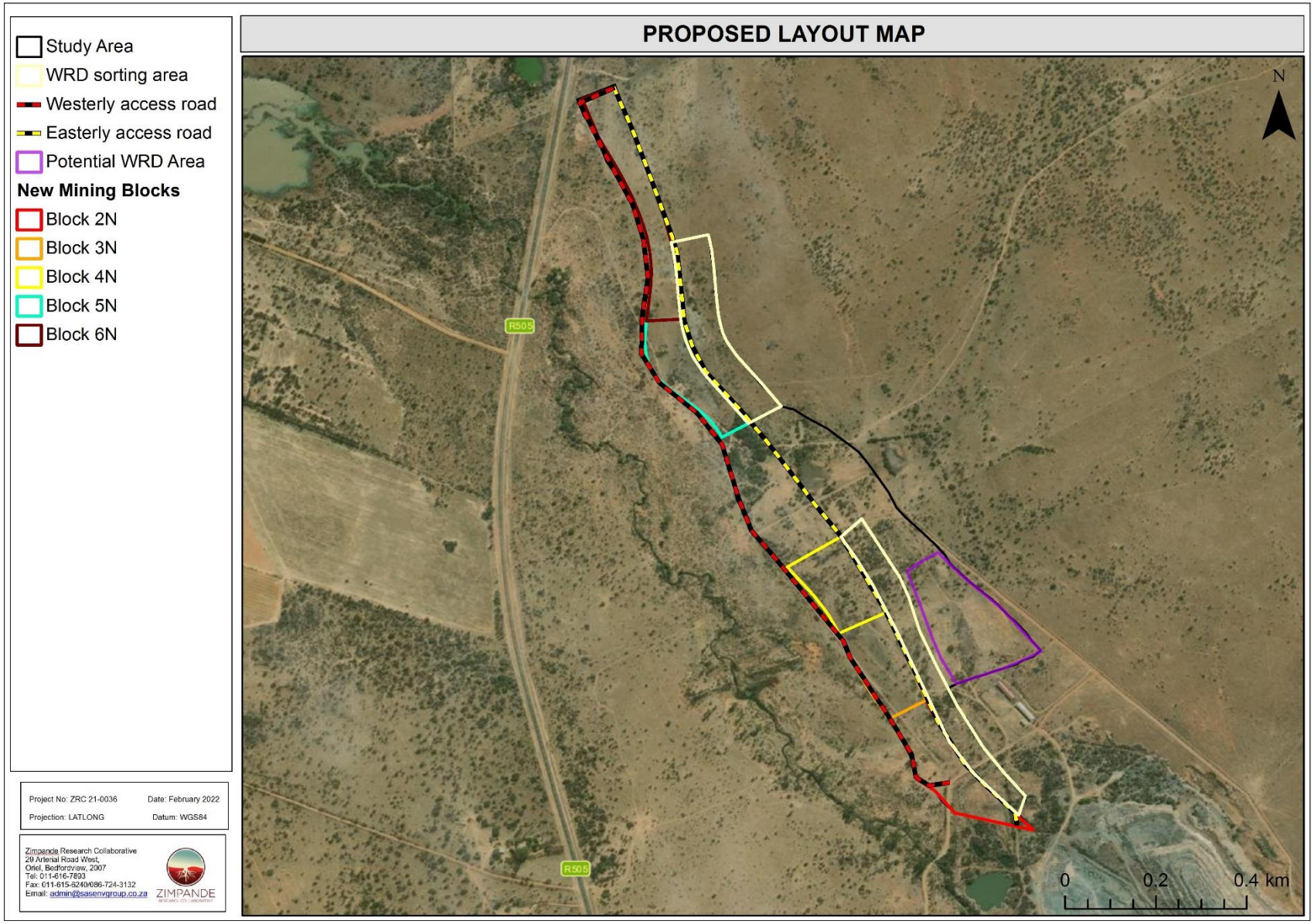


**Figure 4: Proposed layout associated with the study area.**

# 2. SCOPING PHASE - METHOD OF ASSESSMENT

## 2.1 Literature and Database Review

Prior to commencement of the field assessment, a background study, including a literature review, was conducted to collect the pre-determined soil and land capability data in the vicinity of the study area. Various data sources including, but not limited to, the Agricultural Geo-Referenced Information System (AGIS) and other sources as listed under references (Section 9) were utilized to fulfil the objectives for the assessment.

## 2.2 Soil Classification and Sampling

A soil survey will be conducted following the completion of the scoping phase, at which time the identified soils within the study area will be classified into soil forms according to the Soil Classification System: A Natural and Anthropogenic System for South Africa Soil Classification System (2018). The soil survey will also serve to verify previous findings and cover the remaining portion of the study area. The soil survey will be restricted to the study area. Subsurface soil observations will be made using a manual hand auger in order to assess individual soil profiles, which will entail evaluation of physical soil properties and prevailing limitations to various land uses.

## 2.3 Land Capability Classification

Agricultural potential is directly related to Land Capability, as measured on a scale of I to VIII, as presented in Table 1 below; with Classes I to III classified as prime agricultural land that is well suited for annual cultivated crops, whereas, Class IV soils may be cultivated under certain circumstances and specific or intensive management practices, and Land Classes V to VIII are not suitable for cultivation. Furthermore, the climate capability is also measured on a scale of C1 to C8, as illustrated in Table 2 below. The land capability rating is therefore adjusted accordingly, depending on the prevailing climatic conditions as indicated by the respective climate capability rating. The anticipated impacts of the proposed land use on soil and land capability were assessed in order to inform the necessary mitigation measures.

**Table 1: Land Capability Classification (Smith, 2006)**

| Land Capability Class | Increased Intensity of Use | | | | | | | | | Land Capability Groups |
|---|---|---|---|---|---|---|---|---|---|---|
| I | W | F | LG | MG | IG | LC | MC | IC | VIC | Arable land |
| II | W | F | LG | MG | IG | LC | MC | IC | | |
| III | W | F | LG | MG | IG | LC | MC | IC | | |
| IV | W | F | LG | MG | IG | LC | | | | |
| V | W | | LG | MG | | | | | | Grazing land |
| VI | W | F | LG | MG | | | | | | |
| VII | W | F | LG | | | | | | | |
| VIII | W | | | | | | | | | Wildlife |

| | | |
|---|---|---|
| W- Wildlife | MG- Moderate grazing | MC- Moderate cultivation |
| F- Forestry | IG- Intensive grazing | IC- Intensive cultivation |
| LG- Light grazing | LC- Light cultivation | VIC- Very intensive cultivation |

**Table 2: Climate Capability Classification (Scotney et al., 1987)**

| Climate Capability Class | Limitation Rating | Description |
|---|---|---|
| C1 | None to slight | Local climate is favourable for good yield for a wide range of adapted crops throughout the year. |
| C2 | Slight | Local climate is favourable for good yield for a wide range of adapted crops and a year round growing season. Moisture stress and lower temperatures increase risk and decrease yields relative to C1. |
| C3 | Slight to moderate | Slightly restricted growing season due to the occurrence of low temperatures and frost. Good yield potential for a moderate range of adapted crops. |
| C4 | Moderate | Moderately restricted growing season due to low temperatures and severe frost. Good yield potential for a moderate range of adapted crops but planting date options more limited than C3. |
| C5 | Moderate to severe | Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Suitable crops may be grown at risk of some yield loss. |
| C6 | Severe | Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Limited suitable crops for which frequently experience yield loss. |
| C7 | Severe to very severe | Severely restricted choice of crops due to heat, cold and/or moisture stress. |
| C8 | Very severe | Very severely restricted choice of crops due to heat and moisture stress. Suitable crops at high risk of yield loss. |

# 3. DESKTOP ASSESSMENT RESULTS

The following data is applicable to the study area, according to various data sources including but not limited to the Agricultural Geo-referenced Information System (AGIS):

- The Mean Annual Precipitation (MAP) for the majority of the study area is estimated to range between 401 and 600 mm per annum; This rainfall range is not considered sufficient for the majority of most cultivated crops, supplementary irrigation water may be required ;
- The study area has a mean annual evaporation range between 1801 – 2000 mm per annum. The high evaporation rates pose risks to plant yield due possible plant permanent wilting resulting in plant desiccation and lack of adequate soil moisture;
- The geology of the study area comprise of the Witwatersrand formation;
- The Landform type occurring within the study area is classified as a Plain Landform (LP), which means the terrain is suitable to allow agricultural activities.
- The land type associated with the study area is the Bc18, which is characterised by a plinthic catena with widespread eutrophic shallow red soils. Duplex and margalitic soils are rare;
- The Soil and Terrain (SOTER) database indicates that the study area is dominated by Chromic Cambisols;
- Agricultural potential of soils identified within the study area are of intermediate suitability for agricultural potential;
- The land capability of the soils within the study area fall under the Arable Class IV capability classified as marginal arable land;
- According to the AGIS database, the soil medium occurring within the study area is not considered to be saline or sodic;
- According to the AGIS database, the livestock grazing capacity potential is estimated to be approximately 6 hectares per large animal, which considered not ideal for commercial grazing;
- The pH of the majority of soils occurring within the study area ranges between 6.5 and 7.4
- The predicted soil loss of soils within the study area is considered very low; and
- The clay content for the western portion of the study area are characterised by clay content between 15% and 35%.

# 4. PRELIMINARY FIELD ASSESSMENT FINDINGS BASED ON PREVIOUSLY PUBLISHED DATA

## 4.1 Current Land Use

Nhloso, (2013) reported that the land use associated with the Wonderstone study area and the surrounding areas is mainly livestock grazing and mining related activities such as mining pit, infrastructure including offices, processing workshop, powder plant, and other service & maintenance utilities.

## 4.2 Dominant Soil Types

The land type associated with the study area is the Bc18, which is characterised by a plinthic catena with widespread eutrophic shallow red soils. Duplex and margalitic soils are rare. The Soil and Terrain (SOTER) database indicates that the study area is dominated by Chromic Cambisols.

Chromic Cambisols can be described as youthful soils, characterised by the absence of a layer of accumulated clay, humus, soluble salts, or iron and aluminium oxides. The horizon differentiation is weak. This is evident from weak, mostly brownish discolouration and/or structure formation in the soil profile. However, the B-horizon in these soils can be yellow-brown or red in colour and this is dependent on the terrain position along the hillslope. Cambisols occur in different environments and thus their morphological properties are likely to differ. Nevertheless most Cambisols:

- Are medium textured and have good structural stability;
- Have high porosity and a good water holding capacity with good internal drainage;
- Have neutral to weakly acid soil pH; and
- Satisfactory chemical fertility and active fauna.

These properties mentioned above, qualifies these soils to be exploited for agricultural purposes subject to the limitations of terrain and climate conditions.

## 4.3 Land Capability Classification

In South Africa, agricultural land capability is generally restricted by climatic conditions, particularly water availability. However, even within similar climatic zones, different soil types typically have different land use capabilities attributed to their inherent characteristics.

High potential agricultural land is defined as having the soil and terrain quality, growing season and adequate available moisture supply needed to produce sustained economically high crops yields when treated and managed according to best possible farming practices (Scotney *et al*., 1987). For the purpose of this assessment, land capability was inferred in consideration of observed limitations to land use due to physical soil properties and prevailing climatic conditions. Climate Capability (measured on a scale of 1 to 8) was therefore considered in the agricultural potential classification. The study area falls into Climate Capability Class 6 at best, with moderate to severe limitations for arable crops.

The land capability ratings associated with the study area are Arable (Class IV) capability classified as marginal arable land. This can be attributed to the slope conditions, prevailing climatic conditions associated with the study area due to low rainfall (between 401 and 600 mm per annum) and high evaporation demand (between 1801 – 2000 mm per annum) without any supplementary irrigation.

# 5. PRELIMINARY POTENTIAL IMPACTS

## *5.1 Description of Potential Impacts Associated with the Proposed Development*

Several potential risks to the receiving environment by the proposed development have been identified and are presented in the bullets below:

- Topsoil stripping and vegetation clearing within the proposed infrastructure areas as part of site preparation prior to commencement of construction activities, leading to soil disturbances and risk of erosion of exposed soils;
- Construction of surface infrastructure increasing the potential risk of soil erosion, dust emission, sedimentation, and disposal of waste on soil resources which will subsequently lead to the alteration of soil chemistry and quality;
- Contamination resulting from spillages of hydrocarbons, heavy metals, ineffective stormwater management around stockpiles and WRD etc.; and
- Movement of construction vehicles off existing/demarcated roads, leading to soil compaction and potential spillage from machinery / construction vehicles.

## *5.2 High Level Impact Rating*

The study area is dominated by Chromic Cambisols which can be characterised as soils of intermediate suitability for agricultural potential. The study area is surrounded by active mining

related activities. These activities dominate a large portion of the study area and thus has caused significant impact on the soils. The loss of topsoil is anticipated and thus may reduce the quantity of soil material available for future rehabilitation and land use potential of any land that is disturbed by the proposed project. However, the proposed project is not anticipated to cause a significant cumulative impact since this area is not under current cultivation and the extent of the area to be impacted is limited. The significance of impact is anticipated to be Medium without mitigation and Low post mitigation. However, should the outlined mitigation measures not be followed, this may impact on the intensity and the extent of the impacts on the footprint areas. In addition, soils are scarce non-renewable resources which need to be protected, conserved and managed in compliance with the CARA, 1983 (Act No. 43 of 1983).The additional work required to address this issue is described in Section 7 of this Scoping Report.

# 6. PRELIMINARY MITIGATION MEASURES

## *6.1 Soil Erosion and Dust Emission Management*

- The footprint of the proposed development and construction activities should be clearly demarcated to restrict vegetation clearing activities to within the infrastructure footprint as far as practically possible;
- Bare soils within the access roads should be regularly dampened with water to suppress dust during the construction phase, especially when strong wind conditions are predicted according to the local weather forecast;
- All disturbed areas adjacent to the proposed residential development areas should be re-vegetated with an indigenous grass mix, where necessary, to re-establish a protective cover to minimise soil erosion and dust emission; and
- Temporary erosion control measures such as berms should be used to protect the disturbed soils during the construction phase until adequate vegetation has established.

## *6.2 Soil Contamination Management*

- Contamination prevention measures should be addressed in the Environmental Management Programme (EMPr) for the proposed development, and this should be implemented and made available and accessible at all times to the contractors and construction crew conducting the works on site for reference;

- An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur, as well as preventative measures to prevent contamination; and
- Burying of any waste including rubble, domestic waste, empty containers on the site etc. should be strictly prohibited and all construction waste must be removed to an approved disposal site.

## 6.3 Soil Compaction Management

- Soil Compaction is usually greatest when soils are moist, so soils should be stripped when moisture content is as low as possible. If they have to be moved when wet, shovel and truck should be used as bowlscrapers create excessive compaction when moving wet soils;
- Minimize compaction during the stockpile phase by keeping stockpile soil loose and limit stockpile height to 2-3 meters height, to limit internal soil compaction (Coaltech: chamber of mines, 2007);
- Compaction should be minimised by use of appropriate equipment and replacing soils to the greatest possible thickness in single lifts;
- Heavy equipment movement over replaced soils should be minimised;
- Minimise compaction during smoothing of replaced soils by using dozers rather than graders;
- Following placement, compacted soils should be ripped to full rooting depth (at least 60 cm or 30 cm as the bare minimum seedbed) to allow penetration of plant root);
- All vehicular traffic should be restricted to the existing service roads and the selected road servitude as far as practically possible; to avoid unnecessary compaction of the surrounding soils;
- Direct surface disturbance of the identified high clay content(i.e., Calcic Vertisols and Ferric Luvisols.) soils should be limited within demarcated areas where possible to minimise the intensity of compaction due to the susceptibility of these soils to prolonged waterlogging conditions (inundation);
- Compacted soils adjacent to the mining project footprints and associated infrastructure footprint can be lightly ripped to at least 25 cm below ground surface to alleviate compaction prior to re-vegetation, and
- Compaction of soil can be mitigated by ripping the footprint and introducing both organic and inorganic fertilizers.

## 6.4 Soil stockpile management

- Prior to the commencement of the proposed activities, available topsoil material should be estimated before being removed, and stockpiled for future use;
- Surface and subsoil material should be stockpiled separately. This is to prevent the mixing of the fertile topsoil with the nutrient limited subsoils;
- The duration of stockpiling must be minimised where possible;
- Ensure all stockpiles (especially topsoil) are clearly and permanently demarcated and located in defined no-go areas;
- Stockpile height should be restricted to that which can deposited without additional traversing by machinery. A Maximum height of 2-3 m is therefore proposed, and the stockpile should be treated with temporary soil stabilisation methods; such as the application of organic matter to promote soil aggregate formation, leading to increased infiltration rate, thereby reducing soil erosion. Also, the use of lime to stabilise soil pH levels;
- Temporary berms can be installed, around stockpile areas whilst vegetation cover has not established to avoid soil loss through erosion; and
- A short-term fertilizer program should be based on the soil chemical status after levelling and should consists of a pre-seeding lime and fertilizer application, an application with the seeding process as well as a maintenance application for 2 to 3 years during the rollover mining rehabilitation until the area can be declared as self-sustaining by an appropriately qualified soil scientist.

# 7. PRELIMINARY CONCLUSION

Based on the desktop assessment the dominant soils associated with the study area are youthful soils with intermediate suitability for agricultural potential. The low rainfall (between 401 and 600 mm per annum) and high evaporation demand (between 1801 – 2000 mm per annum) without any supplementary irrigation renders the soils more suitable for cultivation under intensive management. The current extent of the study area should be optimised for mining related activities to avoid potential disturbance of adjacent areas which may be used for cultivation. However, the recommended mitigation and management measures must be implemented accordingly. Nevertheless, this will be confirmed by the field visit in which the soil and land capability survey will cover the full extent of the study area and all potential impacts associated with the proposed development activity will be assessed in detail. Additional mitigatory recommendations will be presented in line with the mitigation hierarchy as advocated by the DEA (2013).

# 8. EIA PHASE – PLAN OF STUDY

The scope of work and specific outcomes in terms of the EIA Phase report are presented in the points below:

- Analysis of field results considering the various soil types;
- Data analysis will include a description of physical soil properties, including the following parameters:
  - Terrain morphological unit (landscape position) description;
  - Diagnostic soil horizons and their respective sequence;
  - Texture, estimated as % clay according to the in-situ hand feel method;
  - Depth of identified soil horizons;
  - Soil form classification name(s);
  - Observed land capability limitations of the identified soil forms; and
  - Depth to saturation (water table), if encountered.
- Group uniform soil patterns into map units, according to observed limitations;
- Analyse and interpret soil analysis data to assess the contamination risk / impacts; and
- Provide recommended mitigation measures for the rollover mining process as active mining will take place concurrently with rehabilitation of affected areas, monitoring practices and management practices to implement in order to comply with the National Environmental Management Act (NEMA) 107 of 1998.

The details of the methods of assessment, as they pertain to this study, are provided in Appendix A of this report.

# 9. REFERENCES

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# APPENDIX A: METHOD OF ASSESSMENT

## Desktop Screening

Prior to commencement of the field assessment, a background study, including a literature review, was conducted in order to collect the pre-determined soil and land capability data in the vicinity of the investigated area Various data sources including but not limited to the Agricultural Geo-Referenced Information System (AGIS) and other sources as listed under references were used for the assessment.

## Soil Classification and Sampling

A soil survey is top be conducted by a qualified soil specialist, at which time the identified soils within the infrastructure areas and associated access roads were classified into soil forms according to the Soil Classification Working Group for South Africa (2018). Subsurface soil observations were made using a manual hand auger in order to assess individual soil profiles, which entailed evaluating physical soil properties and prevailing limitations to various land uses.

## Land Capability Classification

Agricultural potential is directly related to Land Capability, as measured on a scale of I to VIII, as presented in Table **A1** below; with Classes I to III classified as prime agricultural land that is well suitable for annual cultivated crops. Whereas, Class IV soils may be cultivated under certain circumstances and management practices, whereas Land Classes V to VIII are not suitable to cultivation. Furthermore, the climate capability is also measured on a scale of 1 to 8, as illustrated in Table **A2** below. The land capability rating is therefore adjusted accordingly, depending on the prevailing climatic conditions as indicated by the respective climate capability rating. The anticipated impacts of the proposed land use on soil and land capability were assessed in order to inform the necessary mitigation measures.

**Table A1: Land Capability Classification (Smith, 2006)**

| Land Capability Class | Increased Intensity of Use | | | | | | | | | Land Capability Groups |
|---|---|---|---|---|---|---|---|---|---|---|
| **I** | W | F | LG | MG | IG | LC | MC | IC | VIC | **Arable land** |
| **II** | W | F | LG | MG | IG | LC | MC | IC | | |
| **III** | W | F | LG | MG | IG | LC | MC | IC | | |
| **IV** | W | F | LG | MG | IG | LC | | | | |
| **V** | W | | LG | MG | | | | | | **Grazing land** |
| **VI** | W | F | LG | MG | | | | | | |
| **VII** | W | F | LG | | | | | | | |
| **VIII** | W | | | | | | | | | **Wildlife** |

| | | |
|---|---|---|
| W- Wildlife | MG- Moderate grazing | MC- Moderate cultivation |
| F- Forestry | IG- Intensive grazing | IC- Intensive cultivation |
| LG- Light grazing | LC- Light cultivation | VIC- Very intensive cultivation |

**Table A2: Climate Capability Classification (Scotney et al., 1987)**

| Climate Capability Class | Limitation Rating | Description |
|---|---|---|
| C1 | None to slight | Local climate is favourable for good yield for a wide range of adapted crops throughout the year. |
| C2 | Slight | Local climate is favourable for good yield for a wide range of adapted crops and a year round growing season. Moisture stress and lower temperatures increase risk and decrease yields relative to C1. |
| C3 | Slight to moderate | Slightly restricted growing season due to the occurrence of low temperatures and frost. Good yield potential for a moderate range of adapted crops. |
| C4 | Moderate | Moderately restricted growing season due to low temperatures and severe frost. Good yield potential for a moderate range of adapted crops but planting date options more limited than C3. |
| C5 | Moderate to severe | Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Suitable crops may be grown at risk of some yield loss. |
| C6 | Severe | Moderately restricted growing season due to low temperatures, frost and/or moisture stress. Limited suitable crops for which frequently experience yield loss. |
| C7 | Severe to very severe | Severely restricted choice of crops due to heat, cold and/or moisture stress. |
| C8 | Very severe | Very severely restricted choice of crops due to heat and moisture stress. Suitable crops at high risk of yield loss. |

The land potential assessment entails the combination of climatic, slope and soil condition characteristics to determine the agricultural land potential of the investigated area. The classification of land potential and knowledge of the geographical distribution within an area of interest. This is of importance for making an informed decision about land use. **Table A3** below presents the land potential classes, whilst Table 4 presents description thereof, according to Guy and Smith (1998).

**Table A3: Land Potential Classes (Guy and Smith, 1998)**

| Land Capability Class | Climate Capability Class | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 |
| I | L1 | L1 | L2 | L2 | L3 | L3 | L4 | L4 |
| II | L1 | L2 | L2 | L3 | L3 | L4 | L4 | L5 |
| III | L2 | L2 | L3 | L3 | L4 | L4 | L5 | L6 |
| IV | L2 | L3 | L3 | L4 | L4 | L5 | L5 | L6 |
| V | Vlei | Vlei | Vlei | Vlei | Vlei | Vlei | Vlei | Vlei |
| VI | L4 | L4 | L5 | L5 | L5 | L6 | L6 | L7 |
| VII | L5 | L5 | L6 | L6 | L7 | L7 | L7 | L8 |
| VIII | L6 | L6 | L7 | L7 | L8 | L8 | L8 | L8 |

**Table A4: The Land Capability Classes Description (Guy and Smith, 1998)**

| Land Potential | Description of Land Potential Class |
|---|---|
| L1 | **Very high potential:** No limitations. Appropriate contour protection must be implemented and inspected. |
| L2 | **High potential:** Very infrequent and/or minor limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected. |
| L3 | **Good potential:** Infrequent and/or moderate limitations due to soil, slope, temperatures or rainfall. Appropriate contour protection must be implemented and inspected. |
| L4 | **Moderate potential:** Moderately regular and/or severe to moderate limitations due to soil, slope, temperature or rainfall. Appropriate permission is required before ploughing virgin land. |
| L5 | **Restricted potential:** Regular and/or moderate to severe limitations due to soil, slope, temperature or rainfall. |
| L6 | **Very restricted potential:** Regular and/or severe limitations due to soil, slope, temperature or rainfall. Non-arable. |
| L7 | **Low potential:** Severe limitations due to soil, slope, temperature or rainfall. Non-arable. |
| L8 | **Very low potential:** Very severe limitations due to soil, slope, temperature or rainfall. Non-arable. |

# APPENDIX B: DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

**1. (a) (i) Details of the specialist who prepared the report**

| | |
|---|---|
| Tshiamo Setsipane | MSc Soil Science (University of the Free State) |
| Braveman Mzila | BSc (Hons) Environmental Hydrology (University of KwaZulu-Natal) |
| Stephen van Staden | MSc (Environmental Management) (University of Johannesburg) |

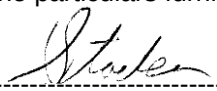
**1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae**

| | | | |
|---|---|---|---|
| Company of Specialist: | Scientific Aquatic Services | | |
| Name / Contact person: | Stephen van Staden | | |
| Postal address: | 29 Arterial Road West, Oriel, Bedfordview | | |
| Postal code: | 2007 | Cell: | 083 415 2356 |
| Telephone: | 011 616 7893 | Fax: | 011 615 6240/ 086 724 3132 |
| E-mail: | stephen@sasenvgroup.co.za | | |
| Qualifications | MSc (Environmental Management) (University of Johannesburg)<br>BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg)<br>BSc (Zoology, Geography and Environmental Management) (University of Johannesburg) | | |
| Registration / Associations | Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)<br>Accredited River Health practitioner by the South African River Health Program (RHP)<br>Member of the South African Soil Surveyors Association (SASSO)<br>Member of the Gauteng Wetland Forum | | |

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Stephen van Staden, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



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Signature of the Specialist

1.(b) A declaration that the specialist is independent in a form as may be specified by the competent authority

I, Braveman Mzila, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

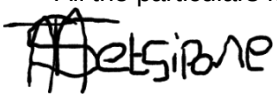
---

Signature of the Specialist

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Tshiamo Setsipane, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



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Signature of the Specialist

**SAS ENVIRONMENTAL GROUP OF COMPANIES –**

**SPECIALIST CONSULTANT INFORMATION**

# CURRICULUM VITAE OF STEPHEN VAN STADEN

## PERSONAL DETAILS

| | |
|---|---|
| Position in Company | Group CEO, Water Resource discipline lead, Managing member, Ecologist, Aquatic Ecologist |
| Joined SAS Environmental Group of Companies | 2003 (year of establishment) |

## MEMBERSHIP IN PROFESSIONAL SOCIETIES

Registered Professional Scientist at South African Council for Natural Scientific Professions (SACNASP)
Accredited River Health practitioner by the South African River Health Program (RHP)
Member of the South African Soil Surveyors Association (SASSO) Member of the Gauteng Wetland Forum
Member of the Gauteng Wetland Forum;
Member of International Association of Impact Assessors (IAIA) South Africa;
Member of the Land Rehabilitation Society of South Africa (LaRSSA)

## EDUCATION

### Qualifications

| | |
|---|---|
| MSc Environmental Management (University of Johannesburg) | 2003 |
| BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) | 2001 |
| BSc (Zoology, Geography and Environmental Management) (University of Johannesburg) | 2000 |
| Tools for wetland assessment short course Rhodes University | 2016 |
| Legal liability training course (Legricon Pty Ltd) | 2018 |
| Hazard identification and risk assessment training course (Legricon Pty Ltd) | 2013 |

### Short Courses

| | |
|---|---|
| Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA) | 2009 |
| Introduction to Project Management - Online course by the University of Adelaide | 2016 |
| Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs | 2017 |

## AREAS OF WORK EXPERIENCE

South Africa – All Provinces
Southern Africa – Lesotho, Botswana, Mozambique, Zimbabwe Zambia
Eastern Africa – Tanzania Mauritius
West Africa – Ghana, Liberia, Angola, Guinea Bissau, Nigeria, Sierra Leona
Central Africa – Democratic Republic of the Congo

## KEY SPECIALIST DISCIPLINES

**Biodiversity Assessments**

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

**Freshwater Assessments**

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Maintenance and Management Plans
- Plant species and Landscape Plan
- Freshwater Offset Plan
- Hydropedological Assessment
- Pit Closure Analysis

**Aquatic Ecological Assessment and Water Quality Studies**

- Habitat Assessment Indices (IHAS, HRC, IHIA & RHAM)
- Aquatic Macro-Invertebrates (SASS5 & MIRAI)
- Fish Assemblage Integrity Index (FRAI)
- Fish Health Assessments
- Riparian Vegetation Integrity (VEGRAI)
- Toxicological Analysis
- Water quality Monitoring
- Screening Test
- Riverine Rehabilitation Plans

**Soil and Land Capability Assessment**

- Soil and Land Capability Assessment
- Soil Monitoring
- Soil Mapping

**Visual Impact Assessment**

- Visual Baseline and Impact Assessments
- Visual Impact Peer Review Assessments
- View Shed Analyses
- Visual Modelling

**Legislative Requirements, Processes and Assessments**

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

**SAS ENVIRONMENTAL GROUP OF COMPANIES –**

**SPECIALIST CONSULTANT INFORMATION**

# CURRICULUM VITAE OF BRAVEMAN MZILA

## PERSONAL DETAILS

| | |
|---|---|
| Position in Company | Wetland Ecologist and Soil Scientist |
| Joined SAS Environmental Group of Companies | 2017 |

## MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Soil Science Society (SASSO)

Member of the Gauteng Wetland Forum (GWF)

## EDUCATION

### Qualifications

| | |
|---|---|
| BSc (Hons) Environmental Hydrology (University of Kwazulu-Natal) | 2013 |
| BSc Hydrology and Soil Science (University of Kwazulu-Natal) | 2012 |

## COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, Free State, North West, Limpopo, Northern Cape, Eastern Cape, KwaZulu-Natal

## KEY SPECIALIST DISCIPLINES

**Hydropedological Assessments:**

- Soil Survey
- Soil Delineation
- Hydrological hillslope classification
- Hydropedological loss Quantification
- Hydropedological impact assessment
- Scientific buffer determination

**Soil, Land use, Land Capability and Agricultural Potential Studies**

- Soil Desktop assessment
- Soil classification
- Agricultural potential
- Agricultural Impact Assessments

**SAS ENVIRONMENTAL GROUP OF COMPANIES –**

**SPECIALIST CONSULTANT INFORMATION**

# CURRICULUM VITAE OF TSHIAMO SETSIPANE

## PERSONAL DETAILS

| | |
|---|---|
| Position in Company | Soil Scientist/ Hydropedologist |
| Joined SAS Environmental Group of Companies | 2020 |

## MEMBERSHIP IN PROFESSIONAL SOCIETIES

South African Council for Natural Scientist Professions (SACNASP)

## EDUCATION

### Qualifications

| | | |
|---|---|---|
| M.Sc. (Agric) Soil Science | (University of the Free State) | 2019 |
| B.Sc. (Agric) Honours Soil Science | (University of the Free State) | 2014 |
| B.Sc. (Agric) Soil Science & Agrometeorology | (University of the Free State) | 2013 |

## COUNTRIES OF WORK EXPERIENCE

South Africa – Kwa-Zulu Natal, Free State and Mpumalanga

## KEY SPECIALIST DISCIPLINES

**Hydropedological Assessments:**

- Soil Survey
- Soil Delineation
- Hydrological hillslope classification
- Hydropedological loss Quantification
- Hydropedological impact assessment
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