Report on Terrestrial Ecosystems & Conservation©

MapAble®
Visualize · Map · Collaborate

Table of content

MapAble®
Visualize · Map · Collaborate

Office Suite 106A · Newland Shopping Centre,
c/o Dely Rd and Lois Ave · NEWLANDS · Pretoria · 0181
✉ 95148 · Waterkloof · 0145
info@mapable.co.za · www.mapable.co.za

List of tables

Report on Terrestrial ecosystems & Conservation

1 Introduction

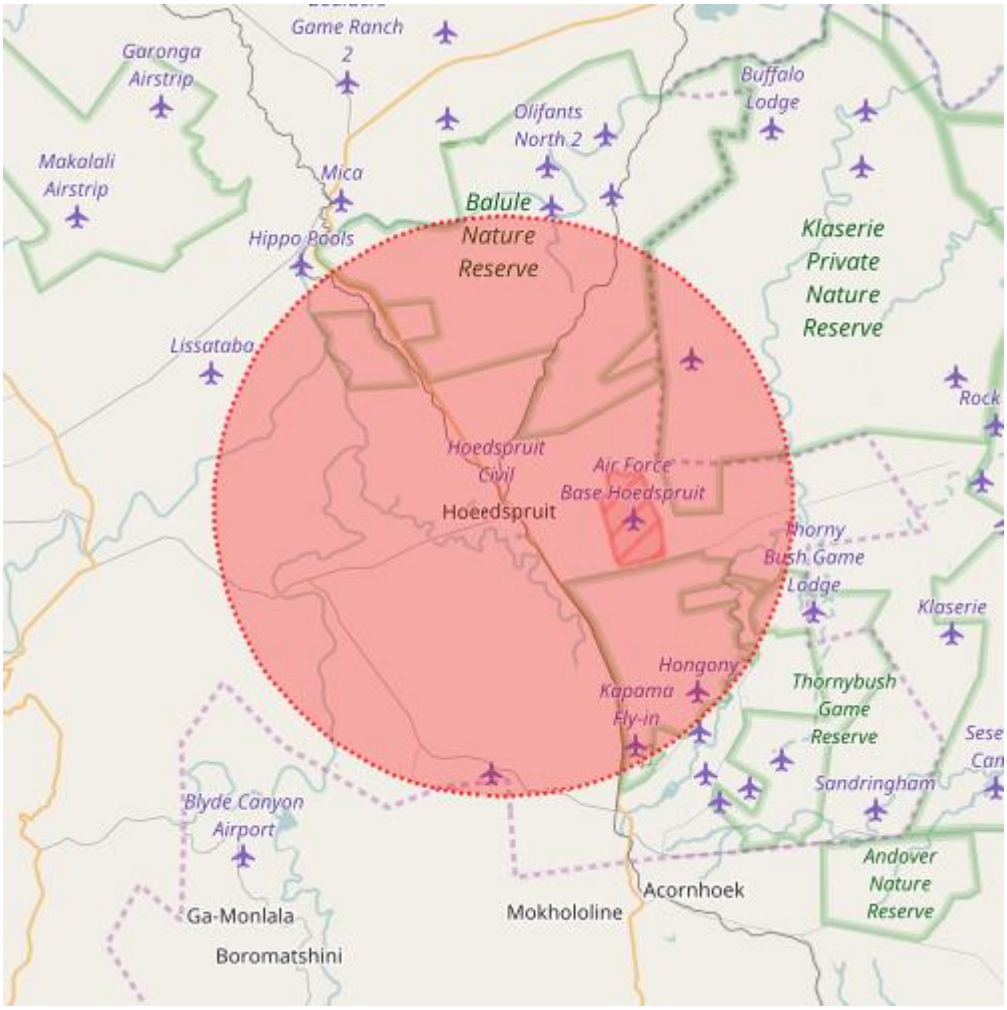
This report was generated by MapAble® showing environmental and conservation characteristics for the area under assessment.

The outputs of this report must always be interpreted with care. Not all the data exists at the same level of detail and the accuracy of the outputs will be affected by the size of the area assessment. One must assume that the smaller the area the less accurate figures might be when sourced from high level national datasets, for example, climate data reported for a farm portion will reflect broader zone data and cannot discount micro climatic conditions created by local topography. Generally, the results of queries on larger areas will be more accurate than queries on smaller areas.

2 Locality

This section provides a short introductory overview of the area's location and extent.

Map of the area under assessment



Province(s) affected:	Limpopo
District Municipality/ Metropolitan area(s) affected:	Ehlanzeni, Mopani
Local municipality(s) affected:	Bushbuckridge Maruleng
Area of area assessed (ha):	126 896 Hectares

The area's nearest neighbours are the following towns, settlements and places. If the results are indicated as 0 km, then it implies that the town or settlement falls within the area assessed. Distances are measured from the boundary of the area and are show as direct distance.

The nearest city:	The nearest city is Mbombela which is 104.42 km away
The nearest major town:	The nearest major town is Phalaborwa which is 29.02 km away
Nearest town:	The nearest town Hoedspruit is 0 km away

The follow small towns or settlement points are in the area:

Table 1: Smaller towns, settlements and villages

Small towns	Settlement points, villages and small places
The area has *0* small town(s), namely: •	The area has 3 small place(s), namely: •Air Force Hoedspruit, Harmony, Kampersrus

3 Data and technical aspects

This report is based on queries generated from the MapAble®data base.

Data partitioning is used in MapAble® to determine values for selected areas. Data partition calculated the proportional ratios of underlying data sets (data linked to polygons such as EA's or sub-places) within a selected query area (ward, municipality, farm portion, etc.). Data partitioning is used to overcome the need for information on areas that are not consistent with the standard boundaries themselves or where data is presented in in a way that does not conform with such boundaries. The proportions are based on the area of the intersecting themes.

Data is queries extract data from multiple sources. One should note that constancies in the value of total might occur due the query process as well as rounding of figures.

4 Population and households

The population and household data is derived from Statistics South Africa. The data reported for the areas is has been prepared through data partitioning. Again, figures for smaller areas might not always be very accurate. Data partitioning is done on the smallest spatial level at which a particular census was released.

Table 2: Population and households

	1996	2001	2011
Population	7 845	8 560	7 398
Households	2 952	2 134	2 782

5 Land cover

This section deals with land cover. The dataset has been derived from multi-seasonal Landsat 8 imagery, using operationally proven, semi-automated modelling procedures developed specifically for the generation of this dataset, based on repeatable and standardised modelling routines. The dataset has been created by GEOTERRAIMAGE (GTI) and is available as a commercial data product. The data is presented at 30m resolution. As a result, the accuracy of the query results is affected accordingly.

The following table lists the extent of land cover in the area under assessment for both 1990 and 2014. The results are expressed as hectares covered by a category and as well as the extent not covered by the specific category.

Table 3: Urban and settlement land cover for 1990 and 2014 [1]

Land cover category	Extent of cover 1990 (ha)	Extent of cover 2014 (ha)
Natural Thicket Dense Bush	12695.93	Invalid layer id: 21875
Natural Woodland	9223.18	79355.63
Forests & Plantations	100.53	83.33
Cultivated commercial fields	1896.04	1523.44
Cultivated commercial pivot	1661.53	1678.28
Cultivated orchard and vines	5327.06	7997.17
Sugarcane		
Subsistence farming		
Erosion dongas	15.5	19.97
School and sports grounds	9.17	8.36
Urban sports and golf	62.39	61.52
Urban built-up	1101.78	1112.45
Urban commercial	36.71	41.67
Urban industrial	7.44	6.91
Urban residential	176	445.86
Urban small holdings	281.9	231.13
Urban townships		
Urban informal		
Rural villages	23.44	18.6
Mining	135.01	46.62
Waterbodies	1660.48	64.35

6 Environmental factors

There are a range of environmental factors that applies to the area under assessment.

6.1 Climate

The climate of Southern Africa is influenced strongly by the position of the subcontinent in relation to the major circulation features of the southern hemisphere. However, in all areas topography exerts a strong control on rainfall and produces clear orographic anomalies

6.1.1 Aridity zones

South Africa is generally dry. The whole of the country east of the 600mm rainfall line is classified as generally dry. From a global perspective, 90% of South Africa falls in the arid and hyper-arid categories. The area under assessment is affected by the following zone(s):

- The assessment area is in a Semi-arid zone

6.1.2 Rainfall and hail

The average rainfall in the area is:

- Rainfall of 400 to 500 mm covers 6.23 %
- Rainfall of 500 to 600 mm covers 69.87 %
- Rainfall of 600 to 700 mm covers 7.98 %
- Rainfall of 700 to 800 mm covers 7.3 %
- Rainfall of 800 to 900 mm covers 5.05 %
- Rainfall of 900 to 1960 mm covers 3.56 %

The data reports:

- 2 hail days per year

[1] "Not applicable" refers to the area in a particular land cover category not covered by the category queried

6.1.3 Temperature and frost

The following temperature characteristics apply to the area:

- Maximum temperatures

Table 4: Maximum temperatures

Maximum annual	Maximum summer	Maximum winter
Temperatures of 27.2 - 28.7 degrees C affects 0.22 % of the area	Temperatures of 24 - 26 degrees C affects 0.04 % of the area	Temperatures of 10 - 12 degrees C affects 98.51 % of the area
Temperatures of 28.7 - 30 degrees C affects 1.49 % of the area	Temperatures of 26 - 27.5 degrees C affects 0.38 % of the area	Temperatures of 12 - 16 degrees C affects 1.08 % of the area
Temperatures of 30 - 31.6 degrees C affects 56.86 % of the area	Temperatures of 27.5 - 29 degrees C affects 1.33 % of the area	Temperatures of 7 - 8.5 degrees C affects 0 % of the area
Temperatures of 31.6 - 33.2 degrees C affects 41.43 % of the area	Temperatures of 29 - 30.5 degrees C affects 28.27 % of the area	Temperatures of 8.5 - 10 degrees C affects 0.41 % of the area
	Temperatures of 30.5 - 32.5 degrees C affects 69.99 % of the area	

- Minimum temperatures

Table 5: Minimum temperatures

Minimum annual	Minimum summer	Minimum winter
Temperatures of 14 - 15.2 degrees C affects 0 % of the area	Temperatures of 14 - 15 degrees C affects 0 % of the area	Temperatures of 10 - 12 degrees C affects 98.51 % of the area
Temperatures of 15.2 - 16.5 degrees C affects 0.32 % of the area	Temperatures of 15 - 16.5 degrees C affects 0.32 % of the area	Temperatures of 12 - 16 degrees C affects 1.08 % of the area
Temperatures of 16.5 - 18 degrees C affects 13.2 % of the area	Temperatures of 16.5 - 18.2 degrees C affects 13.2 % of the area	Temperatures of 7 - 8.5 degrees C affects 0 % of the area
Temperatures of 18 - 23 degrees C affects 86.48 % of the area	Temperatures of 18.2 - 23 degrees C affects 86.48 % of the area	Temperatures of 8.5 - 10 degrees C affects 0.41 % of the area

- These temperatures relate to the first and last dates expected for frost in the area.

First frost date(s)	First frost occurs between June or later and affects 100 % of the area
Last frost date(s)	Last frost occurs from July or earlier and affects 100 % of the area
Extent of frost free areas	13.84 % of the area is Frost free
	86.16 % of the area is Not applicable

6.1.4 Evaporation

Evaporation is expressed in mm per annum. The following is the extent of evaporation in the area:

- Evaporation at rate of 0 - 1400mm per annum affects 0.22 % of the area
- Evaporation at rate of 1400 - 1600mm per annum affects 1.25 % of the area
- Evaporation at rate of 1600 - 1800mm per annum affects 7.83 % of the area
- Evaporation at rate of 1800 - 2000mm per annum affects 90.7 % of the area

6.1.5 Moisture availability

Moisture availability is key to any successful crop production. The moisture availability in the area is:

- Moisture availability is Moderate in 72.74 % of the area
- Moisture availability is Moderate to severe in 14.29 % of the area
- Moisture availability is None to slight in 3.2 % of the area
- Moisture availability is Slight in 9.77 % of the area

The table below describes the moisture availability classes and their impacts.

Table 6: Moisture availability classes

Class	Limitation rating	Description	Moisture availability class	
			Summer rainfall area: October to March	Winter rainfall area: April to September
1	Note to slight	Favourable for growing a wide range of adapted crops.	>50	>58
2	Slight	Less favourable than Class 1 and may limit choice of crops or yields.	36-50	34-58
3	Moderate	Water stress, extremes of temperature and/or damage from frost, wind or hail restrict choice of crops and yield potential.	26-36	24-34
4	Moderate to severe	Less favourable than Class 3. Low and unreliable rainfall, extremes in temperature and severe damage from frost or wind restrict regular crop production. Risks in cropping are high.	18-26	16-24
5	Severe	Unfavourable (mainly rainfall) for growing crops.	10-18	10-16
6	Very severe	Unfavourable for plant production. One or more of the following extremes occur: Severe aridity Extremes in temperature	<10	<10

6.1.6 Rainfall erosivity

Rainfall erosivity is the ability of rainfall to cause soil erosion. Research data from many sources indicates that when factors other than rainfall were kept constant, soil losses from cultivated fields are directly proportional to a rainstorm intensity and duration.

The following data shows the rainfall erosivity index for the area. (less than 100 is low and more than 800 is high)

- The erosivity index for 71.47 % of area is between 301 - 400
- The erosivity index for 24.91 % of area is between 401 - 500
- The erosivity index for 3.62 % of area is between 501 - 600

6.1.7 Predicted soil loss

Soil loss is a consequence of erosion. The average annual soil loss is a function of the following factors:

- Rainfall erosivity.
- Soil erodibility factor.
- Slope length and gradient.
- Land management as far as vegetation cover can be sustained.

Soil loss potential is classified in 5 classes from low to very high. The soil loss potential in the area is as follows:

- The High class covers 0.12 % of the total area
- The Low class covers 65.23 % of the total area
- The Moderate class covers 25.43 % of the total area
- The Very low class covers 9.22 % of the total area

6.2 Geology

After climate, geology is probably the second most important factor in the genesis of the soil-terrain landscapes of South Africa (see Soils). The geological formations constituting the soil parent materials are highly variable with respect to the clay forming potential and silica content. These are passed on to the soils, giving rise to swelling black clays, sands etc. as well as differences in natural fertility and erodibility. Differential weathering of resistant and weatherable rock types serves to amplify the effects of scarp retreat (e.g. at Mariepskop in the Limpopo Province) or results in enhanced local relief (e.g. dolerite capped mesas rising above sedimentary plains in the Karoo). Geology is thus indirectly responsible for a variety of soil-plant niches or habitats. Geology is the basis for soil types, topography and the development of drainage patterns and systems. All these factors contribute to agriculture and food security. A. combinations of these factors as well as climatic variable determines the agricultural potential of any area.

The following list the lithology of the area (The lithology of a rock unit is a description of its visible physical characteristics)

- Gneiss represents 10.19 % of the total area
- Granite represents 89.81 % of the total area

The next table provides a general overview of the properties of the main rock formations

Table 7: Properties of rocks

	Soil Profile	Engineering Qualities	Unique Qualities
Andesite	The rock is exposed to mechanical as well as chemical weathering. The western parts of the Hekpoort Andesite Formation and the Ventersdorp Supergroup have shallow soils. Chemical weathering is dominant in the eastern parts and especially in the central CBD of Johannesburg where very deep weathering of the Ventersdorp Andesite took place. The typical chemical weathering product is a clayey soil.	The residual soils are expansive. Soils are only non-expansive in the early and late stages of weathering. Depth and stage of weathering vary significantly over short distances and may cause foundation problems. Large, unweathered core stones in the soil profile cause problems with installation of piles as well as differential settlement. Damage to houses may be limited by using reinforced masonry work, flexible couplings in pipes and good site drainage with piled foundations or raft foundations in larger structures.	Rocky areas extending from Ventersdorp to Kimberley with deep red soils in the higher rainfall areas
Arenite	Arenites usually occur within recent sand deposits forming local harder zones. Weathering will result in a sandy material consisting of medium sized quartz grains. The residual material is seldom deeper than 1m.	Cause harder zones within recent coastal deposits and may vary from a rock-like material to soft soil. Very low groundwater yields are typical and it is used as a construction material after washing to get rid of the high salt content.	Occur within recent coastal dunes or flat pediplains formed during the previous retreating of the ocean.
Basalt	Weathered basalt forms a clayey silt or silty clay soil depending on the rainfall and topography. In the mountains the erosion rates are very high with virtually no soil cover except in the river valleys. On the Springbok Flats the basalt weathered to a so-called black cotton soil, which is a dark brown to black highly expansive clay. The Dullstroom basalt forms prominent ridges.	The soils have a moderate to high potential expansiveness, and are relatively resistant to erosion. Buildings founded on these soils are prone to extensive damage due to the volume changes in the clay. The unweathered rock forms a good foundation and construction material when crushed. It may sometimes weather rapidly in roads, rockfill dams or embankments. The weathered product may be used for road building and is also a suitable impervious fill material for embankment dams.	The black soils have excellent agricultural potential, especially for the cultivation of cotton.
Clinopyroxenite	This rock will weather to a clayey soil and the thickness will depend on the climate.	The soils will be highly expansive and may cause damage to structures.	None of significance
Dolerite	There are 3 types of weathering depending on the climate. In the western drier parts disintegration takes place resulting in a gravelly soil. In the semi-arid regions some minerals decompose to hydromica minerals and a sandy soil is formed. In the wet eastern parts all the primary minerals are susceptible to decomposition to a clayey soil. The clays are usually red in colour and may be quite thick.	The clayey soils are expansive and may cause damage to foundations. Dolerite is an excellent construction material and especially the slightly weathered varieties in the west of the country is used as road stone. The unweathered rock is widely used as concrete aggregate and in road and dam construction. Care should be taken against the rapid weathering types, which may break down rapidly (days/months).	The general resistance to weathering of these intrusions has caused the distinct positive linear topographic features in the horisontal sedimentary rock strata of the Karoo. It is also generally regarded as a good aquifer in the dry regions. The general use of dolerite as a construction material has caused the widespread occurrence of quarries along roads and near towns and dams.
Dolomite	The rock weathers unevenly along the joints within the rock mass. Rainwater rich in CO2 acts as a weak acid and dissolves the carbonate rock. The bedrock topography is therefore very uneven with a series of vertical slots and cave systems in the rock. The residual soil is referred to as wad and is a low density iron and manganese rich clayey silt. The residual soil has a very low strength and core stones or “floaters” may also occur in the profile.	These areas are prone to sinkhole and surface subsidence formation which can have devastating effects on surface development and even human life. A detailed geological evaluation is necessary prior to any development in these areas. The rock is a good construction material and the transported chert-rich red soils covering the dolomites are also frequently used as road building material or fill.	The cave systems in these rocks make attractive tourist destinations such as the Kango Caves, Echo Caves, Sudwala Caves and the well known Sterkfontein Caves which is now a World Heritage Site.
Gabbro	Gabbro decomposes to a dark clayey soil. The black colour is due to a complex forming between the clay and organic material. Unweathered gabbro is a strong and massive rock, which is widely used in the building industry as dimension stone and concrete aggregate.	The clay soils have very high potential expansiveness and will cause damage to structures. The soils are used as natural liners in waste disposal sites. It usually forms a good foundation for even heavy structures. The rock is strong and widely used in the building industry as dimension stone and as concrete and road aggregate.	Minerals like platinum, nickel, copper, chromite, vanadium, magnetite and tin are associated with this rock type in the Bushveld Igneous Complex. This rock is widely used in the building industry as dimension, monumental and gravestones and is referred to as black granite.

	Soil Profile	Engineering Qualities	Unique Qualities
Gneiss	In humid areas silty sand or clayey silt forms, which is mica rich with quartz grains. These soils are dispersive (highly erodible) and have a high permeability. Core stone development and an uneven bedrock topography may occur. In some areas, e.g. Halfway House, a collapsible grain structure may develop.	Slope instability is frequent when it is saturated– which means that the ground can flow easily downhill. It is a high erodable soil. The core stones can cause problems in the placing of foundations such as piles. A collapsible grain structure may cause damage to structures if proper foundation measures are not implemented. Both the soils and the rock is widely used as aggregates for roads and concrete.	Granite is regarded as a solid rock and is therefore widely used as construction material.
Granite	In humid areas silty sand or clayey silt forms, which is mica rich with quartz grains. These soils are dispersive (highly erodible) and have a high permeability. Core stone development and an uneven bedrock topography may occur. In some areas, e.g. Halfway House, a collapsible grain structure may develop.	Slope instability is frequent when it is saturated– which means that the ground can flow easily downhill. It is a high erodable soil. The core stones can cause problems in the placing of foundations such as piles. A collapsible grain structure may cause damage to structures if proper foundation measures are not implemented. Both the soils and the rock is widely used as aggregates for roads and concrete.	Granite is regarded as a solid rock and is therefore widely used as construction material.
Granodiorite	In humid areas silty sand or clayey silt forms, which is mica rich with quartz grains. These soils are dispersive (highly erodible) and have a high permeability. Core stone development and an uneven bedrock topography may occur. In some areas, e.g. Halfway House, a collapsible grain structure may develop.	Slope instability is frequent when it is saturated– which means that the ground can flow easily downhill. It is a high erodable soil. The core stones can cause problems in the placing of foundations such as piles. A collapsible grain structure may cause damage to structures if proper foundation measures are not implemented. Both the soils and the rock is widely used as aggregates for roads and concrete.	Granite is regarded as a solid rock and is therefore widely used as construction material.
Granophyre	In humid areas silty sand or clayey silt forms, which is mica rich with quartz grains. These soils are dispersive (highly erodible) and have a high permeability. Core stone development and an uneven bedrock topography may occur. In some areas, e.g. Halfway House, a collapsible grain structure may develop.	Slope instability is frequent when it is saturated– which means that the ground can flow easily downhill. It is a high erodable soil. The core stones can cause problems in the placing of foundations such as piles. A collapsible grain structure may cause damage to structures if proper foundation measures are not implemented. Both the soils and the rock is widely used as aggregates for roads and concrete.	Granite is regarded as a solid rock and is therefore widely used as construction material.
Hornfels	The rock usually has a fairly high resistance to weathering and deep residual soils are absent. The soils forming from these rocks are usually fine-grained clayey silts and sands.	The rock mass is usually highly jointed and cause unstable slopes. The weathering depth may vary considerably. The rock is suitable for road stone and usually form suitable foundations.	Not of any significance
Lutaceous arenite	Arenites usually occur within recent sand deposits forming local harder zones. Weathering will result in a sandy material consisting of medium sized quartz grains. The residual material is seldom deeper than 1m.	Cause harder zones within recent coastal deposits and may vary from a rock-like material to soft soil. Very low groundwater yields are typical and it is used as a construction material after washing to get rid of the high salt content.	Occur within recent coastal dunes or flat pediplains formed during the previous retreating of the ocean.
Migmatite	In humid areas silty sand or clayey silt forms, which is mica rich with quartz grains. These soils are dispersive (highly erodible) and have a high permeability. Core stone development and an uneven bedrock topography may occur. In some areas, e.g. Halfway House, a collapsible grain structure may develop.	Slope instability is frequent when it is saturated– which means that the ground can flow easily downhill. It is a high erodable soil. The core stones can cause problems in the placing of foundations such as piles. A collapsible grain structure may cause damage to structures if proper foundation measures are not implemented. Both the soils and the rock is widely used as aggregates for roads and concrete.	Granite is regarded as a solid rock and is therefore widely used as construction material.
Mudstone	Mudstone weathers to a clayey soil, which may have expansive characteristics depending on the original mineralogy of the soils from which the rock formed. In some areas mudrock is weathered to great depths. The soils are usually highly erodable and dispersive.	The unweathered rock is soft to very soft with properties similar to over-consolidated clay. The rock mass is impermeable and the rock may be of the rapid weathering (slaking) type, which break up after exposure to the atmosphere. If the rock mass is dipping at an angle, slopes are usually unstable and movement may take place along bedding planes. If the original clay was of the expansive types, then the rock and the residual soils will	The soils are highly dispersive and this results in deep donga's forming on many slopes in the Karoo.

	Soil Profile	Engineering Qualities	Unique Qualities
		be expansive and may cause damage to structures. Weathered and unweathered mudrock are used as brick-making material.	
Norite	A number of different soil profiles occur on the norites varyiong from a dark reddish brown clayey silt to the typical black cotton soil (clay). These clays are the most expansive soils known in South-Africa and may contain between 30% and 60% clay. The black color is due to a complex forming between clay and organic material. Core stone development is a general feature in the wetter regions.	Unweathered norite is a strong and massive rock and is used widely in the building industry as dimension stone, concrete aggregate and road stone. The clay soils have very high potential expansiveness and will cause damage to structures. The soils are used as natural liners in waste disposal sites.	Minerals like platinum, nickel, copper, chromite, vanadium, magnetite and tin are associated with this rock type in the Bushveld Igneous Complex. This rock is widely used in the building industry as dimension, monumental and gravestones and is referred to as black granite.
Quartz monzonite	In humid areas silty sand or clayey silt forms, which is mica rich with quartz grains. These soils are dispersive (highly erodible) and have a high permeability. Core stone development and an uneven bedrock topography may occur. In some areas, e.g. Halfway House, a collapsible grain structure may develop.	Slope instability is frequent when it is saturated– which means that the ground can flow easily downhill. It is a high erodable soil. The core stones can cause problems in the placing of foundations such as piles. A collapsible grain structure may cause damage to structures if proper foundation measures are not implemented. Both the soils and the rock is widely used as aggregates for roads and concrete.	Granite is regarded as a solid rock and is therefore widely used as construction material.
Quartzite	Due to the recrystallization and predominantly silica rich minerals in quartzite it rarely weathers and is usually covered by only a thin layer of sand.	Quartzite is a very strong rock forming excellent foundations. It is fairly difficult to excavate in these rocks. The residual soils are usually strong, non-compressible and non-heaving. The rock is widely used as concrete and road building materials, although the high sulphur content due to the presence of pyrite cause some problems with salt blisters in roads and stains in concrete in the Witwatersrand.	Quartzite is such an excellent aggregate that it is used as a reference aggregate.
Rhyolite	In humid areas silty sand or clayey silt forms, which is mica rich with quartz grains. These soils are dispersive (highly erodible) and have a high permeability. Core stone development and an uneven bedrock topography may occur. In some areas, e.g. Halfway House, a collapsible grain structure may develop.	Slope instability is frequent when it is saturated– which means that the ground can flow easily downhill. It is a high erodable soil. The core stones can cause problems in the placing of foundations such as piles. A collapsible grain structure may cause damage to structures if proper foundation measures are not implemented. Both the soils and the rock is widely used as aggregates for roads and concrete.	Granite is regarded as a solid rock and is therefore widely used as construction material.
Sand	The soil profile usually consists of a uniform loose sand which may be coloured red due to oxidation. The thickness varies greatly from a couple of centimeters to a number of metres thick.	The sands are sometimes too loose for normal foundations and settlements may take place. It is usually suitable for fine concrete aggregate. In the arid parts a major problem is the movement of these sands by wind.	These loose sands form spectacular dunes and are mobile if vegetation cover is sparse.
Sandstone	Due to the high resistance to weathering of quartz the sandstones usually only have a shallow soil cover. The soils are sandy and usually not very deep.	Some leached soil profiles show settlement characteristics, but the soils are usually inert. Sandstone is a good foundation rock. Depending on the cementing material the rock may be strong enough to be used as concrete and road aggregate. The Karoo sandstones are not suitable for concrete aggregate.	Sandstone is a popular source of dimension stone and many historic buildings were constructed with Karoo sandstone blocks.
Shale	Shale weathers to a clayey soil, which may have expansive characteristics depending on the original mineralogy of the soils from which the shale formed. In some areas the shales are weathered to great depths. The soils are usually highly erodable.	The unweathered rock is soft to very soft with properties similar to over consolidated clay. The rock mass is impermeable and the rock may be of the rapid weathering (slaking) type, which break up after exposure to the atmosphere. If the rockmass is dipping at an angle, slopes are usually unstable and movement may take place along bedding planes. If the original clay was of the expansive types, then the rock and the residual soils will be expansive and may cause damage to structures. Weathered and unweathered shale is the main source for brick-making material.	The soils are highly erodable and this results in deep donga's forming on many slopes in the Karoo.
Slate	Due to the changes taking place during metamorphism slate is usually fairly resistant to weathering and the thin soil cover is usually a clayey silt.	Slate is a popular material used in the building industry for flooring and roofing. It forms suitable foundations.	None of significance.

	Soil Profile	Engineering Qualities	Unique Qualities
Syenite	In humid areas clayey silt forms, which has a high permeability and may be dispersive. Big unweathered core stones may occur.	Soils are highly erodible and saturated slopes are unstable. Core stones may cause problems in the placing of foundations and may cause differential settlement. The rock is used in the building industry and as concrete and road building material.	These rocks are sometimes used as building stone, especially the red varieties.
Tillite	Uneven weathering surfaces occur with shallow soils in the west and deeper clayey soils in the east. The tillite also exhibits rapid weathering characteristics.	Slope instability may cause problems in exposed slopes and cuttings. It is a good construction material and is used widely in KwazuluNatal, but may break down. The soils are sometimes expansive and usually dispersive.	None of significance.
Tonalite	In humid areas silty sand or clayey silt forms, which is mica rich with quartz grains. These soils are dispersive (highly erodible) and have a high permeability. Core stone development and an uneven bedrock topography may occur. In some areas, e.g. Halfway House, a collapsible grain structure may develop.	Slope instability is frequent when it is saturated– which means that the ground can flow easily downhill. It is a high erodable soil. The core stones can cause problems in the placing of foundations such as piles. A collapsible grain structure may cause damage to structures if proper foundation measures are not implemented. Both the soils and the rock is widely used as aggregates for roads and concrete.	Granite is regarded as a solid rock and is therefore widely used as construction material.
Tuff	A deeply weathered soil profile usually forms. This is caused by the highly jointed rock mass.	A moderate collapsible soil may be expected and moderate expansion is found in hillwash originating from these materials. In foundations piles must be used in weathered zones due to core stone development and low strength.	None of significance
Ultramafic rocks	A number of different soil profiles occur, but clay is the predominant soil forming in the wetter parts of the country. These clayey soils are the most expansive known in South Africa. The black colour is due to a complex forming between clay and organic material.	Unweathered rocks are hard and massive and are widely used in the building industry as dimension stone and concrete aggregate. Damage to structures is caused by the volume changes in the clay soil.	These rocks are of great economic importance as minerals like platinum, nickel, copper, chromite, vanadium, magnetite and tin are present in economic quantities.

6.3 Terrain

Terrain is considered in terms of the general terrain types in the area, the impact of slope on development and the main hydrological features of the area.

6.3.1 Terrain types

The terrain types show the impact of the underlying geology of the area. The following terrain types apply to the area.

Low mountains cover 1.01 % of the area
Plains with open high hills or ridges cover 1.39 % of the area
Plains with open low hills or ridges cover 74.22 % of the area
Rolling or irregular plains with low hills or ridges cover 23.39 % of the area

6.3.2 Slope

The following extract from the data shows the slope of the area (slopes less than 4% are not calculated).

Slope more than 25%	0.4 % of the area has a slope of 25% or more 99.6 % of the area has a slope of Not applicable
Slope between 12% and 25%	1.37 % of the area has a slope of 12% to 25% 98.63 % of the area has a slope of Not applicable
Slope between 8% and 12%	3.7 % of the area has a slope of 8% to 12% 96.3 % of the area has a slope of Not applicable
Slope between 4% and 8%	23.41 % of the area has a slope of 4% to 8% 76.59 % of the area has a slope of Not applicable The rest of the area has a slope of less than 4%

6.3.3 Hydrology including wetlands

Catchments are separated from each other by watersheds. The characteristics of any river (physical, chemical, biological) is determined by the nature of the catchment and the activities, both human and natural, that take place in it. Catchments are divided into primary, secondary, tertiary and quaternary catchment areas. The extract below shows the quaternary catchments within which the codes of the higher level catchments area imbedded.

- Catchment B60J covers 41.77 % of the area
- Catchment B71H covers 0.89 % of the area
- Catchment B71J covers 4.28 % of the area
- Catchment B72C covers 2.9 % of the area
- Catchment B72D covers 33.18 % of the area
- Catchment B73B covers 16.98 % of the area

There are *0* wetlands in the area.

6.4 Soils

Soil is a natural body consisting of layers (soil horizons) of minerals of variable thicknesses, which differ from the parent materials in their morphological, physical, chemical, and mineralogical characteristics. It is composed of particles of broken rock that have been altered by chemical and environmental processes that include weathering and erosion. Soil differs from its parent rock due to interactions between the lithosphere, hydrosphere, atmosphere, and the biosphere. It is a mixture of mineral and organic elements that are in solid, gaseous and aqueous states.

6.4.1 Soil classes

The soil classes, as set out below, plays an important role in determining the agricultural potential and capabilities of the area. The following soil classes apply to the area:

- Description
- Association of Classes 13 and 16: Undifferentiated shallow soils and land classes covers 67.87 % of the area
- Association of Classes 17 and 19: Structureless and textural contrast soils covers 7.45 % of the area
- Freely drained, structureless soils covers 8.41 % of the area
- Lithosols (shallow soils on hard or weathering rock) covers 15.86 % of the area
- Non-soil land classes cover 0.41 % of the area

The description can be interpreted through the next table:

Table 8: Soil classes and their properties

	Soil description	Favourable properties	Limitations
1	Soils with humic topsoil horizons	Low erodibility; favourable physical properties; high organic matter	Low base status
2	Freely drained, structureless soils	Favourable physical properties	May have restricted soil depth, excessive drainage, high erodibility, low natural fertility
3	Red or yellow structureless soils with a plinthic horizon	Favourable water-holding properties	Imperfect drainage unfavourable in high rainfall areas
4	Imperfectly drained sandy soils	Favourable water-holding properties	May be highly erodible
5	Swelling clay soils	High natural fertility	High swell-shrink potential; very plastic and sticky
6	Dark clay soils which are not strongly swelling	High natural fertility	Somewhat plastic and sticky
7	Soils with a pedocutanic horizon	Somewhat high natural fertility	Restricted effective depth; may have slow water infiltration
8	Imperfectly drained soils, often shallow and often with a plinthic horizon	Relative wetness favourable in dry areas	May be seasonally wet
9	Podzols	May have favourable water-holding properties	May have restricted effective depth; low natural fertility
10	Poorly drained dark clay soils which are not	High natural fertility	Seasonal wetness; plastic and sticky

	Soil description	Favourable properties	Limitations
	strongly swelling		
11	Poorly drained swelling clay soils	High natural fertility	Wetness; very plastic and sticky
12	Dark clay soils, often shallow, on hard or weathering rock	High natural fertility	Restricted soil depth
13	Lithosols (shallow soils on hard or weathering rock)	May receive water runoff from associated rock	Restricted soil depth; associated with rockiness
14	Texture contrast soils often poorly drained	Relative wetness favourable in dry areas	Seasonal wetness; highly erodible
15	Wetland soils	Sustain wetland vegetation	Excessive wetness
16	Non soil land classes	May be water-intake areas	Restricted land use options
17	Association of Classes 1 to 4: Undifferentiated structureless soils	Favourable physical properties	One or more of: low base status, restricted soil depth, excessive or imperfect drainage, high erodibility
18	Association of Classes 5, 6, 10, 11, 12: Undifferentiated clays	High natural fertility	One or more of: high swell-shrink potential, plastic and sticky, restricted effective depth, wetness
19	Association of Classes 7 and14: Undifferentiated texture contrast soils	Somewhat high natural fertility or relative wetness favourable in dry areas	One or more of: restricted effective depth; slow water infiltration; seasonal wetness; high erodibility
20	Association of Classes 8 and 15: Undifferentiated poorly drained soils	Wetness favourable in dry areas; may sustain wetland vegetation	Seasonal or excessive wetness
21	Association of Classes 13 and 16: Undifferentiated shallow soils and land classes	Soil may receive water runoff from associated rock; water-intake areas	Restricted land use options
22	Association of Classes 17 and 18: Structureless soils and clays	May have favourable physical properties or high natural fertility	Restricted depth, imperfect drainage, wetness, high swell-shrink potential, plastic, sticky
23	Association of Classes 17 and 19: Structureless and textural contrast soils	May have favourable physical properties, somewhat high natural fertility; relative wetness favourable in dry areas	Restricted depth, imperfect drainage, high erodibility; slow water infiltration; seasonal wetness
24	Association of Classes 17 and 20: Structureless and poorly drained soils	May have favourable physical properties; relative wetness favourable in dry areas; may sustain wetland vegetation	Low base status, restricted depth, imperfect to poor drainage, excessive wetness, high erodibility
25	Association of Classes 17 and 9: Structureless soils and podzols	May have favourable physical properties	Low base status, restricted depth, imperfect drainage, high erodibility
26	Association of Classes 17 and 21: Structureless soils, shallow soils and land classes	May have favourable physical properties; soil components may receive water runoff from associated rock; water-intake areas	Low base status, restricted soil depth, excessive or imperfect drainage, high erodibility, restricted land use options
27	No dominance		

6.4.2 Soil depth

Soil depth is important for various reasons. The following soil depth profile apply to the area:

- Soil which is < 450mm deep constitutes 25.71 % of the area
- Soil which is 450mm - 750mm deep constitutes 74.29 % of the area

6.4.3 Swelling clays, drainage and water holding capacity

Swelling clays have a large impact on agriculture and land use activities. The following profile apply to the area:

- Soils with a None clay content covers 1.09 % of the area
- Soils with a Very low clay content covers 98.91 % of the area

Link to clay, soil types and topography is drainage. The following apply to the area:

- Red and yellow soils with low to medium base status. covers 0.09 % of the assessment area
- Red soils with high base status. covers 8.35 % of the assessment area
- Rock with limited soils. covers 0.63 % of the assessment area
- Soils with minimal development, usually shallow, on hard or weathering rock, with or without intermittent diverse soils. Lime generally present in part or most of the landscape. covers 90.48 % of the assessment area
- Soils with minimal development, usually shallow, on hard or weathering rock, with or without intermittent diverse soils. Lime rare or

absent in the landscape. covers 0.45 % of the assessment area

The third factor within this category which requires consideration is water holding capacity to the soils. A profile available water value (mm for the "rootable" soil profile, hence the higher the better ranging from less than 20mm to more than 100mm) was determined for each soil entry. These were averaged per land type and arbitrarily classed as shown.

In the marginal rainfall areas, favourable water-holding classes have been found to extend arability. The largest areas with both a favourable class rating and high rainfall are situated on the Mpumalanga Highveld and in the eastern Free State. The following apply to the area:

- The water holding capacity of 0.41 % of the soil is 0 - 20 mm
- The water holding capacity of 91.26 % of the soil is 21 - 40 mm
- The water holding capacity of 8.33 % of the soil is 41 - 60 mm

7 Vegetation

Natural vegetation is made up of individual plants, few or many, according to the habitat. These usually belong to a number of different species. They live together, competing with each other and perhaps assisting each other, so that a balance is maintained at a level of development determined by the locality or environment.

Vegetation has a direct agricultural impact but also plays an important role in urban development through carbon sequestration and the ability of certain habitats and plants to mitigate the impact of air and water pollution.

7.1.1 Acocks veld types

Vegetation changes according to the way it is treated. The concept of the veld type originated from a consideration of botanical composition and of practical utilization. A veld type is a unit of vegetation whose range of variation is small enough to permit the whole of it to have the same farming potential. The challenge during the original conceptualization of veld types was to group the infinite variations of the vegetation (there are approximately 20 000 species of flowering plants in South Africa) into manageable units, and to separate the natural variations from the man-made ones.

The main driving force causing vegetation change is selective grazing. This causes the actual veld condition (species composition and cover) at a given time to differ from the modal veld type composition or benchmark.

The following veld types cover the area:

- **Inland Tropical Forest Types covers 5.8 % of the area**
- Tropical Bush and Savanna Type (Bushveld) covers 94.2 % of the area

7.1.2 Tree density

The impetus for developing tree cover mapping techniques came from the need to quantify global tree stocks, modelling of global biogeochemical cycles and carbon sequestration. In the local context, tree cover mapping was found useful in refining rangeland grazing capacity ratings obtained by means of Normalized Difference Vegetation Index (NDVI).

The following applies to area:

- 0.17 % of the area has a tree density of < 1.3 tree per ha
- 1.66 % of the area has a tree density of 1.3 - 5 tree per ha
- 35.83 % of the area has a tree density of 19 - 70 tree per ha
- 62.31 % of the area has a tree density of 5 - 19 tree per ha
- **0.03 % of the area has a tree density of 70 - 100 tree per ha**

7.1.3 Invasive plant species

Invasive alien species pose significant threats to human livelihoods, economic development and biodiversity. These threats are likely to be exacerbated by climate change as environments become less hospitable for indigenous species. Invasive alien species are believed to be the second most significant cause of species loss after habitat destruction and thus their threat to biodiversity needs to be dealt with as a matter of urgency.

The South African National Biodiversity Institute (SANBI) has a legal mandate to promote the conservation of South Africa's exceptional biodiversity and also to monitor and report on invasive alien species.

The next table shows the percentage canopy cover in areas that can be attributed to invasive alien plants.

Table 9: Invasive alien plants in the area

% canopy cover	% of area
12-17	4.96 %
Less than 1%	86.38 %
Not applicable	8.66 %

8 Terrestrial ecosystems

This report is based on the results of South Africa's National Biodiversity Assessment (NBA) 2011, which was led by the South African National Biodiversity Institute (SANBI) in partnership with a range of organisations. The NBA 2011 assesses the state of South Africa's biodiversity, across terrestrial, freshwater, estuarine and marine environments, emphasising spatial information for both ecosystems and species. This report generated by MapAble® must be read in conjunction with NDA of 2011[2].

South Africa has a large number of recognised ecosystems. These ecosystems are important and contributes the quality of the environment and general environmental diversity. There are the following ecosystems:

Table 10: List of ecosystems in the area

Ecosystem name	% of area
Granite Lowveld	97.88 %
Legogote Sour Bushveld	1.14 %
Lowveld Riverine Forest	0.42 %
Tzaneen Sour Bushveld	0.56 %

These ecosystems are linked to the following biomes:

Table 11: Biomes covering the area

Biome	% of area
Forests	0.42 %
Savanna Biome	99.58 %

These biomes are representative of the following biome groups in the area of assessment:

Table 12: Biome groups associated with the biomes in the area

Biome group	% of area
Azonal Forests	0.42 %
Lowveld Bioregion	99.58 %

8.1 Terrestrial ecosystem protection level

It is important that ecosystems are protected. The question regarding the local ecosystems is how well the ecosystem types, represented in South Africa's protected area network, are protected. The assessment of ecosystem level is then evaluated as the proportion of each vegetation type protected relative to the biodiversity target. The ecosystem protection level status indicated below is based on the following:

1. If an ecosystem type has more than 100% of its biodiversity target met in either a formal A or B protected area (See Table 19: Classification of protected areas Table 19: Classification of protected area below), it is classified as Well Protected.
2. When less than 100% of the biodiversity target is met in formal A or B protected areas, it is classified it as Moderately Protected.
3. If less than 50% of the biodiversity target is met, it is classified it as Poorly Protected.
4. If less than 5% of the biodiversity target is met, it is Hardly Protected.

The protection status of the ecosystems in the area is the following:

[2] National Biodiversity Assessment 2011 is available from SABI at http://www.sanbi.org/nba#assessment

Table 13: The combined threat status of ecosystems in the assessment area

Protection status	% of area
Moderately protected	97.88 %
Poorly protected	1.7 %
Well protected	0.42 %

8.2 Terrestrial ecosystem threat status

Ecosystem threat status tells us about the degree to which ecosystems are still intact, or alternatively, losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends. Ecosystem types are categorized as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Threatened (LT), based on the following criteria:

Table 14 Criteria describing ecosystem status

Criterion	Critically Endangered (CR)	Endangered (EN	Vulnerable (VU)
A1: Irreversible loss of natural habitat	Remaining natural habitat ≤ biodiversity target[3]	Remaining natural habitat ≤ (biodiversity target* + 15%)	Remaining natural habitat ≤ 60% of original area of ecosystem
A2: Ecosystem degradation and loss of integrity	≥ 60% of ecosystem significantly degraded	≥ 40% of ecosystem significantly degraded	≥ 20% of ecosystem significantly degraded
B: Rate of loss of natural habitat			
C: Limited extent and imminent threat		Ecosystem extent ≤ 3 000ha, and imminent threat	Ecosystem extent ≤ 6 000ha, and imminent threat
D1: Threatened plant species associations	≥ 80 threatened Red Data List plant species	≥ 60 threatened Red Data List plant species	≥ 40 threatened Red Data List plant species
D2: Threatened animal species associations			
E: Fragmentation			
F: Priority areas for meeting explicit biodiversity targets as defined in a systematic biodiversity plan	Very high irreplaceability and high threat	Very high irreplaceability and medium threat	Very high irreplaceability and low threat

Most ecosystem types (based on area) were assessed using criteria A1, i.e. based on how much of an ecosystem's original area remains intact, relative to three different thresholds. Note that the threshold beyond which an ecosystem type becomes critically endangered varies from 16% to 36%, depending on the ecosystem type. The more species-rich the ecosystem type, the higher the threshold. This threshold is also known as the biodiversity target. It represents the proportion of each ecosystem one would ideally like to see included in a formal protected area.

The summarised threat status of the local ecosystems is:

Table 15: The threat status of local ecosystems

Threat status	% of area
Critically endangered	0.42 %
Endangered	1.7 %
Vulnerable	97.88 %

9 River ecosystems

River ecosystems are vital for supplying fresh water, South Africa's most scarce natural resource. Rivers store and transport water and combined with manmade storage and transfer schemes, they bring water to urban and rural areas, irrigate croplands, take away waste and provide cultural and aesthetic services. Healthy tributaries help to maintain natural flow pulses and flush pollutants from hard-working larger rivers, contributing to the quantity and quality of water supplies. Contrary to popular belief, fresh water flowing from rivers out to the sea is not wasted but is essential for maintaining healthy estuaries as well as coastal and marine ecosystems and the benefits received from them. The main pressure faced by river ecosystems is the abstraction of water from rivers and other alterations to the timing and quantity of flows, for example as a result of dams or transfer schemes between catchments. In addition, pollution of rivers is a serious and growing problem, often exacerbated by destruction of natural vegetation along river banks which results in irreversible damage to rivers and their ability to provide ecosystem services.

Fifty-seven percent of river ecosystem types are threatened (25% critically endangered, 19% endangered and 13% vulnerable). Tributaries tend to be in better ecological condition than main rivers, so the proportion of threatened river ecosystem types is

[3] Biodiversity targets range from 16% to 36% depending on the ecosystem type

higher if only main rivers are assessed, with 65% threatened (including 46% critically endangered). The proportion of threatened river ecosystem types is higher among lowland and lower foothill rivers than among upper foothills and mountain streams, reflecting the fact that the intensive agriculture and urban areas are often found in lowlands, as well as the accumulation of impacts on rivers as they flow from source to sea.

Only 14% of river ecosystem types are well protected and 50% are not protected at all. Mountain streams are best protected and lowland rivers have the highest proportion of ecosystem types with no protection. Most land-based protected areas were not designed to protect rivers; however, with some adjustments to their design and management, land-based protected areas could make a much greater contribution to protecting river ecosystems.

High water yield areas are sub-quaternary catchments in which mean annual runoff is at least three times more than the average for the related primary catchment. These areas constitute only 4% of South Africa's surface area and are the water factories of the country. Currently only 18% of them have any form of formal protection. Given their strategic importance for water security, options for formal protection of high water yield areas should be explored, for example declaring them as Protected Environments in terms of the Protected Areas Act.

Because rivers are linear ecosystems and are impacted on by land uses and activities throughout their catchments, protected areas alone will seldom do the full job of protecting river ecosystems. This highlights the importance of integrated water resource management tools provided by the National Water Act, including the ecological reserve, classification of water resources and resource quality objectives, which contribute to the protection of freshwater ecosystems. For all rivers, good land-use practices such as keeping natural vegetation intact along river banks can make a vital difference to their ecological integrity.

9.1 Affected rivers in the assessment area

There are *192,41 km* of river in the assessment area. There are important variables that determines the status of these rivers. The following rivers run through the affected area.

9.2 River types

In terms of seasonal flow, the rivers in the assessment area the data base reports the following:

Table 16: River type

River class	Length
Perennial	148,70 km
Non-perennial	43,71 km
Dry	0,00 km
Unknown	0,00 km

9.3 River natural status

Rivers are affected by human activity. As important development resource urbanisation, agriculture, conservation and recreational activities all impact and change the natural state of rivers over time. The rivers, in terms of the impact of human activities on their natural state are as follows for the assessment area:

Table 17: River status

River class	Length
Largely natural	119,90 km
Moderately modified	56,42 km
Largely modified	16,09 km
No acceptable class	0,00 km

9.4 Threat status

Ecosystem threat status tells us about the degree to which ecosystems are still intact, or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends.

The value of river ecosystems for human wellbeing and the economy is immense. The pressures on river ecosystems can be summarised as:

- The alteration of a rivers flow for example through the building of dams and weirs in river.
- Pollution.
- Destruction of river banks.
- Invasive alien plants.

- Invasive fish species.
- Climate change.
- Land management practices in catchment areas.

The methods used to assess ecosystem threat status and ecosystem protection were explained in Table 14 and apply to all environments. Yet river ecosystems are under pressure from a range of human activities. Because impacts accumulate as one moves downstream, larger main rivers tend to be more heavily impacted than tributaries. Larger rivers also tend to be 'harder working', for example more likely to have dams constructed on them, water abstracted directly from them or pollutants discharged into them.

The MapAble® database reports the following threat status for the rivers in the assessment area:

Table 18: River threat status

River class	Length
Critically endangered	4,57 km
Endangered	184,29 km
Vulnerable	3,55 km
Not endangered	0,00 km

10 Protected areas

The formal protected areas in this assessment include land-based protected areas that are recognised in terms of the Protected Areas Act (Act 57 of 2003). These are:

Table 19: Classification of protected areas

Formal A Protected Areas	
Forest Act Protected Area	Specially protected forest areas, forest nature reserves and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act No. 84 of 1998)
Island Reserve	A sub-set of provincial nature reserves, which are islands administered by provinces in terms of provincial legislation
National Park	An area declared in terms of the National Parks Act, 1976 (Act No. 57 of 1976), or in terms of Section 20 of the Protected Areas Amendment Act, 2004 (Act No. 31, 2004), including private areas declared under this legislation
Other national protected area	A nature reserve other than a national park or special nature reserve, managed by a national organ of state or which falls under the jurisdiction of the Minister for any other reason
Provincial Nature Reserve	An area declared in terms of section 23 of Protected Areas Act, 2003 (No. 57 of 2003), or declared in terms of provincial legislation for conservation purposes, and which is managed by a provincial organ of state, including private areas declared under this legislation
Special nature reserve	An area which was a special nature reserve in terms of the Environment Conservation Act, 1989 (Act No. 73 of 1989), or an area declared in terms of section 18 of Protected Areas Act, 2003 (No. 57 of 2003)
World Heritage Site	A world heritage site declared in terms of the World Heritage Convention Act, 1999 (Act No. 49 of 1999)
Formal B Protected Areas	
Mountain Catchment Area	An area declared in terms of the Mountain Catchment Areas Act, 1970 (Act No. 63 of 1970)
Local Nature Reserve	A nature reserve which is managed by a municipality, potentially of undefined legal status
National Botanical Garden	A reserve managed by the South African National Botanical Institute

10.1 Protected, conservation areas and parks

The protected areas of South Africa include national parks and marine protected areas managed by the national government, public nature reserves managed by provincial and local governments, and private nature reserves managed by private landowners. Most protected areas are intended for the conservation of flora and fauna. National parks are maintained by South African National Parks (SANParks). A number of national parks have been incorporated in transfrontier conservation areas. Protected areas may also be protected for their value and importance as historical, cultural heritage or scientific sites.

The following protected area are located in the assessment area

10.1.1 National parks

The area's nearest the nearest national park to the assessment area is Kruger which is 14.73 km way form the assessment area. If the results are indicated as 0 km, then it implies that the park falls within the area assessed. Distances are measured from the boundary of the area and are shown as direct distance.

Table 20: National parks in the area

National park	% of area
Not applicable	100

10.1.2 Private nature reserves and conservation areas

The area's nearest the nearest private nature reserve to the assessment area is Klaserie Private Nature Reserve is the nearest private nature reserve to the area and is 0 km away. If the results are indicated as 0 km, then it implies that the park falls within the area assessed. Distances are measured from the boundary of the area and are shown as direct distance.

Table 21: Private nature reserves

Private nature reserve	% of area
Klaserie Private Nature Reserve covers 7.9 % of the area assessed	7.9 %
Selati Game Reserve covers 62.23 % of the area assessed	62.23 %
Not applicable covers 29.87 % of the area assessed	29.87 %

This does not include conservation areas to the extent of Game Farm constitutes 62.23 % of the area

Private Nature Reserve constitutes 7.9 % of the area

Not applicable constitutes 29.87 % of the area located in the area

10.1.3 Possible expansion areas

South Africa has a continuous and conscious effort to expand conservation areas. All areas are not necessarily worth conserving. In the area under assessment the extent of these potential expansion areas is indicated in the table below.

Table 22: Focus areas for future expansion

Focus for expansion of conservation areas	% of area
Northeast Escarpment	1.08 %
Not applicable	98.92 %

10.1.4 Conservation management

Various institutions, the private sector and land owners are involved in conservation. Formal protected areas cover 0,00ha. The next table shows the formal conservation areas affecting the area.

Table 23: Formal conservation areas

Formal conservation areas	% of area
Not applicable	100 %

These areas are classified in the following categories:

Table 24: Conservation area types

Conservation area types	% of area
Not applicable	100 %

The management responsibility for these conservation areas are as follows:

Table 25: Management responsibilities

Management responsibilities	% of area
Not applicable	100 %

11 Special areas

There are a number of other conservation areas that are important in forming a complete picture. This specifically refers to important bird areas and fish sanctuaries.

11.1 Birding areas of significance

Important Bird and Biodiversity Areas (IBAs) are sites of international significance for the conservation of the world's birds and other biodiversity. They also provide essential benefits to people, such as food, materials, water, climate regulation and flood attenuation, as well as opportunities for recreation and spiritual fulfilment. By conserving IBAs, we look after all the ecosystem goods and services they provide, which means in effect that we support a meaningful component of the South African economy (such as water management and agriculture).

South Africa had 112 IBAs in 2015. IBAs have also had considerable and increasing relevance when responses have been developed to a number of wider environmental issues, such as habitat loss, ecosystem degradation, climate change and the sustainable use of resources. A coordinated and strategic approach to conserving IBAs is critical since 54% of the network of 112 sites are either only partially protected or completely unprotected. Of greater concern is that the government is currently allocating fewer resources to managing protected areas under its control, many of which are also IBAs.

The following important bird areas are reported in the area under assessment.

Table 26: Important bird areas

Important birding areas	Protection
Blyde River Canyon	17.45 % of the area is Partially protected
Kruger National Park and adjacent areas	82.55 % of the area is Not applicable protected
Not applicable	

11.2 Fish conservation

In the same way as birding areas are important fish as part of the aquatic system. There are 126 896 ha fish conservation areas in the assessment area.

12 Mining and environmental protection

The mining industry plays a vital role in South Africa's growth and development. But if mining is not strategically planned and carefully implemented, it has significant negative impacts on biodiversity and ecosystems, in particular our water catchments, rivers and wetlands that support water-related services. The Mining and Biodiversity Guideline: Mainstreaming biodiversity into the mining sector, interprets the best available biodiversity knowledge and science in terms of the implications and risks for mining in a practical and user-friendly guideline for integrating relevant biodiversity information into decision making. The development of this guideline was initiated by the Chamber of Mines and the South African Mining and Biodiversity Forum (SAMBF), in partnership with the Department of Environmental Affairs and the Department of Mineral Resources, and with technical input and coordination by the South African National Biodiversity Institute's (SANBI) Grasslands Programme.

This Guideline provides a tool to facilitate the sustainable development of South Africa's mineral resources in a way that enables regulators, industry and practitioners to minimise the impact of mining on the country's biodiversity and ecosystem services. It provides the mining sector with a practical, user-friendly manual for integrating biodiversity considerations into the planning processes and managing biodiversity during the operational phases of a mine, from exploration through to closure.

124 080,37 ha of the area under assessment are regarded as important in terms biodiversity criteria. The data reports as follows on the biodiversity importance for the area.

Table 27: Bio-importance and mining

Biodiversity importance	% of area
B. Highest Biodiversity Importance	44.7 %
C. High Biodiversity Importance	53.08 %
Not applicable	2.22 %

The implications for mining are:

Table 28: Conservation status and mining

Conservation status	% of area
High Risk to Mining	53.08 %

Conservation status	% of area
Highest Risk for Mining	44.7 %
Not applicable	2.22 %

Table 29: Mining, conservation and biodiversity

Category	Biodiversity priority areas	Risk for mining	Implications for mining
A. Legally protected	• Protected areas (including National Parks, Nature Reserves, World Heritage Sites, Protected Environments, Nature Reserves) Areas declared under Section 49 of the Mineral and Petroleum Resources Development Act (No. 28 of 2002)	Mining prohibited	• Mining projects cannot commence as mining is legally prohibited. Although mining is prohibited in Protected Areas, it may be allowed in Protected Environments if both the Minister of Mineral Resources and Minister of Environmental Affairs approve it. • In cases where mining activities were conducted lawfully in protected areas before Section 48 of the Protected Areas Act (No. 57 of 2003) came into effect, the Minister of Environmental Affairs may, after consulting with the Minister of Mineral Resources, allow such mining activities to continue, subject to prescribed conditions that reduce environmental impacts.
B. Highest biodiversity importance	• Critically Endangered and Endangered ecosystems • Critical Biodiversity Areas (or equivalent from provincial spatial biodiversity plans areas) • River and wetland Freshwater Ecosystem Priority Areas (FEPAs) and a 1km buffer around these FEPAs • Ramsar Sites	Highest risk for mining	• Environmental screening, environmental impact assessment (EIA) and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features, and to provide site-specific basis on which to apply the mitigation hierarchy to inform regulatory decision-making for mining, water use licences, and environmental authorisations. • If they are confirmed, the likelihood of a fatal flaw for new mining projects is very high because of the significance of the biodiversity features in these areas and the associated ecosystem services. These areas are viewed as necessary to ensure protection of biodiversity, environmental sustainability, and human well-being. • An EIA should include the strategic assessment of optimum, sustainable land use for a particular area and will determine the significance of the impact on biodiversity. This assessment should fully take into account the environmental sensitivity of the area, the overall environmental and socio-economic costs and benefits of mining, as well as the potential strategic importance of the minerals to the country. • Authorisations may well not be granted. If granted, the authorisation may set limits on allowed activities and impacts, and may specify biodiversity offsets that would be written into licence agreements and/or authorisations
C. High biodiversity importance	• Protected area buffers (including buffers around National Parks, World Heritage Sites* and Nature Reserves) • Transfrontier Conservation Areas (remaining areas outside of formally proclaimed protected areas) • Other identified priorities from provincial spatial biodiversity plans • High water yield areas • Coastal Protection Zone • Estuarine functional zone *Note that the status of buffer areas of World Heritage Site is subject to a current intra-governmental process	High risk for mining	• These areas are important for conserving biodiversity, for supporting or buffering other biodiversity priority areas, for maintaining important ecosystem services for particular communities or the country as a whole. • An EIA should include an assessment f optimum, sustainable land use for a particular area and will determine the significance of the impact on biodiversity. • Mining options may be limited in these areas, and limitations for mining projects are possible • Authorisations may set limits and specify biodiversity offsets that would be written into license agreements and/or authorisations.
D. Moderate biodiversity importance	• Ecological support areas • Vulnerable ecosystems • Focus areas for protected area expansion (land-based and offshore protection)	Moderate risk for mining	• These areas of moderate biodiversity value. • EIAs and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features, identifying features (e.g. threatened species) not included in the existing datasets, and on providing site-specific information to guide the

Category	Biodiversity priority areas	Risk for mining	Implications for mining
			application of the mitigation hierarchy. • Authorisations may set limits and specify biodiversity offsets that would be written into license agreements and/or authorisations.

This report was prepared by Albert Ferreira

Report date: 12 April 2017 10:56

(MapAble® report system name: AR04 Terrestrial Ecosystems and conservation)

Annexure A. Data extraction and data mining

This report is based on queries generated from the MapAble® database. The data sources are indicated in the table below. All the data utilised is in the public domain and can be sourced from the respective data custodians.

The bulk of the data comes from census data from Statistics South Africa. Each census is queried at the smallest data level at which a census was released. The 1996 census was released at enumerator area (EA) level while the 2001 census was only released at sub-place level. A sub place consists of a number of EAs. The 2011 census was released as a small area layer (SAL). Small areas are larger than EA's but smaller than sub-places. It is important to note that the censuses are not consistent insofar as data categories are concerned. It was therefore necessary to adjust some census data (subdividing categories or lumping categories together) in order to get the data at a consistent and comparable basis. Due to the way data is extracted from the census the totals in the tables in the report are not necessarily consistent or the same throughout the report. The following affects table totals:

- When data is extracted from the censuses, values of less than 5 are randomised with values between 1 and 5 in order to protect individual's identities. This accounts for smaller variations in totals.
- Data categories are not consistent between the censuses.
- The process of data partitioning is by its very nature affected by the physical scale at which queries are done. The smaller an area is the bigger the possibility for anomalies become.

Notwithstanding these issues, the results are valid and sufficiently accurate for general use.

Data partitioning is used in MapAble® to determine values for the selected areas. Data partitioning calculates the proportional ratios of underlying data sets (data linked to polygons such as EA's or sub-places) within a selected query area (ward, municipality, farm portion, etc.). Data partitioning is used to overcome the need for information on census demographics for areas that are not consistent with the standard boundaries themselves, or as the case in this report, where boundaries change from time to time and area profiles are not directly comparable. The proportions are based on the area of the intersecting themes.

Data partitioning allows for comparisons between datasets, which each having their own unique demarcations, and data that is not necessarily spatially comparable or compatible.

Data sources:

Data table	Data source
Table 1: Smaller towns, settlements and villages	Municipal Demarcation Board
Table 2: Population and households	Census 1996, 2001, 2011
Table 3: Agricultural and non-urban land cover 2014	GeoTeraImage 2014
Table 4: Urban and settlement land cover 2014	GeoTeraImage 2014
Table 5: Maximum temperatures	Agricultural Research Council
Table 6: Minimum temperatures	Agricultural Research Council
Table 7: Moisture availability classes	Agricultural Research Council
Table 8: Properties of rocks	Agricultural Research Council
Table 9: Soil classes and their properties	Agricultural Research Council
Table 10: Invasive alien plants in the area	Agricultural Research Council
Table 11: List of ecosystems in the area	South African National Biodiversity Institute
Table 12: Biomes covering the area	South African National Biodiversity Institute
Table 13: Biome groups associated with the biomes in the area	South African National Biodiversity Institute
Table 14: The combined threat status of ecosystems in the assessment area	South African National Biodiversity Institute
Table 15 Criteria describing ecosystem status	South African National Biodiversity Institute
Table 16: The threat status of local ecosystems	South African National Biodiversity Institute
Table 16: River type	National Geo-Spatial Information
Table 16: River status	National Geo-Spatial Information
Table 16: River threat status	South African National Biodiversity Institute
Table 17: Classification of protected areas	South African National Biodiversity Institute
Table 18: National parks in the area	South African National Biodiversity Institute
Table 19: Private nature reserves	South African National Biodiversity Institute
Table 20: Focus areas for future expansion	South African National Biodiversity Institute
Table 21: Formal conservation areas	South African National Biodiversity Institute
Table 22: Conservation area types	South African National Biodiversity Institute
Table 23: Management responsibilities	South African National Biodiversity Institute
Table 24: Important bird areas	South African National Biodiversity Institute

Data table	Data source
Table 25: Bio-importance and mining	South African National Biodiversity Institute
Table 26: Conservation status and mining	South African National Biodiversity Institute
Table 27: Mining, conservation and biodiversity	South African National Biodiversity Institute