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SOIL, LAND USE AND LAND CAPABILITY ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED DORSTFONTEIN WEST MINE EXPANSION, MPUMALANGA PROVINCE

Prepared for

Nsovo Environmental Consulting

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SAS Environmental Group of Companies

EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed by Nsovo Environmental Consulting to conduct a soil, land use and land capability assessment as part of the Environmental Impact Assessment (EIA) and Water Use License Application process for the proposed Exxaro Dorstfontein West Mine Expansion near Kriel, Mpumalanga Province. The expansion project will henceforth be referred to as the "study area".

Soil, land use and land capability surveys were conducted in January 2019 which entailed evaluating physical soil properties and current restrictions to various land use purposes. Subsurface soil observations were made using a manual hand auger in order to assess individual soil profiles.

Based on the field assessment result, the study area for the proposed Exxaro Dorstfontein West Mine expansion are primarily utilised for cultivated crops (maize and soya beans production) and operational mining activities. This was evident at the time of the assessment as maize and soya bean fields were cultivated in the growing season. Surrounding areas are used for mining, cultivation and residential purposes.

The study area is dominated by arable of soils such as Hutton, Lichtenburg, Avalon, Glencoe, Sepane, Bloemdal and Bainsvlei forms (arable soils) which collectively constitute approximately 36.19 % of the investigated areas, whilst shallow Dresden and Arcadia soil forms (grazing soils) take up approximately 22.87% of the proposed mining footprint. Rensburg, Katspruit etc. Soil forms associated with wetland resources occupy approximately 39.90% of the study area collectively, however the remaining portion of the investigated areas is situated in an area where soils are utilized as farm residences. The identified soil forms are presented in the table below.

Identified soil forms as well as the associated land capability classes and areal extent are presented in the table below.

Land Capability classes for soil forms identified within the study area

Soil Form	Code	Diagnostic Horizon Sequence	Land Capability	Areal Extent (ha)	Percentage (%)
Hutton	Hu	Orthic A/Red Apedal(thick)	Arable (Class II)	95.10	2.58
Avalon	Av	Orthic A/Yellow Brown Apedal/ Soft Plinthic	Arable (Class IV)	1237.80	33.61
Bloemdal	Bd	Orthic A/Red Apedal/Gleyic			
Bainsvlei	Bv	Orthic A/ Red Apedal/ Soft Plinthic			
Lichtenburg	Lc	Orthic A/Red Apedal B/ Hard plinthic			
Sepane	Se	Orthic A/ Pedocutanic /Gleyic			
Glencoe	Gc	Orthic A/ Yellow Brown Apedal/ Hard Plinthic			
Katspruit	Ka	Orthic A/ Gley	Grazing (Class V)	1439.60	39.90
Longlands	Lo	Orthic A/ Albic / soft Plinthic			
Rensburg	Rs	Vertic/ Gley			
Wasbank	Wa	Orthic A/ Albic / Hard Plinthic			
Westleigh	We	Orthic A/ Soft Plinthic/ Gleyic			
Dresden	Dr	Orthic A/ Hard Plinthic	Grazing (Class VI)	842.45	22.87
Arcadia	Ar	Vertic A/ Lithic			
Witbank	Wb	Unspecified	Wildlife (Class VIII)	72.12	1.96
TOTAL				**3683.17**	**100.00**

***Infrastructural areas were not included in the table above since they not considered in the land capability ratings**

The findings of this assessment suggest that the relevant soil limiting factors within the study area for land capability and land use potential include the following:

- Shallow effective rooting depth due to shallow indurated bedrock of the Dresden, and high clay content of the Arcadia soil forms. As such, these soils are not considered to contribute significantly to agricultural productivity as they are not well suited for cultivated crops;
- Limited rooting depth due to periodic waterlogging and the slowly permeable soft plinthic horizon of the Westleigh, Longlands and Avalon soil forms within various portions of the study area;
- Limited rooting depth due to periodic waterlogging and high clay restricting characteristics of the Rensburg and Katspruit soil forms within the associated wetlands. Protection of these soils for conservation purposes takes precedence, according to the National Water Act, 1998 (Act No. 36 of 1998); and
- Lack of soil medium for plants and crop growth for the residential areas and Witbank soil form.

From a land capability point of view, the area where the proposed mining activities (discard dump extension, as well as conveyor belt and associated service road) will occur presents extensive areas of deep and highly arable soils (approximately 36.19%). Whereas other portions are situated in areas which are comprised of wetlands as well as soils not considered arable soils for cultivated agricultural production. The extent of arable soils therefore should be considered sufficient for viable cultivated small commercial farming, and thus should be avoided where feasible to minimise the loss of soil resources for current and future agricultural production.

During the operational phase of the proposed mining project, arable agricultural soils are anticipated to be disturbed by the surface mine related infrastructure establishment. The land use change will predominantly be converting from cultivated agriculture, grazing and wetlands to mining and related activities. Based on the proposed mining related infrastructure, disturbance of arable agricultural soils will be unavoidable, however the resultant impacts on these soil resources will be limited and restricted to the project footprint. The impact can however be reduced, particularly for the adjacent maize and soya bean fields, if mitigation measures and recommendations outlined in this document are considered and implemented accordingly during all phases of development.

From a soil and land capability perspective, the proposed extension of the existing discard dump will impact soil of high cultivation agricultural value as well as disturbed and wetland soils which are not regarded important for cultivation. The conveyor belt options (B) and associated service roads will have high impacts on valuable soils capable of supporting cultivated commercial agricultural production due to:

- Occurrence of arable agricultural soils;
- Adequate rainfall (600 to 800 mm);
- Gently sloping topography (at most); and
- Availability of irrigation options, such as centre pivots.

Movement of farm equipment will also be affected by the conveyor belt, as it will create a barrier in accessing agricultural land. From a soil, land use and land capability perspective, conveyor route A and associated service road is the preferred options since it will likely have minimal disturbance of arable soils in comparison to conveyor route option B.

The proposed mining development is anticipated to directly impact on the land capability of the prevailing soils, as the soils are anticipated to be permanently removed due to the nature of the proposed mining operation (i.e. removal of overburden for discard dump), and after rehabilitation the soils will not be able to regain the original land capability even with mitigation. However, the soils should be rehabilitated to support grazing land capability, should the proposed project be approved.

Following the assessment of the study area and the identified potential impacts as the result of the proposed development, key mitigation and rehabilitation measures were developed and can be summarised as follows:

- Excavation of soil should be limited within the demarcated areas as far as practically possible;
- Ensure that all stockpiles (especially topsoil) are clearly and permanently demarcated and located in defined no-go areas;
- Soil stripping should be done in conjunction with a soil specialist and careful consultation of the pre-mining soil survey is essential. This will ensure optimal soil availability for closure and rehabilitation as well as the post closure land use and avoid excessive mixing of undesirable soil due to over-stripping, as well as loss of available cover soil due to under-stripping. Such consultation is recommended for the whole soil handling process, from stripping through stockpiling to final rehabilitation;
- The A and B-horizons should be stripped separately and replaced in the same sequence on top of the spoil material. The relatively higher organic carbon content of the A-horizons provides a buffer against compaction and hardsetting and serves as a seed source which will enhance the re-establishing of natural species. B-horizons replaced on the surface tend to seal and compact significantly which increases runoff and triggers erosion;
- Stockpile height should be restricted to that which can deposited without additional traversing by machinery. A Maximum height of 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; 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 after rehabilitation or until the area can be declared as self-sustaining by an appropriately qualified soil scientist.

It is the opinion of the specialist therefore that this study provides the relevant information required for the Environmental Impact Assessment phase of the project to ensure that appropriate consideration of the agricultural resources in the study area will be made in support of the principles of Integrated Environmental Management (IEM) and sustainable development.

DOCUMENT GUIDE

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 2.1
(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;	Section 5
(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;	Section 5 and 7
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 4
(n) a reasoned opinion -	
(i) as to whether the proposed activity, activities or portions thereof should be authorised;	Section 7
(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	Section 7
(q) any other information requested by the competent authority.	None

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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.
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.
Vertic	Crack surfaces caused by swelling and shrinking colloidal physical properties as a result of soil moisture content variation. Contains polished peds surfaces often with slickensides
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.
Orthic	Maybe dark, chromic or bleached
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
Watercourse:	In terms of the definition contained within the National Water Act, a watercourse means: • A river or spring; • A natural channel which water flows regularly or intermittently; • A wetland, dam or lake into which, or from which, water flows; and • Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse; • and a reference to a watercourse includes, where relevant, its bed and banks
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
Yellow-brown Apedal	Uniform yellow and brown colouring, apedal to weak structure, non-calcareous

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

Scientific Aquatic Services (SAS) was appointed by Nsovo Environmental Consulting to conduct a soil and land capability assessment as part of the Environmental Impact Assessment (EIA) and Water Use License Application process of the proposed Exxaro Dorstfontein West Mine Expansion near Kriel, Mpumalanga Province. The Expansion project will henceforth be referred to as the "study area".

The proposed study area is located in Nkangala District Municipality of the Mpumalanga Province. The study area is situated approximately 56 km south of the town Middelburg, 45 km southwest of Emalahleni, 38 km west of the town Hendrina, and 33 km southeast of Ogies. Refer to Figure 1 and 3.

The study area for the proposed expansion operation are primarily utilised for agricultural related activities which includes cultivation of soya bean and maize as well as operational mining activities. Surrounding areas are used for mining, residential and farming purposes.

High agricultural potential land is a scarce non-renewable resource, which necessitates an Agricultural Potential assessment prior to land development, particularly for purposes other than agricultural land use which will affect extensive tracts of land, as per Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983). Agricultural potential is directly correlated to Land Capability Class (LCC), measured on a scale of I to VIII, with classes I to III considered as high agricultural potential soils, and classes V to VIII not suitable for cultivation. High potential agricultural land is defined as having "*the soil and terrain quality, growing season and adequate available moisture supply to sustain crop production when treated and managed according to best possible farming practices*" (Land Capability report, ARC, 2006).

Soil, land use and land capability surveys were conducted in January 2019 which is regarded as wet season. Even though the soil surveys were conducted during the wet season, this is not considered as limiting factor since seasonality has no bearing on the soil surveys. The soil surveys entailed evaluating physical soil properties and current restrictions to various land use purposes. Subsurface soil observations were made using a manual hand auger in order to assess individual soil profiles.

1.1 *Project Description*

The proposed Dorstfontein West expansion activities will include:

- The development of the discard dump facility which has become necessary due to the life of the current discard dump coming to the end in 2022. The discard dump extension will cater for both Slurry and discard coal and is expected to cater for the life of mine; and
- The construction of a conveyor belt and associated service road from Dorstfontein West mine which will be linked to the conveyor systems at Dorstfontein East mine to ensure seamless coal is conveyed from Dorstfontein West mine to Dorstfontein East where the coal will be loaded into trains and thereafter transported to Richards Bay Terminal.

1.2 *Terms of Reference and Scope of Work*

The points below summarise the key components of the study:

- A desktop review of existing soil related databases, to establish broad baseline conditions and areas of environmental sensitivity and sensitive agricultural areas;
- Assess spatial distribution of various soil types within the study area;
- Identify restrictive soil properties on land capability under prevailing conditions;
- Compile various maps depicting the on-site conditions, soil forms and land capability based on desktop review of existing data;
- Conduct a soil classification survey within the study area;
- Subsurface soil observations and sampling activities undertaken by means of a manual bucket hand and Dutch auger;
- Classify the dominant soil forms within the study area according to the South African Soil Classification System (Soil Classification Working Group, 2018);
- Compile various maps depicting the soil forms, land use and land capability within the study area based on the field assessment findings;
- Compile a report presenting the results of the desktop study and a description of the findings during the field assessment; and
- Provide recommended mitigation measures and management practices to implement in order to comply with applicable articles of legislation.

1.3 *Assumptions and Limitations*

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

- The soil survey conducted as part of the land capability assessment was confined within the study area, which is considered adequate for the purpose of this investigation;
- Sampling by definition means that not all areas are assessed, and therefore some aspects of soil and land capability may have been overlooked in this assessment. However, it is the opinion of the specialist that this assessment was carried out with sufficient sampling and in sufficient detail to enable the proponent, the Environmental Assessment Practitioner (EAP) and the regulating authorities to make an informed decision regarding the proposed mining activities;
- Land Capability was classified according to current soil restrictions, with respect to prevailing climatic conditions on site; however, it is virtually impossible to achieve 100% purity in soil mapping, the delineated soil map units could include other soil type(s) as the boundaries between the mapped soils are not absolute but rather form a continuum and gradually change from one type to another. Soil mapping and the findings of this assessment were therefore inferred from extrapolations from individual observation points;
- Since soils occur in a continuum with infinite variances, it is often problematic to classify any given soils as one form, or another. for this reason, the classifications presented in this report are based on the "best fit" to the soil classification system of South Africa;

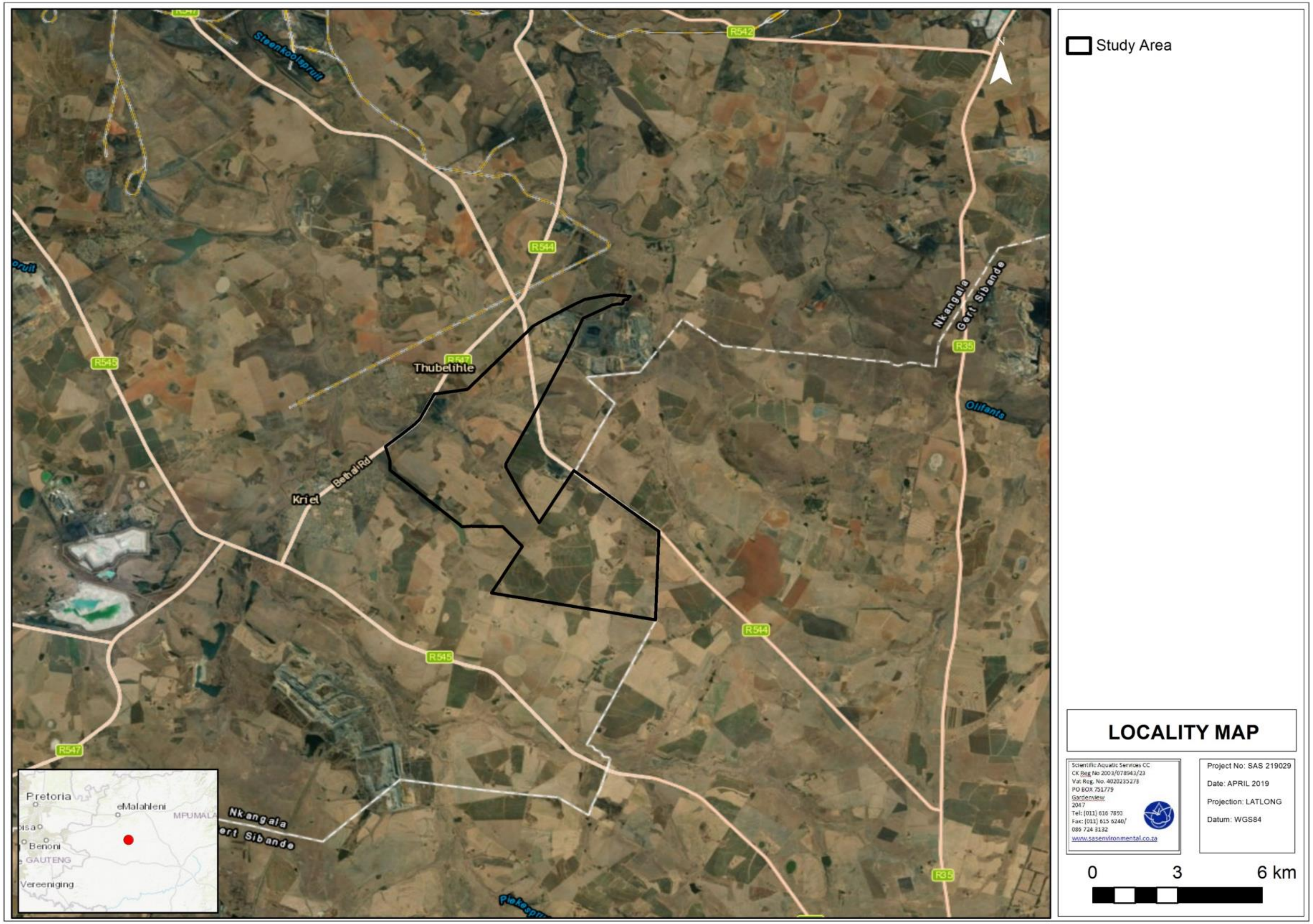

Figure 1: Digital satellite imagery depicting the locality of the study area in relation to the surrounding areas.

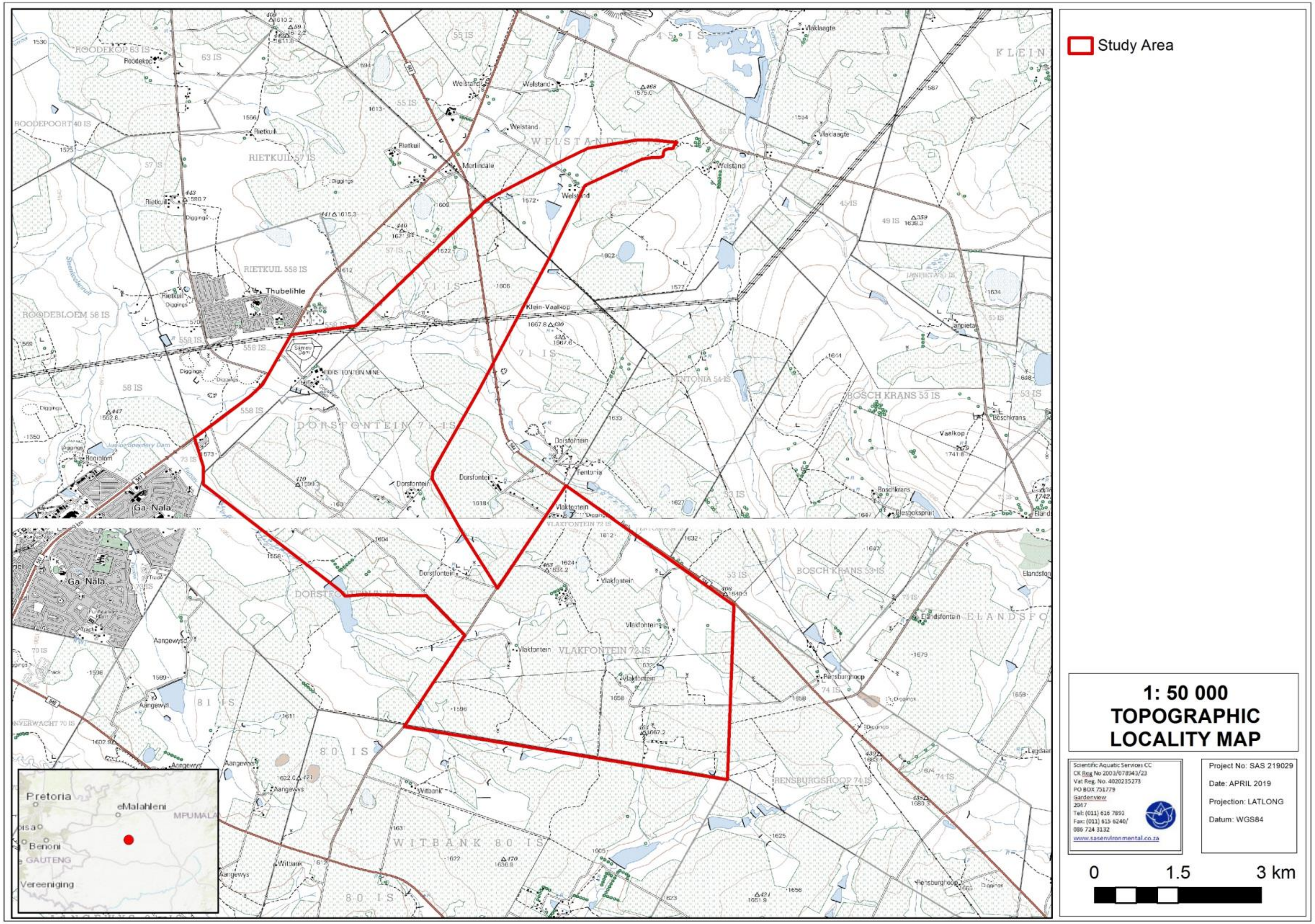

Figure 2: Location of the study area depicted on a 1:50 000 topographical map in relation to surrounding area.

2. METHOD OF ASSESSMENT

2.1 Literature and Database Review

A desktop study was compiled from various data sources including but not limited to the Agricultural Geo-Referenced Information System (AGIS) and other sources as listed under references.

2.2 *Desktop* Screening

A background study including a literature review was conducted prior to commencement of the field assessment. This is done in order to gather the pre-determined soil and land capability data within the study area. Different data sources that are listed under references were used for the assessment, including but not limited to the Agricultural Geo-Referenced Information System (AGIS).

2.3 Soil Classification and Sampling

- A soil survey was conducted in January 2019 by a qualified soil specialist at which time the identified soils within the study area were classified into soil forms;
- 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;
- Dominant soil forms were classified according to the South African Soil Classification System (Soil Classification Working Group, 2018). A Global Positioning System (GPS) was used to record assessed survey and sampling points;
- It was also the objective of the assessment to provide recommended mitigation measures and management practices to implement in order to comply with applicable articles of legislation.

Table 1 and Figure 3 below, illustrate a typical arrangement of master horizons in a soil profile.

Table 1: Typical Arrangement of Master Horizons in Soil Profile

<table>
<tr><td rowspan="6">Soil</td><td rowspan="6">Zone in which soil processes are maximally expressed</td><td colspan="5">Arrangement of master horizons</td></tr>
<tr><td rowspan="5">O-
Organic</td><td rowspan="3">C- Regic sand (c), Stratified alluvium, (c), Man -Made Soil Deposits</td><td rowspan="2">A</td><td colspan="2">Humic, Vertic, Melanic, Orthic</td></tr>
<tr><td colspan="2">E</td></tr>
<tr><td>B</td><td>Red Apedal, yellow Brown Apedal, Soft Plinthic, Hard Plinthic, Prismacutanic, Pedocutanic, Lithocutanic, Neocutanic, Neocarbonate, Podzol, Podzol with placic pan</td><td rowspan="3">G - Horizon</td></tr>
<tr><td>C</td><td colspan="2">Dorbank, Soft Carbonate horizon, Hard Carbonate horizon, Saprolite, Unconsolidated without signs of wetness, Unconsolidated with signs of wetness, Unspecified material with signs of wetness</td></tr>
<tr><td colspan="3">R-Hard Rock</td></tr>
</table>

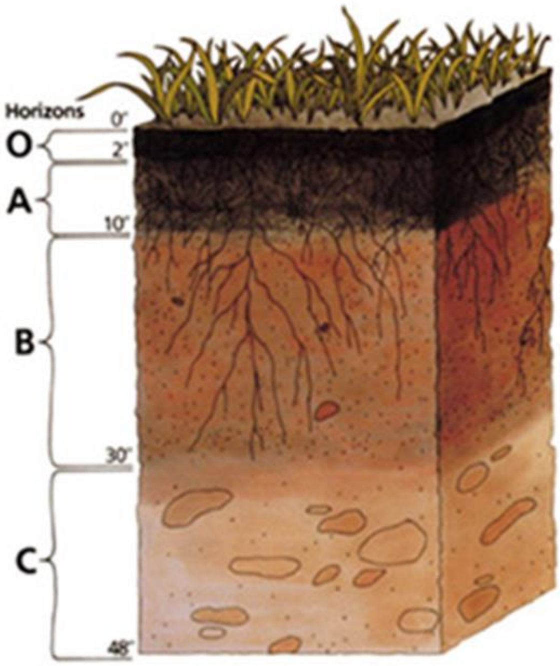

Figure 3: Schematic diagram depicting a conceptual presentation of a typical soil profile

2.4 Land Capability Classification

Agricultural potential is directly related to Land Capability, as measured on a scale of I to VIII, as presented in Table 2 below; with Classes I to III classified as high potential 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 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 to inform the necessary mitigation measures.

Table 2: Land Capability Classification (Camp et al., 1998)

Land Capability Group	Land Capability Class	Increased intensity of use									Limitations
Arable	I	W	F	LG	MG	IG	LC	MC	IC	VIC	No or few limitations. Very high arable potential. Very low erosion hazard
	II	W	F	LG	MG	IG	LC	MC	IC	-	Slight limitations. High arable potential. Low erosion hazard
	III	W	F	LG	MG	IG	LC	MC	-	-	Moderate limitations. Some erosion hazards
	IV	W	F	LG	MG	IG	LC	-	-	-	Severe limitations. Low arable potential. High erosion hazard.
Grazing	V	W	-	LG	MG	-	-	-	-	-	Water course and land with wetness limitations
	VI	W	F	LG	MG	-	-	-	-	-	Limitations preclude cultivation. Suitable for perennial vegetation
	VII	W	F	LG	-	-	-	-	-	-	Very severe limitations. Suitable only for natural vegetation
Wildlife	VIII	W	-	-	-	-	-	-	-	-	Extremely severe limitations. Not suitable for grazing or afforestation.

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 3: 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) and the Mpumalanga Biodiversity Sector Plan (2014).

- The Mean Annual Precipitation (MAP) on the study area is estimated to range between from 601 to 800mm per annum;
- According to the Soil and Terrain (SOTER) database and the 1:250 000 geological map of South Africa, the study area are underlain by Sandstone rock formation;
- The SOTER database indicates that the study area collectively is comprised of strongly weathered acid soils with low base saturation, classified as Para plinthic Acrisols (ACp);
- The desktop assessment indicates that the study area is generally considered to have a high potential arable land capability (Class II) except for areas where restrictions are formed due to shallow soils and soils prime to waterlogging;
- According to the AGIS database, the livestock grazing capacity potential is estimated to be approximately 5 hectares per large animal unit (Morgenthal *et al.*, 2005);
- The natural soil pH is estimated to be range between 5.5 and 6.4, indicating that the soils are anticipated to be slightly acidic to neutral, as interpolated from topsoil pH values obtained from the AGIS database;

- According to the Geology 2001 layer the entire portions of the study area is underlain by geological strata of the Ecca group; and
- According to the Soils 2001 database layer the study area is characterized by a plinthic catena: dystrophic and/or mesotrophic; red soils not widespread, upland duplex and margalitic soils rare.

4. FIELD ASSESSMENT RESULTS

4.1 Current Land Use

The study area is primarily utilised for crops cultivation (maize and soya beans production) and mining activities. This was evident at the time of the assessment as maize and soya bean fields were cultivated during the growing season. Surrounding areas are used for mining, cultivation and residential purposes. Primary land use within the study area is illustrated in Figure 4 and 5 below.

Figure 4: Photographs illustrating the dominant land use within the study area.

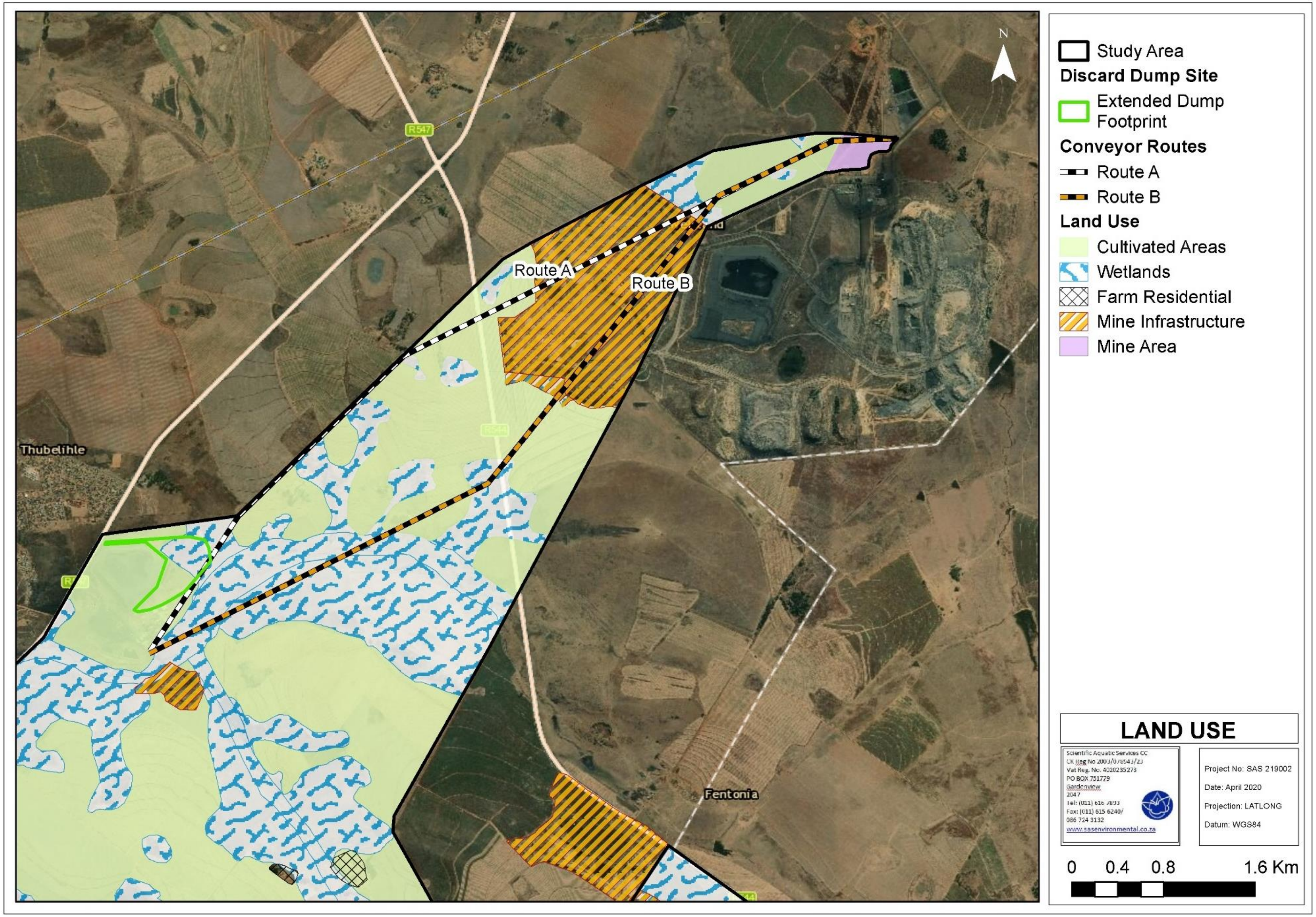

Figure 5: Map depicting current land use overlain by proposed mining operation within the study area

4.2 *Dominant Soil Forms*

The study area collectively comprises approximately 36.19% of arable soils, classified as Hutton (Hu) Bloemdal (Bd), Bainsvlei (Bv), Lichtenburg (Lc), Avalon (Av) and Glencoe (Gc). The occurring arable soils are suitable for cultivation due to their structureless and loose characteristics (sandy loam), thus allowing favorable conditions for the majority of cultivated crops by providing an effective root growth, adequate moisture and nutrient retention to support optimum growth and production. Approximately 22.87% of the study area is comprised of shallow soils such as Dresden (Dr) and Arcadia (Ar). These soils are considered to have low arable potential land capability, attributed to their shallow nature which mainly restrict root growth and moisture retention, thus creating conditions unfavorable for cultivation.

Moreover, soils associated with wetlands (i.e. Rensburg (Rs), Katspruit (Ka), Longlands (Lo), Westleigh (We) and Wasbank (Ws)) constitute approximately 39.90% of the total investigated areas. These soils are generally limited to supporting plants that are tolerant to prolonged wet conditions (i.e. hydrophytes). Soils associated with wetlands are typically of low agricultural potential due to various limiting factors such as high clay content and waterlogging conditions. The spatial distribution of all identified soil forms within the study area is presented in soil map in **Figure 6** below.

Table 4: Diagnostic horizon sequence for soil forms identified within the study area

Soil Form	Code	Diagnostic Horizon Sequence	Land Capability	Areal Extent (ha)	Percentage (%)
Hutton	Hu	Orthic A/Red Apedal/ Unspecified	Arable (Class II)	95.10	2.58
Avalon	Av	Orthic A/Yellow Brown Apedal/ Soft Plinthic	Arable (Class IV)	1237.80	33.61
Bloemdal	Bd	Orthic A/Red Apedal/Gleyic			
Bainsvlei	Bv	Orthic A/ Red Apedal/ Soft Plinthic			
Lichtenburg	Lc	Orthic A/Red Apedal B/ Hard plinthic			
Sepane	Se	Orthic A/ Pedocutanic /Gleyic			
Glencoe	Gc	Orthic A/ Yellow Brown Apedal/ Hard Plinthic			
Katspruit	Ka	Orthic A/ Gley	Grazing (Class V)	1439.60	39.90
Longlands	Lo	Orthic A/ Albic / soft Plinthic			
Rensburg	Rs	Vertic/ Gley			
Wasbank	Wa	Orthic A/ Albic / Hard Plinthic			
Westleigh	We	Orthic A/ Soft Plinthic/ Gleyic			
Dresden	Dr	Orthic A/ Hard Plinthic	Grazing (Class VI)	842.45	22.87
Arcadia	Ar	Vertic A/ Lithic			
Witbank	Wb	Unspecified	Wildlife (Class VIII)	72.12	1.96
TOTAL				**3683.17**	**100.00**

***Infrastructural areas were not included in the table above since they not considered in the land capability ratings**

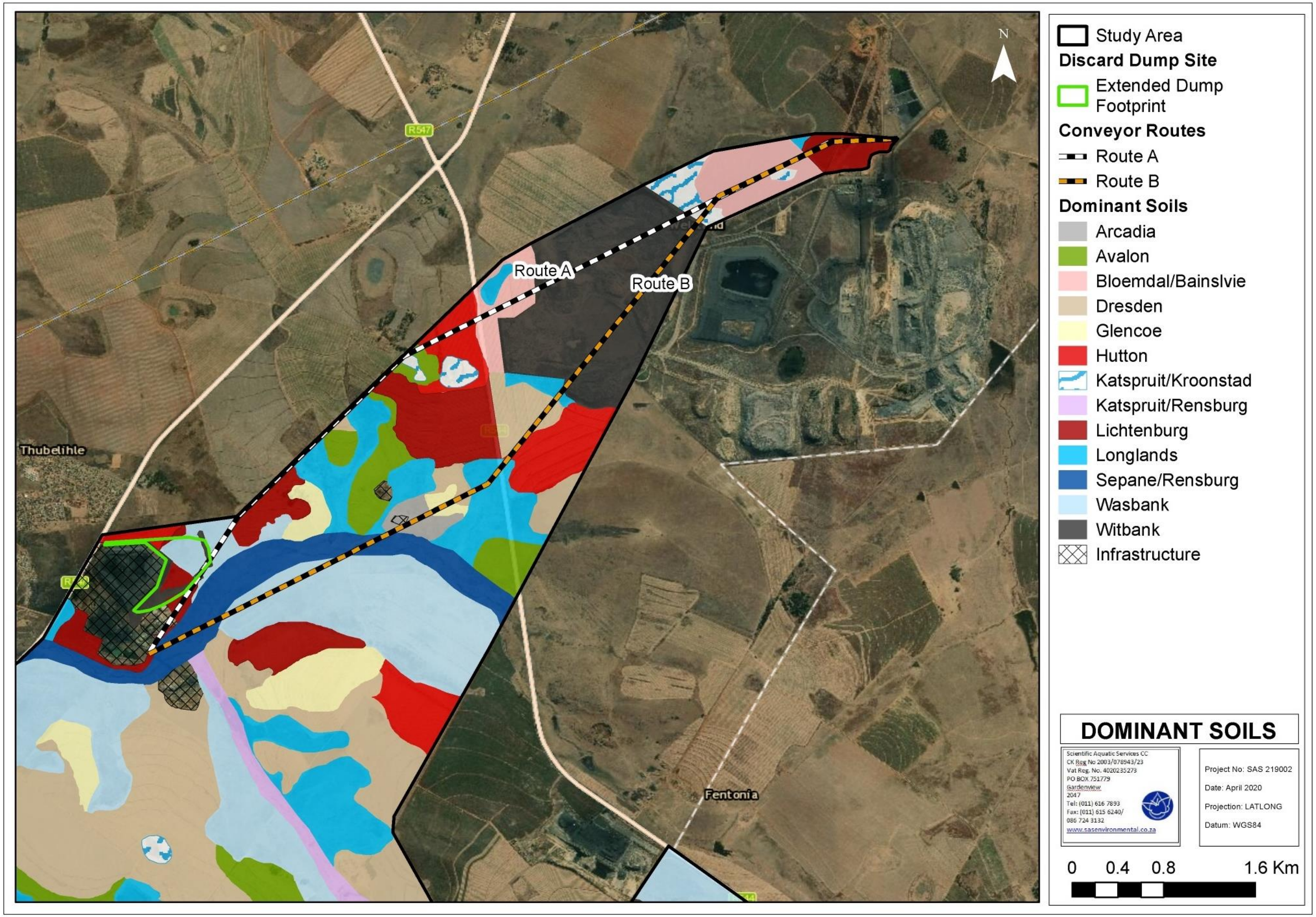

Figure 6: Soil map depicting identified soil forms associated with the mining footprints within the study area

4.3 *Land Capability Classification*

In South Africa, agricultural land capability is usually restricted by climatic conditions, with specific mention to water availability (Rainfall). 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 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 1, with local climate that is favourable for good yield for a wide range of adapted crops throughout the year. The identified soils were classified into land capability classes using the Camp *et. al*. Land Capability Classification system (Camp *et al.,* 1998), as presented from **Figure 7**. The identified land capability limitations for the identified soils are discussed in comprehensive “dashboard style” summary tables presented from Tables 4 to 6 below. The dashboard reports aim to present all the pertinent information in a concise and visually appealing fashion.

Figure 7: Map depicting land capability classes of soils associated with the mining footprints within the study area.

Table 5: Summary discussion of the Arable (Class II) land capability class

Land Capability: Arable - Class II

View of the gently sloping terrain where Hutton soil forms were identified

Terrain Morphological Unit (TMU)	Palin sloping landscape positions < 2 % plain slope	
Soil Form(s)	Hutton	
Diagnostic Horizon Sequence	0 - 36 cm: Orthic A 36 – 90 cm: Red Apedal	
Physical Limitations	None; these soils have sufficient capability to support most cultivated crops, attributable to their good drainage and effective root depth characteristics. These soils are well suited for agricultural production.	
Overall impact significance prior to mitigation	H	These soils are considered to have a significant contribution to food security, as they are well suited for cultivated crops, due to their ability to provide optimum growing conditions for the majority of cultivated crops, thus the proposed mining and related activities are anticipated to pose high impact (Conveyor route A has a higher impact than Conveyor route B), should the mining proceed. However, the impact on land capability of these soils can be minimized to a certain degree, provided that the proposed integrated mitigation and rehabilitation measures are implemented accordingly. As much as the soil will not regain its original status at post mining, they can be still used for natural grazing.
Overall impact significance post mitigation	MH	

Photograph notes	View of the identified Hutton soil forms.

Land Capability
The identified Hutton soil forms are considered prime agricultural soils of high (Class II) land capability, suitable to arable agricultural land use. Therefore, these soil forms are considered to contribute significantly to provincial and/or national agricultural productivity if used for crop cultivation, and are essentially also well-suited for other less intensive land uses such as grazing, forestry, etc. However, emphasis is directed to their agricultural crop productivity due to the scarcity of such soil resources on a national scale and food security concerns.

Business case, Conclusion and Mitigation Requirements:
These soils are considered suitable for cultivated agriculture. They cover a very substantial portion of the study area and sufficient area for viable for commercial agricultural production is available. Therefore, the impact of the proposed mining operation is considered high, as the soils are anticipated to be permanently destroyed by the proposed mining and related activities unless stripping and stockpiling of topsoil is carefully planned and undertaken. Therefore, it is highly recommended that stripping and stockpiling guidelines (refer to the guidelines in Section 6.5 of this report), are carefully applied, as these soils are likely to lose their natural physical and chemical properties during the mining process if not properly managed.

Table 6: Summary discussion of the Arable (Class IV) land capability class

Land Capability: Arable - Class IV

View of the gently sloping terrain where Bloemdal/ Bainsvlei/Sepane soil forms were identified

Terrain Morphological Unit (TMU)	Relatively flat to gently sloping land of <0.5% slope	
Soil Form(s)	**Bloemdal/ Bainsvlei/Sepane**	
Diagnostic Horizon Sequence	0 -18 cm: Orthic A 18 - 52 cm: Red apedal B/ Pedocutanic ≥ 52 cm: Gleyic/ Soft Plinthic	
Physical Limitations	The seasonal waterlogging conditions resulting anoxic conditions on the underlying horizon is the main limitation for these soil forms.	
Overall impact significance prior to mitigation	**MH**	The overall impact of the proposed mining activities on the land capability of these soils is anticipated to be Medium High (MH) without mitigation on areas where extended discard dump footprint will be constructed. These MH anticipated impacts (**conveyor route A, and service road**) can be can reduced to Low (L) with adherence to the mitigation measures stipulated on section 6.5 of this report
Overall impact significance post mitigation	**L**	

Photograph notes	View of the identified Bloemdal / Bainsvlei soil forms.

Land Capability
The identified Bloemdal/ Bainsvlei soil forms are considered to be of moderate (Class IV) land capability and are marginally suitable for arable agricultural land use. Therefore, these soils are considered to make a moderate contribution to agricultural productivity on a regional and national scale.

Business case, Conclusion and Mitigation Requirements:
Although considered to be marginally suitable for arable crops, these soils can yield profitable returns under prudent crop selection and conservative soil management practices. The impact of the proposed mining activities is anticipated to be relatively medium on the land capability of these soils. This is due to the proposed mining related infrastructure which will impose high risk in terms of alteration (both physical and chemical status) and pollution of these soil forms

Table 7: Summary discussion of the Arable (Class IV) land capability class

<table>
<tr><td colspan="3">Land Capability: Arable - Class IV</td><td colspan="2" rowspan="2"> </td></tr>
<tr><td colspan="3">
View of the Avalon soils were encountered</td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td colspan="2">gently landscapes of < 1% slope gradient</td><td rowspan="2">Photograph notes</td><td rowspan="2">View of the identified Avalon soil form.</td></tr>
<tr><td>Soil Form(s)</td><td colspan="2">Avalon</td></tr>
<tr><td>Diagnostic Horizon Sequence</td><td colspan="2">0 – 32 cm: Orthic A
32 – 63 Yellow Brown Apedal
63 – Soft Plinthic B</td><td colspan="2" rowspan="2">Land Capability
The identified Avalon soil forms are considered to be of moderate (class IV) land capability and are marginally suitable for arable agricultural land use. Therefore, these soils are considered to make a moderate contribution to agricultural productivity on a regional and national scale. These soils are suited for relatively shallow rooted crops and cultivated pastures.</td></tr>
<tr><td>Physical Limitations</td><td colspan="2">The prolong water logging and root impediment conditions, due to the underlying plinthic material, consequently limiting the soils form being utilised for cultivated agriculture.</td></tr>
<tr><td>Overall impact significance prior to mitigation</td><td>MH</td><td rowspan="2">The overall impact of the proposed mining operation (conveyor route A & B) on the land capability of these soils is anticipated to be medium low due to the limited potential agricultural opportunities. Though these soils are considered to have low agricultural potential, they are relatively deep thereby allowing a moderate root penetration before reaching the plinthic horizon.</td><td colspan="2" rowspan="2">Business case, Conclusion and Mitigation Requirements:
Although considered to be marginally suitable for arable crops, these soils can yield profitable returns under prudent crop selection and conservative soil management practices. The impact of the proposed operation on the land capability of these soils is anticipated to be moderate. However, implementation of concurrent rehabilitation and the proposed integrated mitigation measures is highly recommended. Furthermore, avoidance of the clayey Avalon soil form associated with the seasonal wetland zone is highly recommended. The proposed integrated mitigation measures are provided on Section 5 and 6 of the report.</td></tr>
<tr><td>Overall impact significance post mitigation</td><td>ML</td></tr>
</table>

Table 8: Summary discussion of the Arable (Class IV) land capability class

Land Capability: Arable - Class IV

View of the gently sloping terrain where Glencoe/Lichtenburg soil forms were identified

Terrain Morphological Unit (TMU)	Relatively flat to gently sloping land of <0.5% slope	**Photograph notes**	View of the identified Glencoe / Lichtenburg soil forms.
Soil Form(s)	**Glencoe/ Lichtenburg**		
Diagnostic Horizon Sequence	0 -18 cm: Orthic A 18 - 52 cm: Red/ yellow-brown Apedal B ≥ 52 cm: Hard plinthite	**Land Capability** The identified Glencoe/ Lichtenburg soil forms are considered to be of moderate (class IV) land capability and are marginally suitable for arable agricultural land use. Therefore, these soils are considered to make a moderate contribution to agricultural productivity on a regional and national scale.	
Physical Limitations	Glencoe and Lichtenburg soil forms contain hard plinthite underlying diagnostic horizon, this horizon cannot be cut with a spade even when wet. The plinthite horizon is associated with seasonal waterlogging condition which is regarded as the main limitation for these soil forms.		
Overall impact significance prior to mitigation	**MH**	The overall impact of the proposed mining operation expansion and associated infrastructure on the land capability of these soils is anticipated to be Medium High (MH) since the proposed infrastructure may result in sever disturbance of soil on both natural physical and chemical characteristics.	**Business case, Conclusion and Mitigation Requirements:** Although considered to be marginally suitable for arable crops, these soils can yield profitable returns under prudent crop selection and conservative soil management practices. The impact of the proposed mining expansion and the associated infrastructure is anticipated to be relatively High (MH) on the land capability of these soils.
Overall impact significance post mitigation	**ML**		

Table 9: Summary discussion of the Grazing (Class V) land capability class

Land Capability: Grazing - Class V

The view of the identified soils with signs of wetness and mottling

Terrain Morphological Unit (TMU)		Relatively plain to gently sloping landscape of < 1.7% slope gradient
Soil Form(s)		Westleigh/Longlands/Wasbank
Diagnostic Horizon Sequence		0 -43 cm: Orthic A 43 - 60 cm: Soft Plinthic B (Westleigh)
		0 – 25 cm: Orthic 25 – 60 cm: Albic 60 cm – 100 cm: Soft Plinthic B (Longlands)
Physical Limitations		The prolong water logging and root impediment conditions, due to the underlying plinthic material, consequently limiting the soils form being utilised for cultivated agriculture.
Overall impact significance prior to mitigation	**ML**	The overall impact of the proposed mine infrastructure such as conveyor routes A & B on the land capability is anticipated to be Medium Low, as these soils are characterised with mottling which is an indication of prolonged wetness, therefore they can be best described as having low agricultural potential, as they are not suited for cultivated crops. However, soils must be stripped according to the rehabilitation soil management plan and stockpiled accordingly, so as to lower the impact to an acceptable level. The summary of the mitigation and rehabilitation measures are outlined under Section 6 of this report.
Overall impact significance post mitigation	**L**	

Photograph notes	View of the morphology of the identified Westleigh and Longlands soil forms.

Land Capability

The identified soils are considered to be of poor (class V) land capability and are not suitable for arable agricultural land use. Theses soils are, at best, suited for natural pastures for light grazing. Therefore, these soils are considered to make a substantial contribution to extensive subsistence farming on a local scale.

Business case, Conclusion and Mitigation Requirements:

The identified soil forms are, are best, suited for grazing. In most cases the land selected for grazing is associated with low agricultural potential due to various limiting factors, root penetration and prolonged water logging restricting the suitability of the land for agricultural productivity especially crop production. As much as these soils are considered to have low agricultural potential, the correct application of the mitigation and rehabilitation measures outlined in this report (on Section 5/6) is deemed necessary, as these soils are important for grazing opportunities.

Table 10: Summary discussion of the Wetlands (Class V) land capability class

<table>
<tr><td colspan="3">Land Capability: Wetland - Class V</td><td colspan="2" rowspan="2"></td></tr>
<tr><td colspan="3">
View of the wetlands where Rensburg soils were encountered</td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td colspan="2">Valley bottoms of < 0.5% slope gradient</td><td rowspan="2">Photograph notes</td><td rowspan="2">View of the identified Rensburg/Katspruit soil forms.</td></tr>
<tr><td>Soil Form(s)</td><td colspan="2">Rensburg/Katspruit soil forms</td></tr>
<tr><td>Diagnostic Horizon Sequence</td><td colspan="2">0 – 33 cm: Vertic A/Orthic
< 50 cm: Unspecified material/G horizon</td><td colspan="2" rowspan="2">Land Capability
These soil forms were classified as class V land capability due to land use limitations related to prolonged waterlogging attributed to inherently poor internal drainage of the underlying G horizon. The prolonged waterlogging of these soils limits their land use largely to wilderness and habitats for various plant species that are inherently tolerant and/or obligate to anoxic conditions. These soils are therefore not considered to contribute significantly to provincial and/or national agricultural productivity. It must however be noted that these soils are considered important from an ecological and water resource management perspective.</td></tr>
<tr><td>Physical Limitations</td><td colspan="2">Plant roots development and water infiltration are largely impeded by the clayey, slowly permeable G horizon occurring at shallow depths of less than 50 cm. Prolonged saturation of these soils are typically induce anoxic (oxygen deficiency) conditions which hamper root development of most arable crops.</td></tr>
<tr><td>Overall impact significance prior to mitigation</td><td>ML</td><td rowspan="2">The overall impact of the proposed mine infrastructure (conveyor routes and extended discard dump footprint) on the land capability of these soils is anticipated to be relatively low due to their inherently poor land capability. However, these soils have an ecological importance that is related to wetland habitat; therefore, an unnecessary disturbance of these soils must be avoided due to the importance from an ecological and water resource management perspective. Furthermore, the susceptibility to prolonged waterlogging conditions (inundation), as implied by the occurrence of the plinthite and G-horizon at relatively shallow depth, should be considered and avoided where possible for soil structural integrity.</td><td colspan="2" rowspan="2">Business case, Conclusion and Mitigation Requirements:
Although not considered to be of significant agricultural productivity, these soils are however considered to be of significant ecological conservation as they are characteristically unique to wetland habitats; and as such the recommendations and management measures of the wetland assessment report conducted as part of the environmental assessment and authorisation process take precedence. It is highly likely that these soils will be affected by the proposed activities, thus it is imperative that the mitigation measure should be implemented during all phases of development. Refer to Section 6 for a detailed mitigation procedure.</td></tr>
<tr><td>Overall impact significance post mitigation</td><td>L</td></tr>
</table>

Table 11: Summary discussion of the Grazing (Class VI) land capability class

<table>
<tr><td colspan="3">Land Capability: Grazing - Class VI

View of the Dresden soils were encountered</td><td colspan="2"></td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td colspan="2">gently landscapes of < 1% slope gradient</td><td rowspan="2">Photograph notes</td><td rowspan="2">View of the identified Dresden soil form.</td></tr>
<tr><td>Soil Form(s)</td><td colspan="2">Dresden</td></tr>
<tr><td>Diagnostic Horizon Sequence</td><td colspan="2">0 – 33 cm: Orthic A
33 – 55 cm: Hard plinthic B</td><td colspan="2" rowspan="2">Land Capability
The identified Dresden soil forms are considered to be of poor (class VI) land capability and are not suitable for arable agricultural land use. This soil is, at best, suitable for natural pastures for light grazing. Therefore, this soil is considered to make a substantial contribution to extensive subsistence farming on a local scale.</td></tr>
<tr><td>Physical Limitations</td><td colspan="2">This soil is characterized by a very shallow effective depth, loamy sand of poor structure overlying relatively impermeable bedrock.</td></tr>
<tr><td>Overall impact significance prior to mitigation</td><td>ML</td><td rowspan="2">The overall impact of the proposed mining activities on the land capability of this soil is anticipated to be low due to the limited potential agricultural opportunities. Moreover, the shallow nature of this soil makes them not suitable for the majority of the cultivated crops, thus they have low yields to contribute to the regional and provincial food production. Soil are to be replaced as per soil management and rehabilitation guidelines; and access routes are to be kept to a minimum as to reduce any unnecessary compaction from occurring.</td><td colspan="2" rowspan="2">Business case, Conclusion and Mitigation Requirements:
The identified soil form is at best, suited for grazing and/or wilderness practices. This is due to the relatively shallow parent rock and lithocutanic material. The impact of the proposed mining activities on the land capability of this soil is anticipated to be low after mitigation. As much as this soil is not considered as prime agricultural soil, this soil is important for potential grazing opportunities. Therefore, implementation of rehabilitation and the proposed integrated mitigation measures that are stipulated on Section 5 and 6 of this report, are recommended to reinstate the natural topography of the area post mining to ensure that the general structure and functionality of the landscape is reinstated.</td></tr>
<tr><td>Overall impact significance post mitigation</td><td>L</td></tr>
</table>

Table 12: Summary discussion of the Grazing (Class VI) land capability class

<table>
<tr><td colspan="3"></td><td colspan="2"></td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td colspan="2">Gently sloping terrain and valley bottom landscapes of < 1% slope gradient</td><td rowspan="2">Photograph notes</td><td rowspan="2">View of the identified Arcadia soil form.</td></tr>
<tr><td>Soil Form(s)</td><td colspan="2">Arcadia (Ar)</td></tr>
<tr><td>Diagnostic Horizon Sequence</td><td colspan="2">0-22 cm: Vertic A
≥ 22 cm: Unspecified</td><td colspan="2" rowspan="2">Land Capability
The identified Arcadia soil form is considered to be of poor (class V) land capability, which is generally not considered suitable to arable agricultural land use. The inherently high natural fertility of these soils is considered to be of significant value for grazing purposes. Traditionally these soils are ploughed for subsistence farming for shallow rooted arable crops like vegetables under resource-poor circumstances, due to their limiting factors such as high clay content which tightly hold soil water such that it is not readily available for plant uptake. Thus, require intensive management practices. While these soils are not considered prime agricultural production soils, these soils are under cultivation for commercial farming thus making a contribution to the local, regional and national food production.</td></tr>
<tr><td>Physical Limitations</td><td colspan="2">Vertic soils inherently have some serious management constraints attributed to excessive stickiness when wet and hardening when dry due to high smectitic (expandable) clay minerals and high plasticity index values (>32 PI).</td></tr>
<tr><td>Overall impact significance prior to mitigation</td><td>ML</td><td rowspan="2">The overall impact of the proposed mine infrastructure (conveyor route B and extended discard dump footprint) on the land capability of these soils is anticipated to be moderate (M). While these soils are not considered prime agricultural soils, historical cultivation activities have occurred as well as livestock grazing which has therefore qualified these soils for cultivation under intensive management. With application of the recommended mitigation measures the impact will effectively be reduced to a low level, so as to ensure that the local and regional food production supply is not disrupted in the long term.</td><td colspan="2" rowspan="2">Business case, Conclusion and Mitigation Requirements:
Although considered to be marginally suitable for arable crops, these soils can yield profitable returns under prudent crop selection and conservative soil management practices. The impact of the proposed operation on the land capability of these soils is anticipated to be moderate. However, implementation of concurrent rehabilitation and the proposed integrated mitigation measures is highly recommended to prevent long term impacts on agricultural productivity. Furthermore, avoidance of the clayey Avalon soil form associated with the seasonal wetland zone is highly recommended. The proposed integrated mitigation measures are provided on Section 5 and 6 of the report.</td></tr>
<tr><td>Overall impact significance post mitigation</td><td>L</td></tr>
</table>

Table 13: Summary discussion of the Wilderness (Class VIII) land capability class

<table>
<tr><td colspan="3">Land Capability: Wilderness - Class VIII

View of the highly disturbed and developed/infrastructure areas classified as the Witbank soil form</td><td colspan="2"></td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td colspan="2">Not applicable; highly disturbed areas</td><td rowspan="2">Photograph notes</td><td rowspan="2">View of the identified Witbank soil forms</td></tr>
<tr><td>Soil Form(s)</td><td colspan="2">Witbank (Anthrosols)</td></tr>
<tr><td>Diagnostic Horizon Sequence</td><td colspan="2">Not applicable; highly disturbed soils</td><td colspan="2" rowspan="2">Land Capability
These identified Witbank soils have very poor (class VIII) land capability attributed to the potential toxicity from historic and on-going coal mining activities in the vicinity of the proposed power line servitude. This land capability class also includes area where the original soil has been buried and/or extensively modified by anthropogenic activities. These soils are therefore not considered to make a significant contribution to agricultural productivity even on a local scale.</td></tr>
<tr><td>Physical Limitations</td><td colspan="2">Comprises of extensively disturbed areas due from anthropogenic activities to an extent that no recognisable diagnostic soil horizon properties could be identified. These soils mainly included the opencast mining areas, as observed during the site assessment. These soils entail various limitations, primarily the absence of soil as a growth medium for arable agriculture.</td></tr>
<tr><td>Overall impact significance prior to mitigation</td><td>L</td><td rowspan="2">The overall impact of the proposed infrastructure development (conveyor route B) on the land capability of these soils is anticipated to be low (L) and can be effectively managed by implementing the general house-keeping mitigatory measures to minimise impacts on adjacent productive soils.</td><td colspan="2" rowspan="2">Business case, Conclusion and Mitigation Requirements:
No particular remedial measures are deemed necessary for these soils, as their current state requires major rehabilitation already. These areas should rather be rehabilitated holistically at closure.</td></tr>
<tr><td>Overall impact significance post mitigation</td><td>VL</td></tr>
</table>

5. IMPACT ASSESSMENT AND MITIGATION MEASURES

The study area is predominantly used for agricultural purposes as they are situated in areas of moderate high arable soils, with maize and soya bean production as an active enterprise. From land use and land capability point of view the proposed mining activities will have a direct and significant impact to these soils and the associated land capability and potentially the end land use. Significant impacts on arable soil is anticipated on the proposed conveyor belt. The extension of the existing discard dump is anticipated to result in a significant loss of some portions of agricultural important soils and soil of low agricultural importance and the suitable land use is grazing. However, such soils may have significant importance in supporting wetland ecosystems and the importance of wetlands must be considered in the overall assessment of impacts of the project. The dominant soils within the study area have an important bearing on agricultural productivity, with significant contribution to the local, regional, provincial as well as national food production. Therefore, their protection, where feasible is deemed imperative to ensure that the area remains functional post closure.

During the construction phase, activities will mainly be establishment of the conveyor belt to transport coal material form Dorstfontein West mine to Dorstfontein East mine, extension of the existing discard dump and construction of service road which will run parallel the conveyor. This will entail the clearing of areas and the disturbance of the topsoil through excavations as well as soil stockpile establishment. The topography and natural drainage lines will be disturbed. The overall impact will be loss of topsoil as a result of erosion and possible contamination of soil resources by dust and hydrocarbons due to the excavation activities. Soil compaction caused by heavy vehicles and machinery surrounding the discard dump area could also be a problem. Soil stripping will require the removal of all soil materials. Construction activities will change the land use from arable and grazing land capability to mining causing unsuitable conditions for any further commercial farming.

During the operational phase, soil erosion through wind, storm water run-off, and soil pollution by means of hydrocarbon contamination is anticipated. Water runoff from roads must be controlled and managed by means of cogently designed and managed storm water management facilities in order to prevent soil erosion on the adjacent fields. Hydrocarbon spills are likely possible in mine site due to the large volumes of diesel and oil storages for consumption by mine vehicles and equipment. Pollution may however be localised. Small pockets of localised pollution may be cleared up easily using commercially available hydrocarbon clean-up kits.

During the decommissioning and closure phase, the anticipated activities to take place includes removal of temporary structures and facilities, removal and appropriate disposal of waste materials (certificates of disposal required), removal of bunded areas as well as removal of temporary fences and signage. Potential soil contamination, compaction and dust emission may however occur as a result of decommissioning plant and equipment. Thus, this needs to be taken into consideration to ensure that mitigation measures are put in place in efforts to minimise the impacts on soil resources during this phase of the project.

5.1 Mining Activities

The potential impact triggers at various phases of the proposed development are presented in Table 14 below.

Table 14: Summary of the anticipated Activities for the proposed development

Phase	Activities
Construction	- Land and footprint preparation; - Topsoil stripping and stockpiling; - Establishment of surface infrastructure; and - Waste Management
Operational	- Soil compaction from frequent traffic of mining machinery; - Establishment of overburden dumps covering and compacting soils; - Soil erosion from bare (un-vegetated) cultivated fields; - Transportation (Conveyor belt); - Operation of infrastructure and roads; and - Waste Management
Closure and Rehabilitation	- Demolishing and decommissioning of all surface infrastructure; - Removal of contaminated soils; - Reshaping of the landscape and reinstatement of the natural topography; and - Rehabilitation of the impacted areas in the vicinity of the mining footprint - Waste Management

5.1.1 Impact: soil erosion and dust emission

The study area is largely encompassed with sandy loam textured soils with low water retention capacity, thus they typically more susceptible to erosion in comparison with clay textured soils, which in contrast are less vulnerable to erosion. However, the parameters determining the extent and severity of soil erosion are highly complex, with water and wind as the main geomorphic agents, and soil erosion is largely dependent on land use and soil management and is generally accelerated by human activities such as mining and tillage practices.

The proposed study area is located on relatively flat and gently sloping terrain. The flat sloping terrain in the greater area largely limits the erosion hazard. However, the identified soils are more vulnerable to erosion, taking into account the current tillage practices that are taking place within the study area, thus the soils are left with no vegetation cover and also the sandy textural character of these soils is an additional factor to exacerbate erosion. It must be noted that in the aspects and activity registers, the impacts of vegetation clearance were not included/assessed, as most areas within the study area are already unvegetated as the result of cultivation activities occurring within the footprints of the proposed development.

Aspects and activities register

Pre-Construction	Construction	Operational	Decommissioning and Closure
Potential poor planning leading to excessive placement of infrastructure outside of the demarcated infrastructure areas.	Site preparation and associated disturbances to soils, leading to increased runoff, erosion and loss of land capability as the soil are unvegetated.	Minimal disturbances of soils the nearby soils, resulting in detachment of soil particles, reduced soil quality and risk of erosion, attributed to the open cast mining activities.	Ineffective rehabilitation may lead to further loosening and detachment of soil particles and risk of erosion.
	Stockpiling of topsoil material on sloping areas leading to increased runoff and erosion.	Ineffective rehabilitation may lead to terrestrial habitat transformation, which will ultimately lead to lower soil quality.	Decommissioning activities may lead to habitat transformation and increased alien plant species proliferation, and potential changing the nutrient status of the soils in the greater area.

Impact assessment results for the mining operation, which include, site preparation, for extension of the existing discard dump, establishment of new conveyor belt infrastructure and construction of service roads.

Issue	Corrective Measures	Impact rating criteria					Significance
		Nature	Extent	Duration	magnitude	Probability	
Soil Erosion and Dust Emission	No	Negative	2	4	8	5	**70** (**High**)
	Yes	Negative	2	2	5	3	**27** (**Low**)
Corrective Action	➢ Any disturbance of high potential agricultural soils must be actively avoided, should this be not feasible, the footprint of the proposed mining and infrastructure areas should be clearly demarcated to restrict the planned activities within infrastructure footprint as far as possible, thus minimising edge effects and reducing the extent and overall significance of impact; ➢ An adequate storm water management plan must be carefully designed and implemented in order to avoid erosion of topsoil on adjacent arable soils throughout all the mining phases. In this regard, special mention is made of: • Sheet runoff from cleared areas, paved surfaces and access roads needs to be curtailed; • Runoff from paved surfaces should be slowed down by the strategic placement of berms; and • All overburden stockpiles and waste stockpiles must have berms and/catchment paddocks at their toe to contain runoff of the facilities; ➢ If possible, commencement of construction activities can be scheduled to coincide with low rainfall conditions when the erosive runoffs and wind are anticipated to be low; ➢ As the footprints of the proposed development are unvegetated it is best to 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; ➢ Bare soils adjacent to the infrastructural areas can be vegetated with an indigenous grass mix, if necessary, to re-establish a protective cover, to minimise soil erosion and dust emission; and ➢ Erosion control is regarded critical as the majority of the soils are susceptible to erosion, as they have finer particles, due their sandy texture and continuous tillage practises taking place.						

5.1.2 Impact: Soil compaction

Heavy equipment traffic during construction and mining related activities is anticipated to cause some soil compaction and the severity of the impact is expected to be high particularly on the arable agricultural soils, such as Hutton, Lichtenburg, Glencoe etc. However, shallow soils such as Dresden and Arcadia are anticipated to be less impaired, attributable to the relatively shallow bedrock which offers resistance to compaction. Additionally, the severity of compaction as the result of the weight of the mining equipment, is anticipated to be medium-high for Rensburg and Katspruit soils associated with the identified various wetland systems due to the clayey texture.

Aspects and activities register

Pre-Construction	Construction	Operational	Decommissioning and Closure
Potential poor planning leading to excessive or unnecessary placement of infrastructure, laydown areas on compaction prone soil resources	Topsoil stockpiling on to high clay content soils such as wetland soils, leading to compaction of underlying soil material	Ongoing disturbances to soils, resulting from mining and related activities, leading to further soil compaction and subsequent impact on soil structure	Disturbance of soils as part of demolition activities and backfilling.
	Earthworks on the soil surface leading to increased soil compaction and crusting of topsoil.	Ineffective application of the recommended mitigation measures may lead to significant soil transformation leading to lower infiltration rate, and consequently increased surface runoff.	Decommissioning activities may lead to further soil compaction and increased runoff.
	Potential frequent movement of excavation machines within and in close proximity to the freshwater resources, leading to excessive compaction, potential soil surface crusting and sealing.	Further movement of construction equipment/machinery leading to further soil compaction.	Ineffective rehabilitation may lead to significant soil transformation leading to lower infiltration rate, and consequently increased surface runoff and reduced land capability.

Impact assessment results for the mining operation, which include, site preparation for extension of the existing discard dump, establishment of new conveyor belt infrastructure and construction of service roads.

Issue	Corrective Measures	Impact rating criteria					Significance
		Nature	Extent	Duration	magnitude	Probability	
Soil Erosion	No	Negative	2	4	8	5	**70 (High)**
	Yes	Negative	2	2	5	3	**27 (Low)**
Corrective Action	➢ 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/wetland (i.e. Katspruit, Rensburg, etc.) 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 foot prints 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.						

5.1.3 Impact: Potential Soil Contamination

All the identified soils are considered equally predisposed to potential contamination (i.e. hydrocarbons), as contamination sources are generally unpredictable and often occur as incidental spills or leak for construction developments. The significance of soil contamination is considered to be high for all the identified soils, largely depending on the nature, volume and/or concentration of the contaminant of concern. Therefore, strict waste management protocols and activity specific Environmental Management Programme (EMP) guidelines should be adhered to during the construction activities.

Aspects and activities register

Pre-Construction	Construction	Operational	Decommissioning and Closure
Potential poor planning leading to excessive or unnecessary placement of infrastructure high potential agricultural soils	Spillage of petroleum hydrocarbons during construction of new facilities	Ongoing disturbances to soils, resulting in increased leaching of soil nutrients and risk of erosion, attributed to mining activities.	Contamination of soils during demolition activities and backfilling.
Potential inadequate design of infrastructure leading to risks of contamination of soils and freshwater due to seepages and runoff.	Soil contamination through leakages of hydrocarbons resulting from constructing machinery	Seepage and runoff from mining infrastructure (e.g. overburden) to the surrounding soils.	Decommissioning activities may lead to soil transformation and increased alien plant species proliferation, which will ultimately alter the chemical composition of the soil.

Pre-Construction	Construction	Operational	Decommissioning and Closure
	Potential indiscriminate disposal of hazardous and non-hazardous waste, including waste material spills and refuse deposits into the soil.	Increased seepage and potential increase in concentrations of contaminant concentration in the soil.	Potential contamination from the decommissioning of mining infrastructure.
			Ineffective rehabilitation may lead to decant which can affect soil chemistry

Impact assessment results for the mining operation, which include, site preparation, for extension of the existing discard dump, establishment of new conveyor belt infrastructure and construction of service roads.

Issue	Corrective Measures	Impact rating criteria					Significance
		Nature	Extent	Duration	magnitude	Probability	
Soil Contamination	No	Negative	2	5	10	5	**85** (**high**)
	Yes	Negative	2	2	4	2	**16** (**Low**)
Corrective Action	➢ 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; ➢ A spill prevention and emergency spill response plan should be compiled to guide the construction works; ➢ An emergency response contingency plan should be put in place to address clean-up measures should a spill and/or a leak occur; and ➢ Mining vehicles/equipment should be regularly checked for leakages to avoid soil contamination by hydrocarbons.						

5.1.4 Impact: Loss of Agricultural Land Capability

A loss of arable soils is anticipated due to the proposed mine surface infrastructure since both conveyor belt routes (although Conveyor Route A has a higher impact) are located within soils suitable for crop production. The extension of the existing discard dump is anticipated to result in a significant loss of some portions of agriculturally important soils and some portions of soils with low agricultural importance and suitable land use is grazing. However, such soils may have significant importance in supporting wetland ecosystems and the importance of wetlands must be considered in the overall assessment of impacts of the project. From land use and land capability point of view, these soils are considered to contribute to the provincial and national agricultural production system. These arable soils are located within the footprints of the proposed development; therefore, it is anticipated that they will be permanently destroyed due to the nature of the proposed mining operation (i.e. discard dump extension).

Additionally, some of the proposed areas are comprised of moderate and low agricultural potential soils (i.e. Dresden, Westleigh, Wasbank, Longlands, Rensburg, Katspruit), which are characterised by limitations, such as, prolonged water logging and root impediment problems, however they can still be utilised for natural grazing, thus rehabilitation is deemed necessary for these soils as well.

Aspects and activities register

Pre-Construction	Construction	Operational	Decommissioning and Closure
Potential poor planning leading to excessive or unnecessary placement of infrastructure high potential agricultural soils	Site preparation, and associated disturbances to soils, leading to increased nutrient leaching, runoff and erosion and consequent sedimentation	Ongoing disturbances to soils, resulting in increased leaching of soil nutrients and risk of erosion, attributed to mining activities	Compaction and contamination of soils during demolition activities and backfilling
Potential inadequate design of infrastructure leading to risks of contamination of soils due to seepages and runoff	Loss of topsoil as a growth medium due to the open cast mining activities and inadequate rehabilitation efforts	Soil Soil surface crusting and sealing of exposed soils, particularly arable soils	Decommissioning activities may lead to soil transformation and increased alien plant species proliferation, which will ultimately alter the chemical composition and nutrient status of the soil
	Potential indiscriminate disposal of hazardous and non-hazardous waste, including waste material spills and refuse deposits into the soil.	Ongoing disturbance as a result of maintenance activities, leading to the altering of quality and nutrient status of the soil	Disturbance of soils as part of demolition activities as well as backfilling, which may lead to the formation of Witbank soils (Anthrosols) which reduce long term land capability.

Impact assessment results for the mining operation, which include, site preparation, extension of the existing discard dump, establishment of new conveyor belt infrastructure and construction of service roads.

Issue	Corrective Measures	Impact rating criteria					Significance
		Nature	Extent	Duration	magnitude	Probability	
Loss of Agricultural Land	No	Negative	2	5	9	5	**80 (High)**
	Yes	Negative	2	5	9	5	**80 (High)**
Corrective Action	➢ Unnecessary disturbances of the potentially arable soils outside the demarcated areas (i.e. Hutton) can be avoided where possible to minimise loss of arable soils; ➢ During the decommissioning phase the footprint should be thoroughly cleaned, and all building material should be removed to a suitable disposal facility; ➢ The footprint should be ripped at 25 cm to alleviate compaction as part of rehabilitation; ➢ Stored topsoil should be replaced (if any) and the footprint graded to a smooth surface; ➢ The landscape should be backfilled and reprofiled to mimic the natural topography for potential agricultural activities and grazing opportunities post mining. If possible, ensure a continuation of the pre-mining surface drainage pattern; ➢ The soil layers should be put back in the reverse order of stripping (e.g. subsoil fist then followed by topsoil); ➢ It is recommended that soil quality assessments (through laboratory analysis) be conducted prior to establishing vegetation on the rehabilitated; ➢ The analytical data should be evaluated by a suitably qualified expert, and soil fertility or soil acidity problems should be corrected prior to vegetation establishment; ➢ Slopes of the backfilled surfaces should change gradually since abrupt changes in slope gradient increase the susceptibility for erosion initiation; and ➢ The footprint should be re-vegetated with a grass seed mixture as soon as possible, preferably in spring and early summer to stabilise the soil and prevent soil loss during the rainy season.						

5.1.5 Cumulative impacts

The surrounding areas within which the proposed mining related activities are to occur, are dominated by high potential agricultural soils (*i.e.* Hutton/ Lichtenburg) and good rainfall for food production. The study area is largely dominated by cultivated agricultural land use, with maize and soya bean production being the current cultivated crops. The conversion of land use from cultivated dryland agriculture to mining will raise food security concerns, as these soils are considered to contribute significantly to provincial and/or national agricultural productivity by state entities such as Department of Agricultural Forestry and Fisheries (DAFF), if used for crop cultivation and are essentially also well-suited for other less intensive land uses such as grazing, forestry, etc. Emphasis is however directed to their agricultural crop productivity due to the scarcity of such soil resources on a national scale where they coincide with areas of good or adequate rainfall. This is largely attributed to the deep nature and good drainage of the dominant soils. For this reason, the proposed mining project is anticipated to contribute to the cumulative loss of arable land. Based on the current mining layout, the disturbance of high potential arable soils is unavoidable, and it is unlikely that the natural landscape setting will be restored post closure to its pre-mining land capability. However, it can be rehabilitated to a freely draining landscape setting, using the stockpiled soil material so that it mimics the natural landscape setting and the area can be relatively productive beyond the life of mine. This can be achieved by abiding to the corrective measure mentioned above as well as mitigation measures outlined in Section 6. Impacts of land use change will be most felt during the life of mine (LOM), and post mining if mitigation measures are not carefully implemented during all phases of development. Although avoidance of high potential agricultural soils is impractical, the impacts thereof can be minimised and rehabilitated to a certain degree.

The physical properties soils in the rehabilitated area, are likely to be significantly changed and potentially contaminated to some degree and not suitable for arable agriculture and/ or grazing unless strict adherence to the proposed mitigatory measures is undertaken. This could impact on land capability and agricultural potential post development. It should be noted the rating of the cumulative impacts at this stage is deemed impractical for the proposed mining-related activities. Adherence to the proposed mitigatory measures provided in the report are considered sufficient to keep the cumulative impacts within the acceptable ranges if the proposed mining-related activities are to be authorised.

6. SUMMARY OF MITIGATION MEASURES

Based on the findings of the soil, land use and land capability assessment, mitigation measures have been developed to minimise the impact on the soil resources of the area, should the proposed project proceed.

6.1 Waste Management

- Burying of any waste including rubble, domestic waste, empty containers on the site should be strictly prohibited;
- All construction rubble waste must be removed to an approved disposal facility; and
- Contractors and construction crew conducting the works on site should be informed about approved waste disposal facilities.

6.2 Stockpile and Stripping Management

- Excavation and long-term stockpiling of soil should be limited within the demarcated areas as far as practically possible;
- Ensure all stockpiles (especially topsoil) are clearly and permanently demarcated and located in defined no-go areas;
- Restrict the amount of mechanical handling, as each handling event increases that compaction level and the changes to the soil structure. Wherever possible, the 'cut and cover' technique (where the stripped soils is immediately placed in an area already prepared for rehabilitation, thus avoiding stockpiling) should be used, and
- Use of heavy machinery such as bulldozers should be avoided as far as possible;
- Soil stripping should be done with oversight by a soil specialist and careful consultation of the pre-mining soil survey is essential. This will ensure optimal soil availability and avoid excessive mixing of undesirable soil due to over-stripping, as well as loss of available cover soil due to under-stripping and as such ensure that as much topsoil as possible is available for rehabilitation during closure. Such consultation is recommended for the whole soil handling process, from stripping through stockpiling to final rehabilitation;
- Separate stockpiling of different soil to obtain the highest post-mining land capability; The A and B-horizons should be stripped separately and replaced in the same sequence on top of the spoil material. The relatively higher organic carbon content of the A-horizons provides a buffer against compaction and hardsetting and serves as a seed source which will enhance the re-establishing of natural species. B-horizons replaced on the surface tend to seal and compact significantly which increases runoff and triggers erosion;

- Separate stripping, stockpiling and replacing of soil horizons [A (0-30 cm) and B (30-60 cm)] in the original natural sequence to combat hardsetting and compaction, and maintain soil fertility;
- 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;
- Soil erosion should be controlled on stockpiles by having control measures to reduce erosion risk such as erosion control blankets, soil binders, revegetation, contours, diversion banks and spillways;
- Stockpiled soils should be stored for a maximum of 3-5 years. in addition, concurrent rehabilitation should strongly be considered to reduce the duration of stockpile storage to ensure that the quality of stored soil material does not deteriorate excessively; especially with regard to leaching and acidification;
- Stockpiles should be revegetated to establish a vegetation cover as an erosion control measure. These stockpiles should also be kept alien vegetation free at all times to prevent loss of soil quality;
- Temporary berms can be constructed, around stockpile areas whilst vegetation cover has not established to avoid soil loss through erosion;
- The recovered soils should be re-used to rehabilitate the mine footprint following mine closure;
- During rehabilitation replace soil to appropriate soil depths in the correct order, and cover areas to achieve an appropriate topographic aspect and attitude so as to achieve a free draining landscape that is as close as possible the pre-mining land capability rating as possible; and
- A short-term fertilizer programs 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 after rehabilitation or until the area can be declared as self-sustaining by an appropriately qualified soil scientist.

7 CONCLUSION

Scientific Aquatic Services (SAS) was appointed by Nsovo Environmental Consulting to conduct a soil, land use and land capability assessment as part of the Environmental Impact Assessment (EIA) and Water Use License Application process for the proposed Exxaro Dorstfontein West Mine Expansion near Kriel, Mpumalanga Province. The expansion project will henceforth be referred to as the "study area".

Soil, land use and land capability surveys were conducted in January 2019 which entailed evaluating physical soil properties and current restrictions to various land use purposes. Subsurface soil observations were made using a manual hand auger in order to assess individual soil profiles.

Based on the field assessment result, the study area for the proposed Exxaro Dorstfontein West Mine expansion are primarily utilised for cultivated crops (maize and soya beans production) and operational mining activities. This was evident at the time of the assessment as maize and soya bean fields were cultivated in the growing season. Surrounding areas are used for mining, cultivation and residential purposes.

The study area is dominated by arable of soils such as Hutton, Lichtenburg, Avalon, Glencoe, Sepane, Bloemdal and Bainsvlei forms (arable soils) which collectively constitute approximately 36.19 % of the investigated areas, whilst shallow Dresden and Arcadia soil forms (grazing soils) take up approximately 22.87% of the proposed mining footprint. Rensburg, Katspruit etc. Soil forms associated with wetland resources occupy approximately 39.90% of the study area collectively, however the remaining portion of the investigated areas is situated in an area where soils are utilized as farm residences. The identified soil forms are presented in the table below.

Identified soil forms as well as the associated land capability classes and areal extent are presented in the table below.

Land Capability classes for soil forms identified within the study area

Soil Form	Code	Diagnostic Horizon Sequence	Land Capability	Areal Extent (ha)	Percentage (%)
Hutton	Hu	Orthic A/Red Apedal(thick)	Arable (Class II)	95.10	2.58
Avalon	Av	Orthic A/Yellow Brown Apedal/ Soft Plinthic	Arable (Class IV)		
Bloemdal	Bd	Orthic A/Red Apedal/Gleyic			
Bainsvlei	Bv	Orthic A/ Red Apedal/ Soft Plinthic			33.61
Lichtenburg	Lc	Orthic A/Red Apedal B/ Hard plinthic		1237.80	
Sepane	Se	Orthic A/ Pedocutanic /Gleyic			

Glencoe	Gc	Orthic A/ Yellow Brown Apedal/ Hard Plinthic			
Katspruit	Ka	Orthic A/ Gley	Grazing (Class V)		
Longlands	Lo	Orthic A/ Albic / soft Plinthic			
Rensburg	Rs	Vertic/ Gley		1439.60	39.90
Wasbank	Wa	Orthic A/ Albic / Hard Plinthic			
Westleigh	We	Orthic A/ Soft Plinthic/ Gleyic			
Dresden	Dr	Orthic A/ Hard Plinthic	Grazing (Class VI)	842.45	
Arcadia	Ar	Vertic A/ Lithic			22.87
Witbank	Wb	Unspecified	Wildlife (Class VIII)	72.12	1.96
TOTAL				**3683.17**	**100.00**

***Infrastructural areas were not included in the table above since they not considered in the land capability ratings**

The findings of this assessment suggest that the relevant soil limiting factors within the study area for land capability and land use potential include the following:

- Shallow effective rooting depth due to shallow indurated bedrock of the Dresden, and high clay content of the Arcadia soil forms. As such, these soils are not considered to contribute significantly to agricultural productivity as they are not well suited for cultivated crops;
- Limited rooting depth due to periodic waterlogging and the slowly permeable soft plinthic horizon of the Westleigh, Longlands and Avalon soil forms within various portions of the study area;
- Limited rooting depth due to periodic waterlogging and high clay restricting characteristics of the Rensburg and Katspruit soil forms within the associated wetlands. Protection of these soils for conservation purposes takes precedence, according to the National Water Act, 1998 (Act No. 36 of 1998); and
- Lack of soil medium for plants and crop growth for the residential areas and Witbank soil form.

From a land capability point of view, the area where the proposed mining activities (discard dump expansion, as well as conveyor belt and associated service road) will occur presents extensive areas of deep and highly arable soils (approximately 36.19%). Whereas other portions are situated in areas which are comprised of wetlands as well as soils not considered arable soils for cultivated agricultural production. The extent of arable soils therefore should be considered sufficient for viable cultivated small commercial farming, and thus should be avoided where feasible to minimise the loss of soil resources for current and future agricultural production.

During the operational phase of the proposed mining project, arable agricultural soils are anticipated to be disturbed by the surface mine related infrastructure establishment. The land use change will predominantly be converting from cultivated agriculture, grazing and wetlands to mining and related activities. Based on the proposed mining related infrastructure, disturbance of arable agricultural soils will be unavoidable, however the resultant impacts on these soil resources will be limited and restricted to the project footprint. The impact can however be reduced, particularly for the adjacent maize and soya bean fields, if mitigation measures and recommendations outlined in this document are considered and implemented accordingly during all phases of development.

From a soil, land use and land capability perspective, the proposed expansion of the existing discard dump will impact soil of high cultivation agricultural value as well as disturbed and wetland soils which are not regarded important for cultivation. The conveyor belt options (B) and associated service roads will have high impacts on valuable soils capable of supporting cultivated commercial agricultural production due to:

- Occurrence of arable agricultural soils;
- Adequate rainfall (600 to 800 mm);
- Gently sloping topography (at most); and
- Availability of irrigation options, such as centre pivots.

Movement of farm equipment will also be affected by the conveyor belt, as it will create a barrier in accessing agricultural land. From a soil, land use and land capability perspective, conveyor route A and associated service road is the preferred options since it will likely have minimal disturbance of arable soils in comparison to conveyor route option B.

The proposed mining development is anticipated to directly impact on the land capability of the prevailing soils, as the soils are anticipated to be permanently removed due to the nature of the proposed mining operation (i.e. removal of overburden for discard dump), and after rehabilitation the soils will not be able to regain the original land capability even with mitigation. However, the soils should be rehabilitated to support grazing land capability, should the proposed project be approved.

Following the assessment of the study area and the identified potential impacts as the result of the proposed development, key mitigation and rehabilitation measures were developed and can be summarised as follows:

- Excavation of soil should be limited within the demarcated areas as far as practically possible;
- Ensure that all stockpiles (especially topsoil) are clearly and permanently demarcated and located in defined no-go areas;

- Soil stripping should be done in conjunction with a soil specialist and careful consultation of the pre-mining soil survey is essential. This will ensure optimal soil availability for closure and rehabilitation as well as the post closure land use and avoid excessive mixing of undesirable soil due to over-stripping, as well as loss of available cover soil due to under-stripping. Such consultation is recommended for the whole soil handling process, from stripping through stockpiling to final rehabilitation;
- The A and B-horizons should be stripped separately and replaced in the same sequence on top of the spoil material. The relatively higher organic carbon content of the A-horizons provides a buffer against compaction and hardsetting and serves as a seed source which will enhance the re-establishing of natural species. B-horizons replaced on the surface tend to seal and compact significantly which increases runoff and triggers erosion;
- Stockpile height should be restricted to that which can deposited without additional traversing by machinery. A Maximum height of 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; 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 after rehabilitation or until the area can be declared as self-sustaining by an appropriately qualified soil scientist.

It is the opinion of the specialist therefore that this study provides the relevant information required for the Environmental Impact Assessment phase of the project to ensure that appropriate consideration of the agricultural resources in the study area will be made in support of the principles of Integrated Environmental Management (IEM) and sustainable development.

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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 study area and proposed pipeline. 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 was conducted on February 2019 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 Taxonomic Soil Classification System 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 2 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 3 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 (Scotney et al., 1987)

Land Capability Group	Land Capability Class	Increased intensity of use									Limitations
Arable	I	W	F	LG	MG	IG	LC	MC	IC	VIC	No or few limitations. Very high arable potential. Very low erosion hazard
	II	W	F	LG	MG	IG	LC	MC	IC	-	Slight limitations. High arable potential. Low erosion hazard
	III	W	F	LG	MG	IG	LC	MC	-	-	Moderate limitations. Some erosion hazards
	IV	W	F	LG	MG	IG	LC	-	-	-	Severe limitations. Low arable potential. High erosion hazard.
Grazing	V	W	-	LG	MG	-	-	-	-	-	Water course and land with wetness limitations
	VI	W	F	LG	MG	-	-	-	-	-	Limitations preclude cultivation. Suitable for perennial vegetation
	VII	W	F	LG	-	-	-	-	-	-	Very severe limitations. Suitable only for natural vegetation
Wildlife	VIII	W	-	-	-	-	-	-	-	-	Extremely severe limitations. Not suitable for grazing or afforestation.

W - Wildlife; F - Forestry; LG - Light grazing
MG – Moderate grazing; IG - Intensive grazing; LC - Light cultivation
MC - Moderate cultivation; IC - Intensive 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.

Impact Assessment

The identified impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.

The first stage of risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructures that are possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[1]. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or wellbeing, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with

[6] *The definition has been aligned with that used in the ISO 14001 Standard.*

time); controversy potential and precedent setting; threat to environmental and health standards.

- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the table below. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary2.

The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Status of Impact

The impacts are assessed as either having a:

Negative effect (i.e. at a `cost' to the environment),

Positive effect (i.e. a `benefit' to the environment), or

Neutral effect on the environment.

Extent of the Impact

Site (site only),	**1**
Local (site boundary and immediate surrounds),	**2**
Regional,	**3**
National, or	**4**
International.	**5**

Duration of the Impact

The length that the impact will last for is described as either:

Immediate (<1 year)	1
Short term (1-5 years),	2
Medium term (5-15 years),	3
Long term (ceases after the operational life span of the project),	4
Permanent.	5

Probability of Occurrence

[2] *Some risks/impacts that have low significance will however still require mitigation*

The likelihood of the impact actually occurring is indicated as either:

None (the impact will not occur),	0
Improbable (probability very low due to design or experience)	1
Low probability (unlikely to occur),	2
Medium probability (distinct probability that the impact will occur),	3
High probability (most likely to occur), or	4
Definite	5

Significance of the Impact

Based on the information contained in the points above, the potential impacts are assigned a significance rating (**S**). This rating is formulated by adding the sum of the numbers assigned to extent (**E**), duration (**D**) and magnitude (**M**) and multiplying this sum by the probability (**P**) of the impact.
S= (E+D+M) P

The significance ratings are given below

Low (i.e. where this impact would not have direct influence on the decision to develop in the area);	(**<30**)
Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated);	(**30-60**)
High (i.e. where the impact must have an influence on the decision process to develop in the area).	(**>60**)

The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
  - Primary project site and related facilities that the client and its contractors develop or controls;
  - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
  - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for prospecting activities and decommissioning and rehabilitation;
- If applicable, transboundary or global effects were assessed;
- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

Mitigation measure development

According to the DEA *et al.,* (2013) "Rich biodiversity underpins the diverse ecosystems that deliver ecosystem services that are of benefit to people, including the provision of basic services and goods such as clean air, water, food, medicine and fibre; as well as more complex services that regulate and mitigate our climate, protect people and other life forms from natural disaster and provide people with a rich heritage of nature-based cultural traditions. Intact ecological infrastructure contributes significant savings through, for example, the regulation of natural hazards such as storm surges and flooding by which is attenuated by wetlands".

According to the DEA *et al.,* (2013) Ecosystem services can be divided into 4 main categories:

- Provisioning services are the harvestable goods or products obtained from ecosystems such as food, timber, fibre, medicine, and fresh water;
- Cultural services are the non-material benefits such as heritage landscapes and seascapes, recreation, ecotourism, spiritual values and aesthetic enjoyment;
- Regulating services are the benefits obtained from an ecosystem's control of natural processes, such as climate, disease, erosion, water flows, and pollination, as well as protection from natural hazards; and
- Supporting services are the natural processes such as nutrient cycling, soil formation and primary production that maintain the other services.

Loss of biodiversity puts aspects of the economy, wellbeing and quality of life at risk, and reduces socio-economic options for future generations. This is of particular concern for the poor in rural areas who have limited assets and are more dependent on common property resources for their livelihoods. The importance of maintaining biodiversity and intact ecosystems for ensuring on-going provision of ecosystem services, and the consequences of ecosystem change for human well-being, were detailed in a global assessment entitled the Millennium Ecosystem Assessment (MEA, 2005), which established a scientific basis for the need for action to enhance management and conservation of biodiversity.

Sustainable development is enshrined in South Africa's Constitution and laws. The need to sustain biodiversity is directly or indirectly referred to in a number of Acts, not least the National Environmental Management: Biodiversity Act (No. 10 of 2004) (hereafter referred to as the Biodiversity Act) and is fundamental to the notion of sustainable development. In addition, International guidelines and commitments as well as national policies and strategies are important in creating a shared vision for sustainable development in South Africa (DEA *et al.,* 2013).

The primary environmental objective of the Mineral and Petroleum Resources Development Act (MPRDA) is to give effect to the environmental right contained in the South African Constitution. Furthermore, Section 37(2) of the MPRDA states that "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".

Pressures on biodiversity are numerous and increasing. According to the DEA *et al.,* (2013) Loss of natural habitat is the single biggest cause of biodiversity loss in South Africa and much of the world. The most severe transformation of habitat arises from the direct conversion of natural habitat for human requirements, including[3]:

- Cultivation and grazing activities;
- Rural and urban development;
- Industrial and mining activities, and
- Infrastructure development.

Impacts on biodiversity can largely take place in four ways (DEA *et al.,* 2013):

- **Direct impacts:** are impacts directly related to the project including project aspects such as site clearing, water abstraction and discharge of water from riverine resources;
- **Indirect impacts:** are impacts associated with a project that may occur within the zone of influence in a project such as surrounding terrestrial areas and downstream areas on water courses;
- **Induced impacts:** are impacts directly attributable to the project but are expected to occur due to the activities of the project. Factors included here are urban sprawl and the development of associated industries; and
- **Cumulative impacts:** can be defined as the sum of the impact of a project as well as the impacts from past, existing and reasonably foreseeable future projects that would affect the same biodiversity resources. Examples include numerous mining operations within the same drainage catchment or numerous residential developments within the same habitat for faunal or floral species.

Given the limited resources available for biodiversity management and conservation, as well as the need for development, efforts to conserve biodiversity need to be strategic, focused and supportive of

[3] Limpopo Province Environment Outlook. A Report on the State of the Environment, 2002. Chapter 4.

sustainable development. This is a fundamental principle underpinning South Africa's approach to the management and conservation of its biodiversity and has resulted the definition of a clear mitigation strategy for biodiversity impacts.

'Mitigation' is a broad term that covers all components of the 'mitigation hierarchy' defined hereunder. It involves selecting and implementing measures – amongst others – to conserve biodiversity and to protect, the users of biodiversity and other affected stakeholders from potentially adverse impacts as a result of mining or any other land use. The aim is to prevent adverse impacts from occurring or, where this is unavoidable, to limit their significance to an acceptable level. Offsetting of impacts is considered to be the last option in the mitigation hierarchy for any project.

The mitigation hierarchy in general consists of the following in order of which impacts should be mitigated (DEA *et al.,* 2013):

- **Avoid/prevent impact:** can be done through utilising alternative sites, technology and scale of projects to prevent impacts. In some cases if impacts are expected to be too high the "no project" option should also be considered, especially where it is expected that the lower levels of mitigation will not be adequate to limit environmental damage and eco-service provision to suitable levels;
- **Minimise impact:** can be done through utilisation of alternatives that will ensure that impacts on biodiversity and ecoservices provision are reduced. Impact minimisation is considered an essential part of any development project;
- **Rehabilitate impact:** is applicable to areas where impact avoidance and minimisation are unavoidable where an attempt to re-instate impacted areas and return them to conditions which are ecologically similar to the pre-project condition or an agreed post project land use, for example arable land. Rehabilitation can however not be considered as the primary mitigation tool as even with significant resources and effort rehabilitation that usually does not lead to adequate replication of the diversity and complexity of the natural system. Rehabilitation often only restores ecological function to some degree to avoid ongoing negative impacts and to minimise aesthetic damage to the setting of a project. Practical rehabilitation should consist of the following phases in best practice:
  - **Structural rehabilitation** which includes physical rehabilitation of areas by means of earthworks, potential stabilisation of areas as well as any other activities required to develop a long terms sustainable ecological structure;
  - **Functional rehabilitation** which focuses on ensuring that the ecological functionality of the ecological resources on the study area supports the intended post closure land use. In this regard special mention is made of the need to ensure the continued functioning and integrity of wetland and riverine areas throughout and after the rehabilitation phase;
  - **Biodiversity reinstatement** which focuses on ensuring that a reasonable level of biodiversity is re-instated to a level that supports the local post closure land uses. In this regard special mention is made of re-instating vegetation to levels which will allow the natural climax vegetation community of community suitable for supporting the intended post closure land use; and
  - **Species reinstatement** which focuses on the re-introduction of any ecologically important species which may be important for socio-cultural reasons, ecosystem functioning reasons and for conservation reasons. Species re-instatement need only occur if deemed necessary.
- **Offset impact:** refers to compensating for latent or unavoidable negative impacts on biodiversity. Offsetting should take place to address any impacts deemed to be unacceptable which cannot be mitigated through the other mechanisms in the mitigation hierarchy. The objective of biodiversity offsets should be to ensure no net loss of biodiversity. Biodiversity offsets can be considered to be a last resort to compensate for residual negative impacts on biodiversity.

The significance of residual impacts should be identified on a regional as well as national scale when considering biodiversity conservation initiatives. If the residual impacts lead to irreversible loss or irreplaceable biodiversity the residual impacts should be considered to be of *very high significance* and when residual impacts are considered to be of *very high significance*, offset initiatives are not considered an appropriate way to deal with the magnitude and/or significance of the biodiversity loss. In the case of residual impacts determined to have *medium to high significance*, an offset initiative may be investigated. If the residual biodiversity impacts are considered of low significance no biodiversity offset is required.[4]

In light of the above discussion the following points present the key concepts considered in the development of mitigation measures for the proposed development.

- Mitigation and performance improvement measures and actions that address the risks and impacts[5] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, mitigation or compensation.
- Desired outcomes are defined, and have been developed in such a way as to be measurable events with performance indicators, targets and acceptable criteria that can be tracked over defined periods, with estimates of the resources (including human resource and training requirements) and responsibilities for implementation wherever possible.

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction and operation.

[4] Provincial Guideline on Biodiversity Offsets, Western Cape, 2007.

[5] Mitigation measures should address both positive and negative impacts

APPENDIX B: DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

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

Ndumiso Sithole BSc hydrology and Soil Science (University of KwaZulu Natal)

Stephen van Staden MSc (Environmental Management) (University of Johannesburg)

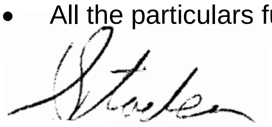
1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

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) BSc (Hons) Zoology (Aquatic Ecology) (University of Johannesburg) BSc (Zoology, Geography and Environmental Management) (University of Johannesburg)		
Registration / Associations	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		

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



Signature of the Project Manager

I, Ndumiso Sithole, 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

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

Position in Company	Managing member, Ecologist with focus on Freshwater Ecology
Date of Birth	13 July 1979
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2003 (year of establishment)
Other Business	Trustee of the Serenity Property Trust and emerald Management Trust

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 International Association of Impact Assessors (IAIA) South Africa;
Member pf 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

COUNTRIES 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 Leone
Central Africa – Democratic Republic of the Congo

PROJECT EXPERIENCE (Over 2500 projects executed with varying degrees of involvement)

1 Mining Coal, Chrome, PGM's, Mineral Sands, Gold, Phosphate, river sand, clay, fluorspar
2 Linear developments
3 Energy Transmission, telecommunication, pipelines, roads
4 Minerals beneficiation
5 Renewable energy (wind and solar)

6 Commercial development
7 Residential development
8 Agriculture
9 Industrial/chemical

REFERENCES

- Terry Calmeyer (Former Chairperson of IAIA SA)
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- Marietjie Eksteen
  Managing Director: Jacana Environmental
  Tel: 015 291 4015

Yours faithfully

STEPHEN VAN STADEN

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF NDUMISO SITHOLE

PERSONAL DETAILS

Position in Company	Wetland Ecologist and Soil Scientist
Date of Birth	21 February 1992
Nationality	South African
Languages	IsiZulu and English
Joined SAS	2019

EDUCATION

Qualifications

BSc (Hons) Environmental Monitoring and Modelling (University of South Africa)	In Progress
BSc Hydrology and Soil Science (University of Kwazulu-Natal)	2014

COUNTRIES OF WORK EXPERIENCE

South Africa – Mpumalanga, North West, Limpopo and KwaZulu Natal

SELECTED PROJECT EXAMPLES

Freshwater Resource Assessment

Freshwater Ecological Assessments

- Freshwater ecological assessment as part of the water use authorisation application Welgemeend Mine, Mpumalanga province.
- Wetland verification as part of the environmental assessment and authorization process for the proposed development Rhenostersruit, North West province.
- Wetland Monitoring as part of water use license requirement Rietvlei Mine, Mpumalanga province
- Wetland verification as part of the environmental assessment and authorization process for the proposed alluvial diamonds mine, EJ Diamonds, North West province.

Soil, Land Use and Land Capability Assessments

- Soil, Land Use and Land Capability Assessment as part of the environmental assessment and authorisation process for the proposed, Royal Sheba Mine Mpumalanga Province
- Soil, Land Use and Land Capability Assessment as part of the environmental assessment and authorisation process for the proposed Theta Hill Mining Project, Mpumalanga Province
- Soil, Land Use and Land Capability Assessment as Part of The Environmental Assessment and Authorisation Process For The Proposed Dorstfontein west Mining Project, Mpumalanga Province
- Soil, Land Use and Land Capability Assessment as Part of the Environmental Assessment and Authorisation Process for the Proposed Tumela Mining Project, Mpumalanga Province