ZIMPANDE
RESEARCH COLLABORATIVE

Soil, Land use and Land Capability Verification

FOR THE NON-INVASIVE PROSPECTING ON FARM PORTION MAREESBURG 8 JT, LIMPOPO PROVINCE.

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EXECUTIVE SUMMARY

The Zimpande Research Collaborative (ZRC) was appointed by Environmental Management Assistance (Pty) Ltd (the Environmental Assessment Practitioner (EAP) on the project) to conduct a soil, land use, land capability and land potential verification assessment within the application area (hereafter referred to as the 'study area') in which Nomamix (Pty) Ltd (the project proponent) are applying for the right to prospect Platinum Group Metals and if appropriate, prepare an agricultural impact and compliance statement as part of the Environmental Authorisation (EA) process for the proposed mining rights application.

The study area is located within the magisterial district of Fetagoma Tubatse on the Mareesburg 8 JT farm portion in the Limpopo province. Lydenburg is the nearest town, 45km east from the area, Mpumalanga Province. The study area extent is 2133 hectares (ha) which encompasses mining and related activities in the northern and western portion of the study area. The majority of the study area contains vacant portions which are utilised for grazing by the local communities and habitat for game species. During the time of assessment no large scale commercial cultivation of crops was observed.

The local climate can be broadly classified as having a moderate capability for good yield for a wide range of adapted crops and a year-round growing season. The Mean Annual Rainfall (MAR) associated with the majority of the study area is estimated to range between 601-800 mm per annum. Whereas the Mean Annual Evaporation (MAE) varies from 1801 mm to 2400 mm. This means that any crops developed in the will be subjected to desiccation during the summer and winter seasons and supplementary irrigation measures may be required from time to time to avoid permanent wilting which might affect the crop yield. The study area falls into Climate Capability Class C5 due to moderately restricted growing season due to low temperatures, frost and/or moisture stress. Suitable crops may be grown at risk of some yield loss.

The identified soil forms within the study area include the shallow soil of the Mispah/Glenrosa, Mayo, Darnall/Swartland, Steendal/Immerpan, Dundee, Didema, Rocky Outcrops and the Witbank formation. Of these identified soils, the Rocky Outcrops comprising of the Mispah/Glenrosa and the Mispah/Mayo soil forms were the dominant soil forms within the study area.

The Mispah/Glenrosa and rock outcrops are typically shallow to no topsoil (rocky outcrops) in nature. These soils are characterised by spatial heterogeneity associated with weathering of the rock material, illuviation, and biotic disturbance (plants and animals) especially along the joints or bedding planes which results in the mixing of soil and rock material in some instances. The topsoil horizon can occur as a single shallow surface horizon with a diagnostic red or yellow brown colours and are accommodated within the Mispah/Glenrosa formations. These types of soils are usually avoided for intensive use and thus left for grazing, forestry, and wildlife land uses since they do not present adequate soil depth for most cultivated crops.

The soils of duplex character such as the Darnall/Swartland formation are characterised by moderately to strongly structured soils with a clear textural distinction between a sandier surface horizon and a higher clay upper subsurface horizon. These types of soils are typically not preferred for cultivation due to the high clay content, strong structure and are prone to waterlogging (highly impermeable when wet). Waterlogging conditions make these soils prone experiencing runoff during high rainfall events and thus the formation of erosion gullies over time. Nonetheless, should these soils be cultivated, intensive management practices would be required.

Soils of melanic character such as the Bonheim/Mayo and Steendal/Immerpan formations are characterised by dark coloured and strongly structured morphology with a high base status and low organic carbon content (less than 10%). These soils are typically encountered along intermediate rocks or in lower terrain positions to receive additional bases via lateral flowpaths. The Steendal/Immerpan soils occur in mostly arid areas owing to the cementation of the calcium and gypsum materials due to the high evaporation demand. Beside depth limitations of these soils as encountered within the study area these soils are fertile but may require irrigation to be highly productive.

The Didema soil form is characterised by topsoil accumulation of organic matter (in various stages of decomposition with dark brown or black morphology) under saturated conditions underlain by hard rock. These soils are typical of high-altitude plateaux and mountainous regions as topsoil layers. The surface horizon typically contains an average of between 10 and 20% organic carbon.

The Dundee soils form is associated with watercourses due to the unconsolidated soil material as a result of deposition by water. These soils are characterised by little evidence of pedogenic horizonation and the presence of clear stratifications may be observed. These soils may contain weathered hard rock fragments sometimes identified as pebbles. These soils typically occur on low lying terrain positions.

The Witbank (Anthrosols) soil forms are soils which have been subjected to physical disturbance because of human interventions. Such interventions include transportation and deposition of the earth material containing soil. As a result, these soils are not ideal for agricultural cultivation.

Table A below indicates the dominant soils occurring within the study area, together with the associated land capability.

Table A: Identified soil forms within the study area and their respective land capability.

Soil Form	Land Capability
Darnall/Swartland	Arable (Class IV)
Didema	Wetland (Class V)
Dundee	Watercourse (Class V)
Bonheim/Mayo	Grazing (Class VI)
Mayo	
Mispah/Glenrosa	
Steendaal/Immerpan	
Rocky Outcrops	Wilderness (Class VIII)
Witbank	

The screening tool analysis indicated the study area to be of very high agricultural sensitivity, however the field verified data indicates that the study area is of Low agricultural sensitivity. Overall, the lithic character (hard to cultivate) of the dominant soils as well as the low and erratic rainfall associated with the study area renders the site not suitable for any commercialised cultivation. However, some of the areas used for grazing may potentially be impacted, which will ultimately impact on the local and regional livestock production to a degree. Although agricultural studies under the CARA Act 1983 prioritise crop cultivated agriculture, it is imperative that land with grazing capability is also conserved where feasible as this will support the highly sensitive faunal ecology of the study area in its present condition and land use. It should be noted that this soil assessment was done at a high level due the low quantum of risk presented by the proposed development and therefore should not be used for any other purpose then it is intended for. Should the quantum of risk of the project change for any reason, then a detailed soil investigation, delineation and classification may have to be undertaken in fulfilment of the applicable legislation. Therefore, the overall impact is anticipated to be low to very low and within acceptable levels from a soil and land capability point of view.

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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
(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
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying alternative;	Section 4 and 5
(g) an identification of any areas to be avoided, including buffers;	N/A
(h) a map superimposing the activity, including the associated structures and infrastructure on the environmental sensitivities of the site, including areas to be avoided, including buffers;	N/A
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.3
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment or activities;	Section 4 and 5
(k) any mitigation measures for inclusion in the EMPr;	N/A
(l) any conditions for inclusion in the environmental authorisation;	N/A
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	N/A
(n) a reasoned opinion -	
(i) as to whether the proposed activity, activities or portions thereof should be authorised;	N/A
(iA) regarding the acceptability of the proposed activity or activities; and	Section 5
(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 5
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report	Section 5
(p) a summary and copies, if any, comments received during any consultation process and, where applicable all responses thereto; and	N/A
(q) any other information requested by the competent authority.	N/A

GLOSSARY OF TERMS

Albic	Grey colours, apedal to weak structure, few mottles (<10 %)
Alluvial soil:	A deposit of sand, mud, etc. formed by flowing water, or the sedimentary matter deposited thus within recent times, especially in the valleys of large rivers.
Catena	A sequence of soils of similar age, derived from similar parent material, and occurring under similar macroclimatic condition, but having different characteristics due to variation in relief and drainage.
Chromic:	Having within ≤150 cm of the soil surface, a subsurface layer ≥30 cm thick, that has a Munsell colour hue redder than 7.5YR, moist.
Ferralic:	Having a ferralic horizon starting ≤150 cm of the soil surface.
Ferralic horizon:	A subsurface horizon resulting from long and intense weathering, with a clay fraction that is dominated by low-activity clays and contains various amounts of resistant minerals such as Fe, Al, and/or Mn hydroxides.
General waste	Waste that does not pose an immediate hazard or threat to health or to the environment, and includes— • domestic waste; • building and demolition waste; • business waste; • inert waste; or • any waste classified as non-hazardous waste in terms of the regulations made under section 69
Gleying:	A soil process resulting from prolonged soil saturation which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Hard Plinthic	Accumulative of vesicular Fe/Mn mottles, cemented
Hydrophytes:	Plants that are adaptable to waterlogged soils
Lithic	Dominantly weathering rock material, some soil will be present.
Mottles:	Soils with variegated colour patterns are described as being mottled, with the "background colour" referred to as the matrix and the spots or blotches of colour referred to as mottles.
Plinthic Catena	South African plinthic catena is characterised by a grading of soils from red through yellow to grey (bleached) soils down a slope. The colour sequence is ascribed to different Fe-minerals stable at increasing degrees of wetness
Red Apedal	Uniform red colouring, apedal to weak structure, no calcareous
Runoff	Surface runoff is defined as the water that finds its way into a surface stream channel without infiltration into the soil and may include overland flow, interflow and base flow.
Hydraulic Conductivity	The volume of water that would move through porous medium in unit time under unit hydraulic gradient through unit area measure perpendicular to the flow direction
Orthic	Maybe dark, chromic or bleached
Salinity:	High Sodium Adsorption Ratio (SAR) above 15% are indicative of saline soils. The dominance of Sodium (Na) cations in relation to other cations tends to cause soil dispersion (deflocculation), which increases susceptibility to erosion under intense rainfall events.
Sodicity:	High exchangeable sodium Percentage (ESP) values above 15% are indicative of sodic soils. Similarly, the soil dispersion.
Soil Map Unit	A description that defines the soil composition of a land, identified by a symbol and a boundary on a map
Soft Plinthic	Accumulation of vesicular Fe/Mn mottles (>10%), grey colours in or below horizon, apedal to weak structure
Integrated Environmental Management	Is a philosophy that is concerned with finding the right balance between development and the environment
Witbank	Man-made soil deposit with no recognisable diagnostic soil horizons, including soil materials which have not undergone paedogenesis (soil formation) to an extent that would qualify them for inclusion in another diagnostic horizon

ACRONYMS

°C	Degrees Celsius.
AGIS	Agricultural Geo-Referenced Information Systems
BA	Basic Assessment
BAR	Basic Assessment Report
DMRE	Department of Minerals, Resources and Energy
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme Report
ET	Evapotranspiration
FAO	Food and Agriculture Organization
GIS	Geographic Information System
GPS	Global Positioning System
IUSS	International Union of Soil Sciences
m	Meter
MAP	Mean Annual Precipitation
MLM	Mogalakwena Local Municipality
MTC	Mapela Traditional Community
NWA	National Water Act
PSD	Particle Size Distribution
SACNASP	South African Council for Natural Scientific Professions
SAS	Scientific Aquatic Services
SOTER	Soil and Terrain
WDM	Waterberg District Municipality

1. INTRODUCTION

The Zimpande Research Collaborative (ZRC) was appointed by Environmental Management Assistance (Pty) Ltd (the Environmental Assessment Practitioner (EAP) on the project) to conduct a soil, land use, land capability and land potential verification assessment within the application area (hereafter referred to as the 'study area') in which Nomamix (Pty) Ltd (the project proponent) are applying for the right to prospect Platinum Group Metals and if appropriate, prepare an agricultural impact and compliance statement as part of the Environmental Authorisation (EA) process for the proposed mining rights application.

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The proposed project may potentially be located in soils, which may potentially support agricultural practices and food production on a regional scale. Thus, it is imperative to understand the surrounding soils, land uses and land capability as well as the land potential to ensure that the proposed project and associated surface infrastructure components within the study area areas takes into consideration the high potential agricultural land, parallel with the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983). 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.

1.1 Project Description

The proposed non-invasive prospecting activities will include the following main techniques:

- Data search, field mapping and desktop studies;
- Logging and sampling historical core; and
- Scoping and (pre) feasibility studies.

For the purposed of this Basic Assessment (BA) process, the Environmental Assessment Practitioner (EAP) and appointed specialist will perform a baseline and/or desktop assessment identifying potential sensitivities in the general area of the properties.

Should additional sampling be required using any invasive prospecting methods, the areas where these activities will take place will require the necessary assessments as per the various protocols published for identified themes and approval from the Department of Minerals, Resources and Energy (DMRE), prior to commencement of any such activities.

1.2 Terms of Reference and Scope of Work

The soil, land use and land capability assessment generally comprise the following aspects:

- A desktop review of existing land type maps, to establish broad baseline conditions and areas of environmental sensitivity and sensitive agricultural areas;
- Assess spatial distribution of various soil types within the focus area at a high level;
- Compile various maps depicting the on-site conditions, soil types and land capability based on desktop review of existing data;
- Subsurface soil observations and sampling undertaken by means of a manual bucket hand auger;
- Classify the dominant soil types according to the South African Soil Classification System (Soil Classification Working Group, 2018);
- Identify restrictive soil properties on land capability under prevailing conditions; and
- Compile a report presenting the agricultural impact statement and a description of the findings during the field assessment to be compared against the screening tool.

1.3 Applicable Legislation

The following legislative requirements were taken into consideration during the assessment:

- National Environmental Management Act, (Act 107 of 1998) (NEMA);
- National Environmental Management: Waste Act (Act 59 of 2008); and
- Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983) (CARA).

1.4 Assumptions and Limitations

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

- The soil delineations as well as the associated land capability and land potential was done at a high level due the low quantum of risk presented by the proposed development and therefore should not be used for any other purpose than it is intended for. Should the quantum of risk of the project change for any reason, then a detailed soil investigation, delineation and classification would have to be undertaken in fulfilment of the applicable legislation;

- The soil and land capability desktop assessment are confined to the study area and does not include the neighbouring and adjacent properties,
- 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 project;
- 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 on this report was undertaken at a high level, and the findings of this assessment were therefore inferred from extrapolations from individual observation points; and
- 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.

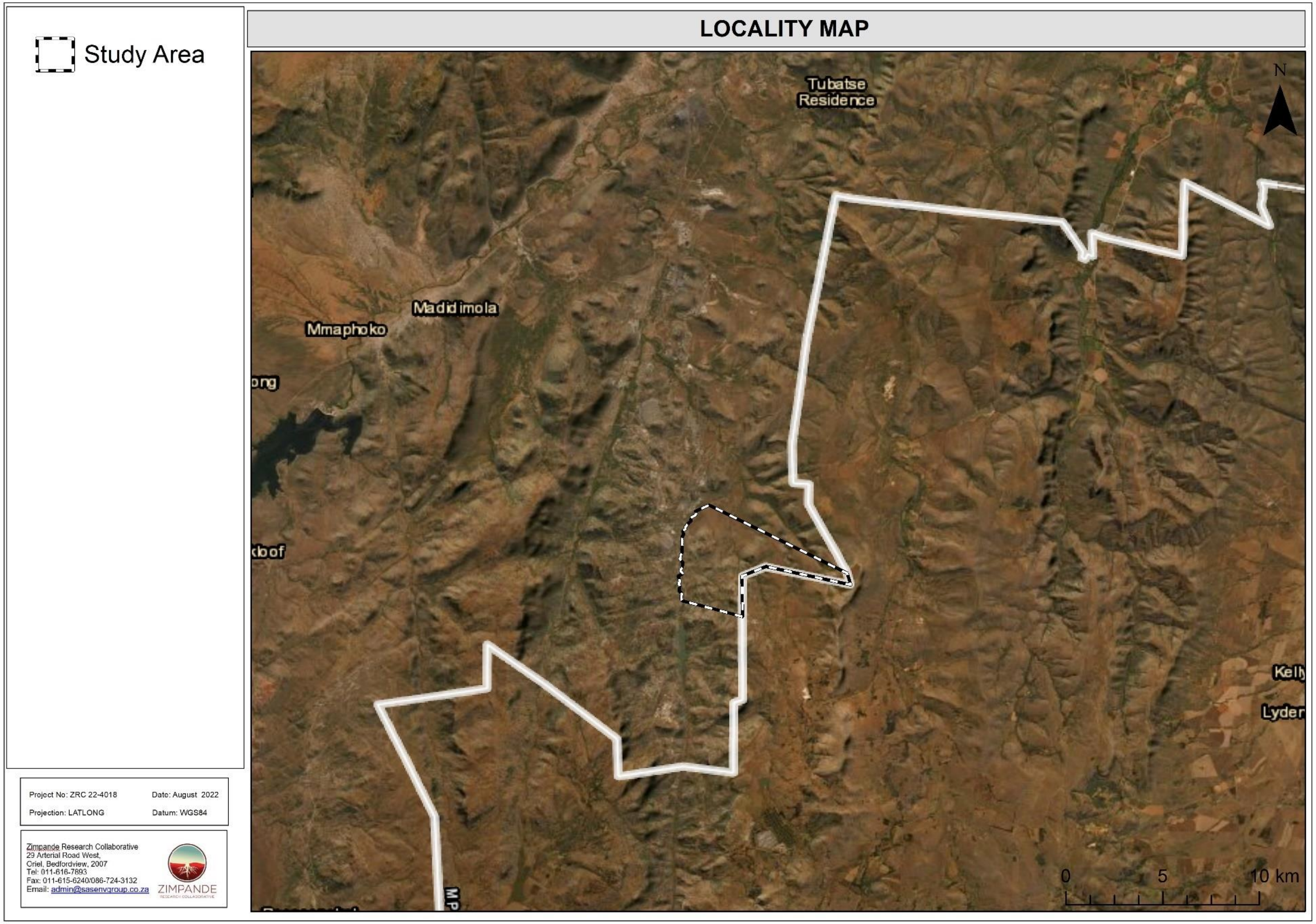


Figure 1: Digital satellite imagery depicting the locality of the study area in relation to the surrounding areas.

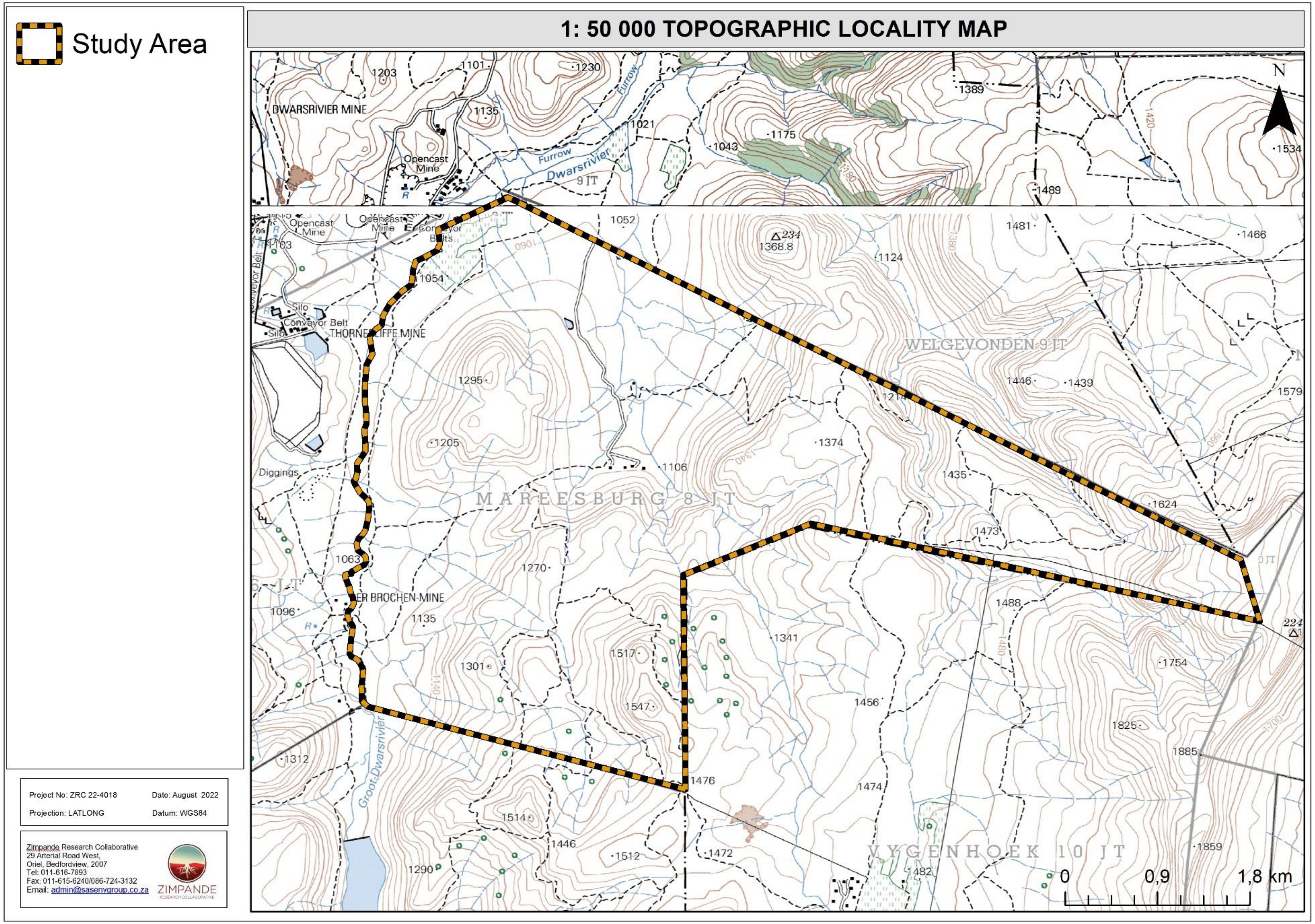


Figure 2: Location of the study area depicted on a 1:50 000 topographical map in relation to surrounding area.

2. METHOD OF ASSESSMENT

2.1 Literature and Database Review

Prior to commencement of the field assessment, a background study, including a literature review, was conducted to collect the pre-determined soil and land capability data in the vicinity of the investigated study area. Various data sources including but not limited to the Agricultural Geo-Referenced Information System (AGIS) and other sources as listed under references were utilised to fulfil the objectives for the assessment. This was followed by a field investigation exercise to ground truth the pre-determined soil results which were undertaken using desktop methods.

2.2 Soil Classification and Sampling

A soil survey was conducted in September 2022 at which time the identified soils within the study area were classified into soil forms according to the Soil Classification System: A Natural and Anthropogenic System for South Africa Soil Classification System (2018). The soil survey was restricted to the study area. Subsurface soil observations were made using a manual hand auger to assess individual soil profiles, which will entail evaluation of physical soil properties and prevailing limitations to various land uses.

2.3 Land Capability Classification

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

Table 1: Land Capability Classification (Smith, 2006)

Land Capability Class	Increased Intensity of Use									Land Capability Groups	Limitations
I	W	F	LG	MG	IG	LC	MC	IC	VIC	Arable land	No or few limitations
II	W	F	LG	MG	IG	LC	MC	IC			Slight limitations
III	W	F	LG	MG	IG	LC	MC	IC			Moderate limitations
IV	W	F	LG	MG	IG	LC					Severe limitations
V	W	F	LG	MG						Grazing land	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
VIII	W									Wildlife	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 2: Climate Capability Classification (Scotney et al., 1987)

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

The land potential assessment entails the combination of climatic, slope and soil condition characteristics to determine the agricultural land potential of the investigated study area. The classification of agricultural land potential and knowledge of the geographical distribution of agricultural viable land within an area of interest. This is of importance for making an informed decision about land use. Table 3 below presents the land potential classes, whilst Table 4 presents a description thereof, according to Guy and Smith (1998).

Table 3: Table of Land Potential Classes (Adapted from Guy and Smith, 1998)

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

Table 4: The Land Capability Classes Description (Guy and Smith, 1998)

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

2.4 Consideration of DEA Screening Tool

The Agricultural Agro-Ecosystem Assessment protocol provides the criteria for the assessment and reporting of impacts on agricultural resources for activities requiring environmental authorisation. The assessment requirements of this protocol are associated with a level of environmental sensitivity determined by the national web-based environmental screening tool which for agricultural resources is based on the most recent land capability evaluation values as provided by the Department of Agriculture, Forestry and Fisheries. The national web-based environmental screening tool can be accessed at: https://screening.environment.gov.za/screeningtool .

The main purpose of the Agricultural Agro-Ecosystem Assessment is to ensure that the sensitivity of the site to the proposed land use change (from potential agricultural and residential land to the proposed future developments) is sufficiently considered. The information provided in this report aims to enable the Competent Authority to come to a sound conclusion on the impact of the proposed future developments on the food production potential of the site.

To meet this objective, site sensitivity verification must be conducted of which the results must meet the following objectives:

- It must confirm or dispute the current land use and the environmental sensitivity as was indicated by the National Environmental Screening Tool;
- It must contain proof (e.g., photographs) of the current land use and environmental sensitivity pertaining to the study area;
- All data and conclusions are submitted together with the main report for the proposed proposed future developments;
- It must indicate whether or not the proposed proposed future developments will have an unacceptable impact on the agricultural production capability of the site, and in the event where it does, whether such a negative impact is outweighed by the positive impact of the proposed development on agricultural resources; and
- The report is prepared in accordance with the requirements of the Basic Assessment Regulations.

The report is thus compiled in a manner that meets the minimum report content requirements for impacts on agricultural resources by the proposed prospecting activities.

3. DESKTOP STUDY ASSESSMENT RESULTS

It should be noted that the desktop results (not field verified data) presented in this section were sourced from various databases such as the Agricultural Geo-referenced Information System (AGIS) and Soil and Terrain (SOTER) database. Thus, inaccuracies may exist in the data presented. The data however gives useful information of the surrounding soils.

Table 5: Desktop based soil background information sourced from various databases.

Parameters	Description
Mean Annual precipitation (MAP)	Majority of the study area is dominated by 601 – 800 mm of rainfall per annum and the remaining north western portion is dominated by 401 - 600 mm of rainfall per annum. These conditions have a fair to low yield potential for a moderate range of adapted crops but planting date options are limited for supporting rain fed agriculture. (Figure 3)
Mean Annual Evaporation (MAE)	2201 – 2400 mm for the western portion of the study area, 2001 – 2200 mm for the eastern portion of the study area and 1801 – 2000 mm for the far western tip of the study area. Moisture deficit may be a problem for non-irrigated crops. (Figure 4)
Geology	Rustenburg, Lebowa and Rashoop formations
Soil pH	Slightly acidic to acidic with pH range of 5.5 - 6.4. Certain critical plant nutrients may no be available for uptake and the acidic soil pH may need to ameliorated.
Land Type Data	The dominant land types within the study area is the Dominated by Ib31/Ib154 (Rocky areas with miscellaneous soils), to a lesser extent is there Dc31 (dominated by Pedocutanic, Prismacutanic and Vertic/Melanic horizon) and Ab29 (Red/yellow soils freely drained which are dystrophic and/or mesotrophic). (Figure 5)
Desktop land capability	The majority of the study area is characterised by non-arable land (Wilderness Class VIII), followed by moderate potential arable land (Arable Class III) along the south eastern portion of the study area and lastly non-arable land (Wilderness Class VIII) and to a lesser extent marginal potential land (Grazing Class VI). The arable soils are moderately suitable for cultivation. (Figure 6)
Desktop Grazing Capacity	Most of the study area is characterised by the grazing capacity of 8 – 10 hectares per Livestock Unit (ha/LSU) and the remaining western portion of 5 – 7 (ha/LSU). Small portions on the north and south of the study area are characterised by 11 – 13 (ha/LSU). The study area is suitable to support moderate to limited grazing activities. (Figure 7)
Water Retaining Capacity of the soil	Scarce or absent
Alkalinity and Sodicity of the soils	The soils are neither alkaline or sodic, this indicates soils are not affected by high concentration of salts
Predicted soil loss	High for majority of the study area and Low towards the eastern portion of the study area. (Figure 8)
Screening Tool Analysis	High Sensitivity to Agriculture (Figure 9)

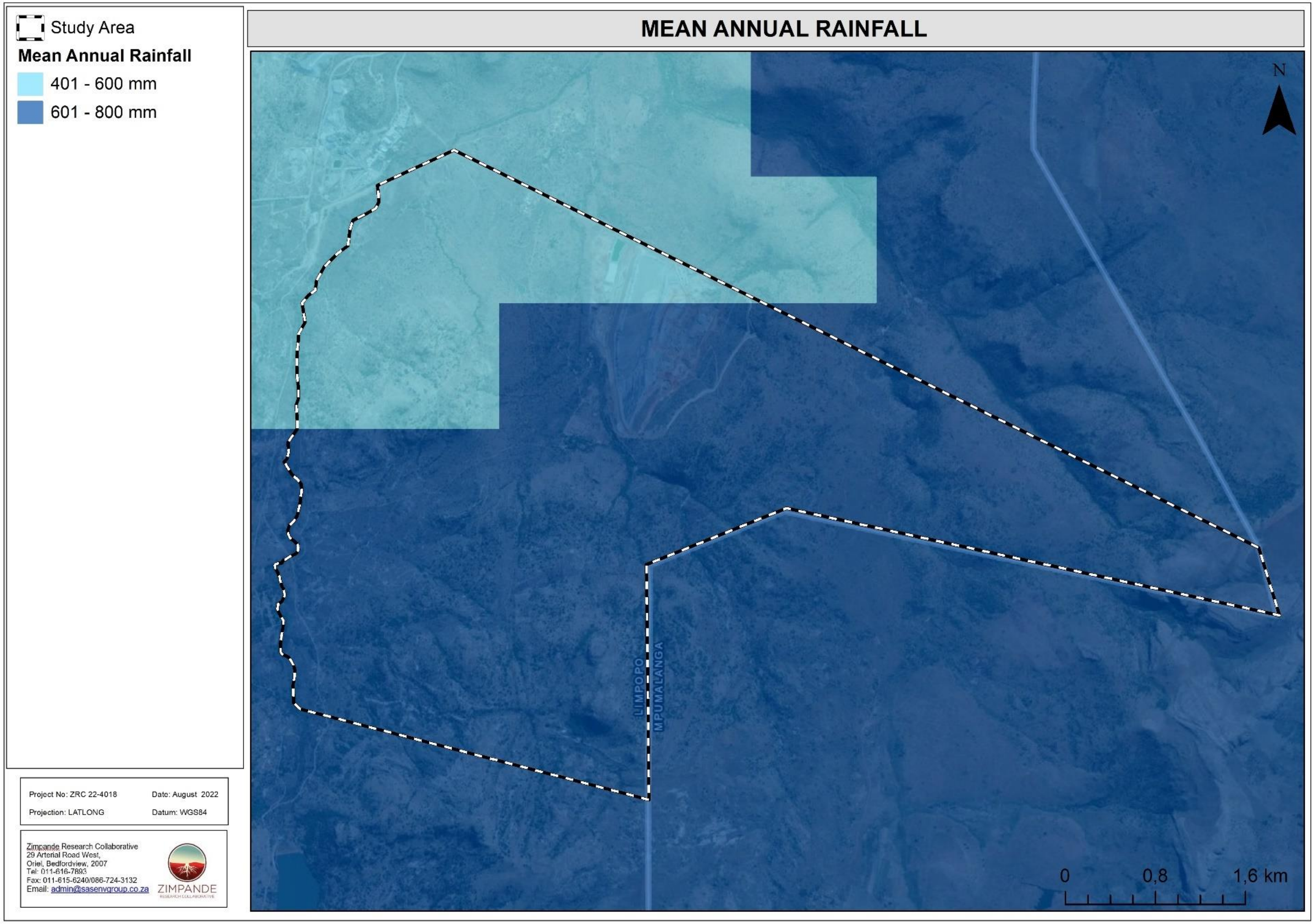


Figure 3: Mean annual rainfall associated with the study area.

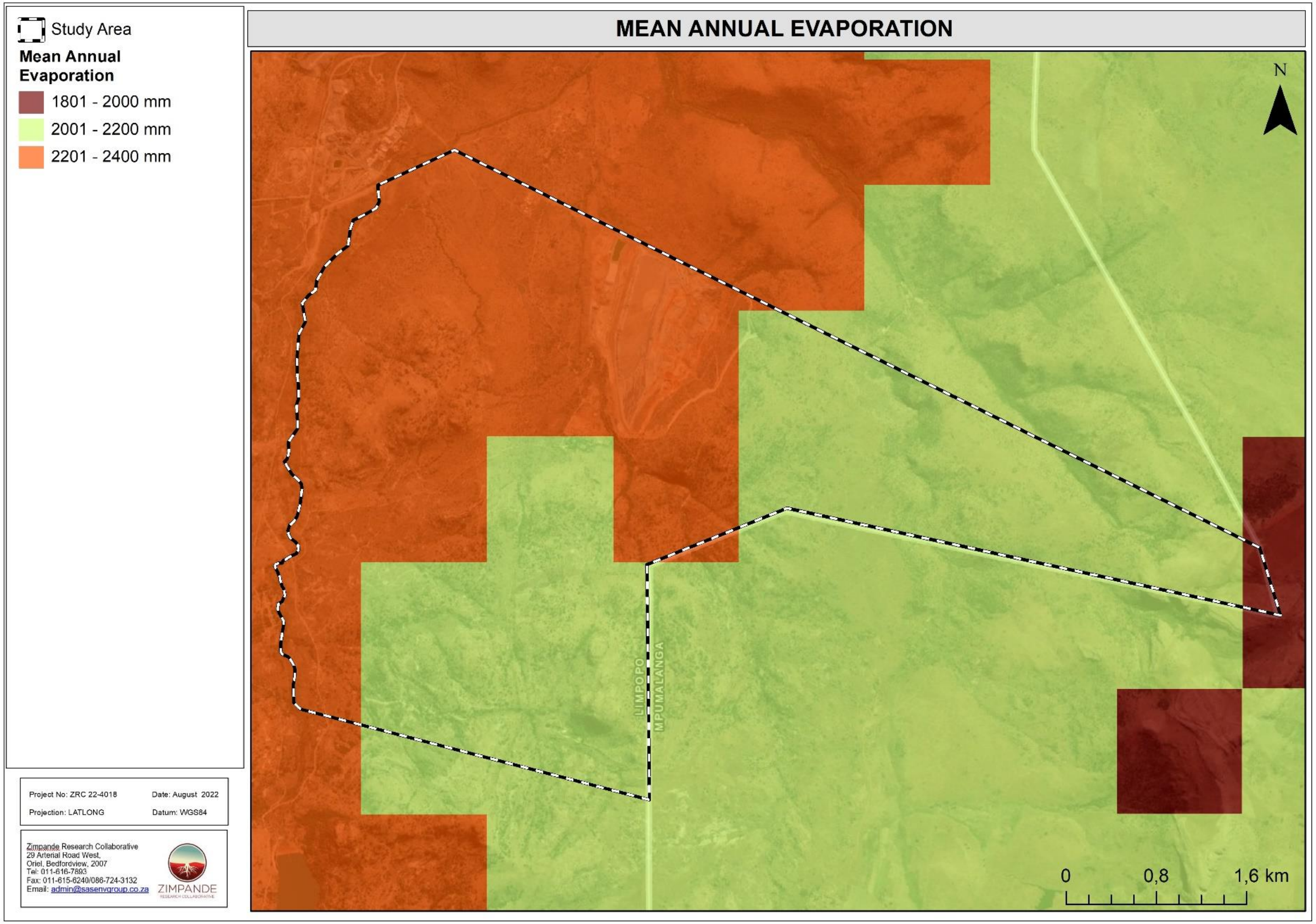


Figure 4: Mean annual evaporation associated with the study area.

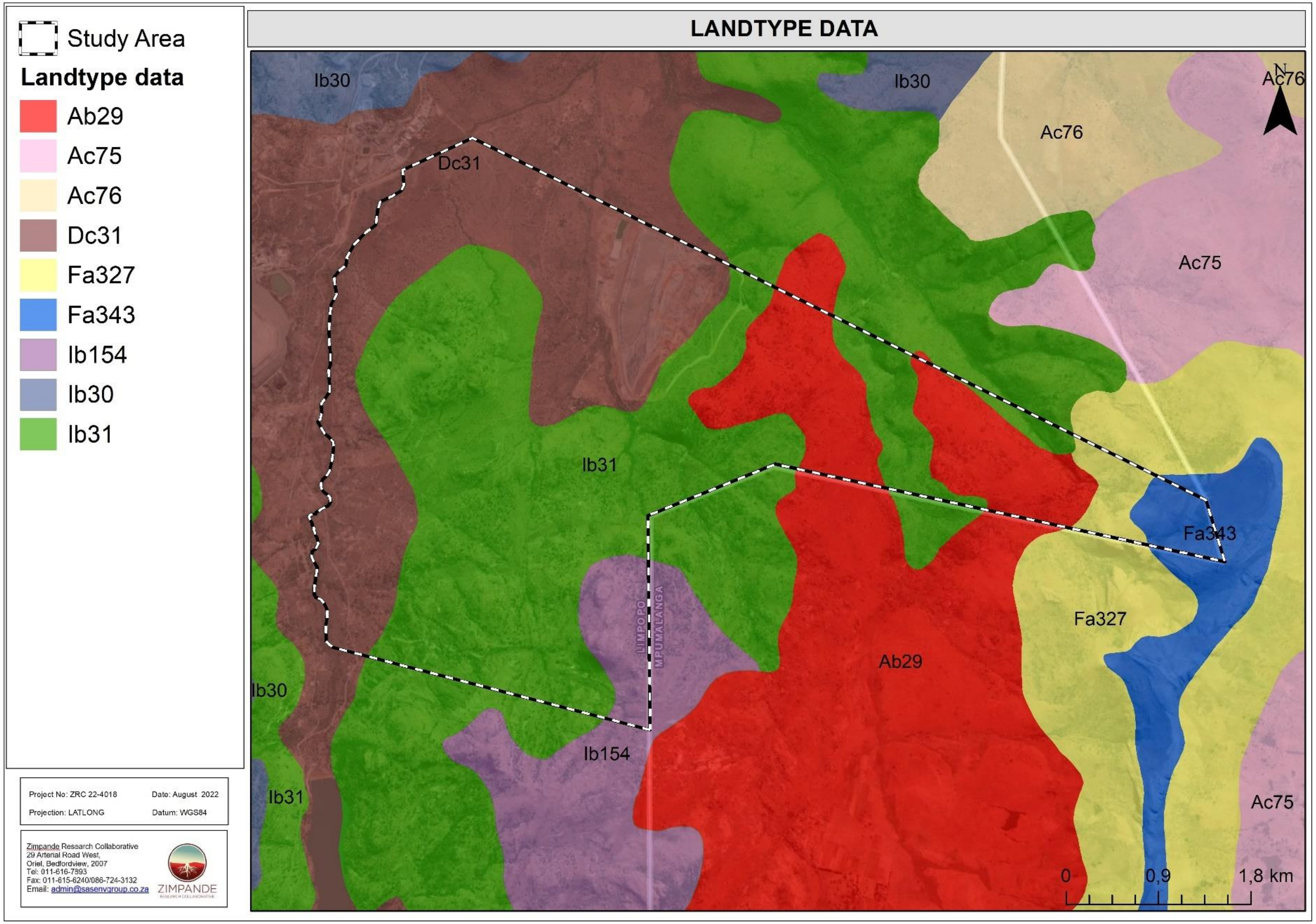


Figure 5: Landtype data associated with the study area.

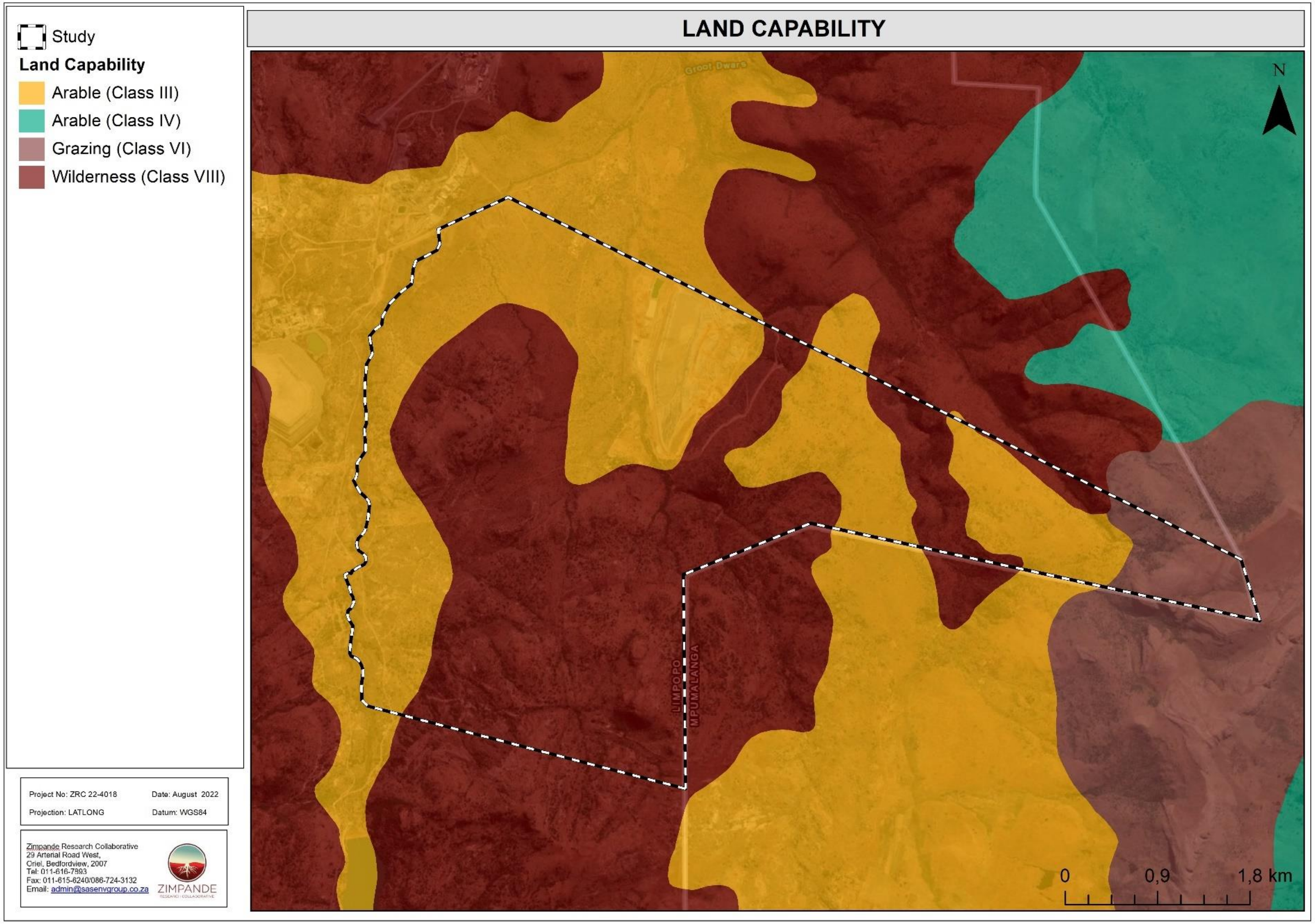


Figure 6: Desktop Land Capability associated with the study area.

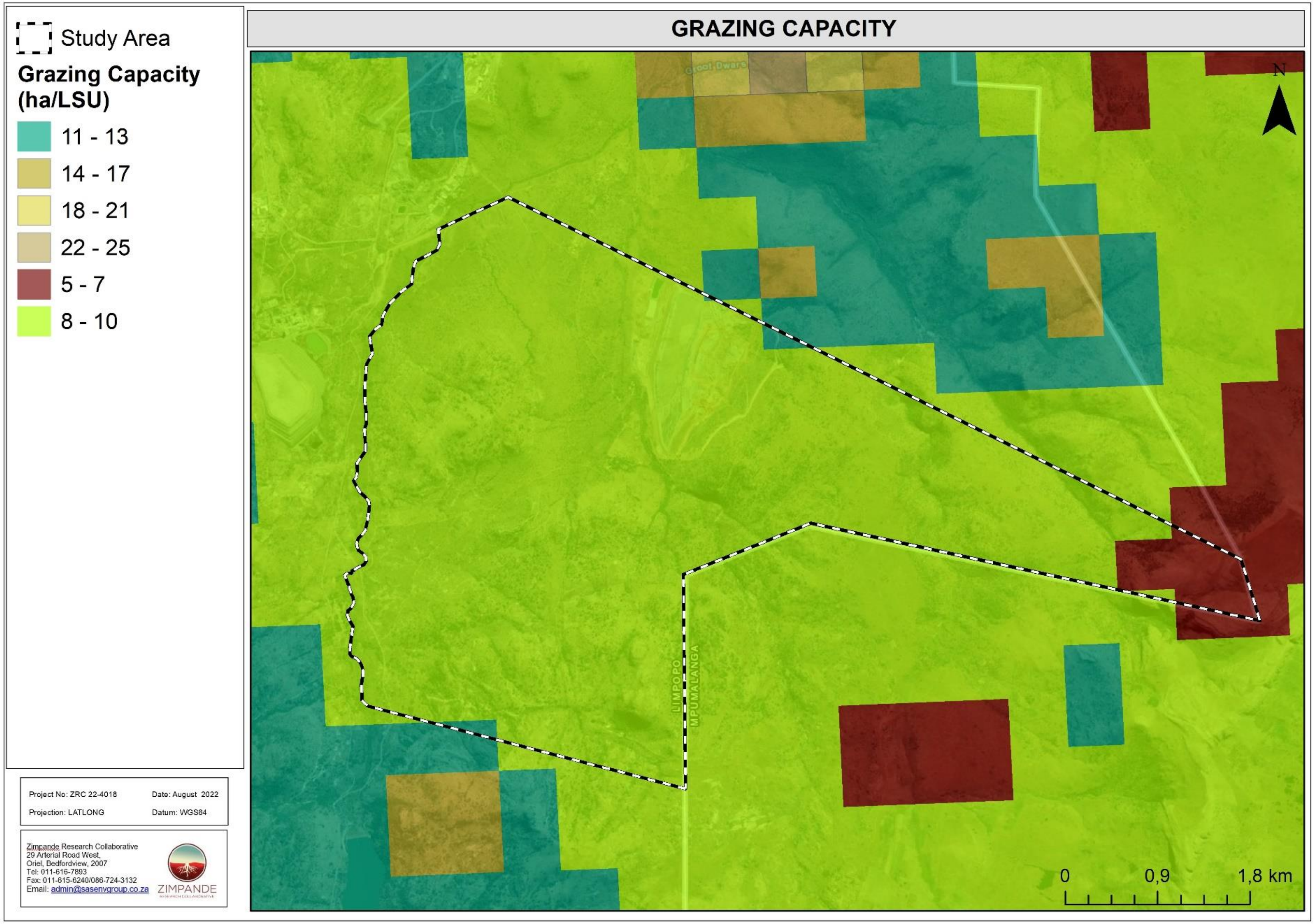


Figure 7: Grazing capacity associated with the study area.

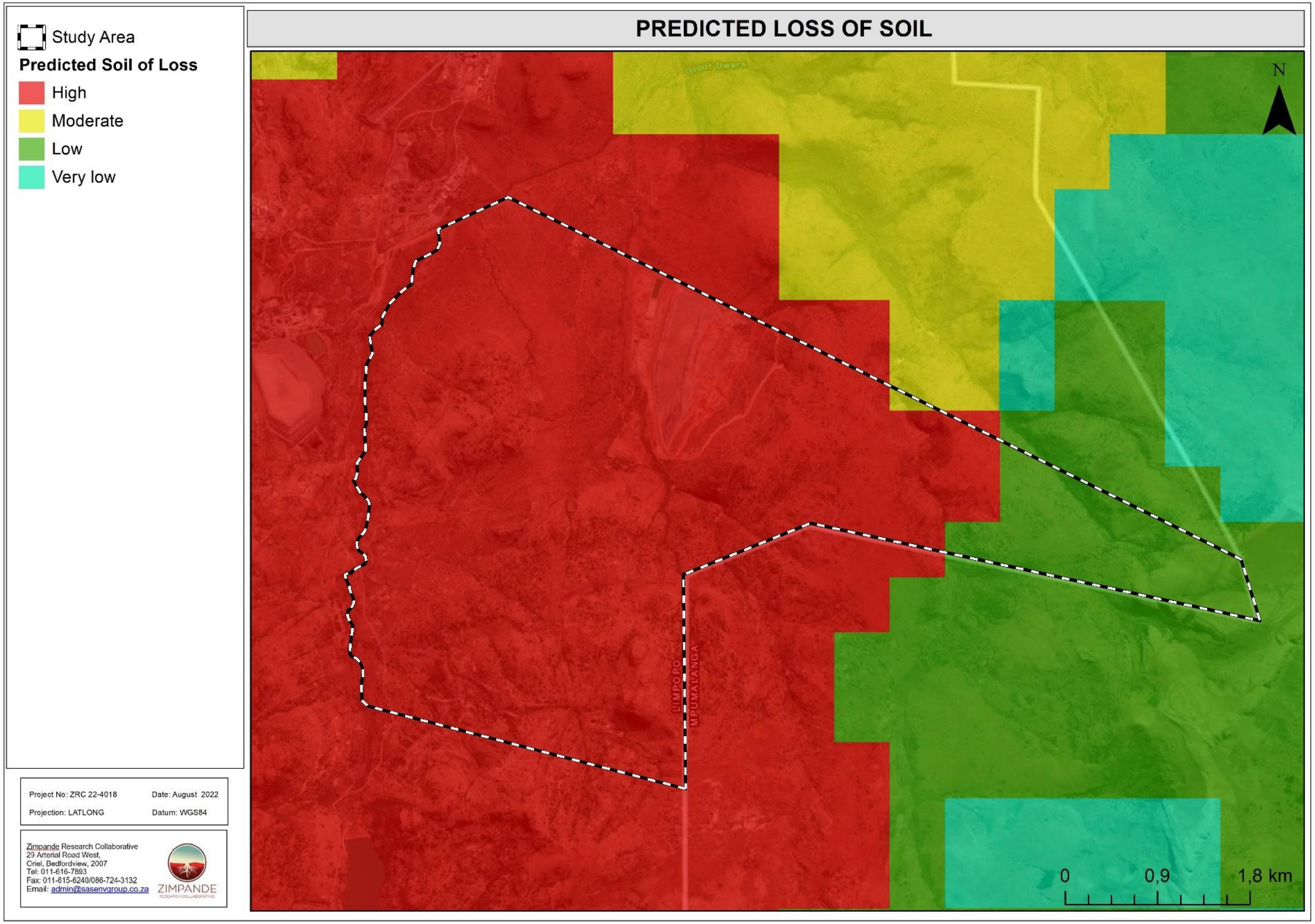
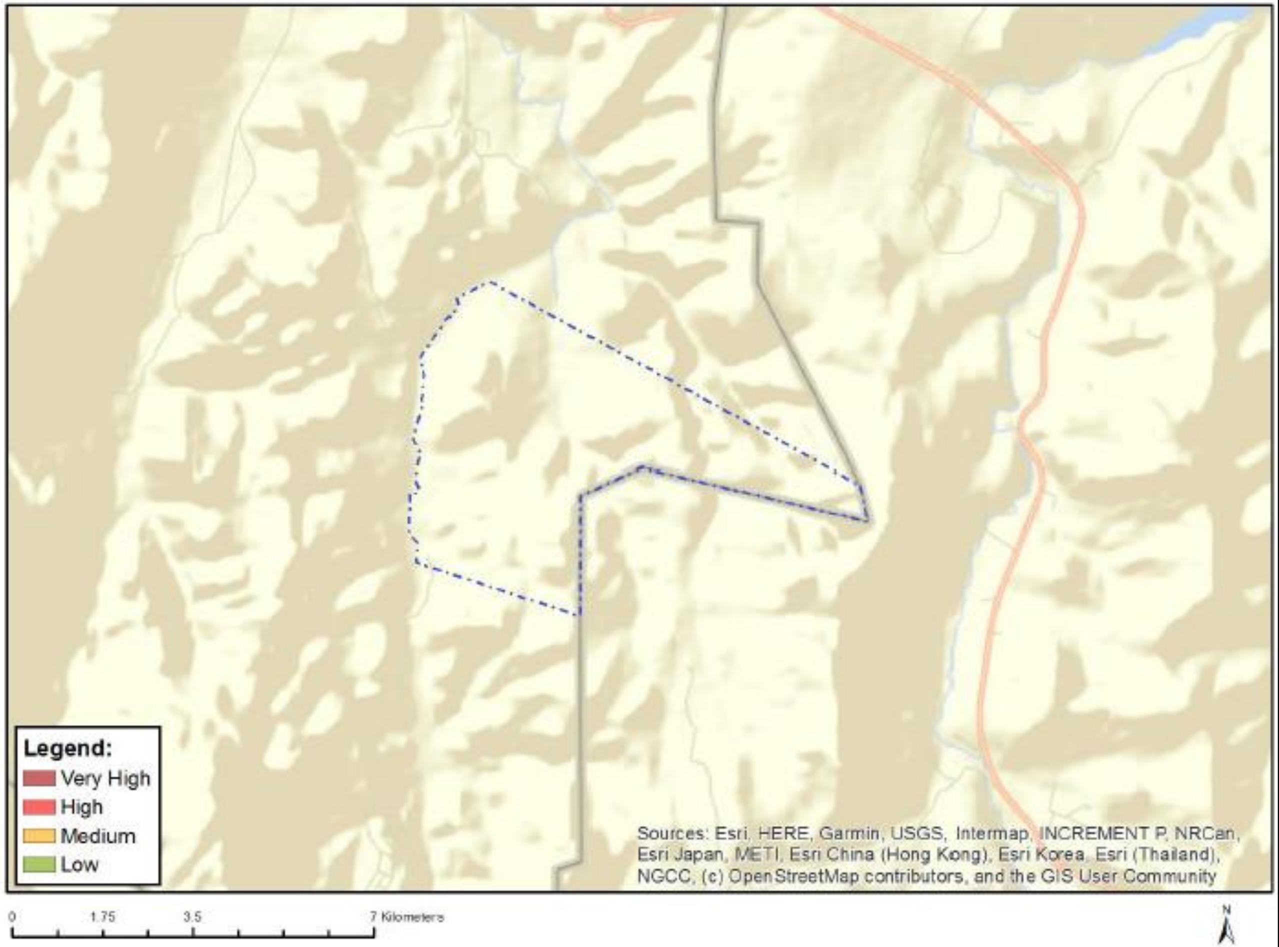


Figure 8: Predicted soil loss associated with the study area.



Very High sensitivity	High sensitivity	Medium sensitivity	Low sensitivity
	X		

Figure 9: Screening tool results depicting the combined agricultural sensitivity for the study area.

4. FIELD ASSESSMENT FINDINGS

4.1 Current Land Use

According to observations made during the site assessment the study area is dominated by open veld or vacant areas (often utilised for grazing by the locals and as habitat for wildlife) while the northern portion is comprised of mining related activities. During the time of assessment, no large scale cultivation of crops was observed. Figure 10 below depicts the dominant landuses associated with the study area.

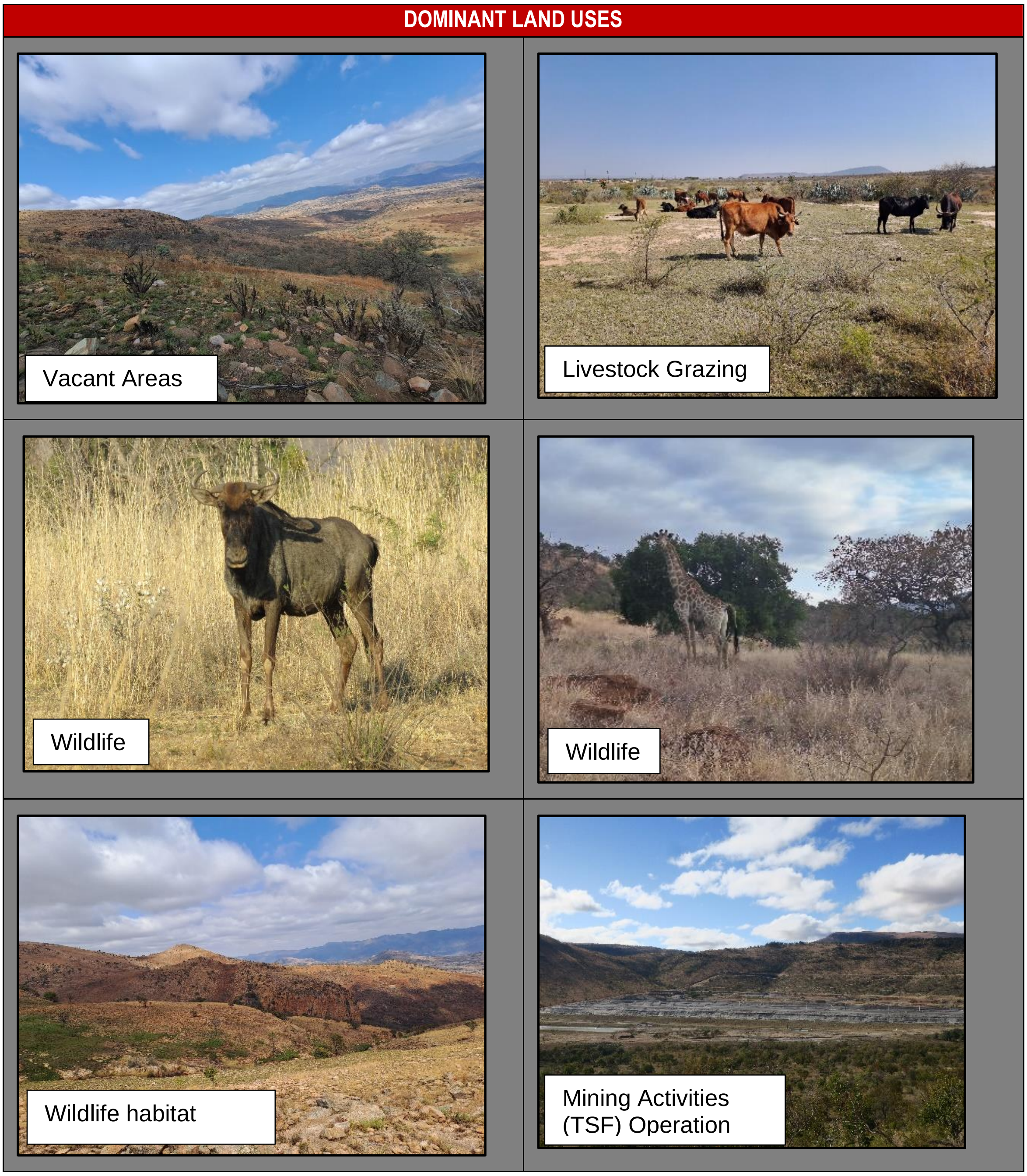


Figure 10: Photographs illustrating the dominant land use within the study area.

4.2 Dominant Soil Forms

The identified soil forms within the study area include the shallow soil of the Mispah/Glenrosa, Mayo, Darnall/Swartland, Steendal/Immerpan, Dundee, Didema, Rocky Outcrops and the Witbank formation. Of these identified soils, the Rocky Outcrops comprising of the Mispah/Glenrosa and the Mispah/Mayo soil forms were the dominant soil forms within the study area.

The Mispah/Glenrosa and rock outcrops are typically shallow to no topsoil (rocky outcrops) in nature. These soils are characterised by spatial heterogeneity associated with weathering of the rock material, illuviation, and biotic disturbance (plants and animals) especially along the joints or bedding planes which results in the mixing of soil and rock material in some instances. The topsoil horizon can occur as a single shallow surface horizon with diagnostic red or yellow brown colours and are accommodated within the Mispah/Glenrosa formations. These types of soils are usually avoided for intensive use and thus left for grazing, forestry, and wildlife land uses since they do not present adequate soil depth for most cultivated crops.

The soils of duplex character such as the Darnall/Swartland formation are characterised by moderately to strongly structured soils with a clear textural distinction between a sandier surface horizon and a higher clay upper subsurface horizon. These types of soils are typically not preferred for cultivation due to the high clay content, strong structure and are prone to waterlogging (highly impermeable when wet). Waterlogging conditions make these soils prone experiencing runoff during high rainfall events and thus the formation of erosion gullies over time. Nonetheless, should these soils be cultivated, intensive management practices would be required.

Soils of melanic character such as the Bonheim/Mayo and Steendal/Immerpan formations are characterised by dark coloured and strongly structured morphology with a high base status and low organic carbon content (less than 10%). These soils are typically encountered along intermediate rocks or in lower terrain positions to receive additional bases via lateral flowpaths. The Steendal/Immerpan soils occur in mostly arid areas owing to the cementation of the calcium and gypsum materials due to the high evaporation demand. Beside depth limitations of these soils as encountered within the study area these soils are fertile but may require irrigation to be highly productive.

The Didema soil form is characterised by topsoil accumulation of organic matter (in various stages of decomposition with dark brown or black morphology) under saturated conditions underlain by hard rock. These soils are typical of high-altitude plateaux and mountainous regions as topsoil layers. The surface horizon typically contains an average of between 10 and 20% organic carbon.

The Dundee soils form is associated with watercourses due to the unconsolidated soil material as a result of deposition by water. These soils are characterised by little evidence of pedogenic horizonation and the presence of clear stratifications may be observed. These soils may contain weathered hard rock fragments sometimes identified as pebbles. These soils typically occur on low lying terrain positions.

The Witbank (Anthrosols) soil forms are soils which have been subjected to physical disturbance because of human interventions. Such interventions include transportation and deposition of the earth material containing soil. As a result, these soils are not ideal for agricultural cultivation.

Table 6: Identified soil forms associated with the study area.

Soil Form	Diagnostic Horizons
Bonheim/Mayo	Melanic A/Pedocutanic B or Lithic
Darnall/Swartland	Orthic A or Melanic A/ Pedocutanic B/Lithic
Didema	Organic O/Lithic
Dundee	Orthic A/Alluvial or Alluvial
Mayo	Melanic A/Lithic
Mispah/Glenrosa	Orthic A/Lithic or Hard Rock
Swartland/Darnall	Orthic/ Pedocutanic B/ Lithic or Hard Rock
Steendaal/Immerpan	Melanic A/Soft Carbonate or Hard Carbonate
Rocky Outcrops	Solid rock
Witbank	Transported Technosols

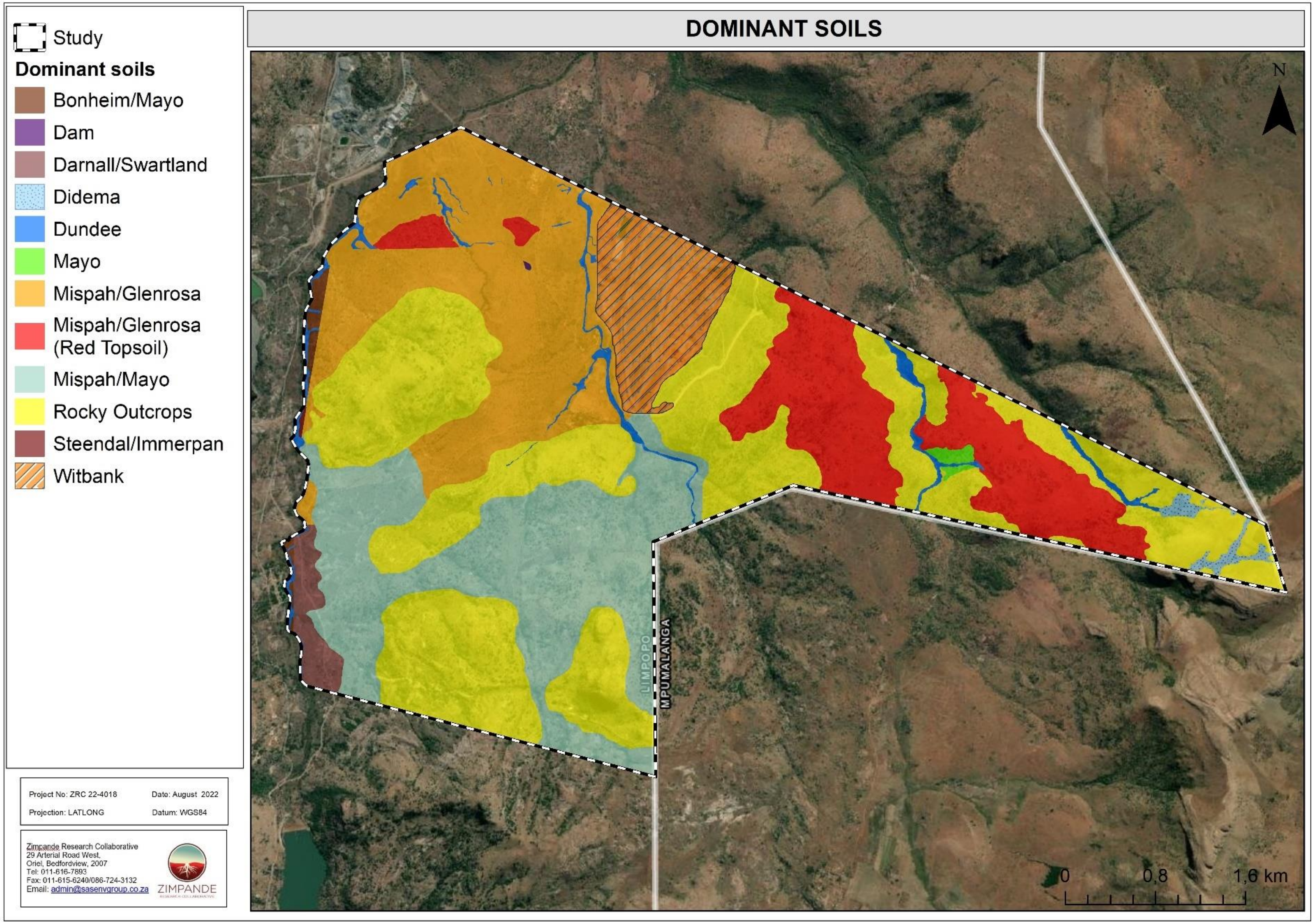


Figure 11: Dominant soil forms associated with the study area.

4.3 Land Capability Classification

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

High potential agricultural land is defined as having the soil and terrain quality, growing season and adequate available moisture supply needed to produce sustained economically high crops yields when treated and managed according to best possible farming practices (Scotney *et al*., 1987). For the purpose of this assessment, land capability was inferred in consideration of observed limitations to land use due to physical soil properties and prevailing climatic conditions. Climate Capability (measured on a scale of 1 to 8) was therefore considered in the agricultural potential classification. The study area falls into Climate Capability Class 5 at best, with moderate to severe limitations for arable crops. Table 7 and Figure 12 below presents the identified soil forms with their respective land capability. Figure 13 presents the soil potential associated with the soils. The dashboards presented from Table 8 to 11 below present the land capability of the identified soil forms in a summarised and comprehensive manner.

Table 7: Land capability associated with the soils occurring within the study area.

Soil Form	Land Capability
Darnall/Swartland	Arable (Class IV)
Didema	Wetland (Class V)
Dundee	Watercourse (Class V)
Bonheim/Mayo	Grazing (Class VI)
Mayo	
Mispah/Glenrosa	
Steendaal/Immerpan	
Rocky Outcrops	Wilderness (Class VIII)
Witbank	

Table 8: Summary discussion of the Arable (Class IV) land capability class for the Swartland and Darnall soil forms.

<table>
<tr><th colspan="4">Land Capability: Arable - Class IV</th></tr>
<tr><td colspan="4">Occurrence of Swartland/Darnall soil forms within the study area.
</td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td>Depressional areas, flat and lower lying landscape</td><td rowspan="2">Photograph notes</td><td rowspan="2">View of the Melanic, Pedocutanic and Lithic horizons associated with the Swartland/ Darnall and Bonheim soil forms occurring within the study area.</td></tr>
<tr><td>Soil Form(s)</td><td>Swartland/Darnall and Bonheim</td></tr>
<tr><td>Diagnostic Horizon Sequence</td><td>Melanic A or Orthic A/Pedocutanic/ Lithic</td><td colspan="2" rowspan="2">Land Capability
The identified soil forms are of moderate (Class IV) land capability, and suitable for arable agricultural land use with restrictions. Therefore, these soils are considered to make a moderate contribution to agricultural productivity on a regional and national scale.</td></tr>
<tr><td>Physical Limitations</td><td>Shallow effective rooting depth in some instances as well as the shrink and swell properties of the topsoil which damages the root system of crops.</td></tr>
<tr><td colspan="4">Business case and Conclusion:
The identified soils are generally not considered significant in terms of agricultural productivity unless under irrigation. These soils are known for their shrinking and expansion characteristics upon wetting and drying thus necessitating intense management practices to be applied, which are usually costly and not economical based on the expected yields from these soils. This is exacerbated by the climate of the area. These soils are thus typically suited for subsistence agriculture for both cropping and grazing.</td></tr>
</table>

Table 9: Summary discussion of the watercourse/wetland (Class V) land capability class for the alluvial and wetland soils.

<table>
<tr><th colspan="4">Land Capability: Watercourse - Class V</th></tr>
<tr><td colspan="4">View of the Dundee soils form (watercourses) and Didema (wetland) identified.
</td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td>Valley bottoms and gently landscapes of < 0.5% slope gradient</td><td rowspan="2">Photograph notes</td><td rowspan="2">View of the identified Didema, Alluvial soils and Montane flowpaths, associated with the watercourses.</td></tr>
<tr><td>Soil Form(s)</td><td>Alluvial (Dundee) and Didema</td></tr>
<tr><td>Diagnostic Horizon Sequence</td><td>Orthic/ Alluvial and Organic O/Lithic</td><td colspan="2" rowspan="2">Land Capability
These soils were classified as class V land capability due to land use limitations related to their occurrence within a water course. These soils are not considered to contribute significantly to local, provincial and/or national agricultural productivity.</td></tr>
<tr><td>Physical Limitations</td><td>These soils are not ideal for cultivation due to their occurrence within watercourses. Furthermore, the lack of soil structure and nutrients disqualifies these soils from commercial agriculture.</td></tr>
<tr><td colspan="4">Business case, Conclusion and Mitigation Requirements:
Although not considered to be of significant agricultural productivity, these soils are considered of significant value as part of the freshwater habitats, and as such the recommendations and management measures of the freshwater resource assessment report conducted as part of the EIA and WULA process take precedence.</td></tr>
</table>

Table 10: Summary discussion of the Grazing (Class VI) land capability class for the shallow lithic soils.

<table>
<tr><th colspan="4">Land Capability: Grazing - Class VI</th></tr>
<tr><td colspan="4">Occurrence of the Mispah/Glenrosa or Mayo soil forms within the study area.
</td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td>Depressional areas and lower lying landscape</td><td rowspan="2">Photograph notes</td><td rowspan="2">View of the morphology of the identified Mispah/Glenrosa/Mayo soil forms and the rocky outcrops.</td></tr>
<tr><td>Soil Form(s)</td><td>Mispah/Glenrosa, Mayo and Rocky Outcrops</td></tr>
<tr><td>Diagnostic Horizon Sequence</td><td>0-35 cm: Melanic A or Orthic A
≥ 35 cm: Hard rock/Lithic</td><td colspan="2" rowspan="2">Land Capability
The identified Mispah/Glenrosa and Mayo soil forms are of poor (Class VI) land capability and are not suitable for arable agricultural land use. Theses soils are, at best, suitable for natural pastures for light grazing. Therefore, these soils are not considered to make a substantial contribution to extensive subsistence farming on a local scale.</td></tr>
<tr><td>Physical Limitations</td><td>Shallow effective rooting depth as well as the shrink and swell properties of the top soil which damages the root system of crops.</td></tr>
<tr><td colspan="4">Business case and Conclusion:
The identified soils are generally not considered to be of significance in terms of agricultural productivity and are better suited for grazing purposes. Despite the low importance in terms of agricultural potential their importance in terms of biodiversity support must be considered.</td></tr>
</table>

Table 11: Summary discussion of the Wilderness (Class VIII) land capability class for the rocky outcrops and anthropogenically disturbed soils.

<table>
<tr><th colspan="4">Land Capability: Wilderness - Class VIII</th></tr>
<tr><td colspan="4">Occurrence of anthropogenically disturbed soils within the study area associated with the TSF.
 </td></tr>
<tr><td>Terrain Morphological Unit (TMU)</td><td>Very Steep landscapes</td><td rowspan="2">Photograph notes</td><td rowspan="2">View of the morphology of the identified rocky outcrops and the anthropogenically disturbed soils of the Witbank formation.</td></tr>
<tr><td>Soil Form(s)</td><td>Mispah/Glenrosa/Mayo and Witbank</td></tr>
<tr><td>Diagnostic Horizon Sequence</td><td>0 - ≥ 35 cm: Hard rock/Lithic or disturbed</td><td colspan="2" rowspan="2">Land Capability
The identified Rocky Outcrops are of poor (Class VIII) land capability and are not suitable for arable agricultural land use. Theses soils are, at best, suitable for natural pastures for light grazing. Therefore, these soils are not considered to make a substantial contribution to extensive subsistence farming on a local scale. The identified Witbank soils associated with anthropogenic disturbance also have very poor (class VIII) land capability attributed to human impacts.</td></tr>
<tr><td>Physical Limitations</td><td>Minimal effective rooting depth for crops is the primary limitation of the land capability of the Rocky Outcrops. Physically disturbed soils which may require rehabilitation before cultivation.</td></tr>
<tr><td colspan="4">Business case and Conclusion:
The identified rocky outcrops are, at best, suited for grazing and/or wildlife practices. These soils are generally not considered of significant agricultural productivity. These soils, at best are suited for grazing. Despite the low importance in terms of agricultural potential their importance in terms of biodiversity support must be considered. Mitigation measures should this put in place to minimise further disruption of other adjacent soils which can potentially be used for grazing. The current state of these of the Witbank soils will require significant rehabilitation in future especially due to the steep slopes and erodibility of the landscape.</td></tr>
</table>

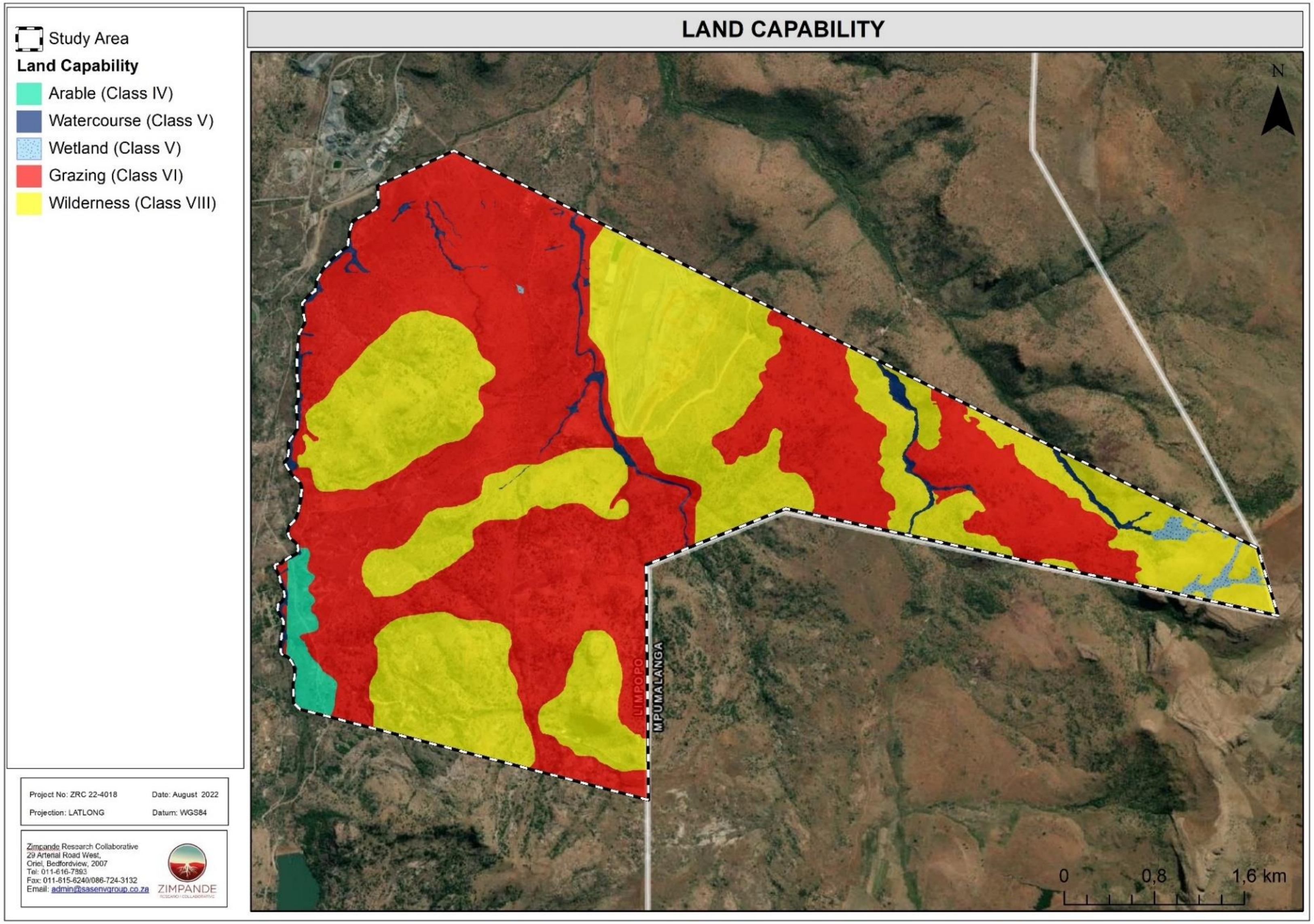


Figure 12: Land capability of the soil forms associated with the study area.

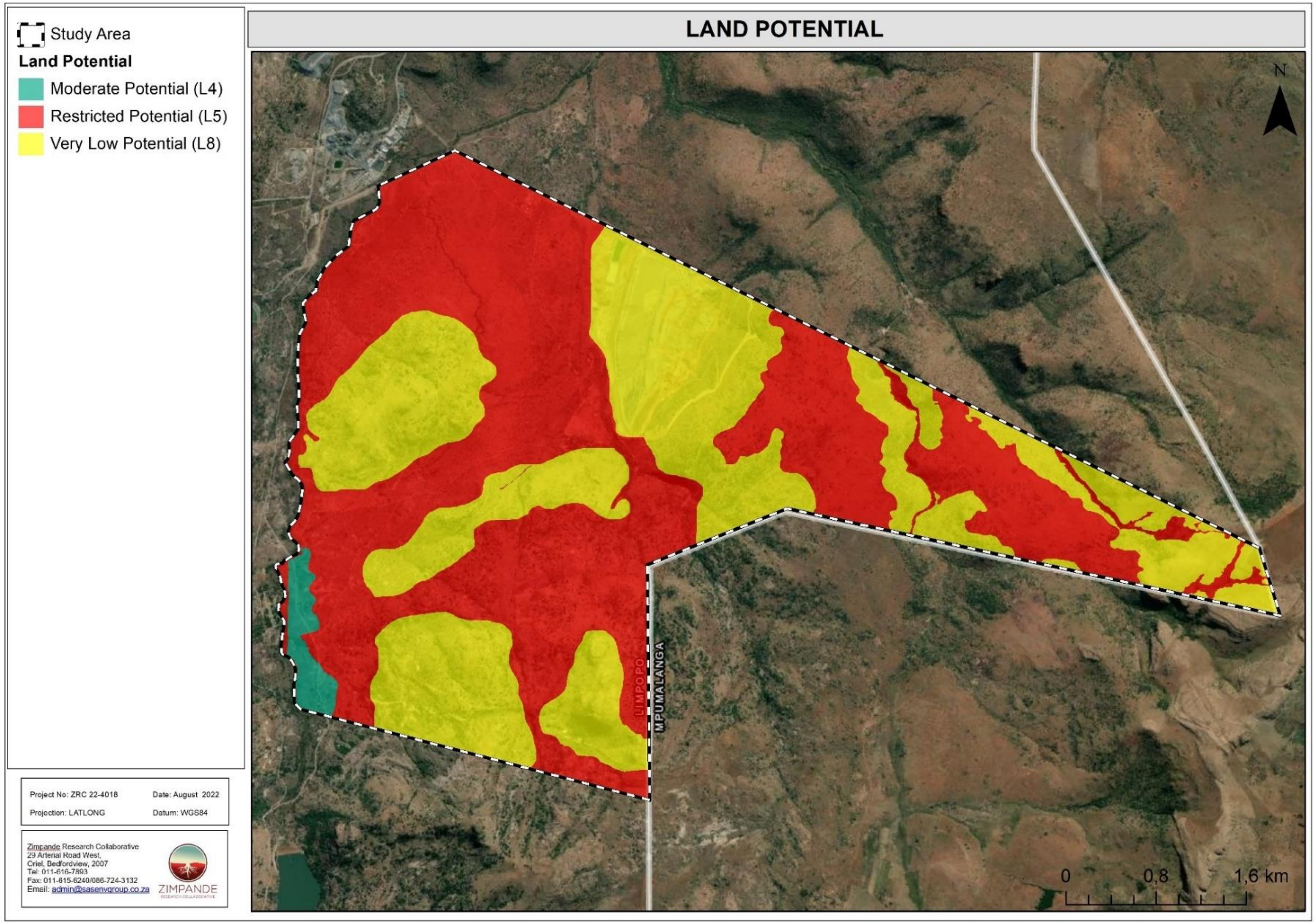


Figure 13: Land potential of the soil forms associated with the study area.

5. CONCLUSION

5.1 Impact Statement and Verification Outcomes

The screening tool analysis indicated the study area to be of very high agricultural sensitivity, however the field verified data indicates that the study area is of Low agricultural sensitivity. This can be attributed to the rocky outcrops and shallow soils of the Mispah/Glenrosa formation. These soils are characterised by limited to not available topsoil material which will hinder any proposed cultivation within the study area. Also, these soils typically occur along steep slopes along mountainous areas and thus proving difficult for mechanical handling and if mechanically handled the soils are still prone to erosion. These soils are usually avoided for cultivation and rather used as veld areas for grazing purposes or as wildlife conservation areas. Therefore, the overall impact is anticipated to be low to very low and within acceptable levels from a soil and land capability point of view.

Table 12: Outcomes of the soil assessment findings.

Screening Tool Assigned Sensitivity	Verified Sensitivity	Outcome Statement / Plan of Study	Relevant Section Motivating Verification
High for most of the study area.	Majority of the study area is dominated by shallow soils of lithic character soils which are low sensitivity to very low sensitivity.	It is recommended that a detailed Agricultural Impact Assessment must be undertaken in future ***should the prospecting rights application be altered or approved to allow any activities other than non-invasive activities as currently proposed by the applicant that would result in the potential for impacts on soil resources to result from such prospecting activities***. This detailed assessment should also be undertaken for any future mining-right or mining activities-related application for Environmental Authorisation.	Section 4

5.2 Reasoned Opinion for issuing of EA

Overall, the lithic character (hard to cultivate) of the dominant soils as well as the low and erratic rainfall associated with the study area renders the site not suitable for any commercialised cultivation. However, some of the areas used for grazing may potentially be impacted, which will ultimately impact on the local and regional livestock production to a degree. Although agricultural studies under the CARA Act 1983 prioritise crop cultivated agriculture, it is imperative that land with grazing capability is also conserved where feasible as this will support the highly sensitive faunal ecology of the study area in its present condition and land use. It should be noted that this soil assessment was done at a high level due the low quantum of risk presented by the proposed development and therefore should not be used for any other purpose then it is intended for. Should the quantum of risk of the project change for any reason, then a detailed soil investigation, delineation and classification may have to be undertaken in fulfilment of the applicable legislation.

6. REFERENCES

Agricultural Geo-referenced Information System (AGIS) database. www.agis.agric.za

Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983).

Department of Agriculture, Forestry and Fisheries. Agricultural Geo-referenced Information system (AGIS). Grazing Capacity Maps (1993).

Morgenthal, T.L., Newby, T., Smith, H.J.C., and Pretorius, D.J. (2004*). Developing and refinement of a grazing capacity map for South Africa using NOAA (AVHRR) satellite derived data*. Report GW/A/2004/66. ARC Institute for Soil, Climate and Water, Pretoria.

National Department of Agriculture, 2002. Development and Application of a Land Capability Classification System for South Africa

Soil Classification Working Group, 2018. Soil classification. A Natural and Anthropogenic system for South Africa. Mem. agric. nat. Resource. S. Afr. No. 15. Dept. Agric. Dev., Pretoria.

APPENDIX A: METHOD OF ASSESSMENT

Desktop Screening

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

Soil Classification and Sampling

A soil survey was conducted from September 2022 by a qualified soil specialist, at which time the identified soils within the infrastructure areas and associated access roads were classified into soil forms according to the Soil Classification Working Group for South Africa (2018). Subsurface soil observations were made using a manual hand auger in order to assess individual soil profiles, which entailed evaluating physical soil properties and prevailing limitations to various land uses.

Land Capability Classification

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

Table A1: Land Capability Classification (Smith, 2006)

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

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

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

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

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

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

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

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

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

APPENDIX B: DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

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

Braveman Mzila	BSc (Hons) Environmental Hydrology (University of KwaZulu-Natal)
Tshiamo Setsipane	MSc Soil Science (University of the Free State)
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		

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF STEPHEN VAN STADEN

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

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

EDUCATION

Qualifications

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

Short Courses

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

AREAS OF WORK EXPERIENCE

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

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

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

Freshwater Assessments

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

Aquatic Ecological Assessment and Water Quality Studies

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

Soil and Land Capability Assessment

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

Visual Impact Assessment

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

Legislative Requirements, Processes and Assessments

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

SAS ENVIRONMENTAL GROUP OF COMPANIES –

SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF BRAVEMAN MZILA

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Soil Science Society (SASSO)

Member of the Gauteng Wetland Forum (GWF)

EDUCATION

Qualifications

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

COUNTRIES OF WORK EXPERIENCE

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

KEY SPECIALIST DISCIPLINES

Hydropedological Assessments:

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

Soil, Land use, Land Capability and Agricultural Potential Studies

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

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF TSHIAMO SETSIPANE

PERSONAL DETAILS

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

MEMBERSHIP IN PROFESSIONAL SOCIETIES

South African Council for Natural Scientist Professions (SACNASP)

EDUCATION

Qualifications

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

COUNTRIES OF WORK EXPERIENCE

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

KEY SPECIALIST DISCIPLINES

Hydropedological Assessments:

- Soil Survey
- Soil Delineation
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