



Soils and Land Capability Scoping Assessment for the Kangala Extension Project

Mpumalanga, South Africa

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CLIENT



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Report Name	Soils and Land Capability Scoping Assessment for the Kangala Extension Project	
Reference	Kangala - Biodiversity	
Submitted to	EIMS	
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Report Writer	Wayne Jackson	
Declaration	<p>The Biodiversity Company and its associates operate as independent consultants under the auspice of the South African Council for Natural Scientific Professions. We declare that we have no affiliation with or vested financial interests in the proponent, other than for work performed under the Environmental Impact Assessment Regulations, 2017. We have no conflicting interests in the undertaking of this activity and have no interests in secondary developments resulting from the authorisation of this project. We have no vested interest in the project, other than to provide a professional service within the constraints of the project (timing, time and budget) based on the principals of science.</p>	



Declaration

I, Wayne Jackson 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 Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, 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; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.



Wayne Jackson

Soil Specialist

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5 May 2018



Table of Contents

1	Introduction	1
2	Project Area	3
3	Limitations.....	5
4	Methodology	5
4.1	Impact Assessment Methodology	5
5	Legislative & Policy Framework	6
6	Results.....	6
6.1	Climate	6
6.2	Terrain	7
6.3	Soils & Geology	10
7	Discussion	11
7.1	Impact Assessment.....	13
7.2	Field Verification Methodology	18
8	References	20

Tables

Table 1: Loss of land capability assessed for the proposed project during the planning phase	14
Table 2: Loss of land capability assessed for the proposed project during the construction and operational phase	16
Table 3: Loss of land capability assessed for the proposed project during the decommissioning phase.....	17
Table 4: Land capability class and intensity of use (Smith, 2006).....	18
Table 5: The combination table for land potential classification.	18
Table 6: The Land Potential Classes.....	19

Figures

Figure 1: The relationship between soil and above-ground ecological succession	2
Figure 2: The proposed Kangala project area	4



Kangala Extension

Figure 3: The climate summary for the Eastern Highveld Grassland (Gm 12) region (Mucina & Rutherford, 2006) 7

Figure 4: The relief map for the project area 8

Figure 5: The Slope Percentage map for project area 9

Figure 6: The Slope Aspect map for project area 9

Figure 7: An illustration of the terrain units of the Bb3 land type 10

Figure 8: Land type map for the project area 11

Figure 9: Land use map for the project area 12



1 Introduction

The Biodiversity Company (TBC) was appointed by Environmental Impact Management Services (Pty) Ltd (EIMS) to conduct a comprehensive soils and land capability scoping study, including baseline and impact assessment for the proposed extension of the Kangala Colliery near Delmas in Mpumalanga. The proposed project will involve the extension of the Kangala Colliery through the addition of a new opencast mining pit and associated soft, hard and topsoil stockpiles. This report represents the scoping phase assessment only.

Universal Coal Development 1 (hereafter referred to as UCD1), a subsidiary of Universal Coal plc wishes to develop a new opencast coal mining pit, adjacent to the existing Universal Coal's Kangala Colliery on various portions of the Farm Strypan 243 IR - herein referred to as the Kangala Extension Project. The proposed Kangala Extension Project is anticipated to use a standard truck and shovel mining method based on strip mining design and layout. The existing Coal Handling and Processing Plant (CHPP) at the Kangala Colliery will be utilised for the proposed Kangala Extension Project. It is expected that no new surface infrastructure such as offices, dams, stores facility, workshops, or change house will be required for the project.

The conservation of South Africa's limited soil resources is essential. In the past, misuse and poor management of the soil resource has led to the loss of these resources through erosion and destabilisation of the natural systems. In addition, loss of high potential agricultural land due to land use changes is a big concern presently in South Africa.

Soils can be seen as the foundation for ecological function as shown in Figure 1. Without a healthy soil system for microbes to thrive in, both flora and fauna would be negatively impacted, which in turn feeds the natural soil system with organics and nutrients.

To identify soils accurately, it will be necessary to undertake a soil survey in the EIA phase of this EIA process. The aim being to provide an accurate record of the soil resources of the proposed project area. The objective of determining the land capability is to find and identify the most sustainable use of the soil resource without degrading the system.





Figure 1: The relationship between soil and above-ground ecological succession

2 Project Area

The existing Kangala Colliery is located approximately 7 km south-west of Delmas, in the Mpumalanga Province, South Africa. The area surrounding the project area consists predominantly of agricultural fields, secondary roads and various coal mining operations.

The various land-use activities within, and adjacent to, the project area have impacted upon the associated ecosystems and many of the watercourses are identified as moderately modified according to available desktop information (DWS, 2013). The proposed extension of the Kangala Colliery is situated within the Olifants Water Management Area (WMA) within the B20A quaternary catchment. A locality map of the project area is presented in Figure 2.

The dominant land use of the surrounding area is cultivated land/agriculture, predominantly maize cropping and to a lesser extent other crop plants such as Soya. Remaining areas of natural vegetation are utilized for livestock grazing predominantly by cattle. Other land uses nearby include extensive coal mining operations, most of which are open-cast mines.

The following infrastructure exists in the project area and surrounds:

- Various secondary farm roads;
- Open-cast coal mines and related infrastructure and activities;
- Farm dams and at least one large man-made dam;
- Power lines;
- Telephone lines;
- Agricultural homesteads; and
- Dwellings.



Kangala Extension

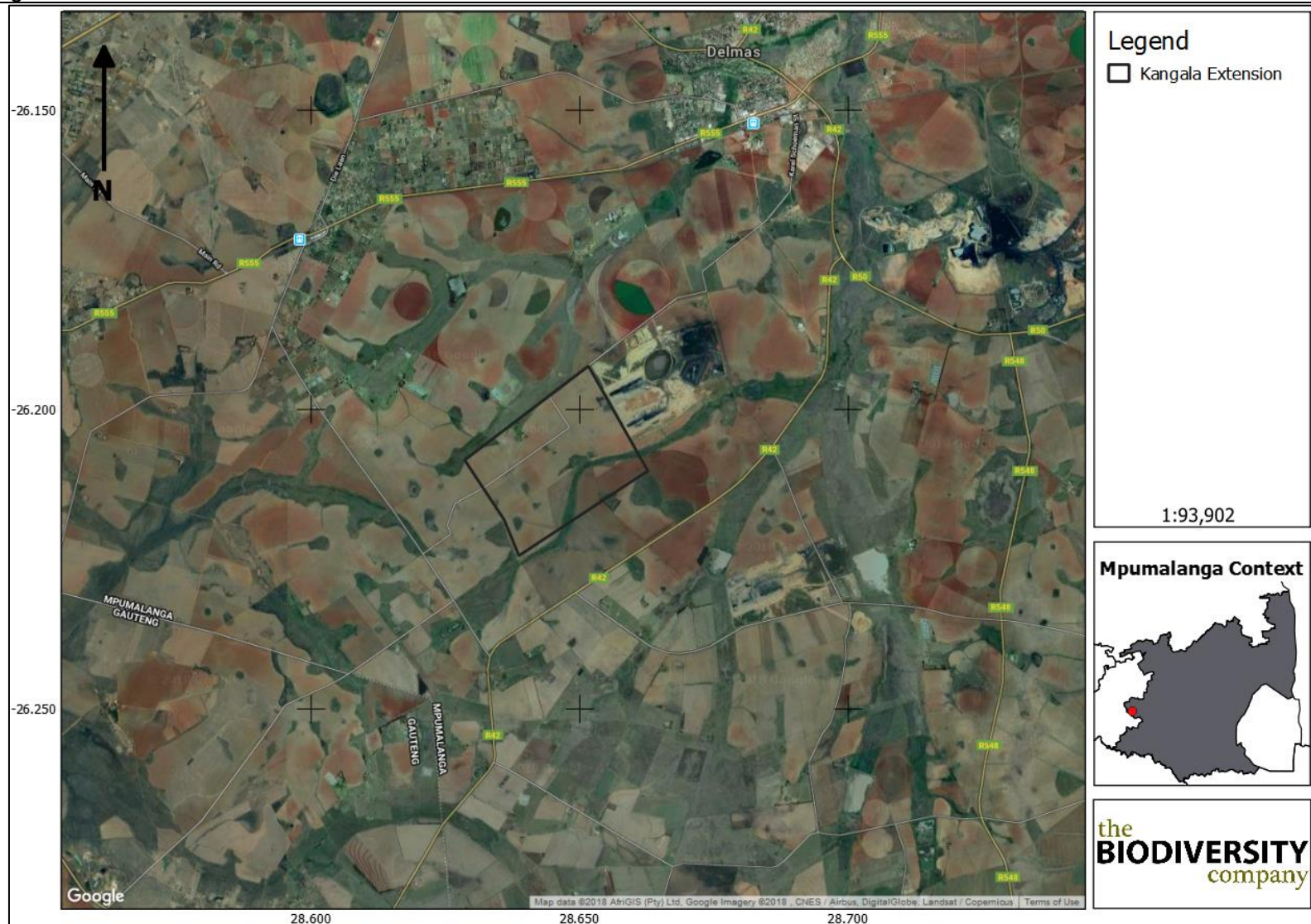


Figure 2: The proposed Kangala Extension Project area



3 Limitations

This scoping level assessment was conducted as a desktop study exercise only, no site inspections have been completed. The scoping study has therefore assumed that all information provided for the study is correct.

4 Methodology

The agricultural assessment was conducted using the Provincial and National Departments of Agriculture recommendations. The assessment was divided into two phases. Phase 1 is a desktop assessment to determine the following:

- Historic climatic conditions;
- The terrain features using 5m contours;
- The base soils information from the land type database (Land Type Survey Staff, 1972 - 2006); and
- The geology for the proposed development site.

Phase 2 involves:

- The delineation of soil types in the project area;
- The existing land capability;
- The current land uses;
- A detailed soil report describing all the above; and
- An impact assessment report.

4.1 Impact Assessment Methodology

The impact assessment methodology was provided by EIMS and is guided by the requirements of the NEMA EIA Regulations (2014), as amended. The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts, public concern, and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall/final significance (S).



5 Legislative & Policy Framework

Currently, various pieces of legislation and related policies exist that guide and direct the land user in terms of land use planning both on a national and provincial level. This legislation includes, but is not limited to:

- The Constitution of the Republic of South Africa (Act 108 of 1996);
- Sub-division of Agricultural Land Act (Act 70 of 1970);
- Municipal Structures Act (Act 117 of 1998);
- Municipal Systems Act (Act 32 of 2000); and
- Spatial Planning and Land Use Management Act, 16 of 2013 (not yet implemented).

The above mentioned Acts are supported by additional legislation that aims to manage the impact of development on the environment and the natural resource base of the country. Related legislation to this effect includes:

- Conservation of Agricultural Resources Act (Act 43 of 1983);
- Environment Conservation Act (Act 73 of 1989);
- National Environmental Management Act (Act 107 of 1998); and
- National Water Act (Act 36 of 1998).

6 Results

6.1 Climate

The project area falls within the Eastern Highveld Grassland region (Gm12) (Mucina & Rutherford, 2006). Strongly seasonal summer rainfall, with very dry winters. The mean annual precipitation (MAP) is between 650-900 mm (overall average: 726 mm), whereby the MAP is relatively uniform across most of this unit, but increases significantly in the extreme southeast. The coefficient of variation in MAP is 25% across most of the unit, but drops to 21% in the east and southeast. There is an incidence of frost from 13-42 days, but this is higher at higher elevations.



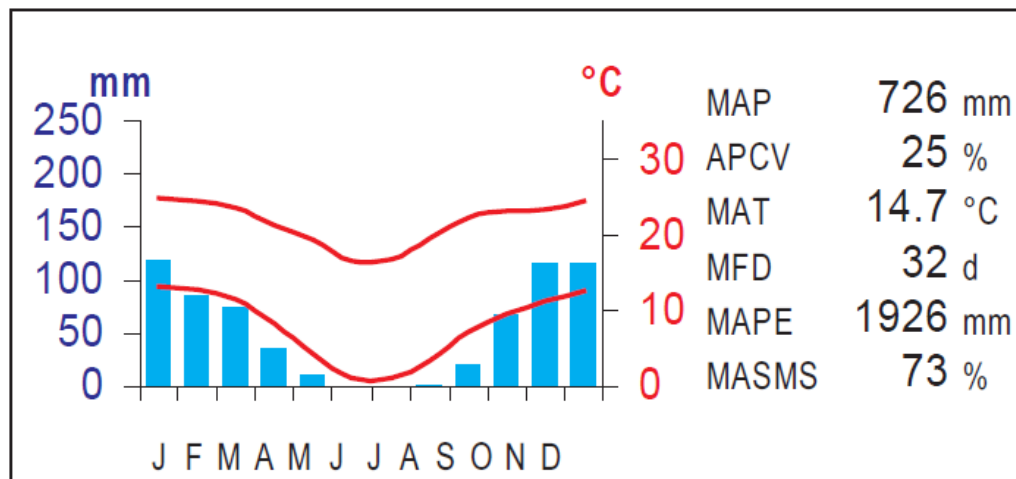


Figure 3: The climate summary for the Eastern Highveld Grassland (Gm 12) region (Mucina & Rutherford, 2006)

6.2 Terrain

A National Aeronautics and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM) (V3.0, 1 arcsec resolution) Digital Elevation Model (DEM) was obtained from the United States Geological Survey (USGS) Earth Explorer website. Basic terrain analysis was performed on this DEM using the SAGA GIS software that encompassed slope and channel network analyses in order to detect catchment areas and potential drainage lines respectively. The following processes have been considered for the desktop assessment:

- The relief map (Figure 4): The project area is gently sloping to the north east, with an elevation range from approximately 1570 meter above sea level (masl) to 1620 masl.
- The slope map (Figure 5): The project area is dominated by flat/gentle slopes between 0% and 4% without any major height changes within the project boundaries.



Kangala Extension

- The aspect map (Figure 6): The map shows that the northern portion is north facing, with the remainder either being east facing.

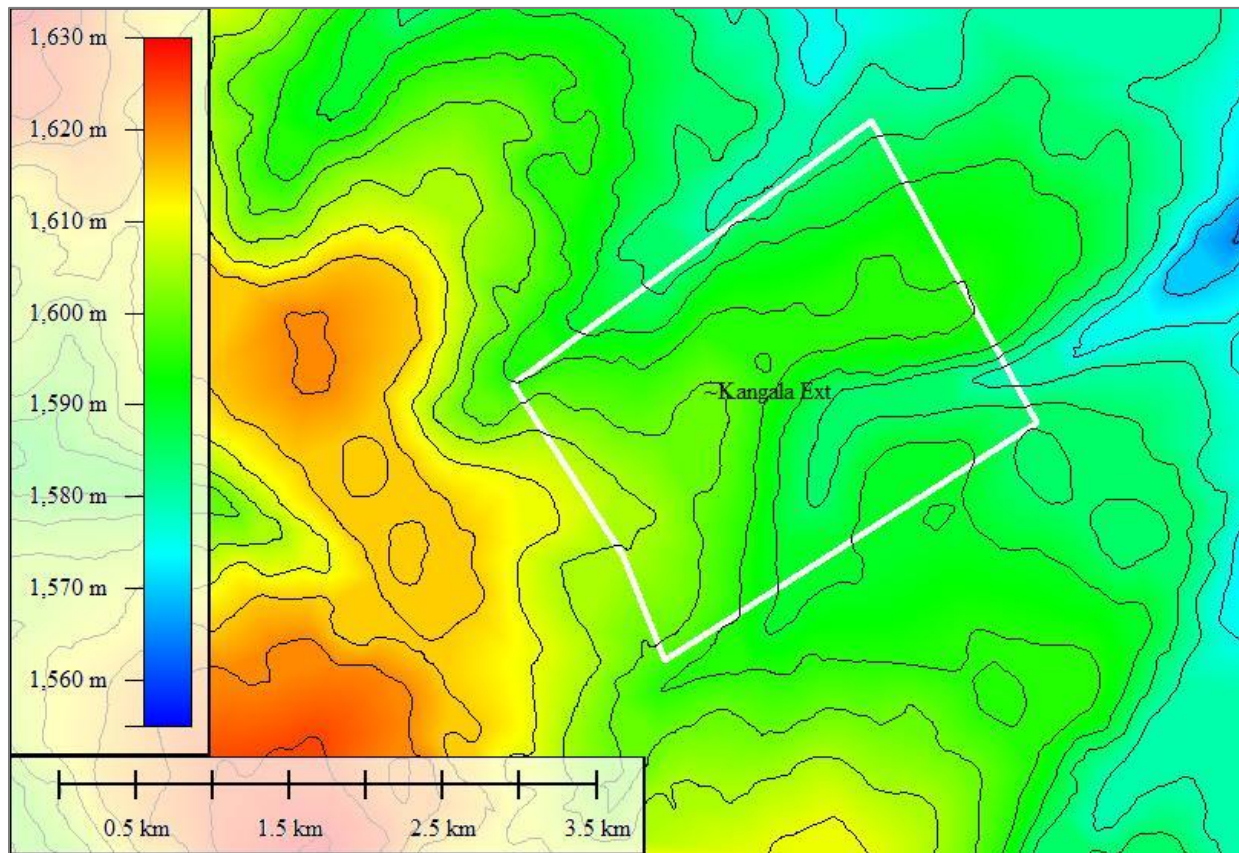


Figure 4: The Relief Map for the project area

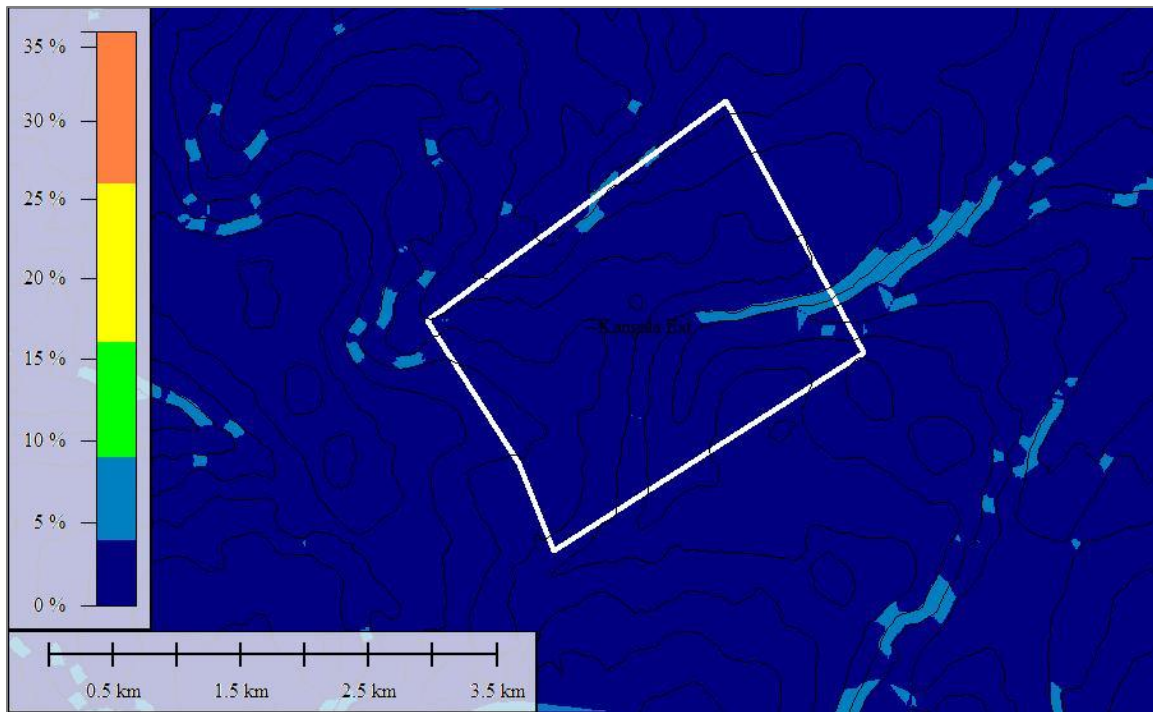


Figure 5: The Slope Percentage map for project area

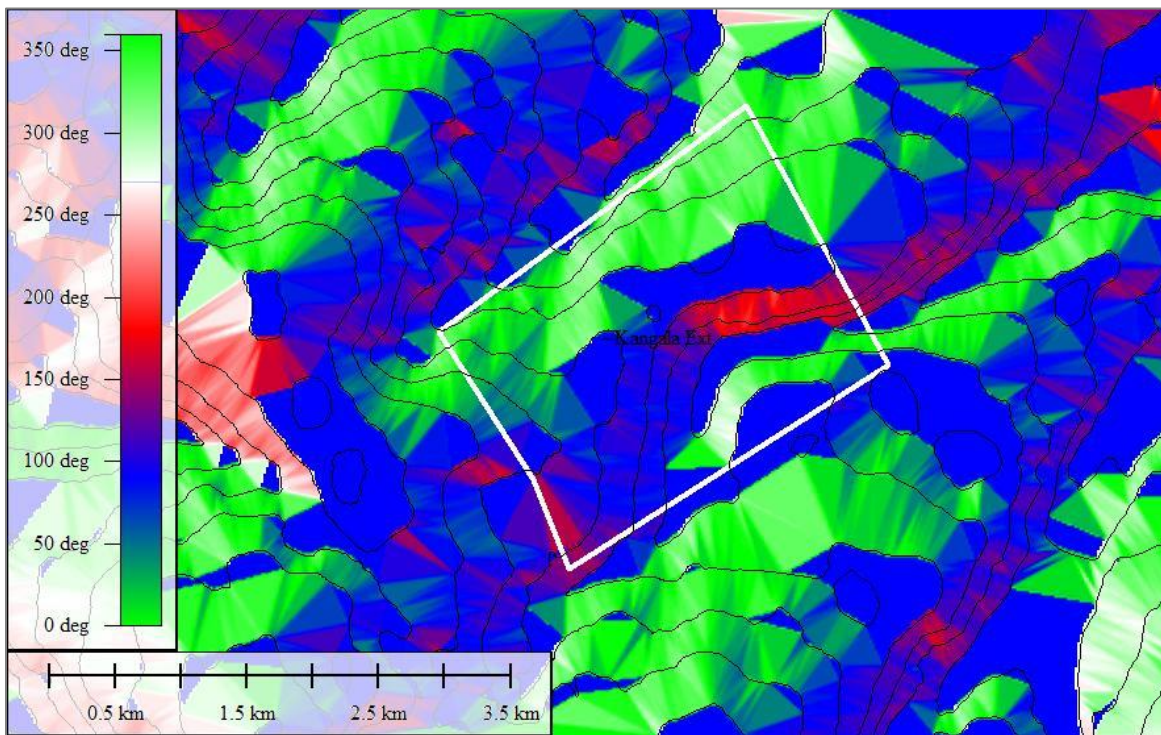


Figure 6: The Slope Aspect map for project area



6.3 Soils & Geology

According to the land type database (Land Type Survey Staff, 1972 - 2006) the project falls within the Bb3 land type (Figure 8).

The Bb3 land type is dominated by the crest (1) and midslope (3) terrain units (Figure 7). These landscape positions are dominated by Avalon and Hutton soil forms. The valley bottom (5) positions are dominated by Rensburg, Katspruit, and Willowbrooke soil forms.

The geology is dominated by shale, sandstone, clay, conglomerate, limestone and marl of the Ecca Group; shale and tillite of the Dwyka Formation, Karoo Sequence; dolerite; occasional Ventersdorp lava, Witwatersrand quartzite and slate; and dolomite.

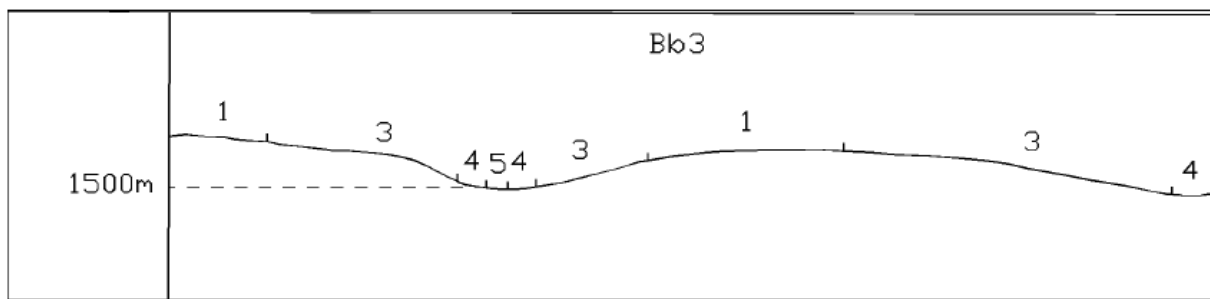


Figure 7: An illustration of the terrain units of the Bb3 land type



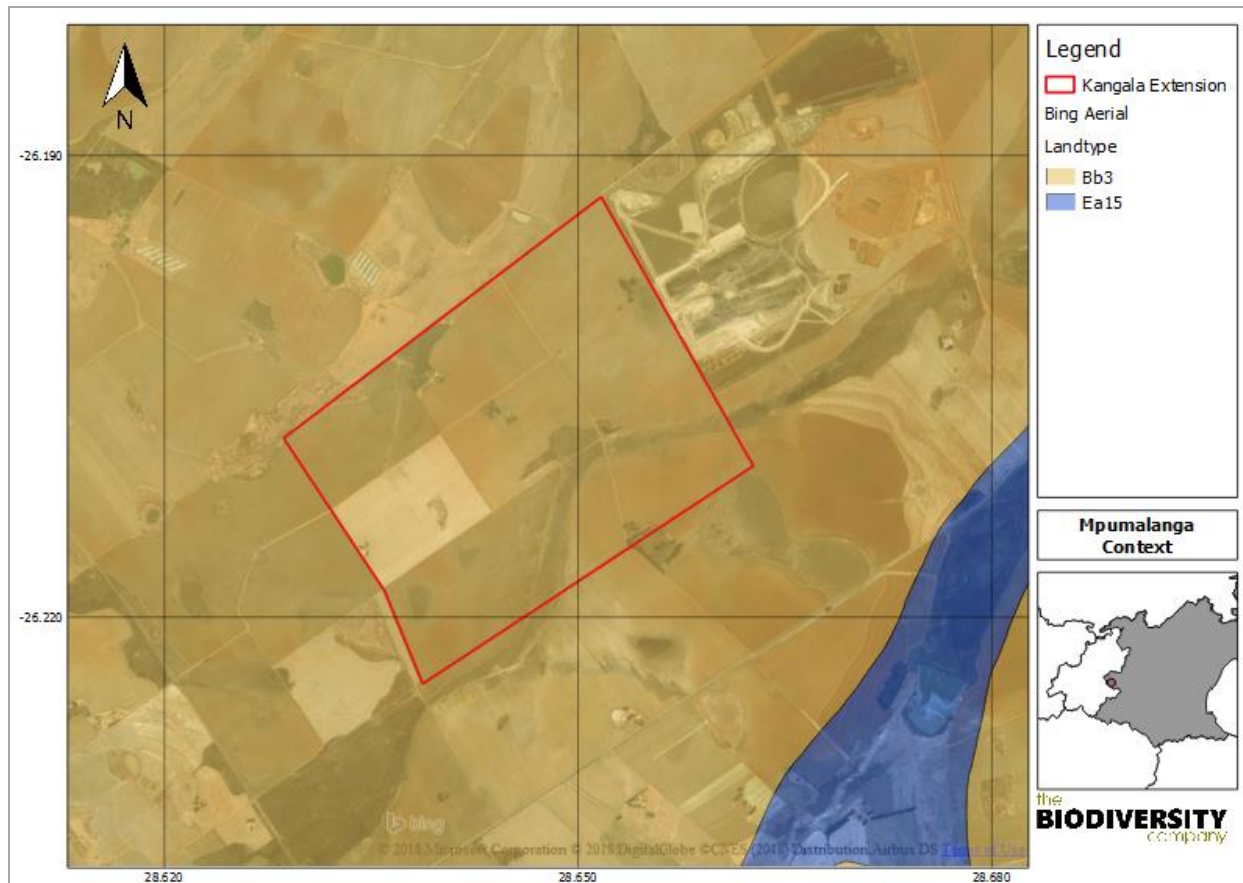


Figure 8: Land type map for the project area

7 Discussion

The project area is gentle in relief with slopes of less than 4%. The land type data suggest that soils of the Hutton and Avalon soil forms are present in the crest to midslope positions, with Rensburg, Katspruit, and Willowbrooke soil forms in the valley bottoms. The average land capability based on the land type data is that of a class III (moderate cultivation). Class III land would pose moderate limitations to agriculture with some erosion hazard potential and would require special conservation practice and tillage methods. The farming method for this land capability would require the rotation of crops and ley (50%).

The current land use seems to be croplands with some depressions within the project boundary, the area to the east of the project study area has been mined (Figure 9). The cropped areas' land capability must be verified during the EIA phase whereby soil samples are to be taken.



Kangala Extension



Figure 9: Land use map for the project area



7.1 Impact Assessment

From an agricultural perspective, the loss of high value farm land and/or food security production, as a result of the proposed activities, is the primary concern of this assessment. In South Africa there is a scarcity of high potential agricultural land, with less than 14% of the total area being suitable for dry land crop production (Smith, 2006).

It must be noted that no detailed or defined project activity list has been provided at this scoping phase, however the following potential soils and land capability impacts that could occur from the proposed Kangala Project Extension have been assessed in terms of planning, construction, operational, and decommissioning phases.

Planning Phase (Table 1): a detailed Project Program, Soil Stripping Guideline and Rehabilitation Plan must be completed before commencement. Poor planning of soil stripping stockpiling and rehabilitation will result in losses of land capability and soil as a valuable and irreplaceable resource.

Proper planning prior to construction would reduce the level of impacts from a Medium to a Low impact.



Table 1: Loss of land capability assessed for the proposed project during the planning phase

Loss of Land Capability					
Impact Name	Loss of Land Capability				
Alternative	Kangala Expansion				
Phase	Planning				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	5	3
Extent of Impact	1	1	Reversibility of Impact	3	2
Duration of Impact	5	2	Probability	5	2
Environmental Risk (Pre-mitigation)					-17,50
Mitigation Measures					
<ul style="list-style-type: none"> • Proper planning of project sequences; • Stripping and stockpiling guidelines; and • Rehabilitation and monitoring plans. 					
Environmental Risk (Post-mitigation)					-4,00
Degree of confidence in impact prediction:					High
Impact Prioritisation					
Public Response					1
<i>Low: Issue not raised in public responses</i>					
Cumulative Impacts					2
<i>Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.</i>					
Degree of potential irreplaceable loss of resources					3
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Soils that are lost or mined lose their land capability and regenerate extremely slowly over time (Irreplaceable resource)					
Prioritisation Factor					1,50
Final Significance					-6,00



Construction phase (Table 2): The impacts to consider are those relating to the disturbance of the natural soil state. When soil is stripped the physical properties are changed and this impacts on the soils health. When the soil is stockpiled, the soils chemical properties will deteriorate unless properly managed. These all lead to the loss of the topsoil layer as a natural resource. Soil is considered a slowly regenerating resource due to the fact that it takes hundreds of years for a soil profile to gain 10cm of additional soil through natural processes. During a single rainfall event on unprotected bare soil, erosion could remove that same amount of soil if not more.

Whilst the construction takes place, vehicles will drive on the soil surface compacting it. This reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. This then reduces vegetative cover and increases runoff potential. The increased runoff potential then leads to increased erosion hazards.

If the topsoil and subsoil are stripped and stockpiled as one unit, the topsoil's seed bank and natural fertility balance is diluted. This will affect the regrowth of vegetation on the stockpiles as well as the regrowth of vegetation when the soils have been replaced during the rehabilitation process, therefore soils should be handled with care from the construction phase through to the decommissioning phase.

Operational phase (Table 2): During the operational phase, similar impact scores are expected regarding the extent of the impacts as those scored for the construction phase. It is of vital importance that the correct procedures be adhered to during this activity and that the different soil horizons be kept separate. During this phase, erosion is a major concern for the topsoil and subsoil stockpiles, especially in cases where proper vegetation has not been established. Erosion within these sections will cause extensive sediment transport and ultimately pollution and degradation of healthy water courses and soil resources nearby.

These designated stockpiles often compact the soil underneath them due to their extremely high masses. Compaction of natural soil resources for extended time periods can cause irreversible degradation. Stockpiles themselves are not the only aspect contributing to compaction. During the operational phase, a large degree of vehicle activity takes place to ensure that extracted minerals as well as additional waste material is transported to its designated storage areas. These heavy machinery vehicles compact the soil between the project site and the mentioned storage areas severely. Additionally, such stockpiles tend to entail very fine sediment that is prone to be carried away by gusts of wind and ultimately contribute to dust pollution.



Table 2: Loss of land capability assessed for the proposed project during the construction and operational phases

C. Loss of Land Capability - Opencast					
Impact Name	Loss of Land Capability				
Alternative	Kangala Expansion				
Phase	Construction and Operation				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	4	5
Extent of Impact	2	2	Reversibility of Impact	5	4
Duration of Impact	5	4	Probability	5	4
Environmental Risk (Pre-mitigation)					-20.00
Mitigation Measures					
<ul style="list-style-type: none"> Bush clearing of all bushes and trees taller than one meter; ensure proper storm water management designs are in place; If any erosion occurs, corrective actions (erosion berms) must be undertaken to minimize any further erosion from taking place; If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; Only the designated access routes are to be used in order to reduce any unnecessary compaction; Compacted areas are to be ripped to loosen the soil structure; The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks; Topsoil stockpiles are to be kept to a maximum height of 4m; Topsoil is to be stripped when the soil is dry, so as to reduce compaction; Bush clearing contractors will only clear bushes and trees larger than 1m the remaining vegetation will be stripped with the top 0.3 m of topsoil to conserve as much of the nutrient cycle, organic matter and seed bank as possible; The subsoil approximately 0.3m to the designated thickness in the stripping guidelines, will then be stripped and stockpiled separately; The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate significantly; Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles; Stockpiles should only be used for their designated final purposes (i.e. rehabilitation); The stockpiles will be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil. Place the above cleared vegetation where the topsoil stockpiles are to be placed; and <p>Strip the topsoil and the remaining vegetation as per the rehabilitation guideline and place in the allocated locations for the various soil types, on top of the previously cleared bushes and trees.</p>					
Environmental Risk (Post-mitigation)					-15.00
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.					
Soils that are lost or mined lose their land capability and regenerate extremely slowly over time (Irreplaceable resource)					
Prioritisation Factor					1.50
Final Significance					-20.00



Decommissioning phase (Table 3): During this phase, vehicle activity is likely to compact soils even further due to the necessary activities. The infrastructure established during the construction phase is subsequently destroyed to ensure as little as possible is left after the relevant operations.

Table 3: Loss of land capability assessed for the proposed project during the decommissioning phase

Loss of Land Capability - Opencast					
Impact Name	Loss of Land Capability				
Alternative	Kangala Expansion				
Phase	Decommissioning				
Environmental Risk					
Attribute	Pre-mitigation	Post-mitigation	Attribute	Pre-mitigation	Post-mitigation
Nature of Impact	-1	-1	Magnitude of Impact	4	3
Extent of Impact	2	2	Reversibility of Impact	5	3
Duration of Impact	5	3	Probability	5	3
Environmental Risk (Pre-mitigation)					-20.00
Mitigation Measures					
<ul style="list-style-type: none"> • Ensure proper storm water management designs are in place; • Ensure that proper phyto-stabilization takes place on top of the relevant stockpiles; • Only the designated access routes are to be used to reduce any unnecessary compaction; • If erosion occurs, corrective actions (erosion berms) must be undertaken to minimize any further erosion from taking place; • Only the designated access routes are to be used to reduce any unnecessary compaction; • Implement land rehabilitation measures as defined in rehabilitation report. • Follow rehabilitation guidelines; • The topsoil should be moved by means of an excavator bucket, and loaded onto dump trucks; • Topsoil is to be moved when the soil is dry, as to reduce compaction; • After the completion of the project, the extension area is to be cleared of all infrastructure; • The foundations to be removed; • Topsoil to be replaced for rehabilitation purposes; • The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate; • Stockpiles should only be used for their designated final purposes; and • Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated. 					
Environmental Risk (Post-mitigation)					-8.25
Degree of confidence in impact prediction:					Low
Impact Prioritisation					
Public Response					1
Low: Issue not raised in public responses					
Cumulative Impacts					2
Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.					
Degree of potential irreplaceable loss of resources					2
The impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited. Soils that are lost or mined lose their land capability and regenerate extremely slowly over time (Irreplaceable resource)					
Prioritisation Factor					1.33
Final Significance					-11.00



7.2 Field Verification Methodology (Plan for EIA Phase)

A soil auger will be used to determine the soil form/family and depth. The soil will be hand augured to the first restricting layer or 1.5 m. Soil survey positions will be recorded as waypoints using a handheld GPS. Soils will be identified to their soil family level as per the “Soil Classification: A Taxonomic System for South Africa” (Soil Classification Working Group, 1991). Landscape features such as existing open trenches will also be helpful in determining soil types and depth.

Land Potential Assessment

Land capability and agricultural potential is determined by a combination of soil, terrain and climate features. Land capability is defined by the most intensive long-term sustainable use of land under rain-fed conditions. At the same time an indication is given about the permanent limitations associated with the different land use classes (Smith, 2006)

Land capability is divided into eight classes and these may be divided into three capability groups. Table 4 shows how the land classes and groups are arranged in order of decreasing capability and ranges of use. The risk of use increases from class I to class VIII (Smith, 2006).

Table 4: Land capability class and intensity of use (Smith, 2006)

Land Capability Class	Increased Intensity of Use									Land Capability Groups
	W	F	LG	MG	IG	LC	MC	IC	VIC	
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			
IV	W	F	LG	MG	IG	LC				
V	W	N/A	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					

The land potential classes are determined by combining the land capability results and the climate capability of a region as shown in Table 5. The final land potential results are then described in Table 6.

Table 5: The combination table for land potential classification

Land Capability Class	Climate Capability Class
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Kangala Extension

	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 6: The Land Potential Classes.

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, temperatures or rainfall. Appropriate permission is required before ploughing virgin land.
L5	Restricted potential: Regular and/or severe to moderate limitations due to soil, slope, temperatures or rainfall.
L6	Very restricted potential: Regular and/or severe limitations due to soil, slope, temperatures or rainfall. Non-arable.
L7	Low potential: Severe limitations due to soil, slope, temperatures or rainfall. Non-arable.
L8	Very low potential: Very severe limitations due to soil, slope, temperatures or rainfall. Non-arable.



8 References

Land Type Survey Staff. (1972 - 2006). *Land Types of South Africa: Digital Map (1:250 000 Scale) and Soil Inventory Databases*. Pretoria: ARC-Institute for Soil, Climate, and Water.

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