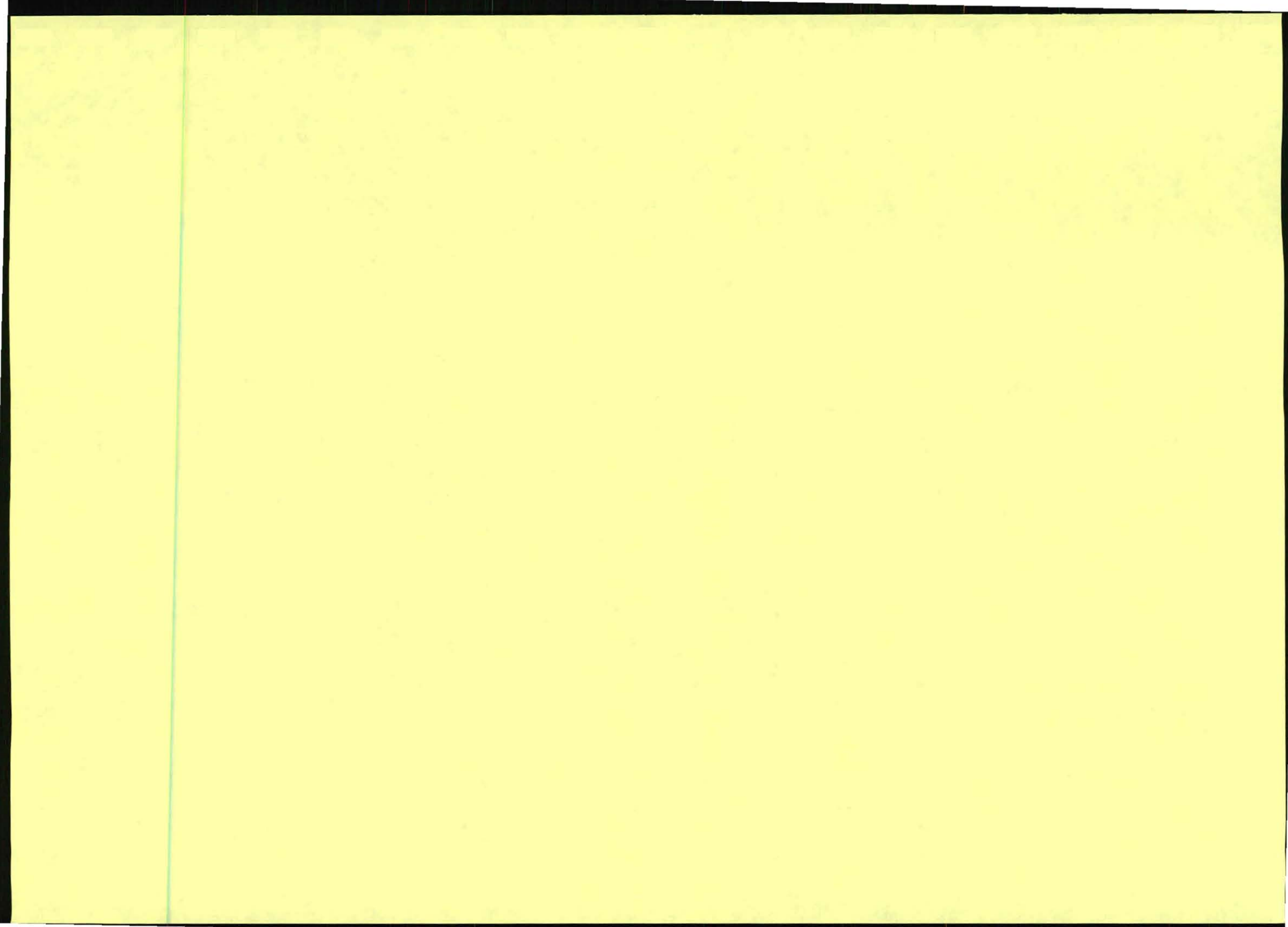


**Appendix D4:
Photo Records**



KABI VAALKOP SOLAR PV ENERGY FACILITY - SITE PHOTOGRAPHS



Figure 1: Site photograph positions.



Figure 2: View eastwards from point A showing the Mines water reservoirs

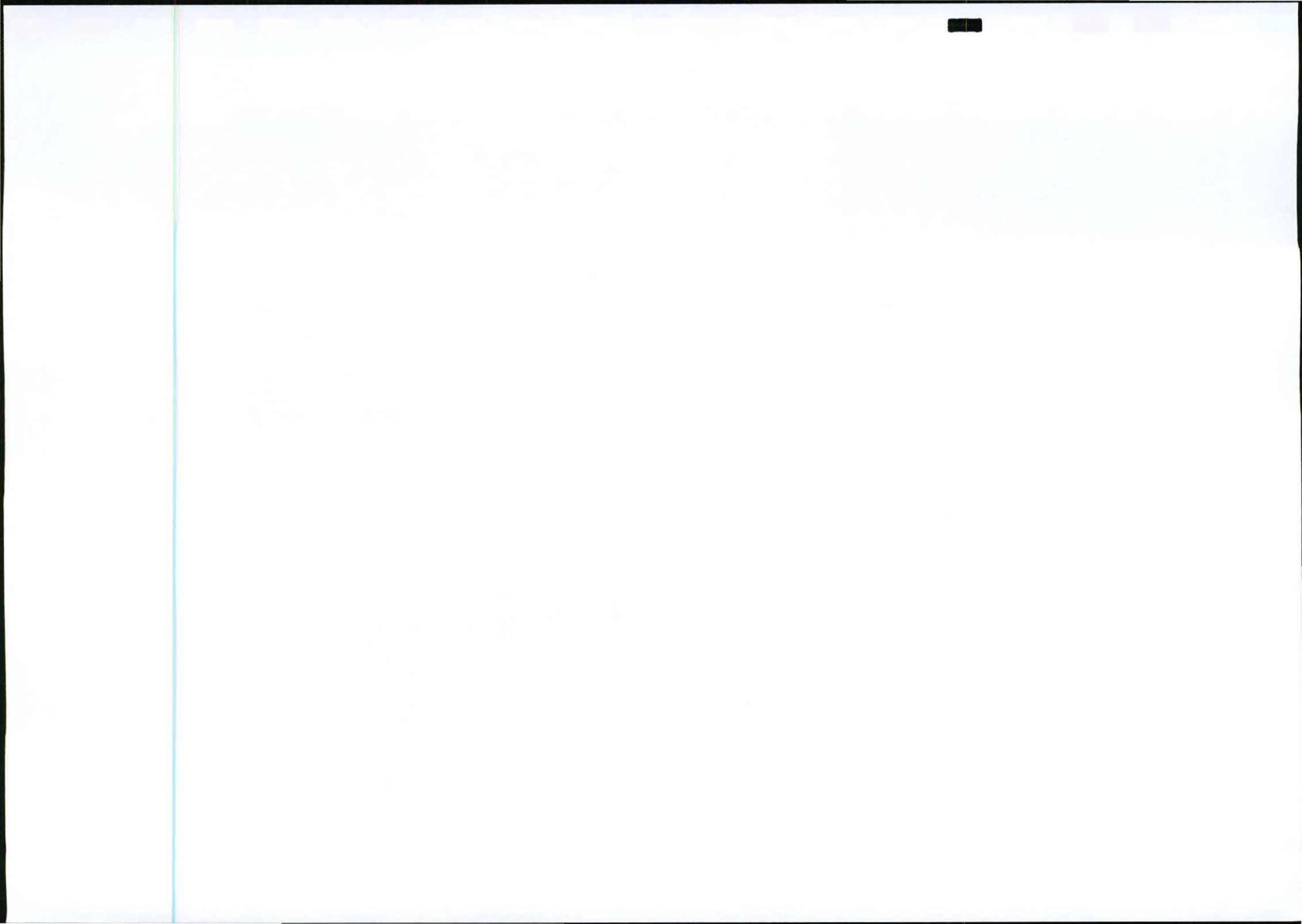




Figure 3: View northwards from point A showing the site.



Figure 4: View westwards from point A showing the site.





Figure 5: View facing south from point A with the R502 on the horizon.



Figure 6: View eastwards from point B

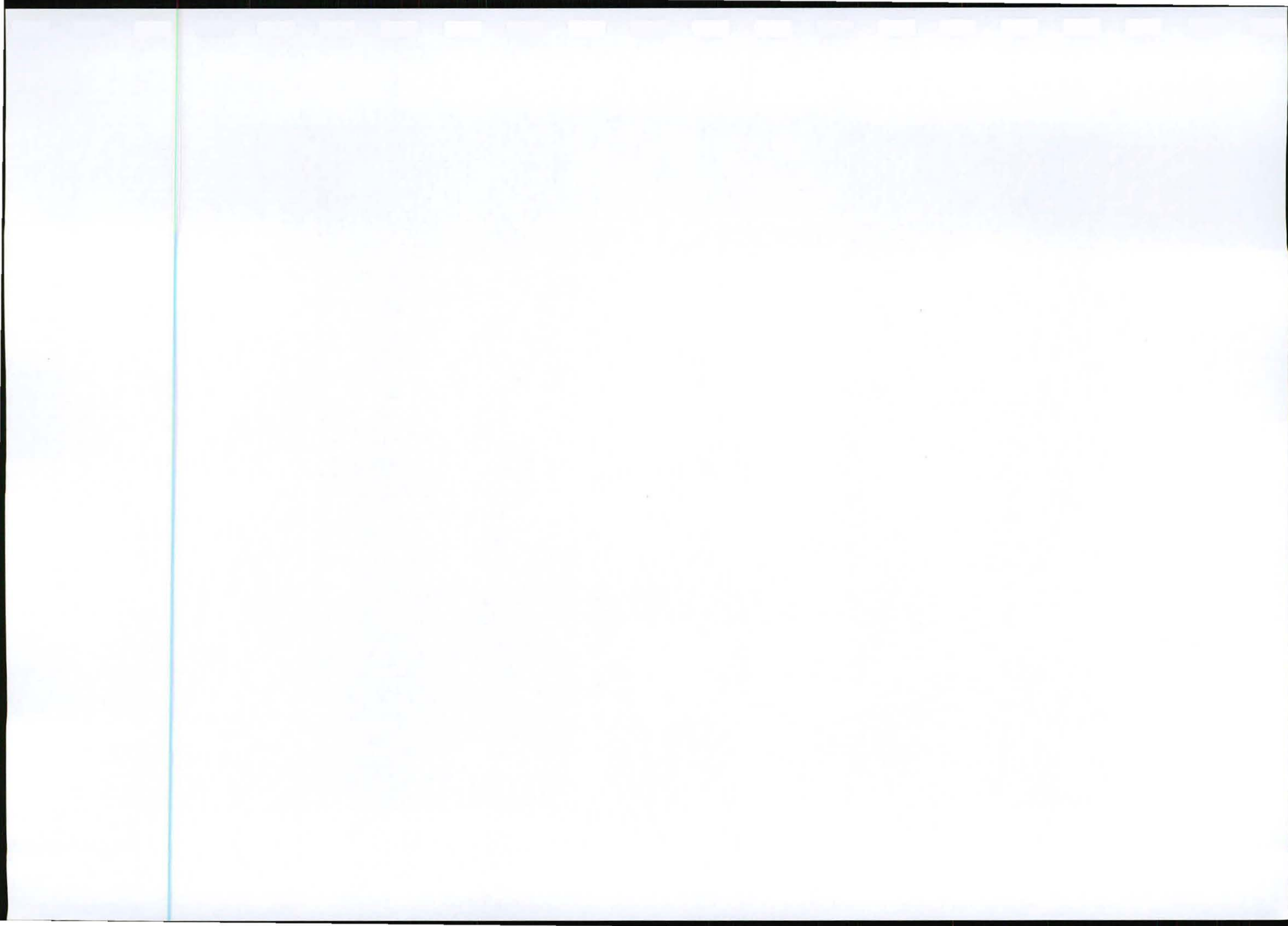




Figure 7: View northwards from point B showing powerlines that cross the site.



Figure 8: Mine water booster pump next to point B.

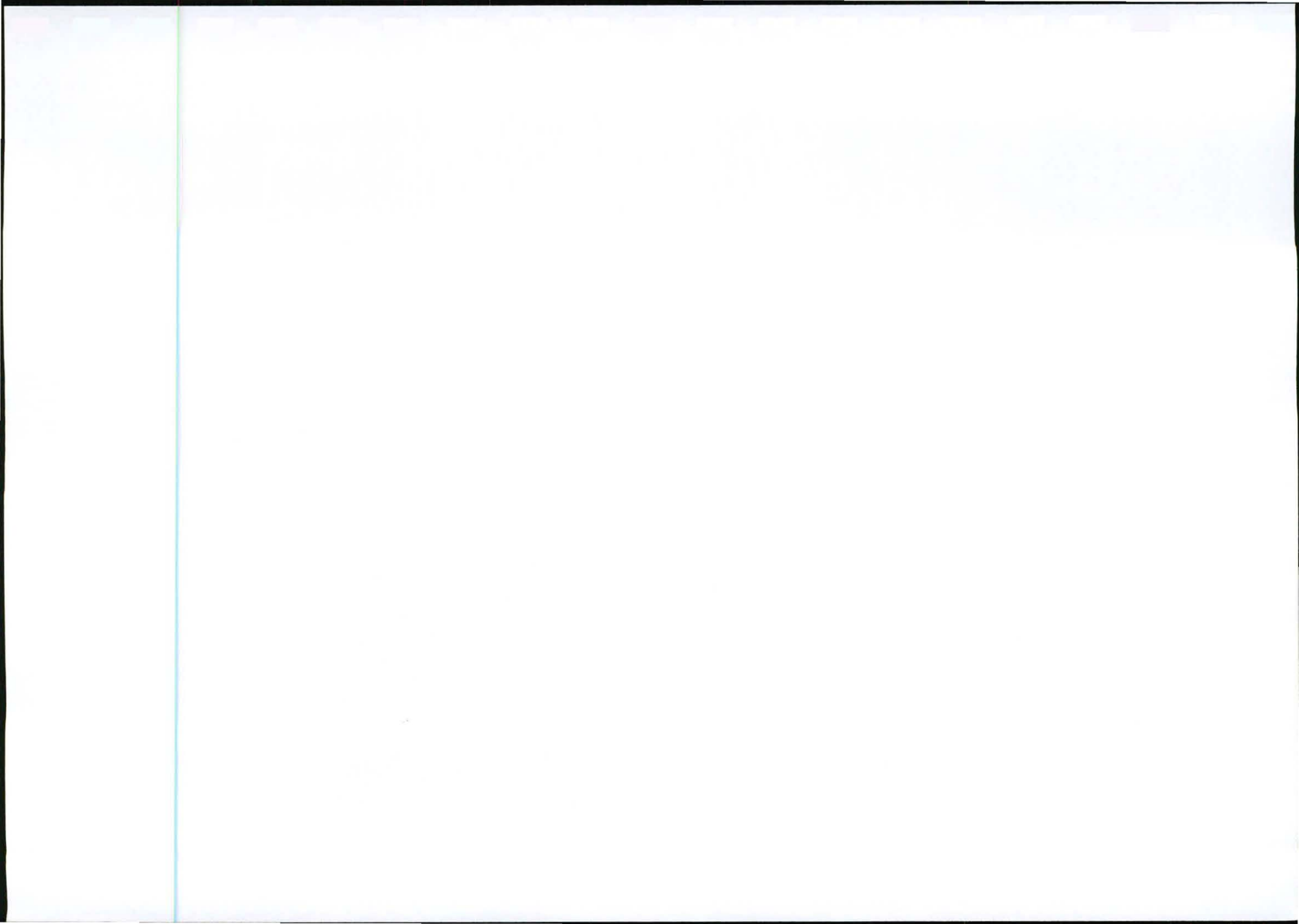




Figure 9: View eastwards from point B showing the access track on site.

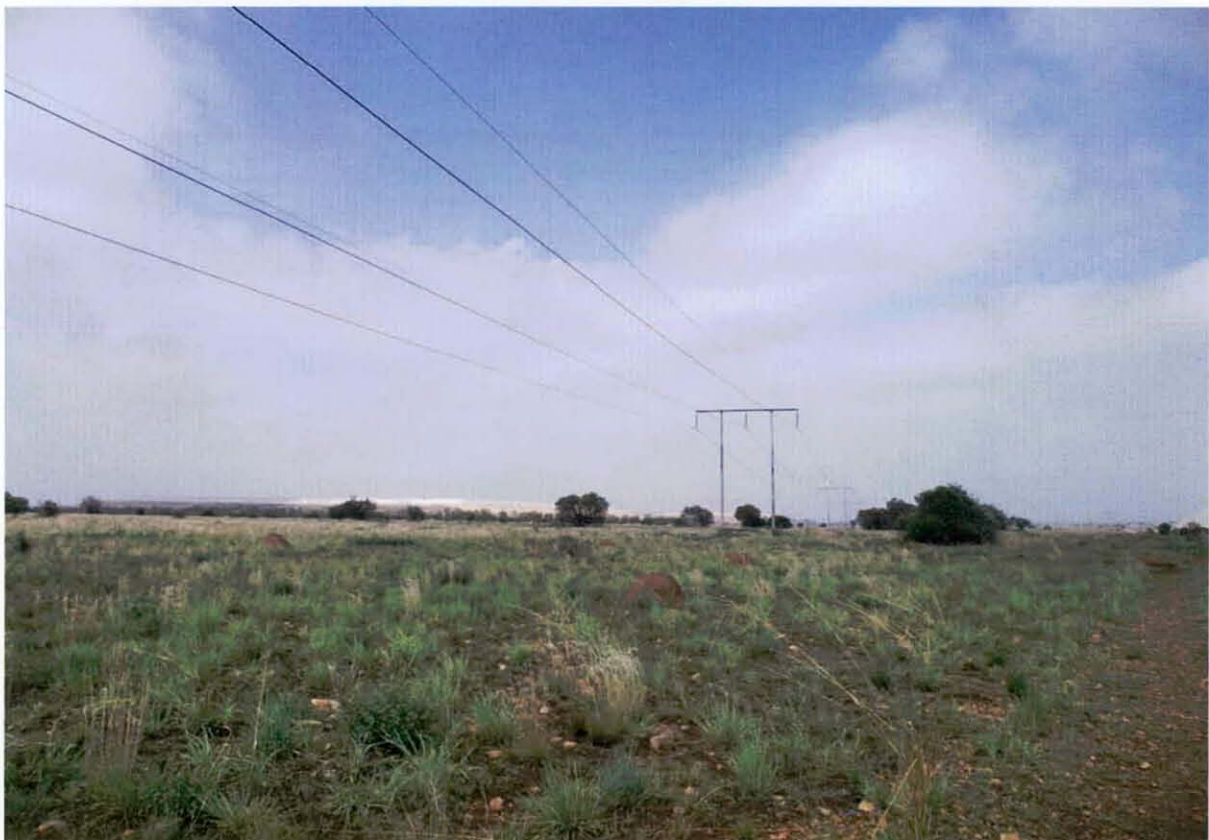


Figure 10: View westwards from point C powerlines that cross the site





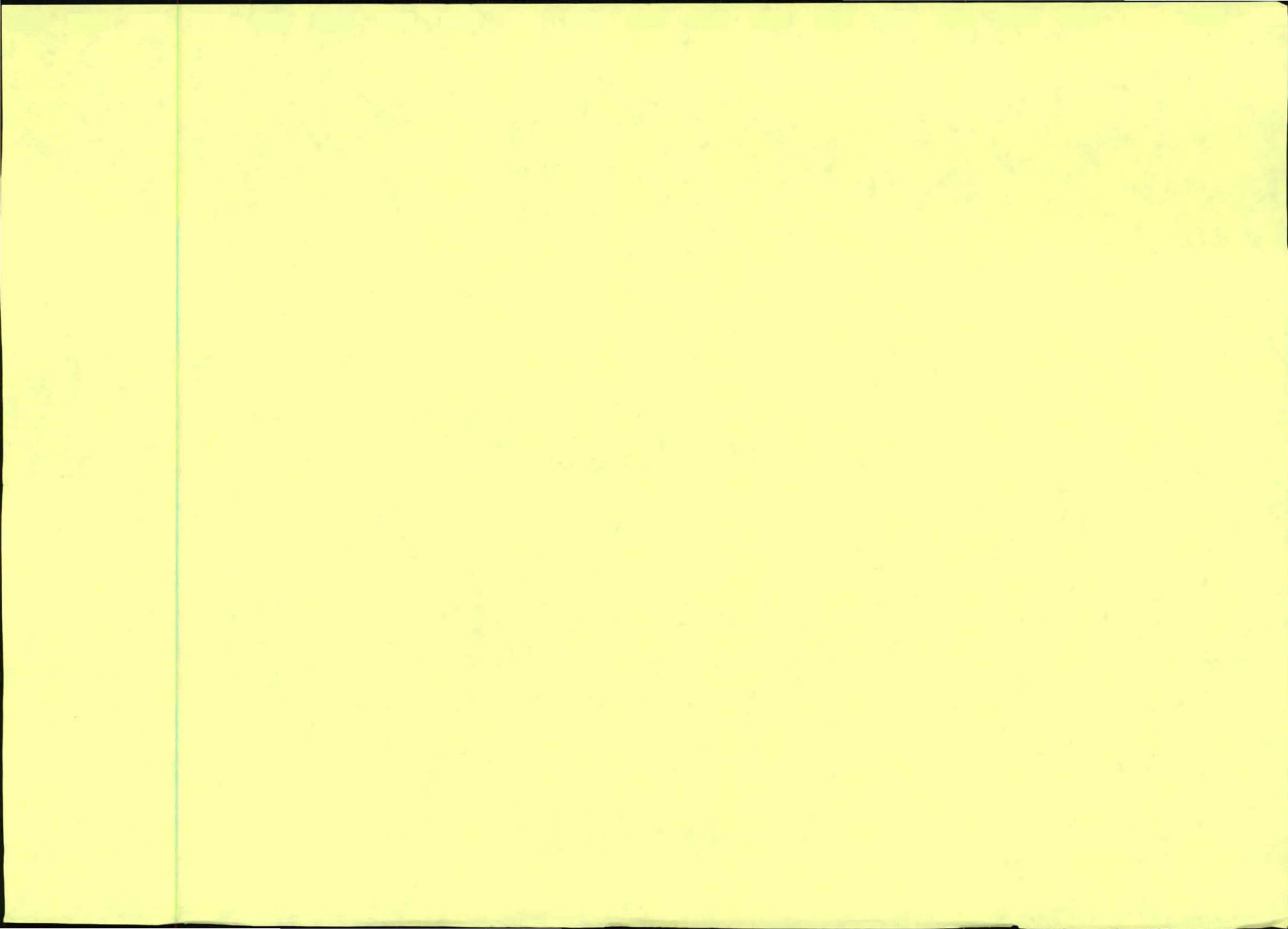
Figure 11: View northwards from point D.



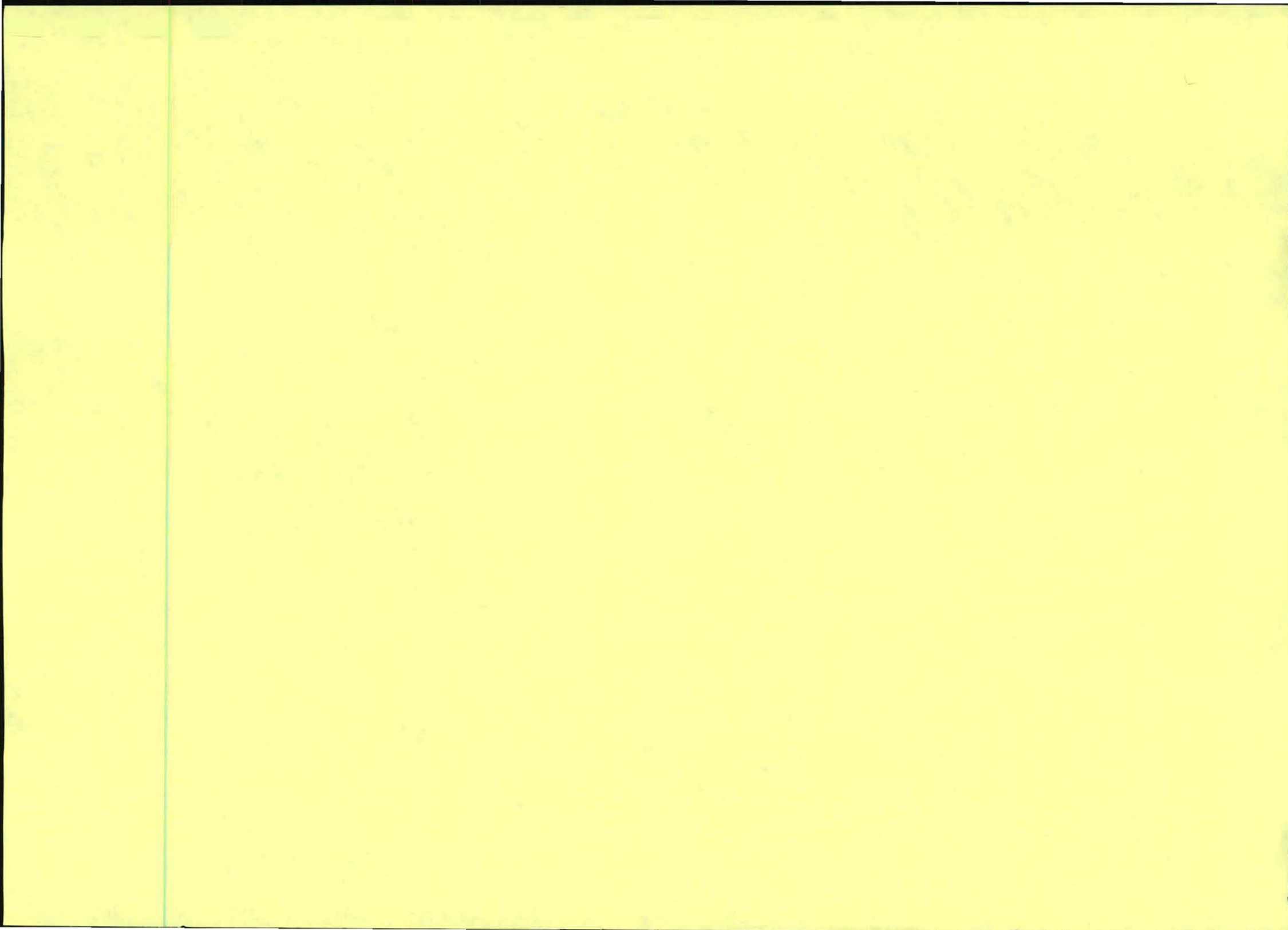
Figure 12: View of the Pamodzi Gold mine from point D (mine not operational)



Appendix E:
Background Information Document



Appendix F:
Ecological Scoping Study



SCOPING REPORT:

Specialist ecological study on the potential impacts of the proposed
Kabi Vaalkop Solar PV Facility, near Orkney, North-West Province

Prepared by

Dr David Hoare
(Ph.D., Pr.Sci.Nat.)

David Hoare Consulting cc
41 Soetdoring Ave
Lynnwood Manor,
Pretoria

for

Savannah Environmental (Pty) Ltd
PO Box 148,
Sunninghill,
2197

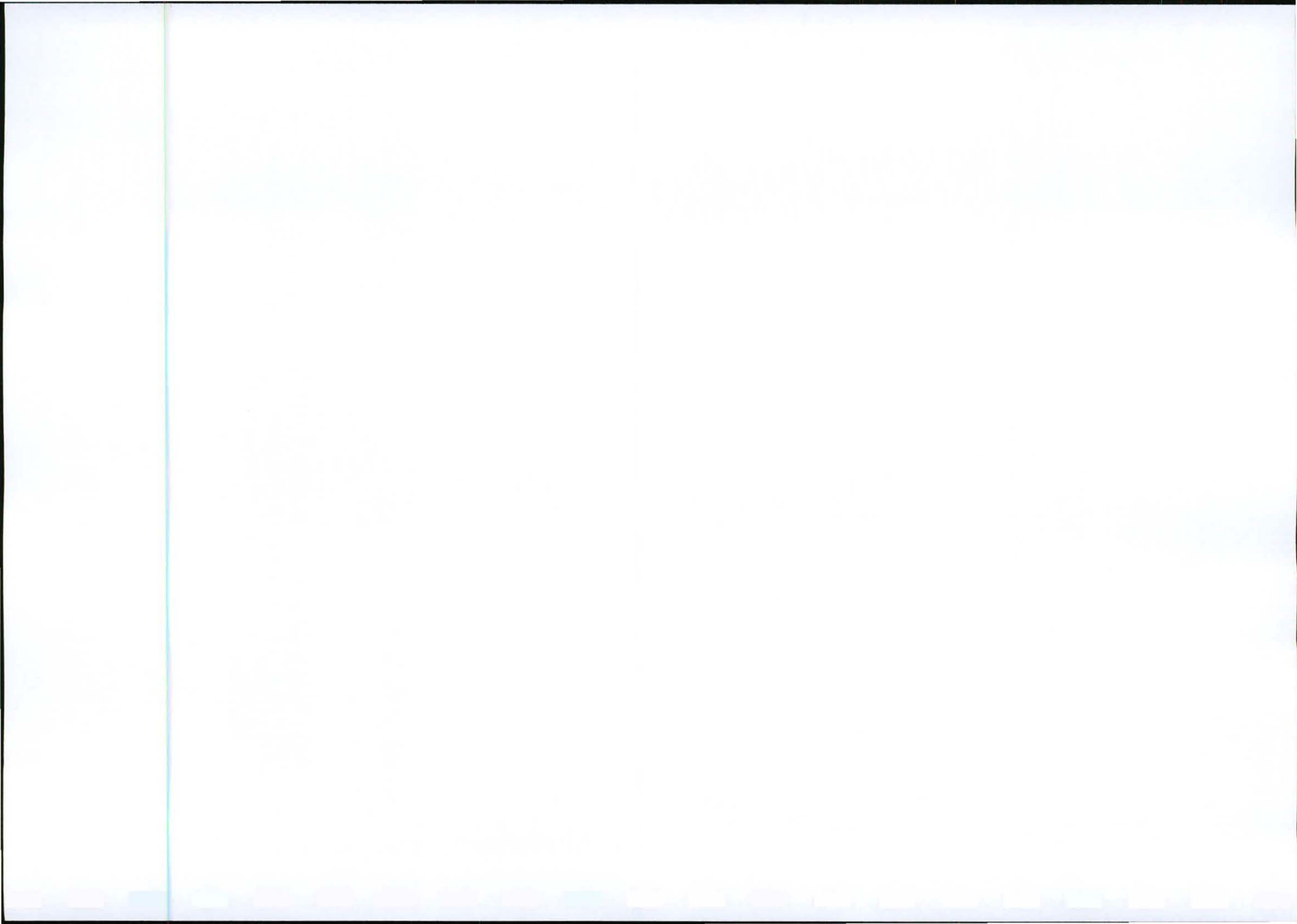
on behalf of
Kabi Solar (Pty) Ltd

3 February 2012

SCOPING REPORT: 2nd Draft



David Hoare Consulting cc
Biodiversity Assessments, Vegetation Description /
Mapping, Species Surveys



REGULATIONS GOVERNING THIS REPORT

This report has been prepared in terms the EIA Regulations promulgated under the *National Environmental Management Act* No. 107 of 1998 (NEMA) and is compliant with Regulation 543 Section 32 - Specialist reports and reports on specialized processes under the Act. Relevant clauses of the above regulation are quoted below and reflect the required information in the "Control sheet for specialist report" given above.

Regulation 32. (1): An applicant or the EAP managing an application may appoint a person who is independent to carry out a specialist study or specialized process.

Regulation 32. (2): A person referred to in subregulation (1) must comply with the requirements of regulation (17) i.e. is independent

Regulation 33. (3): A specialist report or a report on a specialized process prepared in terms of these Regulations must contain:

- (a) details of (i) the person who prepared the report, and
(ii) the expertise of that person to carry out the specialist study or specialized process;
- (b) declaration that the person is independent in a form as may be specified by the competent authority;
- (c) indication of the scope of, and the purpose for which, the report was prepared;
- (d) description of the methodology adopted in preparing the report or carrying out the specialized process;
- (e) description of any assumptions made and any uncertainties or gaps in knowledge;
- (f) description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment;
- (g) recommendations in respect of any mitigation measures that should be considered by the applicant and the competent authority;
- (h) description of any consultation process that was undertaken during the course of carrying out the study;
- (i) summary and copies of any comments that were received during any consultation process;
- (j) any other information requested by the competent authority.

Appointment of specialist

David Hoare of David Hoare Consulting cc was commissioned by Savannah Environmental (Pty) Ltd to provide specialist consulting services for the Environmental Impact Assessment for the proposed Kabi Vaalkop solar PV facility near Orkney in the North-West Province. The consulting services comprise an assessment of potential impacts on the flora, fauna, vegetation and ecology in the study area by the proposed project.

Details of specialist

Dr David Hoare
David Hoare Consulting cc
Postnet Suite no. 116
Private Bag X025
Lynnwood Ridge, 0040

Telephone: 012 804 2281

Cell: 083 284 5111
Fax: 086 550 2053
Email: dhoare@lantic.net

Summary of expertise

Dr David Hoare:

- Registered professional member of The South African Council for Natural Scientific Professions (Ecological Science, Botanical Science), registration number 400221/05.
- Founded David Hoare Consulting cc, an independent consultancy, in 2001.
- Ecological consultant since 1995.
- Conducted, or co-conducted, over 320 specialist ecological surveys as an ecological consultant.
- Published six technical scientific reports, 15 scientific conference presentations, seven book chapters and eight refereed scientific papers.
- Attended 15 national and international congresses & 5 expert workshops, lectured vegetation science / ecology at 2 universities and referee for 2 international journals.

Independence

David Hoare Consulting cc and its Directors have no connection with Kabi Solar (Pty) Ltd. David Hoare Consulting cc is not a subsidiary, legally or financially, of the proponent. Remuneration for services by the proponent in relation to this project is not linked to approval by decision-making authorities responsible for authorising this proposed project and the consultancy has no interest in secondary or downstream developments as a result of the authorisation of this project. David Hoare is an independent consultant to Savannah Environmental (Pty) Ltd and has no business, financial, personal or other interest in the activity, application or appeal in respect of which he was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of this specialist performing such work.

Scope and purpose of report

The scope and purpose of the report are reflected in the "Terms of reference" section of this report.

Conditions relating to this report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. David Hoare Consulting cc and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from on-going research or further work in this field, or pertaining to this investigation.

This report must not be altered or added to without the prior written consent of the author. This also refers to electronic copies of this report which are supplied for the purposes of inclusion as part of other reports, including main reports. Similarly, any recommendations, statements or conclusions drawn from or based on this report must make reference to this report. If these form part of a main report relating to this investigation or report, this report must be included in its entirety as an appendix or separate section to the main report.

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INTRODUCTION

Terms of reference and approach

Savannah Environmental (Pty) Ltd. was appointed by Kabi Solar (Pty) Ltd to undertake an application for environmental authorisation through an Environmental Impact Assessment (EIA) for a proposed solar energy facility on a site near Orkney, North-West Province. The project involves the establishment of a renewable energy facility for power generation and its associated infrastructure, including an array of photovoltaic (PV) panels, power lines to connect to Eskom's existing power lines, on-site substation/s to facilitate the connection between the facility and the power lines, internal and external access roads, maintenance buildings, lay down areas, and a site office. The purpose of the EIA is to identify environmental impacts associated with the project.

On 11 January 2012 David Hoare Consulting cc was appointed by Savannah Environmental (Pty) Ltd to undertake an ecological assessment of the study area. The specific terms of reference for the ecological scoping study include:

- to provide a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed project;
- to provide a description and evaluation of potential environmental issues and potential impacts (including direct, indirect and cumulative impacts) that have been identified;
- Direct, indirect and cumulative impacts of the identified issues must be evaluated within the Scoping Report in terms of the following criteria:
 - the **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected;
 - the **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international;
- a statement regarding the potential significance of the identified issues based on the evaluation of the issue/impacts;
- A statement regarding the desk-top evaluation of full site, with high-level identification of potential areas of sensitivity (for input into a sensitivity map)
- identification of potentially significant impacts to be assessed within the EIA phase;
- to provide recommendations regarding the methodology to be adopted in assessing potentially significant impacts in the EIA phase (sufficiently detailed to be included within the Plan of Study for EIA and must include a description of the proposed method of assessing the potential environmental impacts associated with the project).

This report provides details of the results of the Scoping phase. The findings of the study are based on a desktop assessment of the study area, including mapping from aerial imagery.

Study area location

At a regional level the study area falls within the North-West Province to the north-east of the town of Orkney. A more detailed description of the study area is provided in a section below.

METHODOLOGY

The assessment is to be undertaken in two phases, a Scoping phase and an Environmental Impact Assessment phase. The objective of the Scoping phase study was to review fauna and flora patterns within the study area in order to identify any highly sensitive areas that should be avoided during development. It was therefore necessary to provide checklists of sensitive species that could potentially occur in the study area as well as habitats with high conservation value. For potential species, only those of high conservation concern are provided. It was also intended to provide a draft habitat map of the study area based on available maps and database information. The results of the Scoping phase study are provided in this report.

Assessment philosophy

Many parts of South Africa contain high levels of biodiversity at species and ecosystem level. At any single site there may be large numbers of species or high ecological complexity. Sites also vary in their natural character and uniqueness and the level to which they have been previously disturbed. Assessing the potential impacts of a proposed development often requires evaluating the conservation value of a site relative to other natural areas and relative to the national importance of the site in terms of biodiversity conservation. A simple approach to evaluating the relative importance of a site includes assessing the following:

- Is the site unique in terms of natural or biodiversity features?
- Is the protection of biodiversity features on the site of national/provincial importance?
- Would development of the site lead to contravention of any international, national or provincial legislation, policy, convention or regulation?

Thus, the general approach adopted for this type of study is to identify any critical biodiversity issues that may lead to the decision that the proposed project cannot take place, i.e. to specifically focus on red flags and/or potential fatal flaws. Biodiversity issues are assessed by documenting whether any important biodiversity features occur on site, including species, ecosystems or processes that maintain ecosystems and/or species. These can be organised in a hierarchical fashion, as follows:

Species

1. threatened plant species
2. protected trees
3. threatened animal species

Ecosystems

1. threatened ecosystems
2. protected ecosystems
3. critical biodiversity areas
4. areas of high biodiversity
5. centres of endemism

Processes

1. corridors
2. mega-conservancy networks
3. rivers and wetlands
4. important topographical features

It is not the intention to provide comprehensive lists of all species that occur on site, since most of the species on these lists are usually common or widespread species. Rare, threatened, protected and conservation-worthy species and habitats are considered to be the highest priority, the presence of which are most likely to result in significant negative impacts on the ecological environment. The focus on national and provincial priorities and critical biodiversity issues is in line with National legislation protecting environmental and biodiversity resources, including, but not limited to the following which ensure protection of ecological processes, natural systems and natural beauty as well as the preservation of biotic diversity in the natural environment:

1. Environment Conservation Act (Act 73 of 1989)
2. National Environmental Management Act, 1998 (NEMA) (Act 107 of 1998)
3. National Environmental Management Biodiversity Act, 2004. (Act 10 of 2004)

Plant and animal species of conservation concern

There are two types of species of concern for the site under investigation, (i) those listed by conservation authorities as being on a Red List and are therefore considered to be at risk of extinction, and (ii) those listed as protected according to National and/or Provincial legislation.

Red List plant species

Determining the conservation status of a species is required in order to identify those species that are at greatest risk of extinction and, therefore, in most need of conservation action. South Africa has adopted the IUCN Red List Categories and Criteria to provide an objective, rigorous, scientifically founded system to identify Red List species. A published list of the Red List species of South African plants (Raimondo et al. 2009) contains a list of all species that are considered to be at risk of extinction. This list is updated regularly to take new information into account, but these are not published in book/paper format. Updated assessments are provided on the SANBI website (<http://redlist.sanbi.org/>). According to the website of the Red List of Southern African Plants (<http://redlist.sanbi.org/>), *the conservation status of plants indicated on the Red List of South African Plants Online represents the status of the species within South Africa's borders. This means that when a species is not endemic to South Africa, only the portion of the species population occurring within South Africa has been assessed. The global conservation status, which is a result of the assessment of the entire global range of a species, can be found on the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species: <http://www.iucnredlist.org>.* The South African assessment is used in this study.

The purpose of listing Red List plant species is to provide information on the potential occurrence of species at risk of extinction in the study area that may be affected by the proposed infrastructure. Species appearing on these lists can then be assessed in terms of their habitat requirements in order to determine whether any of them have a likelihood of occurring in habitats that may be affected by the proposed infrastructure.

Lists were compiled specifically for any species at risk of extinction (Red List species) previously recorded in the area. Historical occurrences of threatened plant species were obtained from the South African National Biodiversity Institute (<http://posa.sanbi.org>) for the quarter degree square/s within which the study area is situated. Habitat information for each species was obtained from various published sources. The probability of finding any of these species will then be assessed by comparing the habitat requirements with those habitats that occur on site.

Protected trees

Regulations published for the National Forests Act (Act 84 of 1998) as amended, provide a list of protected tree species for South Africa. The species on this list were assessed in order to determine which protected tree species have a geographical distribution that coincides with the study area and habitat requirements that may be met by available habitat in the study area. The distribution of species on this list were obtained from published sources (e.g. van Wyk & van Wyk 1997) and from the SANBI Biodiversity Information System website (<http://sibis.sanbi.org/>) for quarter degree grids in which species have been previously recorded. Species that have been recorded anywhere in proximity to the site (within 100 km), or where it is considered possible that they could occur there, were listed in the Scoping Report and were considered as being at risk of occurring there.

Other protected species

National legislation was evaluated in order to provide lists of any plant or animal species that have protected status. The most important legislation is the following:

- *National Environmental Management: Biodiversity Act (Act No 10 of 2004)*

This legislation contains lists of species that are protected. These lists were scanned in order to identify any species that have a geographical range that includes the study area and habitat requirements that are met by those found on site. These species were searched for within suitable habitats on site or, where relevant, it was stated that it was considered possible that they could occur on site.

There is additional legislation that provides lists of protected species, but the legislation to which these are attached deal primarily with harvesting or trade in listed species and do not specifically address transformational threats to habitat or individuals. This includes the following legislation:

- *CITES: Convention on the Trade in Endangered Species of Wild Fauna and Flora.*

Red List animal species

Lists of threatened animal species that have a geographical range that includes the study area were obtained from literature sources (for example, Alexander & Marais 2007, Branch 1988, 2001, du Preez & Carruthers 2009, Friedmann & Daly 2004, Mills & Hes 1997, Monadjem et al. 2010). The likelihood of any of them occurring was evaluated on the basis of habitat preference and habitats available at each of the proposed sites. The three parameters used to assess the probability of occurrence for each species were as follows:

- *Habitat requirements:* most Red Data animals have very specific habitat requirements and the presence of these habitat characteristics within the study area were assessed;
- *Habitat status:* in the event that available habitat is considered suitable for these species, the status or ecological condition was assessed. Often, a high level of degradation of a specific habitat type will negate the potential presence of Red Data species (especially wetland-related habitats where water-quality plays a major role); and
- *Habitat linkage:* movement between areas used for breeding and feeding purposes forms an essential part of ecological existence of many species. The connectivity of the study area to these surrounding habitats and adequacy of these linkages are assessed for the ecological functioning Red Data species within the study area.

Species probability of occurrence

Some species are highly mobile (e.g. many birds) or, in the case of plants, may be cryptic, difficult to find, rare, ephemeral or generally not easy to spot while undertaking a survey of a large area. An assessment of the possibility of these species occurring there was therefore provided. For all threatened or protected organisms (flora and fauna) that occur in the general

geographical area of the site, a rating of the likelihood of it occurring on site is given as follows:

- **LOW**: no suitable habitats occur on site / habitats on site do not match habitat description for species;
- **MEDIUM**: habitats on site match general habitat description for species (e.g. karoo shrubland), but detailed microhabitat requirements (e.g. mountain shrubland on shallow soils overlying sandstone) are absent on the site or are unknown from the descriptions given in the literature or from the authorities;
- **HIGH**: habitats found on site match very strongly the general and microhabitat description for the species (e.g. m mountain shrubland on shallow soils overlying sandstone);
- **DEFINITE**: species found in habitats on site.

Habitat sensitivity

The purpose of producing a habitat sensitivity map is to provide information on the location of potentially sensitive features in the study area. This was compiled by taking the following into consideration:

1. The general status of the vegetation of the study area was derived by compiling a landcover data layer for the study area (*sensu* Fairbanks et al. 2000) using available satellite imagery and aerial photography. From this it can be seen which areas are transformed versus those that are still in a natural status.
2. Various provincial, regional or national level conservation planning studies have been undertaken in the area, e.g. the National Spatial Biodiversity Assessment (NSBA). The mapped results from these were taken into consideration in compiling the habitat sensitivity map.
3. Habitats in which various species of plants or animals occur that may be protected or are considered to have high conservation status are considered to be sensitive.

An explanation of the different sensitivity classes is given in Table 1. Areas containing untransformed natural vegetation of conservation concern, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered potentially sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to potentially have low sensitivity.

Table 1: Explanation of sensitivity ratings.

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
VERY HIGH	<p>Indigenous natural areas that are highly positive for <u>any</u> of the following:</p> <ul style="list-style-type: none"> • presence of threatened species (Critically Endangered, Endangered, Vulnerable) and/or habitat critical for the survival of populations of threatened species. • <u>High</u> conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk). • <u>Protected</u> habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain 	<ul style="list-style-type: none"> • CBA 1 areas. • Remaining areas of vegetation type listed in Draft Ecosystem List of NEM:BA as Critically Endangered, Endangered or Vulnerable. • Protected forest patches. • Confirmed presence of populations of threatened species.

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
	Catchment Areas Act, Lake Areas Development Act) And may also be positive for the following: <ul style="list-style-type: none"> • <u>High</u> intrinsic biodiversity value (<u>high</u> species richness and/or turnover, unique ecosystems) • <u>High</u> value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value) • <u>Low</u> ability to respond to disturbance (low resilience, dominant species very old). 	
HIGH	Indigenous natural areas that are positive for any of the following: <ul style="list-style-type: none"> • <u>High</u> intrinsic biodiversity value (<u>moderate/high</u> species richness and/or turnover). • presence of habitat highly suitable for threatened species (Critically Endangered, Endangered, Vulnerable species). • <u>Moderate</u> ability to respond to disturbance (<u>moderate</u> resilience, dominant species of intermediate age). • <u>Moderate</u> conservation status (moderate proportion remaining intact, moderately fragmented, habitat for species that are at risk). • <u>Moderate to high</u> value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value). And may also be positive for the following: <ul style="list-style-type: none"> • <u>Protected</u> habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act) 	<ul style="list-style-type: none"> • CBA 2 "critical biodiversity areas". • Habitat where a threatened species could potentially occur (habitat is suitable, but no confirmed records). • Confirmed habitat for species of lower threat status (near threatened, rare). • Habitat containing individuals of extreme age. • Habitat with low ability to recover from disturbance. • Habitat with exceptionally high diversity (richness or turnover). • Habitat with unique species composition and narrow distribution. • Ecosystem providing high value ecosystem goods and services.
MEDIUM-HIGH	Indigenous natural areas that are positive for <u>one</u> or <u>two</u> of the factors listed above, but not a combination of factors.	<ul style="list-style-type: none"> • CBA 2 "corridor areas". • Habitat with high diversity (richness or turnover). • Habitat where a species of lower threat status (e.g. (near threatened, rare) could potentially occur (habitat is suitable,

Sensitivity	Factors contributing to sensitivity	Example of qualifying features
		but no confirmed records).
MEDIUM	Other indigenous natural areas in which factors listed above are of no particular concern. May also include natural buffers around ecologically sensitive areas and natural links or corridors in which natural habitat is still ecologically functional.	
MEDIUM-LOW	Degraded or disturbed indigenous natural vegetation.	
LOW	No natural habitat remaining.	

Any natural vegetation within which there are features of conservation concern will be classified into one of the high sensitivity classes (MEDIUM-HIGH, HIGH or VERY HIGH. The difference between these three high classes is based on a combination of factors and can be summarised as follows:

1. Areas classified into the VERY HIGH class are vital for the survival of species or ecosystems. They are either known sites for threatened species or are ecosystems that have been identified as being remaining areas of vegetation of critical conservation importance. CBA1 areas would qualify for inclusion into this class.
2. Areas classified into the HIGH class are of high biodiversity value, but do not necessarily contain features that would put them into the VERY HIGH class. For example, a site that is known to contain a population of a threatened species would be in the VERY HIGH class, but a site where a threatened species could potentially occur (habitat is suitable), but it is not known whether it does occur there or not, is classified into the HIGH sensitivity class. The class also includes any areas that are not specifically identified as having high conservation status, but have high local species richness, unique species composition, low resilience or provide very important ecosystem goods and services. CBA2 "irreplaceable biodiversity areas" would qualify for inclusion into this class, if there were no other factors that would put them into the highest class.
3. Areas classified into the MEDIUM-HIGH sensitivity class are natural vegetation in which there are one or two features that make them of biodiversity value, but not to the extent that they would be classified into one of the other two higher categories. CBA2 "corridor areas" would qualify for inclusion into this class.

Limitations and exclusions

- Red List species are, by their nature, usually very rare and difficult to locate. Compiling the list of species that could potentially occur in an area is limited by the paucity of collection records that make it difficult to predict whether a species may occur in an area or not. The methodology used in this assessment is designed to reduce the risks of omitting any species, but it is always possible that a species that does not occur on a list may be unexpectedly located in an area.
- It is not the intention of this study to produce comprehensive lists of species occurring on site (see "Assessment philosophy" section above). This would require detailed site assessments that are not necessary for providing an assessment of impacts associated with the proposed project. No checklists of species occurring on site are, therefore, provided for this study, although they are available from previous studies of the site.

DESCRIPTION OF STUDY AREA

Location

The study site is situated to the north-east of Orkney within the North-West Province (Figure 1). The site falls within the quarter degree grid 2626DC. The proposed facility would occur on the following farm portions: portion 7 of the Farm Vaalkop 439 IP, a portion of Portion 3 of Farm Vaalkop 439 IP, and a portion of Portion 200 of the Farm Nooitgedacht 434 IP.

No alternative site is currently being considered for the proposed facility, but the current site is sufficiently large to allow placement of the facility in alternative positions within the site in order to avoid any identified environmental sensitivities. The site was selected based on the local topography, solar irradiation and access to the electricity grid.

The study area is accessible from Orkney via the R502 and from various local access roads. The site is therefore relatively accessible by means of existing roads.

Topography

The topography of the study site is relatively flat. There is a slight drop in elevation towards the Vaal River and from east to west. The elevation on site varies from 1330 to 1344 m above sea level over a distance of 1.5 km, which is a very gentle slope. There are no obvious

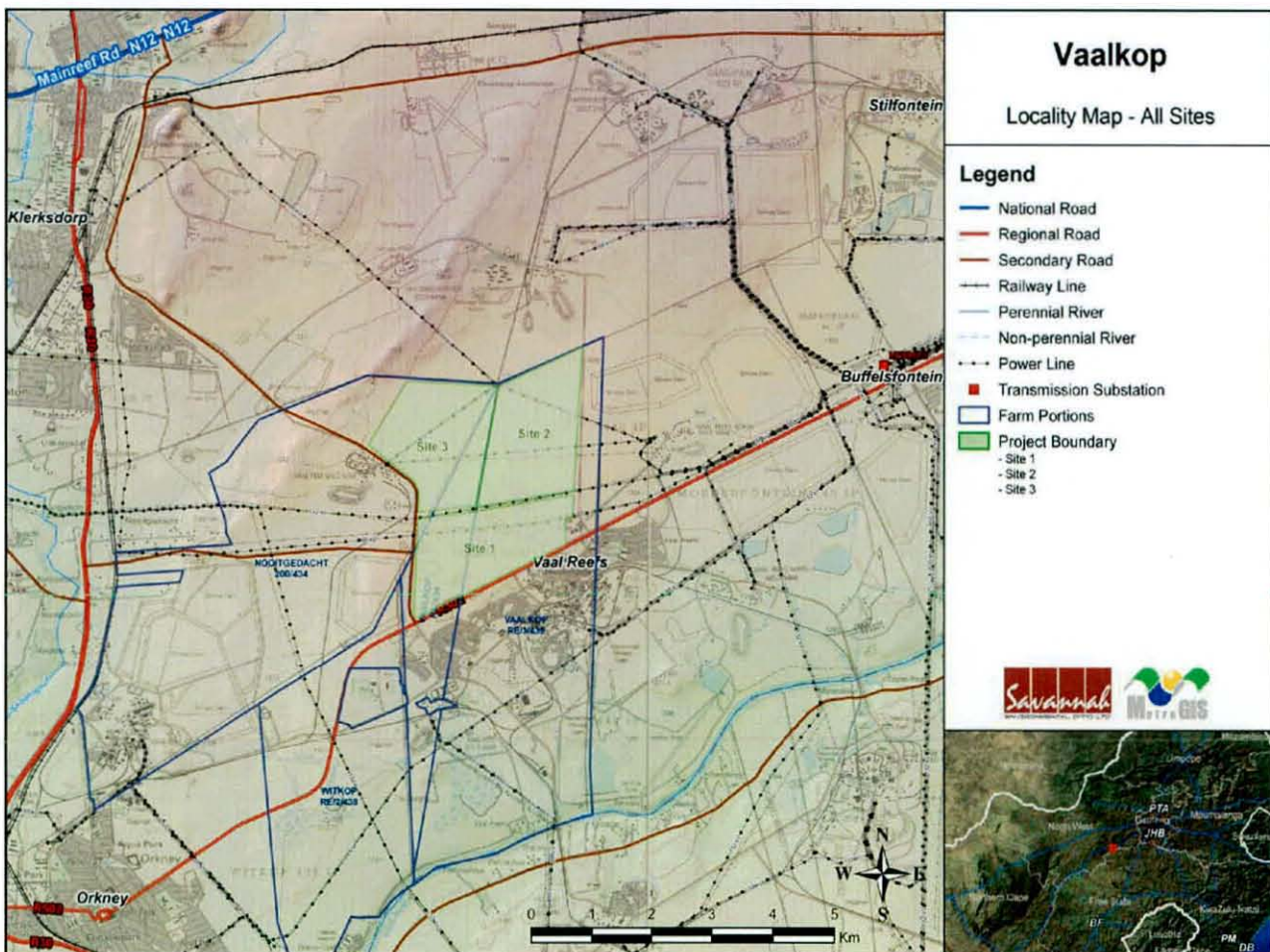
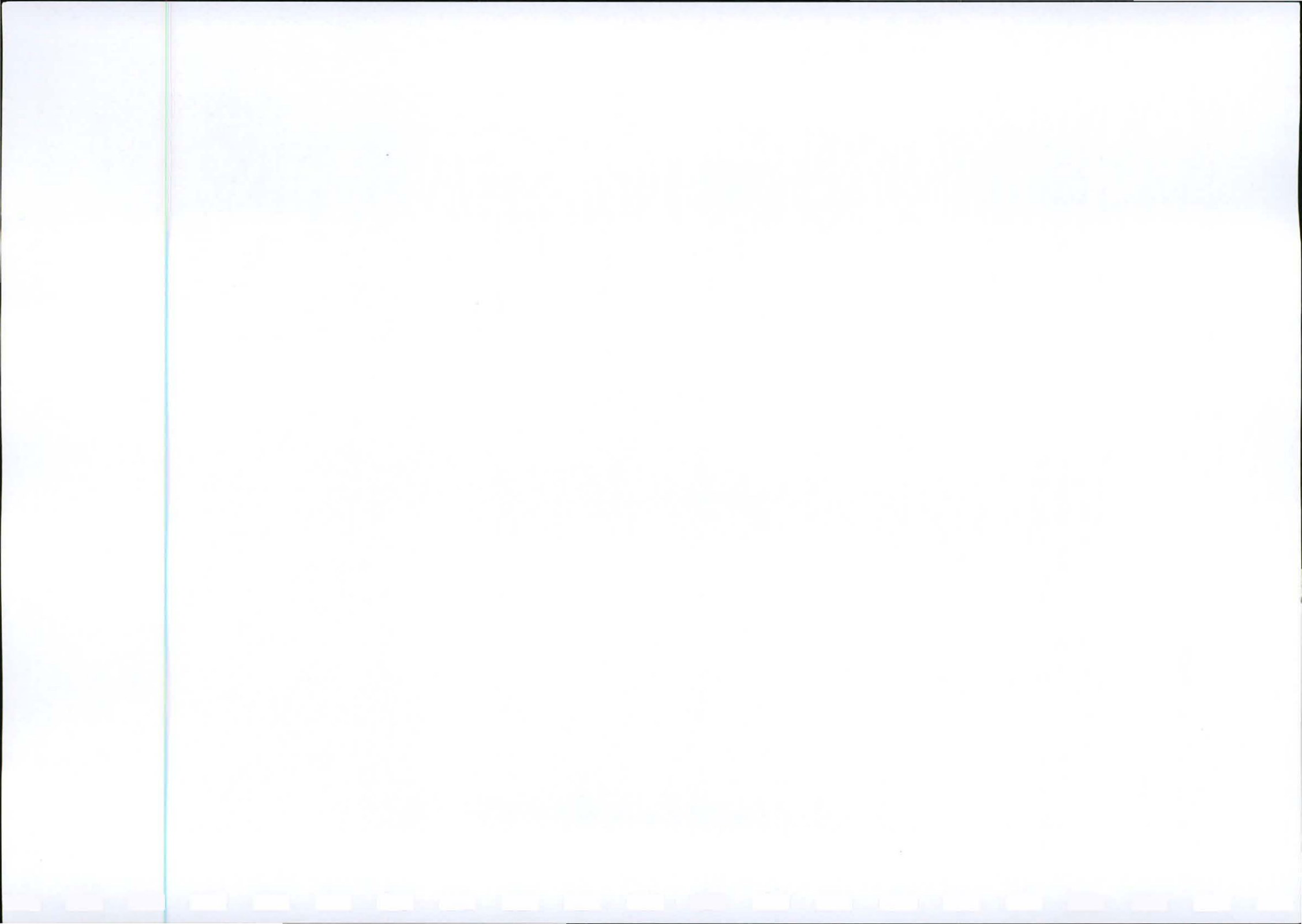


Figure 1: Location of the proposed Solar Power Plant



topographical features on site nor are there any obvious drainage lines and/or wetland features.

Land types and soils

Detailed soil information is not available for broad areas of the country. As a surrogate, landtype data was used to provide a general description of soils in the study area (landtypes are areas with largely uniform soils, topography and climate). There is one land type in the study area, namely the Fa land type (Land Type Survey Staff, 1987).

The F-group of land types refer to pedologically young landscapes that are not predominantly rock and nor predominantly alluvial or aeolian and in which the dominant soil-forming processes have been rock weathering, the formation of orthic topsoil horizons and, commonly, clay illuviation, giving rise typically to lithocutanic horizons (MacVicar et al. 1974). The soil forms that epitomise these processes are Glenrosa and Mispah. The Fa landtype consists of land in which lime in the soil is not encountered regularly in any part of the landscape (MacVicar et al. 1974).

Climate

The climate is typical of the Highveld. Rainfall occurs from November to April. Mean annual rainfall is 520 mm per year. All areas with rainfall of between 400 mm and 600 mm are considered to be intermediate between dry and moist. The study area can therefore be considered to be an intermediate, summer rainfall area.

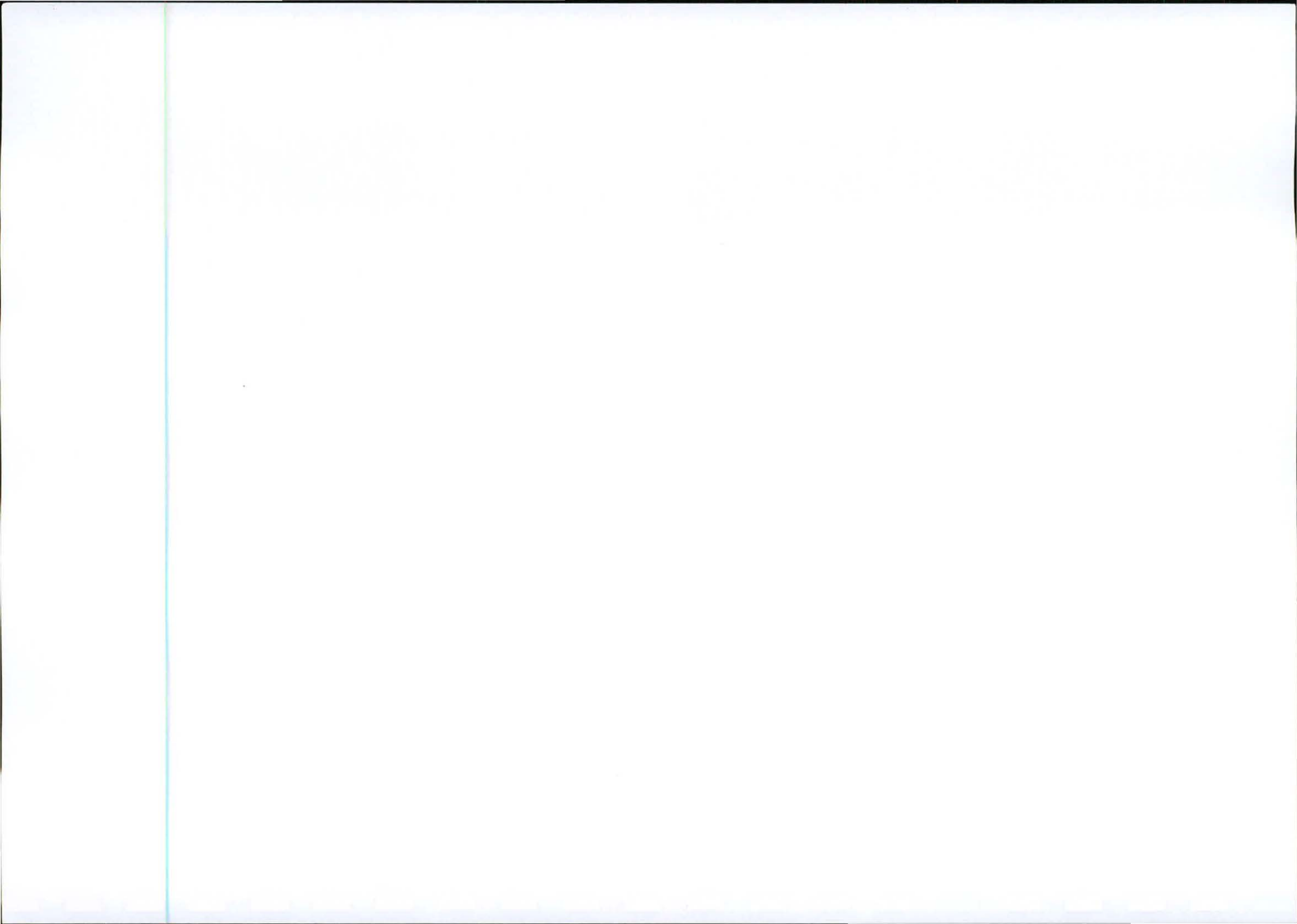
Landuse and landcover of the study area

The general area is within a mining belt. There are a number of mines nearby as well as urban centres to accommodate mine-related industries and staff. Nearby urban centres include Orkney, Klerksdorp, Alabama and Stilfontein. The major land-use in the area is, however, agriculture and there are extensive areas of cultivated lands nearby, especially to the south across the Vaal River.

A landcover map of the study area (Fairbanks *et al.* 2000) indicates that the entire site consists of natural vegetation. The landcover on site is classified as "unimproved grassland". This is the same as indicated on the 1:50 000 topo-cadastral map, which shows only natural vegetation on site, with the exception of a small area of diggings in the south-western part of the site. Google imagery of the site provides a similar assessment. This shows some disturbance to natural vegetation in the south-western parts of the site associated with diggings of some sort, otherwise the entire site is natural vegetation.

Broad vegetation types of the region

The study area falls within the Grassland Biome (Rutherford & Westfall 1986, Mucina & Rutherford 2006). The most recent and detailed description of the vegetation of this region is part of a national map (Mucina, Rutherford & Powrie, 2005; Mucina *et al.* 2006). This map shows one vegetation type occurring within the study site, namely Vaal Reefs Dolomite Sinkhole Woodland. There is a small area of azonal Highveld Salt Pans to the south of the site, Vaal-Vet Sandy Grassland nearby and Rocky Highveld Grassland towards the east, but these



do not fall within the study area. Further away towards the north-east is Carletonville Dolomite Grassland associated with the same geology as that found on site and which may, therefore, contain floristic elements similar to those found on site. The vegetation type that occurs on site is described in more detail below.

Vaal Reefs Dolomite Sinkhole Vegetation

This vegetation type occurs in a small area associated with dolomite sinkholes in and around Stilfontein and Orkney and occurs only to the north of the Vaal River. It occurs on a slightly undulating landscape that is dissected by prominent rocky chert ridges. The vegetation is a grassland-woodland complex of which the woodland is the most typical feature. This woodland occurs naturally in clumps around sinkholes, especially in places of dolomite outcrops (Mucina et al., 2006). The vegetation type is considered to be mapped at too coarse a scale and requires more clear separation from Carletonville Dolomite Grassland (Mucina et al., 2006). This remark indicates that, where there is no woodland, the vegetation is a grassland that could be considered to be floristically equivalent to Carletonville Dolomite Grassland.

Conservation status of broad vegetation types

On the basis of a recently established approach used at national level by SANBI (Driver et al. 2005), vegetation types can be categorised according to their conservation status which is, in turn, assessed according to the degree of transformation relative to the expected extent of each vegetation type. The status of a habitat or vegetation type is based on how much of its original area still remains intact relative to various thresholds. The original extent of a vegetation type is as presented in the most recent national vegetation map (Mucina, Rutherford & Powrie 2005) and is the extent of the vegetation type in the absence of any historical human impact. On a national scale the thresholds are as depicted in Table 1, as determined by best available scientific approaches (Driver et al. 2005).

The level at which an ecosystem becomes Critically Endangered differs from one ecosystem to another and varies from 16% to 36% of the ecosystem still remaining in a natural state (Driver et al. 2005). The vegetation types occurring in the study area (Table 2) is classified as Vulnerable (Driver et al. 2005; Mucina et al., 2006).

Table 1: Determining ecosystem status (from Driver et al. 2005). *BT = biodiversity target (the minimum conservation requirement).

Habitat remaining (%)	80-100	least threatened	LT
	60-80	vulnerable	VU
	*BT-60	endangered	EN
	0-*BT	critically endangered	CR

The Draft National List of Threatened Ecosystems (GN1477 of 2009), published under the National Environmental Management: Biodiversity Act (Act No. 10, 2004), lists national vegetation types that are afforded protection on the basis of rates of transformation. The thresholds for listing in this legislation are higher than in the scientific literature, which means there are fewer ecosystems listed in the Draft Ecosystem List versus in the scientific literature. The vegetation types occurring on site are not listed in the Draft National List of Threatened Ecosystems (GN1477 of 2009).

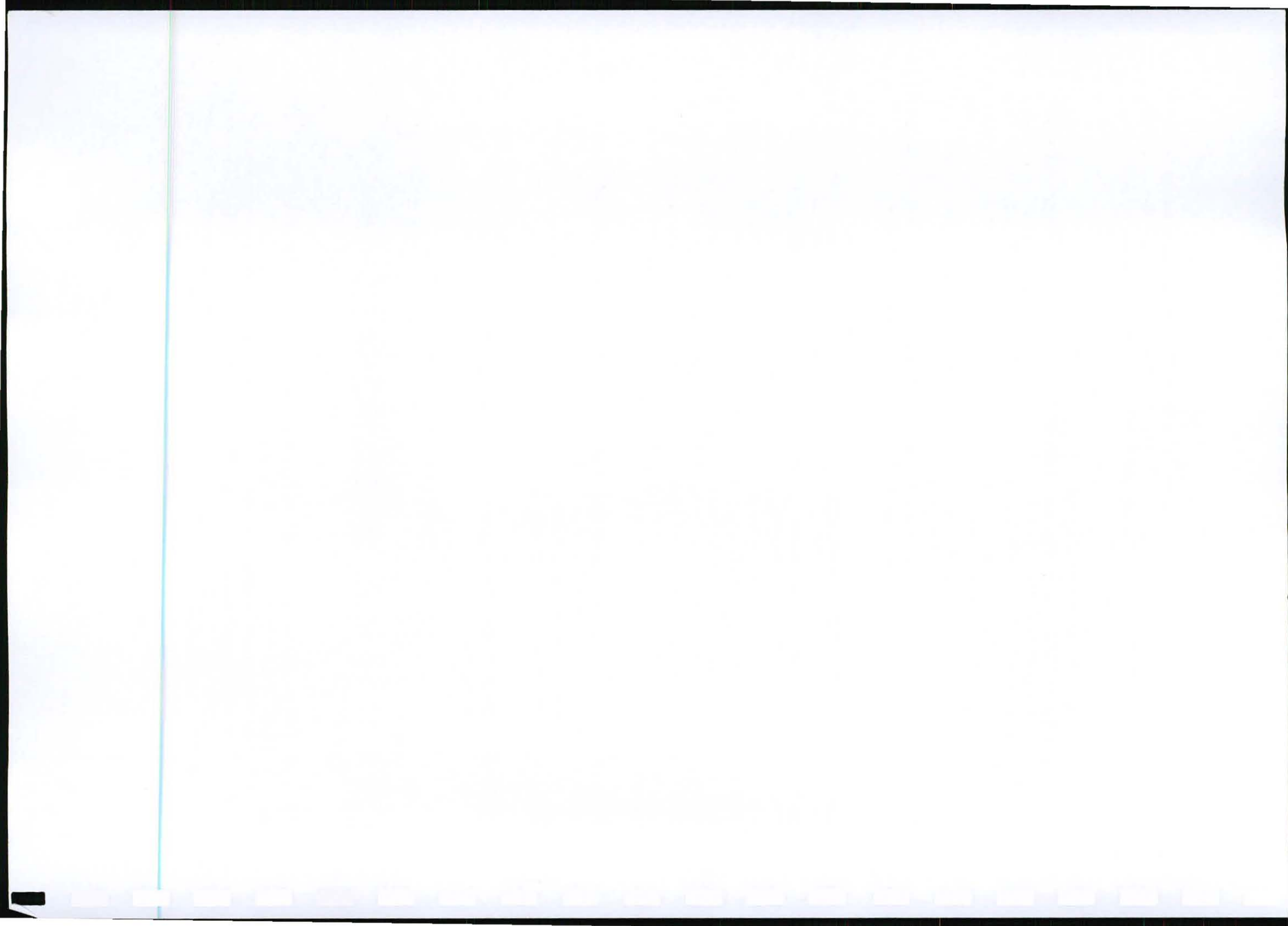


Table 2: Conservation status of different vegetation types occurring in the study area, according to Driver *et al.* 2005 and Mucina *et al.* 2005.

Vegetation Type	Target (%)	Conserved (%)	Transformed (%)	Conservation status	
				Driver <i>et al.</i> 2005; Mucina <i>et al.</i> , 2006	National Ecosystem List (NEMBA)
Vaal Reefs Dolomite Sinkhole Vegetation	24	0	23	Vulnerable	Not listed

No Critical Biodiversity Areas have been identified for municipal areas of the North-West Province (bgis.sanbi.org). It is therefore not possible to identify areas of concern at a regional level in the current study area.

Red List plant species of the study area

Lists of plant species of conservation concern previously recorded in the quarter degree grids in which the study area is situated were obtained from the South African National Biodiversity Institute. These are listed in Appendix 1. Additional species that could occur in similar habitats, as determined from database searches and literature sources, but have not been recorded in these grids are also listed.

There were five species on this list, one listed as Near Threatened and four listed as Declining. The conservation categories of "declining" and "rare" are of much lower conservation importance than species classified as threatened (critically endangered, endangered or vulnerable) or near threatened.

The species, *Lithops lesliei* subsp. *lesliei*, is listed as Near Threatened. Information from the SANBI website indicates that this species has not been previously listed in the grid in which the site is located, but occurs in neighbouring grids. The site is within the species' overall distribution range. *Lithops lesliei* subsp. *lesliei* therefore has a high probability of occurring on site. This species is found primarily in arid grasslands, usually in rocky places, growing under the protection of forbs and grasses. The main threats to this species are muthi harvesting, which has recently become the biggest threat to its persistence, followed by succulent collectors and habitat destruction.

The bulb, *Crinum bulbispermum*, is listed as Declining. It is found near rivers and streams, in seasonal pans and in damp depressions. There is a moderate probability of it occurring in the wet areas that are known to occur on site.

The geophytic forb, *Pelargonium sidoides*, is listed as Declining. This species is usually found in short grassland, sometimes with occasional shrubs or trees, often in stony soils. previous surveys of the property (De Castro 2007, van Wyk & Gotze 2011) indicate that suitable conditions probably occur on site.

The bulb, *Boophane disticha*, is listed as Declining. It was found on site during previous surveys of the property (De Castro 2007, van Wyk & Gotze 2011). This species is found in dry grassland and rocky areas.

The bulb, *Hypoxis hemerocallidea*, is listed as Declining. It was found on site during previous surveys of the property (De Castro 2007, van Wyk & Gotze 2011). This species may occur in a

wide range of habitats, including open, rocky grassland, dry, stony, grassy slopes, mountain slopes and plateaus and is also often recorded on the footslopes adjacent to wetland areas.

On the basis of the information presented here, it is concluded that there are no threatened plant species that are likely to occur on site, but there is one near threatened species that could occur on site, two Declining plant species that definitely occur there and an additional two Declining plant species that could occur there.

Table 3: Explanation of IUCN Ver. 3.1 categories (IUCN, 2001), and Orange List categories (Victor & Keith, 2004).

IUCN / Orange List category	Definition	Class
EX	Extinct	Extinct
CR	Critically Endangered	Red List
EN	Endangered	Red List
VU	Vulnerable	Red List
NT	Near Threatened	Orange List
Declining	Declining taxa	Orange List
Rare	Rare	Orange List
Critically Rare	Rare: only one subpopulation	Orange List
Rare-Sparse	Rare: widely distributed but rare	Orange List
DDD	Data Deficient: well known but not enough information for assessment	Orange List
DDT	Data Deficient: taxonomic problems	Data Deficient
DDX	Data Deficient: unknown species	Data Deficient

Protected plants (National Environmental Management: Biodiversity Act)

Plant species protected under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) are listed in Appendix 5. There is one plant species that appears on this list that could potentially occur in the region, *Harpagophytum procumbens* (devil's claw). This species has not previously been recorded in the grid and the site is >50 km to the north-east of the known range of this species. This species is associated mainly with dry sandveld on deep Kalahari sand. It usually occupies plains, dune bases and interdunes. Soils are usually sandy but can be rocky. They are generally nutrient poor, often with lime. On the basis of distribution and substrate requirements, it is considered highly unlikely that it occurs on site.

Red List and protected animal species of the study area

All Red List vertebrates (mammals, birds, reptiles, amphibians) that could occur in the study area are listed in Appendix 2. A complete list of all vertebrates (mammals, birds, reptiles, amphibians) that could potentially occur in the study area are listed in Appendix 5. Those Red List vertebrate species with a geographical distribution that includes the study area, and habitat preference that includes habitats available in the study area are discussed further.

There are four mammal species of conservation concern that could occur in available habitats in the study area. This includes one species classified as Endangered, the White-tailed Rat, one species classified as Near Threatened (NT), the Brown Hyaena and two species classified in South Africa as Near Threatened, but globally as Least Concern (LC), the South African Hedgehog and the Honey Badger. There are an additional two mammal species that could occur on site that are not listed as of conservation concern, but which are protected. These are the Black-footed Cat and Cape Fox.

There are three threatened bird species (Blue Crane, Lesser Kestrel, White-bellied Korhaan, all VU) and two Near Threatened bird species (Lanner Falcon, Melodious Lark) that have a medium to high probability of utilising available habitats in the study area, either for foraging or breeding. These species may use the site or parts of the site primarily for foraging. Loss of a relatively small area of foraging will not affect these species significantly.

The Giant Bullfrog is the only amphibian species of conservation concern with a distribution that includes the study area and which could occur on site. This species is classified as Least Concern globally and Near threatened in South Africa. It is, however, protected under the National Environmental Management: Biodiversity Act and any impacts on a specimen of this species or that may negatively affect the survival of the species would require a permit. The Giant Bullfrog inhabits a variety of vegetation types where it breeds in seasonal, shallow, grassy pans in flat, open areas. It also utilises non-permanent vleis and shallow water on margins of waterholes and dams. It prefers sandy substrates although they sometimes inhabit clay soils. Habitats such as these probably do not occur on site. It was therefore assessed that there was a low probability of it occurring on site.

There is one reptile species of conservation concern that has a distribution that includes the study area, the Striped Harlequin Snake, listed as Near Threatened. This is a small, slender snake found in moist savannah and grassland, inhabiting deserted termite mounds or is found under stones in grassland. It is endemic to South Africa. It is a shy species that is seldom found and also lives mostly underground. It could potentially occur on site.

The threatened, near threatened and protected species of potential concern for the site are therefore as follows:

- White-tailed Rat (EN),
- Brown Hyaena (NT, protected),
- South African Hedgehog (NT/LC, protected),
- Black-footed Cat (protected),
- Honey Badger (NT/LC, protected),
- Cape Fox (protected),
- Blue Crane (VU),
- Lanner Falcon (NT),
- Lesser Kestrel (VU),
- Melodious Lark (NT),
- White-bellied Korhaan (VU),
- Striped Harlequin Snake (NT),
- Giant Bullfrog (protected).

Protected trees

Tree species protected under the National Forest Act are listed in Appendix 3. There are two that have a geographical distribution that includes the study area, *Boscia albitrunca* (Shepherd's Tree / Witgatboom / !Xhi) and *Acacia erioloba* (Camel Thorn, Kameeldoring).

Boscia albitrunca occurs in semi-desert areas and bushveld, often on termitaria, but is common on sandy to loamy soils and calcrete soils. It is usually quite common where it is found. The site is just outside the very edge of its distribution range. It was not recorded on site during previous detailed floristic studies of the site (De Castro 2007, van Wyk & Gotze 2011).

The tree, *Acacia erioloba*, occurs in dry woodland along watercourses in arid areas where underground water is present as well as on deep Kalahari sands. It has been previously recorded in the grid in which the site is located, but was not recorded on site during previous detailed floristic studies of the site (De Castro 2007, van Wyk & Gotze 2011).

On the basis of the information presented here, it is concluded that, although there are two protected tree species that could occur in the geographical area that includes the site, there are no protected tree species on the site itself.

Sensitivity assessment

The sensitivity assessment identifies those parts of the study area that have high conservation value or that may be sensitive to disturbance. Areas of sensitivity are shown in Figure 2. An explanation of the different sensitivity classes is given in Table 4.

Table 4: Explanation of sensitivity ratings.

Sensitivity	Factors contributing to sensitivity
VERY HIGH	Indigenous natural areas that are highly positive for the following: <ul style="list-style-type: none"> • <u>High</u> intrinsic biodiversity value (<u>high</u> species richness and/or turnover, presence of species of concern, unique ecosystems). • <u>Low</u> ability to respond to disturbance (low resilience, dominant species very old). • <u>High</u> conservation status (low proportion remaining intact, highly fragmented, habitat for species that are at risk). • <u>High</u> value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value) • <u>Protected</u> habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)
HIGH	Indigenous natural areas that are moderately positive for the following: <ul style="list-style-type: none"> • <u>Moderate</u> intrinsic biodiversity value (<u>moderate</u> species richness and/or turnover, presence of species of concern). • <u>Moderate</u> ability to respond to disturbance (<u>moderate</u> resilience, dominant species of intermediate age). • <u>Moderate</u> conservation status (low proportion remaining intact, moderately fragmented, habitat for species that are at risk). • <u>Moderate</u> value ecological goods & services (e.g. water supply, erosion control, soil formation, carbon storage, pollination, refugia, food production, raw materials, genetic resources, cultural value). <p>And may also be positive for the following:</p> <ul style="list-style-type: none"> • <u>Protected</u> habitats (areas protected according to national / provincial legislation, e.g. National Forests Act, Draft Ecosystem List of NEM:BA, Integrated Coastal Zone Management Act, Mountain Catchment Areas Act, Lake Areas Development Act)
MEDIUM-HIGH	Indigenous natural areas that are positive for <u>one</u> or <u>two</u> of the factors listed above.
MEDIUM	Other indigenous natural areas in which factors listed above are of no particular concern. May also include natural buffers around ecologically sensitive areas and natural links or corridors in which natural habitat is still ecologically functional.
MEDIUM-LOW	Degraded or disturbed indigenous natural vegetation.
LOW	No natural habitat remaining.

Areas containing untransformed natural vegetation of conservation concern, high diversity or habitat complexity, Red List organisms or systems vital to sustaining ecological functions are considered potentially sensitive. In contrast, any transformed area that has no importance for the functioning of ecosystems is considered to potentially have low sensitivity. The information provided in the preceding sections was used to evaluate sensitivity of natural habitats and areas important for maintaining ecological processes in the study area. There are a number of features that need to be taken into account in order to evaluate sensitivity in the study area. These include the following:

1. Potential occurrence of populations of Red List or protected organisms, including flora and fauna, that have been evaluated as having a probability of occurring within natural habitats within the study area. The species of potential concern for the site are listed in a section above.

These factors have been taken into account in evaluating sensitivity within the study area (Figure 2). The sensitivity classification is as follows:

1. MEDIUM-HIGH: Remaining natural vegetation in the study is classified as having medium-high sensitivity (see Table 4 and Figure 2). Although the vegetation is considered to be in moderate to poor condition (van Wyk & Gotze 2011), these are areas of natural vegetation which are potential habitat for various plant and animal species of conservation concern (see Table 4 for definition of sensitivity classes). The

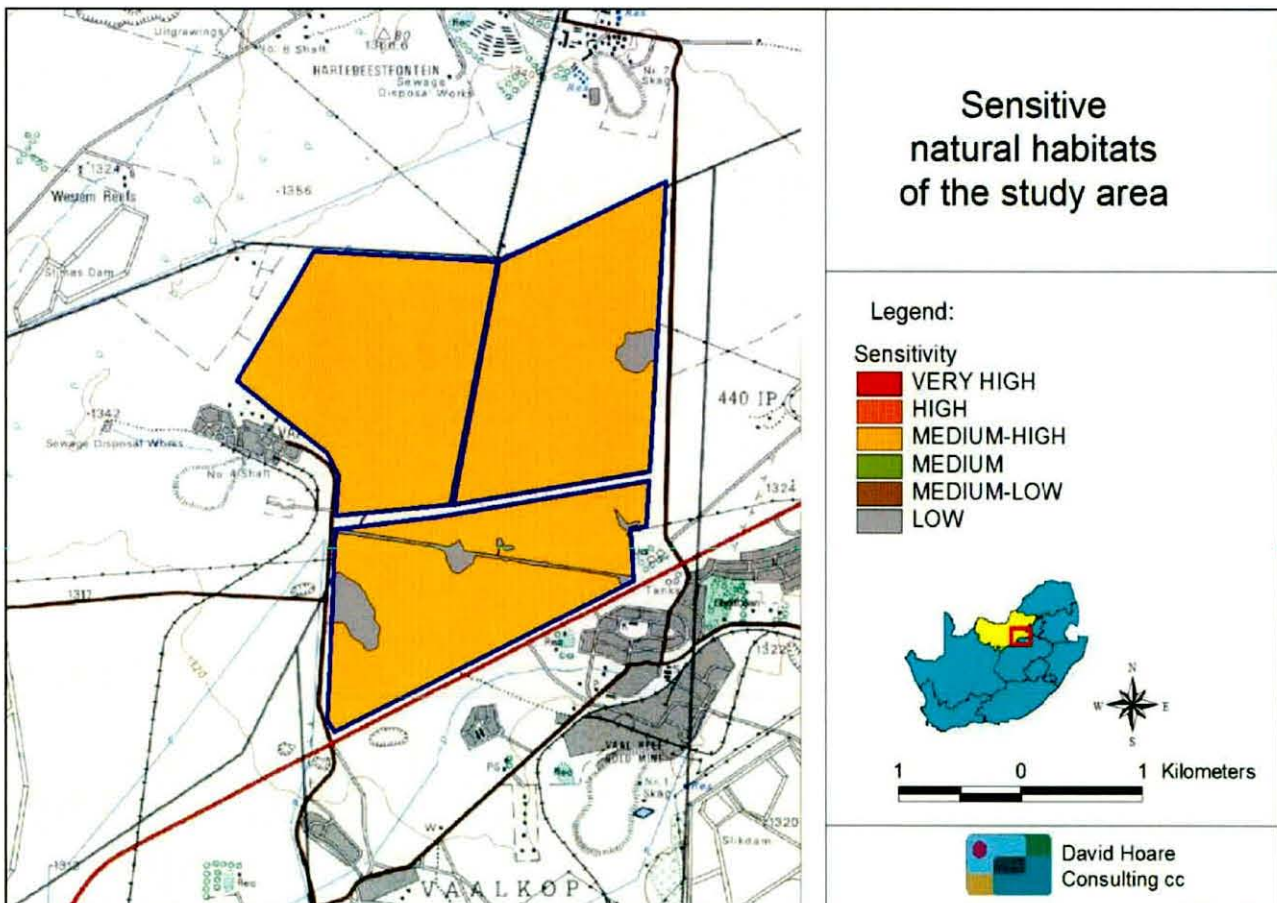
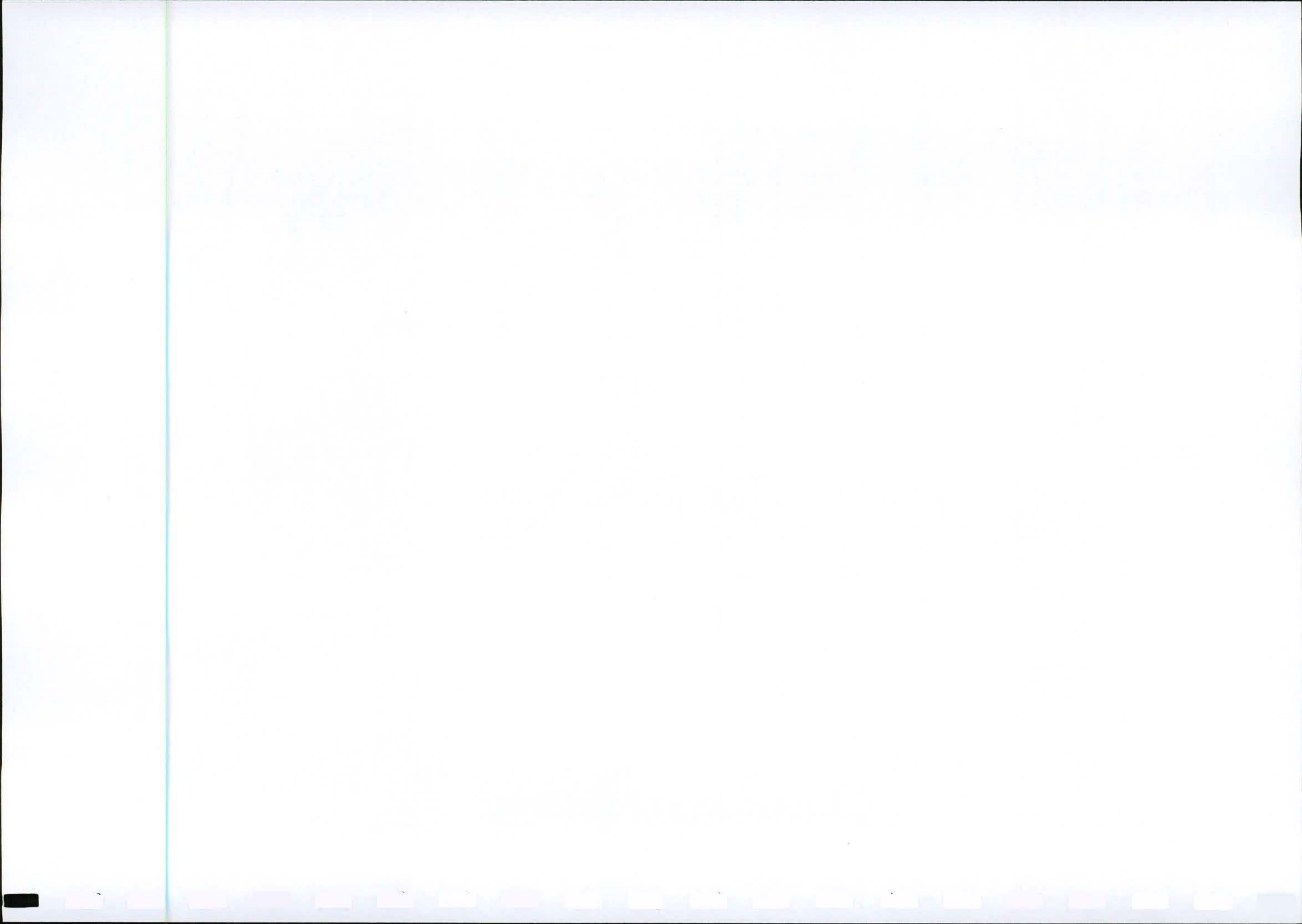


Figure 2: Potentially sensitive areas of the study area.



vegetation type that occurs on site is listed in the scientific literature (Mucina et al. 2006) as being Vulnerable. The plants and animals of potential conservation concern that could occur on site are listed and described in other sections of this report. From the project point of view, these are areas where infrastructure should be placed with caution or mitigation measures must be implemented to minimize impacts on features of concern.

2. LOW: Areas where there is no remaining natural vegetation are classified as having low sensitivity (see Table 4 and Figure 2). From the project point of view, these are areas where it is preferred that infrastructure is placed.

RELEVANT LEGISLATIVE AND PERMIT REQUIREMENTS

Relevant legislation is provided in this section to provide a description of the key legal considerations of importance to the proposed project. The applicable legislation is listed below.

Legislation

National Environmental Management Act, Act No. 107 of 1998 (NEMA)

NEMA requires, inter alia, that:

- "development must be socially, environmentally, and economically sustainable",
- "disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied.",
- "a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions",

NEMA states that "the environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage."

Environment Conservation Act No 73 of 1989 Amendment Notice No R1183 of 1997

The ECA states that:

Development must be environmentally, socially and economically sustainable.

Sustainable development requires the consideration of inter alia the following factors:

- that pollution and degradation of the environment is avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;
- that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised; and
- that negative impacts on the environment and on peoples' environmental rights be anticipated and prevented, and where they cannot be altogether prevented are minimised and remedied.

The developer is required to undertake Environmental Impact Assessments (EIA) for all projects listed as a Schedule 1 activity in the EIA regulations in order to control activities which might have a detrimental effect on the environment. Such activities will only be permitted with written authorisation from a competent authority.

National Forests Act (Act no 84 of 1998)

Protected trees

According to this act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. The prohibitions provide that 'no person may cut, damage, disturb, destroy or remove any *protected tree*, or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister'.

Forests

Prohibits the destruction of indigenous trees in any natural forest without a licence.

National Environmental Management: Biodiversity Act (Act No 10 of 2004)

In terms of the Biodiversity Act, the developer has a responsibility for:

- The conservation of endangered ecosystems and restriction of activities according to the categorisation of the area (not just by listed activity as specified in the EIA regulations).

- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

Chapter 4 of the Act relates to threatened or protected ecosystems or species. According to Section 57 of the Act, "Restricted activities involving listed threatened or protected species":

- (1) A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7.

Such activities include any that are "of a nature that may negatively impact on the survival of a listed threatened or protected species".

Chapter 5 of the Act relates to species and organisms posing a potential threat to biodiversity. According to Section 75 of the Act, "Control and eradication of listed invasive species":

- (1) Control and eradication of a listed invasive species must be carried out by means of methods that are appropriate for the species concerned and the environment in which it occurs.
- (2) Any action taken to control and eradicate a listed invasive species must be executed with caution and in a manner that may cause the least possible harm to biodiversity and damage to the environment.
- (3) The methods employed to control and eradicate a listed invasive species must also be directed at the offspring, propagating material and re-growth of such invasive species in order to prevent such species from producing offspring, forming seed, regenerating or re-establishing itself in any manner.

Government Notice No. 1002 of 2011: National List of Ecosystems that are Threatened and in need of protection

Published under Section 52(1)(a) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004). This Act provides for the listing of threatened or protected ecosystems based on national criteria. The list of threatened terrestrial ecosystems supersedes the information regarding terrestrial ecosystem status in the National Spatial Biodiversity Assessment (2004).

The Environmental Impact Assessment (EIA) Regulations include three lists of activities that require environmental authorisation:

- Listing Notice 1: activities that require a basic assessment (R544 of 2010),
- Listing Notice 2: activities that require seeping and environmental impact report (EIR) (R545 of 2010),
- Listing Notice 3: activities that require a basic assessment in specific identified geographical areas only (R546 of 2010).

Activity 12 in Listing Notice 3 relates to the clearance of 300m² of more of vegetation, which will trigger a basic assessment within any critically endangered or endangered ecosystem listed in terms of S52 of the Biodiversity Act. This means any development that Involves loss of natural habitat In a listed critically endangered or endangered ecosystem Is likely to require at least a basic assessment in terms of the EIA regulations.

It is important to note that while the original extent of each listed ecosystem has been mapped, a basic assessment report In terms of the EIA regulations Is triggered only In remaining natural habitat within each ecosystem and not in portions of the ecosystem where natural habitat has already been irreversibly lost.

GNR 151: Critically Endangered, Endangered, Vulnerable and Protected Species List

Published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

GNR 1187: Amendment of Critically Endangered, Endangered, Vulnerable and Protected Species List

Published under Section 56(1) of the National Environmental Management: Biodiversity Act (Act No. 10 of 2004).

Conservation of Agricultural Resources (Act No. 43 of 1983) as amended in 2001

Declared Weeds and Invaders in South Africa are categorised according to one of the following categories:

- Category 1 plants: are prohibited and must be controlled.
- Category 2 plants: (commercially used plants) may be grown in demarcated areas providing that there is a permit and that steps are taken to prevent their spread.
- Category 3 plants: (ornamentally used plants) may no longer be planted; existing plants may remain, as long as all reasonable steps are taken to prevent the spreading thereof, except within the floodline of watercourses and wetlands.

National Water Act (Act No. 36 of 1998)

Wetlands, riparian zones and watercourses are defined in the Water Act as a water resource and any activities that are contemplated that could affect the wetlands requires authorisation (Section 21 of the National Water Act of 1998). A "watercourse" in terms of the National Water Act (Act 36 of 1998) means:

- River or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and

Any collection of water which the Minister may, by notice in the gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

National Veld and Forest Fire Act (Act No. 101 of 1998)

Provides requirements for veldfire prevention through firebreaks and required measures for fire-fighting. Chapter 4 of the Act places a duty on landowners to prepare and maintain firebreaks. Chapter 5 of the Act places a duty on all landowners to acquire equipment and have available personnel to fight fires.

Other Acts

Other Acts that may apply to biodiversity issues, but which are considered to not apply to the current site are as follows:

- National Environmental Management Protected Areas Act (Act No. 57 of 2003)
- Marine Living Resources Act (Act No. 18 of 1998)
- Sea Birds and Seals Protection Act (Act No. 46 of 1973)
- Lake Areas Development Act (Act No. 39 of 1975)
- Mountain Catchment Areas Act (Act No. 63 of 1970)
- Integrated Coastal Zone Management Act (Act No. 24 of 2008)

IDENTIFICATION OF RISKS AND POTENTIAL IMPACTS

Potential issues relevant to potential impacts on the ecology of the study area include the following:

- Impacts on biodiversity: this includes any impacts on populations of individual species of concern (flora and fauna), including protected species, and on overall species richness. This includes impacts on genetic variability, population dynamics, overall species existence or health and on habitats important for species of concern.
- Impacts on sensitive habitats: this includes impacts on any sensitive or protected habitats, including indigenous forest, fynbos and wetland vegetation that leads to direct or indirect loss of such habitat.
- Impacts on ecosystem function: this includes impacts on any processes or factors that maintain ecosystem health and character, including the following:
 - Disruption to nutrient-flow dynamics;
 - Impedance of movement of material or water;
 - Habitat fragmentation;
 - Changes to abiotic environmental conditions;
 - Changes to disturbance regimes, e.g. Increased or decreased incidence of fire;
 - Changes to successional processes;
 - Effects on pollinators;
 - Increased invasion by alien plants.

Changes to factors such as these may lead to a reduction in the resilience of plant communities and ecosystems or loss or change in ecosystem function.

- Secondary and cumulative impacts on ecology: this includes an assessment of the impacts of the proposed project taken in combination with the impacts of other known projects for the area or secondary impacts that may arise from changes in the social, economic or ecological environment.
- Impacts on the economic use of vegetation: this includes any impacts that affect the productivity or function of ecosystems in such a way as to reduce the economic value to users, e.g. reduction in grazing capacity, loss of harvestable products. It is a general consideration of the impact of a project on the supply of so-called ecosystem goods and services.

A number of direct risks to ecosystems that would result from **construction** of the proposed solar energy facility are as follows:

- Clearing of land for construction.
- Construction of access roads.
- Placement of power lines, cables and water pipelines (if applicable).
- Establishment of borrow and spoil areas.
- Chemical contamination of the soil by construction vehicles and machinery.
- Operation of construction camps.
- Storage of materials required for construction.

Description of potential impacts

Major potential impacts are described briefly below. These are compiled from a generic list of possible impacts derived from previous projects of this nature and from a literature review of the potential impacts of solar energy facilities on the ecological environment. The major expected negative impact will be due to loss of habitat which may have direct or indirect impacts on individual organisms.

Impact 1: Loss or fragmentation of indigenous natural vegetation (terrestrial)

Nature: Construction of infrastructure may lead to direct loss of vegetation. This may lead to localised or more extensive reduction in the overall extent of vegetation. There are factors that may aggravate this potential impact. For example, where this vegetation has already been stressed due to degradation and transformation at a regional level, the loss may lead to increased vulnerability (susceptibility to future damage) of the habitat and a change in the conservation status (current conservation situation). Consequences of the potential impact of loss of indigenous natural vegetation occurring may include:

1. Negative change in conservation status of habitat (Driver et al. 2005);
2. Increased vulnerability of remaining portions to future disturbance;
3. General loss of habitat for sensitive species;
4. Loss in variation within sensitive habitats due to loss of portions of it;
5. General reduction in biodiversity;
6. Increased fragmentation (depending on location of impact);
7. Disturbance to processes maintaining biodiversity and ecosystem goods and services; and
8. Loss of ecosystem goods and services.

The vegetation types on site is Vaal Reefs Dolomite Sinkhole Vegetation, which is classified as Vulnerable. Most of the site is still in a natural state.

Impact 2: Loss of individuals of threatened plants

Nature: Plant species are especially vulnerable to infrastructure development due to the fact that they cannot move out of the path of the construction activities, but are also affected by overall loss of habitat.

Threatened species include those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened plant species, loss of a population or individuals could lead to a direct change in the conservation status of the species, possibly extinction. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations. Consequences may include:

1. Fragmentation of populations of affected species;
2. Reduction in area of occupancy of affected species; and
3. Loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chance of survival of the species.

Two Declining plant species are known to occur on site. In addition, there is the potential for one Near threatened and two more Declining plant species to occur on site.

Impact 3: Loss of individuals of protected tree species

There are a number of tree species that are protected according to Government Notice no. 1012 under section 12(I)(d) of the National Forests Act, 1998 (Act No. 84 of 1998). In terms of section 15(1) of the National Forests Act, 1998 "no person may cut, disturb, damage or destroy any protected tree or possess, collect, remove, transport, export, purchase, sell donate or in any other manner acquire or dispose of any protected tree or any forest product derived from a protected tree, except under a license granted by the Minister to an (applicant and subject to such period and conditions as may be stipulated".

Two species have a geographic distribution that includes the study area, *Boscia albitrunca* and *Acacia erioloba*, but neither species has been previously recorded on site.

Impact 4: Loss of individuals of protected plant species

There is one plant species that is protected according to National Environmental Management: Biodiversity Act (Act No. 10 of 2004). According to this Act, "a person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7". Such activities include any that are "of a nature that may negatively impact on the survival of a listed threatened or protected species". This implies that any negative impacts on habitats in which populations of protected species occur or are dependent upon would be restricted according to this Act.

One species has a geographic distribution that includes the study area, *Harpagophytum procumbens*, but suitable habitat conditions for this species do not occur there and the species has not been previously recorded on site.

Impact 5: Loss of habitat for threatened and protected animals and birds

Nature: Threatened animal species are indirectly affected primarily by the overall loss of habitat, since direct construction impacts can often be avoided due to movement of individuals from the path of construction. Animals are generally mobile and, in most cases, can move away from a potential threat.

Threatened species include those classified as critically endangered, endangered or vulnerable. For any other species a loss of individuals or localised populations is unlikely to lead to a change in the conservation status of the species. However, in the case of threatened animal species, loss of a population or individuals could lead to a direct change in the conservation status of the species. This may arise if the proposed infrastructure is located where it will impact on such individuals or populations or the habitat that they depend on. Consequences may include:

1. Fragmentation of populations of affected species;
2. Reduction in area of occupancy of affected species; and
3. Loss of genetic variation within affected species.

These may all lead to a negative change in conservation status of the affected species, which implies a reduction in the chances of the species overall survival chances.

There are four mammal species of conservation concern that could occur in available habitats in the study area. This includes one species classified as Endangered, the White-tailed Rat, one species classified as Near Threatened (NT), the Brown Hyaena and two species classified in South Africa as Near Threatened, but globally as Least Concern (LC), the South African Hedgehog and the Honey Badger. There are an additional two mammal species that could occur on site that are not listed as of conservation concern, but which are protected. These are the Black-footed Cat and Cape Fox. There are four mammal species of conservation concern

that could occur in available habitats in the study area (White-tailed Rat, Brown Hyaena, Honey Badger and South African Hedgehog) and two protected mammal species that could occur there (Black-footed Cat, Cape Fox). The Brown Hyaena, Honey Badger and South African Hedgehog are also protected.

There are three threatened bird species (Blue Crane, Lesser Kestrel, White-bellied Korhaan, all VU) and two Near Threatened bird species (Lanner Falcon, Melodious Lark) that have a medium to high probability of utilising available habitats in the study area, either for foraging or breeding.

There is one reptile species of conservation concern that has a distribution that includes the study area, the Striped Harlequin Snake, listed as Near Threatened. It is considered possible that this species occurs on site, but individuals are difficult to locate.

The protected Giant Bullfrog (not listed as threatened) could occur on site, but it is considered unlikely.

Impact 6: Collisions of individuals of threatened birds with overhead power lines

Nature: Threatened bird species may be directly affected by collisions with overhead powerlines. Cranes, bustards, flamingos, waterfowl, shorebirds, gamebirds and falcons are among the most frequently affected (Jenkins et al. 2010). Ludwig's Bustard is especially affected by collisions with overhead power lines.

There are three threatened bird species (Blue Crane, Lesser Kestrel, White-bellied Korhaan, all VU) and two Near Threatened bird species (Lanner Falcon, Melodious Lark) that have a medium to high probability of utilising available habitats in the study area, either for foraging or breeding.

Impact 7: Impacts on watercourses and drainage areas

Nature: There do not appear to be any wetland features on site, but this must be confirmed during the field survey of the site. According to the National Water Act, these are classified as wetlands or water resources. Construction, if it occurred within any of these areas, would lead to some direct or indirect loss of or damage to some of these areas or changes to the catchment of these areas. This may affect the hydrology of the landscape or lead to loss of habitat for species that depend on this habitat type.

Impact 8: Establishment and spread of declared weeds and alien invader plants

Major factors contributing to invasion by alien invader plants includes *inter alia* high disturbance (such as clearing for construction activities) and negative grazing practices (Zachariades et al. 2005). Exotic species are often more prominent near infrastructural disturbances than further away (Gelbard & Belnap 2003, Watkins et al. 2003). Consequences of this may include:

1. Loss of indigenous vegetation;
2. Change in vegetation structure leading to change in various habitat characteristics;
3. Change in plant species composition;
4. Change in soil chemical properties;
5. Loss of sensitive habitats;
6. Loss or disturbance to individuals of rare, endangered, endemic and/or protected species;
7. Fragmentation of sensitive habitats;
8. Change in flammability of vegetation, depending on alien species;

9. Hydrological impacts due to increased transpiration and runoff; and
10. Impairment of wetland function.

Potential invasive weeds with a distribution centred on this part of the country include *Melia azeradach*, *Sesbania punicea*, *Opuntia ficus-indica*, *Opuntia imbricata*, *Prosopis glandulosa*, *Populus x canescens*, *Salix babylonica*, *Morus alba*, *Gleditsia triacanthos*, *Agave americana*, *Datura ferox*, *Datura stramonium*, *Arundo donax* and *Nicotiana glauca*. Many of these species invade riverbeds, riverbanks and drainage lines. There is therefore the potential for alien plants to spread or invade following disturbance on site.

DISCUSSION AND CONCLUSIONS

There is one major vegetation type that occurs in the study area, namely Vaal Reefs Dolomite Sinkhole Vegetation, classified as Vulnerable and also has a restricted distribution and extent. The natural vegetation across most of the site is therefore considered, from this perspective, to have moderately high conservation status. The site does not occur within any Centre of Floristic Endemism.

Local factors that may lead to parts of the study area are the potential presence of some animal species of conservation concern, the known presence of two plant species of conservation concern and the potential presence of three additional plant species of conservation concern.

There are a number of animal species of conservation concern and protected animal species that may occur in habitats within the broad study area. This includes four mammal species of conservation concern (White-tailed Rat, Brown Hyaena, Honey Badger and South African Hedgehog) and five protected mammal species (Brown Hyaena, Black-footed Cat, Honey Badger, Cape Fox, South African Hedgehog), three threatened bird species (Blue Crane, Lesser Kestrel, White-bellied Korhaan, all VU) and two Near Threatened bird species (Lanner Falcon, Melodious Lark). The protected Giant Bullfrog could also occur on site. Habitat requirements for these species are provided in the appendices to this report.

There are two protected tree species that have a geographical distribution that includes the study area, *Boscia albitrunca* (Shepherd's Tree / Witgatboom / !Xhi) and *Acacia erioloba* (Camel Thorn, Kameeldoring), but neither species is known to occur on site.

There are five plant species of conservation concern that have a likelihood of occurring in available habitats in the study area. One of these is listed as Near Threatened (*Lithops lesliei* subsp. *lesliei*) and four as Declining (*Pelargonium sidoides*, *Boophane disticha*, *Hypoxis hemerocallidea* and *Crinum bulbispermum*). Two of these species (*Boophane disticha* and *Hypoxis hemerocallidea*) are known to occur on site.

There is one plant species protected according to the National Environmental Management: Biodiversity Act (Act No 10 of 2004) that occurs in the general area, *Harpagophytum procumbens* subsp. *procumbens*, but on the basis of habitat requirements, it is considered unlikely that it occurs on site.

The study area appears to be in a mostly natural condition, although it is considered from previous studies of the site (van Wyk & Gotze 2011) that the vegetation is in moderate to poor condition. From the project point of view, these are areas where infrastructure should only be placed with caution or mitigation measures must be implemented to minimize impacts.

A risk assessment was undertaken which identified eight main potential negative impacts on the ecological receiving environment. The identified potential impacts are the following:

1. Loss or fragmentation of indigenous natural vegetation
2. Loss of individuals of threatened plants
3. Loss of individuals of protected tree species
4. Loss of individuals of other protected plants
5. Loss of habitat for threatened animals
6. Collisions of individuals of threatened bird species with overhead power lines
7. Damage to watercourses and drainage areas
8. Establishment and spread of declared weeds and alien invader plants.

The significance of these impacts will be assessed during the EIA phase after collection of relevant field data. An initial assessment indicates that some of these impacts may be significant or that there is a legislative benefit to establishing whether they will occur or not.

Summary of proposed EIA methodology

The following assessments will be done during the EIA phase in order to properly assess potential impacts on the ecological receiving environment by the proposed solar thermal facility:

- A detailed sensitivity map of the entire site will be produced from aerial photography and on-site observation during the EIA phase. This will include mapping and incorporation of any sensitive features that may occur on site.
- The presence and distribution of drainage lines or wetland features on site will be evaluated in the field. This will be done primarily using a combination of aerial photograph interpretation and field evaluation of conditions on site. The current view is that there are no such features on this site.
- The presence of species of concern will be evaluated during the EIA phase. For plant species this will be done by searching for populations that could occur in the study area based on habitat requirements and historical collection records. For animal species this will be done by assessing habitat suitability for those species that have been assessed as potentially occurring in the area. The lists provided in this Scoping Report will form the basis for those assessments and surveys. Particular attention will be paid to those species classified as threatened (VU, EN or CR), Near Threatened or Critically rare, including the following:
 - Five plant species of conservation concern (*Lithops lesliei* subsp. *lesliei*, *Pelargonium sidoides*, *Boophane disticha*, *Hypoxis hemerocallidea* and *Crinum bulbispermum*),
 - Four mammal species of conservation concern (White-tailed Rat, Brown Hyaena, Honey Badger and South African Hedgehog) and five protected mammal species (Brown Hyaena, Black-footed Cat, Honey Badger, Cape Fox, South African Hedgehog),
 - Three Vulnerable bird species (Blue Crane, Lesser Kestrel, White-bellied Korhaan) and two Near Threatened bird species (Lanner Falcon, Melodious Lark),
 - It will be confirmed during the survey whether habitat suitable for the protected Giant Bullfrog occurs on site or not.

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APPENDICES:**Appendix 1: Plant species of conservation importance (Threatened, Near Threatened and Declining) that have historically been recorded in the study area.**

Sources: South African National Biodiversity Institute in Pretoria.

Family	Taxon	Status	Habitat	Likelihood of occurrence on site
AMARYLLIDACEAE	<i>Crinum bulbispermum</i>	Declining	Near rivers, streams, seasonal pans and in damp depressions.	HIGH
MESEMBRYANTHEMACEAE	<i>Lithops lesliei</i> subsp. <i>lesliei</i>	Near Threatened	Arid grasslands, usually in rocky places, growing under the protection of forbs and grasses	HIGH
GERANIACEAE	<i>Pelargonium sidoides</i>	Declining	Usually in short grassland, sometimes with occasional shrubs or trees, often in stony soils varying from clay-loam, shale or basalt.	HIGH
HYPOXIDACEAE	<i>Hypoxis hemerocallidea</i>	Declining	Occurs in a wide range of habitats, including sandy hills on the margins of dune forests, open, rocky grassland, dry, stony, grassy slopes, mountain slopes and plateaus. Appears to be drought and fire tolerant.	DEFINITE
AMARYLLIDACEAE	<i>Boophane disticha</i>	Declining	Dry grassland and rocky areas.	DEFINITE

* Conservation Status Category assessment according to IUCN Ver. 3.1 (IUCN, 2001), as evaluated by the Threatened Species Programme of the South African National Biodiversity Institute in Pretoria. *IUCN (3.1) Categories: VU = Vulnerable, EN = Endangered, CR = Critically Endangered, NT = Near Threatened.

Appendix 2: Threatened vertebrate species with a geographical distribution that includes the current study area.

MAMMALS

Common name	Taxon	Habitat	National status	Global status ²	Likelihood of occurrence
Black rhinoceros	<i>Diceros bicornis minor</i>	Wide variety of habitats, but currently only occurs in game reserves.	VU	VU	NONE , only occurs in game reserves
Brown hyena	<i>Hyaena brunnea</i>	Savanna, urban areas, scavenger	NT	NT	MEDIUM , overall geographical distribution includes this area, habitat is suitable.
Spotted-necked otter	<i>Lutra maculicollis</i>	Permanent, unsilted, unpolluted rivers, streams and freshwater lakes where sufficient numbers of its prey occur.	NT	NT	LOW , no suitable permanent water on site, but there is nearby in the Vaal River
Honey badger	<i>Mellivora capensis</i>	Wide variety of habitats. Probably only in natural habitats.	NT	LC	HIGH overall geographical distribution includes this area. Habitat is suitable.
Natal long-fingered bat	<i>Miniopterus natalensis</i>	Caves and sub-terranean habitats in Fynbos, savanna, woodland, succulent and Nama Karoo, grassland; cave-dwelling aerial insectivore.	NT	NT	LOW , overall geographical distribution includes this area, no suitable roosting habitat on site
Geoffroy's horseshoe bat	<i>Rhinolophus clivosus</i>	Caves and subterranean habitats; fynbos, shrubland, grassland, succulent and Nama-karoo; insectivore	NT	LC	LOW , overall geographical distribution includes this area, no suitable roosting habitat on site
Darling's horseshoe bat	<i>Rhinolophus darlingii</i>	Savanna, roosting in caves and sub-terranean habitats	NT	LC	LOW , on edge of overall geographical distribution; no suitable roosting habitat on site
South African hedgehog	<i>Aterelix frontalis</i>	Wide variety of habitats where there is ample ground cover. Avoids mesic habitats.	NT	LC	HIGH , within known distribution and suitable habitat on site.
White-tailed rat	<i>Mystromus albicaudatus</i>	Highveld and montane grassland, requires sandy soils with good cover. Found throughout South Africa except Northern Cape and Limpopo	EN	EN	MEDIUM , previously recorded in nearby grid and overall geographical distribution includes this area., presence of suitable substrate unknown

¹Distribution and national status according to Friedmann & Daly 2004.

²Global status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 10 January 2012.

AMPHIBIANS

Common name	Species	Habitat	Status	Likelihood of occurrence
Giant Bullfrog	<i>Pyxicephalus adspersus</i>	Widely distributed in southern Africa, mainly at higher elevations. Inhabits a variety of vegetation types where it breeds in seasonal, shallow, grassy pans in flat, open areas; also utilises non-permanent vleis and shallow water on margins of waterholes and dams. Prefer sandy substrates although they sometimes inhabit clay soils.	NT ¹ LC ² Protected (NEMBA)	HIGH , within distribution range and suitable habitat (pans) occur on site.

¹Status according to Minter et al. 2004.

²Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org). Downloaded on 10 January 2012.

REPTILES

Common name	Species	Habitat	Status ³	Likelihood of occurrence
Striped	<i>Homoroselaps</i>	Old termitaria and under stones in grassland.	RARE ³	MEDIUM ,

harlequin snake	<i>dorsalis</i>		NT ⁴	previously recorded in nearby grids and distribution coincides with Grassland Biome.
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³Distribution according to Alexander & Marais 2007.

⁴Status according to Alexander & Marais 2007.

BIRDS

Common name	Species	Habitat	Status	Importance of site for species
African Marsh Harrier	<i>Circus ranivorus</i>	Marsh, vlei, grassland (usually near water); may hunt over grassland, cultivated lands and open savanna. Roosts in dense grass or reeds, sometimes communally when not breeding. Uncommon resident in study area.	VU Protected (NEMBA)	LOW, breeding, LOW, foraging
Bittern	<i>Botaurus stellaris</i>	Reedbeds, marshes, papyrus swamps. Uncommon resident in study area.	CR	LOW, breeding, LOW, foraging
Black harrier	<i>Circus maurus</i>	Grassveld, karoo scrub, mountain fynbos, cultivated lands, subalpine vegetation, semidesert. Uncommon, non-breeding migrant in study area.	VU	ZERO, breeding, LOW, foraging
Black Stork	<i>Ciconia nigra</i>	Feeds in or around marshes, dams, rivers and estuaries; breeds in mountainous regions. Forages by walking slowly, usually in shallow water, and stabbing at prey. Roosts in trees or on cliffs or power pylons. Nests on cliff ledge, in cave or pothole, rarely on nest of Hamerkop or Black Eagle. Uncommon resident.	NT Protected (NEMBA)	ZERO, breeding, ZERO, foraging
Blackwinged pratincole	<i>Glareola nordmannii</i>	Open grassland. Uncommon non-breeding migrant in study area.	NT	ZERO, breeding, LOW, foraging
Blue Crane	<i>Anthropoides paradisea</i>	Midland and highland grassveld, edge of karoo, cultivated land, edges of vleis. Roosts on ground or in shallow water. Nest: Scrape on bare ground or rock (klipplaat) in open grassveld, often in moist places; sometimes thinly lined or ringed with pebbles, sheep droppings or bits of plant material. Uncommon resident.	VU Protected (NEMBA)	MEDIUM, breeding, MEDIUM, foraging
Cape vulture	<i>Gyps coprotheres</i>	Mostly mountainous country, or open country with inselbergs and escarpments; less commonly in savanna or desert. Uncommon resident.	VU Protected (NEMBA)	ZERO, breeding, LOW, foraging
Caspian tern	<i>Sterna caspia</i>	Estuaries, marine shores, larger inland dams and pans. Uncommon resident.	NT	LOW, breeding, LOW, foraging
Chestnut-banded Plover	<i>Charadrius pallidus</i>	Saline lagoons, saline and brackish pans, saltworks; occasionally estuaries and sandy lagoons.	NT	LOW, breeding, LOW, foraging
Grass Owl	<i>Tyto capensis</i>	Long grass, usually near water, vleis, marshes.	VU Protected (NEMBA)	LOW, breeding, LOW, foraging
Greater Flamingo	<i>Phoenicopterus ruber</i>	Large bodies of shallow water, both inland and coastal; saline and brackish waters preferred.	NT	LOW, breeding, LOW, foraging
Lanner Falcon	<i>Falco biarmicus</i>	Widespread species, occurring in Afrotropics, Middle East and western Palearctic. Occurs in mountains or open country from semidesert to woodland and agricultural land; also cities (Durban, Harare). Common resident.	NT	LOW, breeding, MEDIUM, foraging

Common name	Species	Habitat	Status	Importance of site for species
Lesser Flamingo	<i>Phoenicopterus minor</i>	Larger brackish or saline inland and coastal waters.	NT	LOW, breeding, LOW, foraging
Lesser Kestrel	<i>Falco naumannii</i>	Open grassveld, mainly on highveld, usually near towns or farms. Highly gregarious; roosts communally in thousands in tall trees, usually around human habitations, especially in towns. Common non-breeding migrant in study area.	VU Protected (NEMBA)	ZERO, breeding, MEDIUM, foraging
Marabou stork	<i>Leptoptilos crumeniferus</i>	Open to semi-arid woodland, bushveld, fishing villages, rubbish tips, lake shores. Nest above ground, in trees, villages or on cliffs	NT	LOW, breeding, LOW, foraging
Martial Eagle	<i>Polemaetus bellicosus</i>	The Martial Eagle is widespread but uncommon throughout South Africa and neighbouring countries. It tolerates a wide range of vegetation types, being found in open grassland, scrub, Karoo and woodland. It relies on large trees (and electricity pylons) to provide nest sites. It is found typically in flat country and is rarer in mountains and forests. One of the main reasons it is declining is because of persecution on private land.	VU ¹ NT ² Protected (NEMBA)	LOW, breeding, LOW, foraging
Melodious lark	<i>Mirafra cheniana</i>	Open climax grassland, especially Red Grass (Rooigras) <i>Themeda triandra</i> and species of <i>Eragrostis</i> and Russet Grass <i>Loudetia simplex</i> , sometimes with rocky outcrops, termite mounds or sparse bushes; also cultivated fields of Teff <i>Eragrostis tef</i> ; in KwaZulu-Natal at 550-1750 m elevation, rainfall 400-800 mm/year; moves into the Karoo after good rains. Common resident in study area.	NT	LOW, breeding, MEDIUM, foraging
Old world painted snipe	<i>Rostratula benghalensis</i>	Marshes, swamps, edges of lakes, dams, ponds and streams, with marginal vegetation.	NT	LOW, breeding, LOW, foraging
Pallid Harrier	<i>Circus macrourus</i>	Open grassveld, cultivated fields; less commonly in open to semi-arid savanna (but more likely in arid areas than Montagu's Harrier). Uncommon migrant in study area.	NT	ZERO, breeding, LOW, foraging
Peregrine Falcon	<i>Falco peregrinus</i>	Cliffs, mountains, steep gorges; may hunt over open grassland, farmland and forests; rarely enters cities to hunt pigeons. Uncommon migrant in study area.	NT Protected (NEMBA)	LOW, breeding, LOW, foraging
Pinkbacked Pelican	<i>Pelecanus rufescens</i>	Coastal bays and estuaries, seldom inland on larger rivers, marshes and floodplains.	VU	LOW, breeding, LOW, foraging
Secretarybird	<i>Sagittarius serpentarius</i>	Widespread across South Africa, occurring in savanna and open grassland from coastal regions to high altitudes, but avoids thick bush and forest. Sensitive to disturbance and high human population numbers - higher numbers usually found in conservation areas.	NT	LOW, breeding, LOW, foraging
White Pelican	<i>Pelecanus onocrotalus</i>	Coastal bays, estuaries, lakes, larger pans and dams.	NT	LOW, breeding, LOW, foraging
Whitebacked vulture	<i>Gyps africanus</i>	Savanna and bushveld. Uncommon resident.	VU Protected (NEMBA)	LOW, breeding, LOW, foraging
Whitebellied korhaan	<i>Eupodotis barrowii</i>	Open grassland; sometimes in sparse Acacia thornveld. Uncommon resident	VU	LOW, breeding, MEDIUM, foraging
Yellow-billed Stork	<i>Mycteria ibis</i>	Mainly inland waters; rivers, dams, pans, floodplains, marshes; less often estuaries. Uncommon non-	NT	ZERO, breeding,

Common name	Species	Habitat	Status	Importance of site for species
		breeding migrant in study area.		LOW, foraging

¹Status according to Barnes 2000.

²Status according to IUCN 2010. IUCN Red List of Threatened Species. Version 2010.3. (www.iucnredlist.org).

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Appendix 3: List of protected tree species (National Forests Act).

<i>Acacia erioloba</i>	<i>Acacia haematoxylon</i>
<i>Adansonia digitata</i>	<i>Azelia quanzensis</i>
<i>Balanites</i> subsp. <i>maughamii</i>	<i>Barringtonia racemosa</i>
<i>Boscia albitrunca</i>	<i>Brachystegia spiciformis</i>
<i>Breonadia salicina</i>	<i>Bruguiera gymnorhiza</i>
<i>Cassipourea swaziensis</i>	<i>Catha edulis</i>
<i>Ceriops tagal</i>	<i>Cleistanthus schlechteri</i> var. <i>schlechteri</i>
<i>Colubrina nicholsonii</i>	<i>Combretum imberbe</i>
<i>Curtisia dentata</i>	<i>Elaeodendron (Cassine) transvaalensis</i>
<i>Erythrophysa transvaalensis</i>	<i>Euclea pseudebenus</i>
<i>Ficus trichopoda</i>	<i>Leucadendron argenteum</i>
<i>Lumnitzera racemosa</i> var. <i>racemosa</i>	<i>Lydenburgia abottii</i>
<i>Lydenburgia cassinoides</i>	<i>Mimusops caffra</i>
<i>Newtonia hildebrandtii</i> var. <i>hildebrandtii</i>	<i>Ocotea bullata</i>
<i>Ozoroa namaensis</i>	<i>Philenoptera violacea (Lonchocarpus capassa)</i>
<i>Pittosporum viridiflorum</i>	<i>Podocarpus elongatus</i>
<i>Podocarpus falcatus</i>	<i>Podocarpus henkelii</i>
<i>Podocarpus latifolius</i>	<i>Protea comptonii</i>
<i>Protea curvata</i>	<i>Prunus africana</i>
<i>Pterocarpus angolensis</i>	<i>Rhizophora mucronata</i>
<i>Sclerocarya birrea</i> subsp. <i>caffra</i>	<i>Securidaca longependunculata</i>
<i>Sideroxylon inerme</i> subsp. <i>inerme</i>	<i>Tephrosia pondoensis</i>
<i>Warburgia salutaris</i>	<i>Widdringtonia cedarbergensis</i>
<i>Widdringtonia schwarzii</i>	

Acacia erioloba and *Boscia albitrunca* have a geographical distribution that coincides with the study area.

Appendix 4: Checklist of plant species recorded during previous botanical surveys in the study area and surrounds.

(Species from quarter degree grid in which the site is located as well as surrounding grids in which similar vegetation is found)

Acacia karroo Hayne
Acacia hereroensis Engl.
Acacia robusta Burch. subsp. robusta
Acalypha angustata Sond.
Acalypha caperonioides Baill. var. caperonioides
Acalypha segetalis Müll.Arg.
Acanthospermum glabratum (DC.) Wild
Acrotome hispida Benth.
Acrotome inflata Benth.
Aerva leucura Moq.
Agrostis lachnantha Nees var. lachnantha
Albuca setosa Jacq.
Aloe ferox Mill.
Aloe grandidentata Salm-Dyck
Ambrosia artemisiifolia L.
Ammannia baccifera L. subsp. baccifera
Ammocharis coranica (Ker-Gawl.) Herb.
Anchusa azurea Mill.
Andropogon appendiculatus Nees
Andropogon eucomus Nees
Andropogon schirensis Hochst. ex A.Rich.
Anthephora pubescens Nees
Anthospermum rigidum Eckl. & Zeyh. subsp. rigidum
Anthospermum spathulatum Spreng. subsp. saxatile Puff
Apium graveolens L.
Aptosimum elongatum Engl.
Aptosimum indivisum Burch. ex Benth.
Arctotis arctotoides (L.f.) O.Hoffm.
Aristida adscensionis L.
Aristida bipartita (Nees) Trin. & Rupr.
Aristida canescens Henrard subsp. canescens
Aristida congesta Roem. & Schult. subsp. barbicollis (Trin. & Rupr.) De Winter
Aristida congesta Roem. & Schult. subsp. congesta
Aristida diffusa Trin. subsp. burkei (Stapf) Melderis
Aristida junciformis Trin. & Rupr. subsp. junciformis
Aristida meridionalis Henrard
Aristida scabrivalvis Hack
Aristida stipitata Hack. subsp. graciliflora (Pilg.) Melderis
Aristida stipitata Hack. subsp. stipitata
Artemisia afra Jacq. ex Willd. var. afra
Asclepias aurea (Schltr.) Schltr.
Asclepias eminens (Harv.) Schltr.
Asclepias gibba (E.Mey.) Schltr. var. gibba
Asclepias gibba (E.Mey.) Schltr. var. media N.E.Br.
Asclepias meyeriana (Schltr.) Schltr.
Asparagus laricinus Burch.
Asparagus suaveolens Burch.
Aspidoglossum biflorum E.Mey.
Aster squamatus (Spreng.) Hieron.
Azolla filiculoides Lam.
Babiana bainesii Baker
Babiana hypogea Burch.

Barleria macrostegia Nees
 Barleria obtusa Nees
 Bergia decumbens Planch. ex Harv.
 Berkheya radula (Harv.) De Wild.
 Berula thunbergii (DC.) H.Wolff
 Blepharis angusta (Nees) T.Anderson
 Blepharis integrifolia (L.f.) E.Mey. ex Schinz
 Bonatea antennifera Rolfe
 Boophane disticha (L.f.) Herb.)
 Brachiaria eruciformis (Sm.) Griseb.
 Brachiaria nigropedata (Ficalho & Hiern) Stapf
 Brachiaria serrate (Thunb.) Stapf
 Brachystelma barberae Harv. ex Hook.f.
 Brachystelma circinatum E.Mey.
 Brachystelma foetidum Schltr.
 Brachystelma ramosissimum (Schltr.) N.E.Br.
 Bryum argenteum Hedw.
 Buchnera reducta Hiern
 Bulbine abyssinica A.Rich.
 Bulbine narcissifolia Salm-Dyck
 Bulbostylis burchellii (Ficalho & Hiern) C.B.Clarke
 Bulbostylis hispidula (Vahl.) R.W.Haines subsp. pyriformis (Lye) R.W.Haines
 Camptorrhiza strumosa (Baker) Oberm.
 Carissa bispinosa (L.) Desf. ex Brenan
 Celosia argentea L. forma argentea
 Celtis africana Burm.f.
 Centaurea repens L.
 Ceratophyllum muricatum Cham. subsp. muricatum
 Chascanum hederaceum (Sond.) Moldenke var. hederaceum
 Chascanum hederaceum (Sond.) Moldenke var. natalense (H.Pearson) Moldenke
 Chascanum pinnatifidum (L.f.) E.Mey.
 Cheilanthes hirta Sw. var. hirta
 Cheilanthes involuta (Sw.) Schelpe & N.C.Anthony var. obscura (N.C.Anthony) N.C.Anthony
 Chenopodium multifidum L.
 Chenopodium schraderianum Roem. & Schult.
 Chlorophytum fasciculatum (Baker) Kativu
 Chloris virgata Sw.
 Choritaenia capensis Benth.
 Cineraria lyratififormis Cron
 Clematis brachiata Thunb.
 Cleome monophylla L.
 Cleome rubella Burch.
 Coccinia sessilifolia (Sond.) Cogn.
 Colchicum (Androcymbium) melanthioides Willd. subsp. melanthioides
 Commelina africana L. var. barberae (C.B.Clarke) C.B.Clarke
 Commelina livingstonii C.B.Clarke
 Commicarpus pentandrus (Burch.) Heimerl
 Conium chaerophylloides (Thunb.) Sond.
 Convolvulus sagittatus Thunb.
 Conyza bonariensis (L.) Cronquist
 Conyza podocephala DC.
 Corchorus asplenifolius Burch.
 Cordylogyne globosa E.Mey.
 Cotula anthemoides L.
 Cotula microglossa (DC.) O.Hoffm. & Kuntze ex Kuntze
 Crabbea angustifolia Nees
 Crassula lanceolata (Eckl. & Zeyh.) Endl. ex Walp. subsp. lanceolata

Crassula lanceolata (Eckl. & Zeyh.) Endl. ex Walp. subsp. *transvaalensis* (Kuntze) Toelken
Crotalaria burkeana Benth.
Crotalaria distans Benth. subsp. *distans*
Crotalaria lotoides Benth.
Crotalaria sphaerocarpa Perr. ex DC. subsp. *sphaerocarpa*
Cucumis zeyheri Sond.
Cuscuta campestris Yunck.
Cyanotis speciosa (L.f.) Hassk.
Cymbopogon excavates (Hochst.) Stapf ex Burt Davy
Cymbopogon nardus (L.) Rendle
Cymbopogon pospischilii (K. Schum.) C.E.Hubb.
Cynodon dactylon (L.) Pers.
Cynodon hirsutus Stent
Cynoglossum hispidum Thunb.
Cyperus capensis (Steud.) Endl.
Cyperus difformis L.
Cyperus esculentus L.
Cyperus fastigiatus Rottb.
Cyperus margaritaceus Vahl var. *margaritaceus*
Cyperus obtusiflorus Vahl var. *flavissimus* (Schrad.) Boeck.
Cyperus obtusiflorus Vahl var. *obtusiflorus*
Cyperus sphaerospermus Schrad.
Cyphia assimilis Sond.
Cyphostemma hereroense (Schinz) Desc. ex Wild & R.B.Drumm.
Datura ferox L.
Daubenyia comata (Burch. ex Baker) J.C.Manning & A.van der Merwe
Denekia capensis Thunb.
Deverra burchellii (DC.) Eckl. & Zeyh.
Dicliptera leistneri K.Balkwill
Dicoma anomala Sond. subsp. *anomala*
Dicoma macrocephala DC.
Dierama reynoldsii I.Verd.
Digitaria eriantha Steud.
Digitaria longiflora (Retz.) Pers.
Digitaria tricholaenoides Stapf
Diheteropogon amplexans (Nees) Clayton
Diospyros austro-africana De Winter var. *microphylla* (Burch.) De Winter
Diospyros lycioides Desf. subsp. *lycioides*
Diospyros lycioides Desf. subsp. *lycioides*
Dombeya rotundifolia (Hochst.) Planch. var. *rotundifolia*
Drimiopsis burkei Baker subsp. *burkei*
Ehretia rigida (Thunb.) Druce subsp. *nervifolia* Retief & A.E.van Wyk
Eleocharis dregeana Steud.
Elephantorrhiza elephantina (Burch.) Skeels
Eleusine coracana (L.) Gaertn. subsp. *africana* (Kenn.-O'Byrne) Hilu & de Wet
Elionurus muticus (Spreng.) Kunth
Enneapogon desvauxii P.Beauv.
Eragrostis biflora Hack. Ex Schinz
Eragrostis chloromelas Steud.
Eragrostis curvula (Schrad.) Nees
Eragrostis gummiflua Nees
Eragrostis lehmanniana Nees var. *lehmanniana*
Eragrostis micrantha Hack.
Eragrostis nindensis Ficalho & Hiern
Eragrostis obtusa Munro ex Ficalho & Hiern
Eragrostis plana Nees
Eragrostis racemosa (Thunb.) Steud.

Eragrostis superba Peyr.
Eragrostis trichophora Coss. & Durieu
Eragrostis viscosa (Retz.) Trin.
Erythrina zeyheri Harv.
Euclea crispa (Thunb.) Guerke subsp. *crispa*
Euclea undulata Thunb.
Euphorbia inaequilatera Sond. var. *inaequilatera*
Euphorbia indica Lam.
Euphorbia serpens Kunth
Euphorbia striata Thunb. var. *striata*
Eustachys paspaloides (Vahl.) Lanza & Mattei
Felicia muricata (Thunb.) Nees subsp. *muricata*
Fingerhuthia africana Lehm.
Foveolina dichotoma (DC.) Källersjö
Galinsoga parviflora Cav.
Gazania krebsiana Less.
Geigeria aspera Harv. var. *aspera*
Geigeria aspera Harv. var. *rivularis* (J.M.Wood & M.S.Evans) Merxm.
Geigeria brevifolia (DC.) Harv.
Geranium multisectum N.E.Br.
Gerbera piloselloides (L.) Cass.
Gethyllis transkarooica D.Müll.-Doblies
Gisekia africana (Lour.) Kuntze var. *africana*
Gisekia pharnacioides L. var. *pharnacioides*
Gladiolus crassifolius Baker
Gladiolus permeabilis D.Delaroche subsp. *edulis* (Burch. ex Ker Gawl.) Oberm.
Gnaphalium filagopsis Hilliard & B.L.Burt
Gnidia burchellii (Meisn.) Gilg
Gnidia capitata L.f.
Gnidia kraussiana Meisn. var. *kraussiana*
Gomphocarpus fruticosus (L.) Aiton f. subsp. *decipiens* (N.E.Br.) Goyder & Nicholas
Gomphostigma virgatum (L.f.) Baill.
Grewia flava DC.
Grewia occidentalis L. var. *occidentalis*
Guilleminea densa (Willd. ex Roem. & Schult.) Moq.
Gymnosporia buxifolia (L.) Szyszyl.
Haplocarpha scaposa Harv.
Harpochloa falx (L.f.) Kuntze
Helichrysum argyrosphaerum DC.
Helichrysum caespititium (DC.) Harv.
Helichrysum callicomum Harv.
Helichrysum cephaloideum DC.
Helichrysum coriaceum Harv.
Helichrysum nudifolium (L.) Less. var. *nudifolium*
Helichrysum paronychioides DC.
Helichrysum rugulosum Less.
Helichrysum setosum Harv.
Hemarthria altissima (Poir.) Stapf & C.E.Hubb.
Hermannia coccocarpa (Eckl. & Zeyh.) Kuntze
Hermannia depressa N.E.Br.
Hermannia lancifolia Szyszyl.
Hermannia quartiniana A.Rich.
Hermannia stellulata (Harv.) K.Schum.
Heteropogon contortus (L.) Roem. & Schult.
Hibiscus calyphyllus Cav.
Hibiscus microcarpus Garcke
Hibiscus trionum L.

Hyparrhenia hirta (L.) Stapf
Hypoxis filiformis Baker
Hypoxis hemerocallidea Fisch., C.A.Mey. & Avé-Lall.
Hypoxis iridifolia Bak.
Hypoxis rigidula Baker var. rigidula
Imperata cylindrical (L.) Raeusch.
Indigofera cryptantha Benth. ex Harv. var. cryptantha
Indigofera dimidiata Vogel ex Walp.
Indigofera heterotricha DC.
Indigofera oxalidea Welw. ex Baker
Indigofera vicioides Jaub. & Spach var. vicioides
Ipomoea bathycolpos Hallier f.
Ipomoea crassipes Hook. var. crassipes
Ipomoea oenotheroides (L.f.) Raf. ex Hallier f.
Ipomoea ommanneyi Rendle
Ischaemum afrum (J.F.Gmel.) Dandy
Jamesbrittenia aurantiaca (Burch.) Hilliard
Jamesbrittenia burkeana (Benth.) Hilliard
Jamesbrittenia montana (Diels) Hilliard
Jatropha zeyheri Sond.
Juncus effuses L.
Juncus exsertus Buchenau
Kalanchoe rotundifolia (Haw.) Haw.
Kniphofia ensifolia Baker subsp. ensifolia
Kohautia amatymbica Eckl. & Zeyh.
Kohautia caespitosa Schnizl. subsp. brachyloba (Sond.) D.Mantell
Kohautia virgata (Willd.) Bremek.
Kyllinga pulchella Kunth
Lactuca serriola L.
Lagarosiphon muscoides Harv.
Lantana rugosa Thunb.
Ledebouria luteola Jessop
Ledebouria marginata (Baker) Jessop
Ledebouria revolute (L.f.) Jessop
Leersia hexandra Sw.
Leidesia procumbens (L.) Prain
Lemna gibba L.
Lemna minor L.
Lessertia phillipsiana Burt Davy
Leucas capensis (Benth.) Engl.
Leucas martinicensis (Jacq.) R.Br.
Limosella africana Glück var. africana
Lippia scaberrima Sond.
Lithospermum cinereum A.DC.
Litogyne gariepina (DC.) Anderb.
Lobelia erinus L.
Lobelia thermalis Thunb.
Lotononis bainesii Baker
Lotononis calycina (E.Mey.) Benth.
Lotononis listii Polhill
Lycium arenicola Miers
Lycium pilifolium C.H.Wright
Mannia capensis (Steph.) S.W.Arnell
Mariscus uitenhagensis Steud.
Marsilea farinosa Launert subsp. farinosa
Marsilea macrocarpa C.Presl
Medicago laciniata (L.) Mill. var. laciniata

Melinis nerviglumis (Franch.) Zizka
 Melinis repens (Willd.) Zizka subsp. repens
 Menodora africana Hook.
 Menodora heterophylla Moric. ex DC. var. australis Steyererm.
 Mesogramma apiifolium DC.
 Michrochloa caffra Nees
 Mimosa pigra L.
 Mimulus gracilis R.Br.
 Monocymbium ceresiiforme (Nees) Stapf
 Monsonia angustifolia E.Mey. ex A.Rich.
 Mundulea sericea (Willd.) A.Chev. subsp. sericea
 Myriophyllum spicatum L.
 Nemesia fruticans (Thunb.) Benth.
 Neorautanenia ficifolia (Benth. ex Harv.) C.A.Sm.
 Nerine frithii L.Bolus
 Nesaea anagalloides (Sond.) Koehne
 Nidorella hottentotica DC.
 Nidorella resedifolia DC. subsp. resedifolia
 Nolletia arenosa O.Hoffm.
 Nolletia ciliaris (DC.) Steetz
 Ocimum angustifolium Benth.
 Oenothera tetraptera Cav.
 Oligomeris dregeana (Müll.Arg.) Müll.Arg.
 Orbea lutea (N.E.Br.) Bruyns subsp. lutea
 Oropetium capense Stapf
 Osteospermum muricatum E.Mey. ex DC. subsp. muricatum
 Oxalis corniculata L.
 Oxalis depressa Eckl. & Zeyh.
 Oxalis obliquifolia Steud. ex Rich.
 Pachycarpus schinzianus (Schltr.) N.E.Br.
 Pachystigma pygmaeum (Schltr.) Robyns
 Panicum coloratum L. var. coloratum
 Panicum maximum Jacq.
 Panicum novemnerve Stapf
 Panicum repens L.
 Parapodium costatum E.Mey.
 Paspalum distichum L.
 Pavonia burchellii (DC.) R.A.Dyer
 Pearsonia bracteata (Benth.) Polhill
 Pelargonium auritum (L.) Willd. var. carneum (Harv.) E.M.Marais
 Pelargonium nelsonii Burttt Davy
 Pelargonium sidoides DC.
 Pellaea calomelanos (Sw.) Link var. calomelanos
 Pentarrhinum insipidum E.Mey.
 Pentzia globosa Less.
 Perotis patens Gand.
 Persicaria amphibia (L.) Gray
 Persicaria hystricula (J.Schust.) Soják
 Persicaria lapathifolia (L.) Gray
 Persicaria limbata (Meisn.) H.Hara
 Pharnaceum brevicaula (DC.) Bartl.
 Phragmites australis (Cav.) Steud.
 Phragmites mauritianus Kunth
 Phyllanthus incurvus Thunb.
 Phyllanthus maderaspatensis L.
 Phyllanthus parvulus Sond. var. parvulus
 Physalis viscosa L.

Plantago lanceolata L.
Platycarphella parvifolia (S.Moore) V.A.Funk & H.Rob.
Pogonarthria squarrosa (Roem. & Schult.) Pilg.
Pollichia campestris Aiton
Polygala hottentotta C.Presl
Polygonum aviculare L.
Polygonum plebeium R.Br.
Portulaca quadrifida L.
Potamogeton pectinatus L.
Potamogeton schweinfurthii A.Benn.
Pseudognaphalium luteo-album (L.) Hilliard & B.L.Burt
Pseudognaphalium oligandrum (DC.) Hilliard & B.L.Burt
Pterodiscus speciosus Hook.
Pycreus macranthus (Boeck.) C.B.Clarke
Ranunculus multifidus Forssk.
Raphionacme hirsuta (E.Mey.) R.A.Dyer
Raphionacme velutina Schltr.
Rhynchosia minima (L.) DC. var. *prostrata* (Harv.) Meikle
Rhynchosia nervosa Benth. ex Harv. var. *nervosa*
Rhynchosia totta (Thunb.) DC. var. *totta*
Riccia okahandjana S.W.Arnell
Rorippa fluviatilis (E.Mey. ex Sond.) Thell. var. *fluviatilis*
Rubia horrida (Thunb.) Puff
Rumex conglomeratus Murb.
Rumex lanceolatus Thunb.
Salix mucronata Thunb. subsp. *mucronata*
Salvia disermas L.
Salvia runcinata L.f.
Scabiosa columbaria L.
Schizachyrium jeffreysii (Hack.) Stapf
Schizachyrium sanguineum (Retz.) Alston
Schizocarphus nervosus (Burch.) Van der Merwe
Schkuhria pinnata (Lam.) Kuntze ex Thell.
Schoenoplectus triqueter (L.) Palla
Scirpoides burkei (C.B.Clarke) Goetgh., Muasya & D.A.Simpson
Searsia lancea L.f.
Searsia leptodictya (Diels) T.S.Yi, A.J.Mill. & J.Wen forma *leptodictya*
Searsia pyroides (Burch.) Moffett var. *pyroides*
Searsia rigida (Mill.) F.A.Barkley var. *margaretae* (Burt Davy ex Moffett) Moffett
Seddera capensis (E.Mey. ex Choisy) Hallier f.
Selago burkei Rolfe
Selago densiflora Rolfe
Selago mixta Hilliard
Selago tenuifolia (Rolfe) Hilliard
Selago welwitschii Rolfe var. *australis* Hilliard
Senecio consanguineus DC.
Senecio coronatus (Thunb.) Harv.
Senecio erubescens Aiton var. *erubescens*
Senecio harveianus MacOwan
Senecio inornatus DC.
Senecio venosus Harv.
Senna italica Mill. subsp. *arachoides* (Burch.) Lock
Seriphium plumosum L.
Sesamum triphyllum Welw. ex Asch. var. *triphyllum*
Sesbania bispinosa (Jacq.) W.Wight var. *bispinosa*
Setaria incrassata (Hochst.) Hack.
Setaria nigrirostris (Nees) T.Durand & Schinz

Setaria pumila (Poir.) Roem. & Schult.
Setaria sphacelata (Schumach.) Stapf & C.E.Hubb. ex M.B.Moss var. *torta* (Stapf) Clayton
Setaria verticillata (L.) P.Beauv.
Silene burchellii Otth var. *angustifolia* Sond.
Solanum incanum L.
Solanum lichtensteinii Willd.
Solanum panduriforme E.Mey.
Solanum supinum Dunal var. *supinum*
Sonchus dregeanus DC.
Sonchus wilmsii R.E.Fr.
Sporobolus albicans (Nees ex Trin.) Nees
Sporobolus discosporus Nees
Sporobolus fimbriatus (Trin.) Nees
Sporobolus stapfianus Gand.
Stachys hyssopoides Burch. ex Benth.
Stachys spathulata Burch. ex Benth.
Stenostelma capense Schltr.
Stipagrostis uniplumis (Licht.) De Winter var. *neesii* (Trin. & Rupr.) De Winter
Stipagrostis uniplumis (Licht.) De Winter var. *uniplumis*
Striga elegans Benth.
Tagetes minuta L.
Tarchonanthus camphoratus L.
Tephrosia capensis (Jacq.) Pers. var. *hirsuta* Harv.
Tephrosia longipes Meisn. subsp. *longipes*
Tephrosia lupinifolia DC.
Tephrosia semiglabra Sond.
Teucrium trifidum Retz.
Themeda triandra Forssk.
Thesium transvaalense Schltr.
Thesium utile A.W.Hill
Tolpis capensis (L.) Sch.Bip.
Trachyandra saltii (Baker) Oberm. var. *saltii*
Trachypogon spicatus (L.f.) Kuntze
Tragus berteronianus Schult.
Trichodesma angustifolium Harv. subsp. *angustifolium*
Trichoneura grandiglumis (Nees) Ekman
Trifolium africanum Ser. var. *africanum*
Tripteris aghillana DC. var. *aghillana*
Triraphis andropogonoides (Steud.) E.Phillips
Triumfetta sonderi Ficalho & Hiern
Trochomeria debilis (Sond.) Hook.f.
Utricularia stellaris L.f.
Urelytrum agropyroides (Hack.) Hack.
Urochloa brachyuran (Hack.) Stapf
Vahlia capensis (L.f.) Thunb. subsp. *vulgaris* Bridson var. *linearis* E.Mey. ex Bridson
Verbena brasiliensis Vell.
Verbena officinalis L.
Vernonia oligocephala (DC.) Sch. Bip. ex Walp.
Vernonia poskeana Vatke & Hildebr.
Vicia sativa L. subsp. *sativa*
Vigna unguiculata (L.) Walp. subsp. *stenophylla* (Harv.) Maréchal, Mascherpa & Stainier
Wahlenbergia denticulata (Burch.) A.DC. var. *transvaalensis* (Adamson) W.G.Welman
Wahlenbergia krebsii Cham. subsp. *krebsii*
Wahlenbergia magaliesbergensis Lammers
Wahlenbergia undulata (L.f.) A.DC.
Withania somnifera (L.) Dunal
Xanthium spinosum L.

Xenostegia tridentata (L.) D.F.Austin & Staples subsp. angustifolia (Jacq.) Lejoly & Lisowski
Zanthoxylum capense (Thunb.) Harv.
Zinnia peruviana (L.) L.
Ziziphus mucronata Willd. subsp. mucronata
Ziziphus zeyheriana Sond.
Zornia glochidiata Rchb. ex DC.

Appendix 5: Animal species with a geographical distribution that includes the study area.

Notes:

1. Species of conservation concern are in red lettering.
2. Species protected according to the Western Cape Nature Conservation Laws Amendment Act of 2000 (Act 3 of 2000) marked with "P"
3. Species protected according to the National Environmental Management: Biodiversity Act of 2004 (Act 10 of 2000) marked with "N"

Mammals:

Red hartebeest

Springbok

^NBlack wildebeest

Blue wildebeest

Blesbok

^N**Black rhinoceros (VU)**

Klipspringer

Warthog

Steenbok

Common duiker

Eland

Kudu

Rock hyrax

Cape clawless otter

Water mongoose

Black-backed jackal

Caracal

Yellow mongoose

^NBlack-footed cat

African wild cat

Slender mongoose

Small-spotted genet

Large-spotted genet

^N**Brown hyaena (NT)**

White-tailed mongoose

Striped polecat

^N**Spotted-necked otter (NT, global LC)**

^N**Honey badger (NT)**

Bat-eared fox

African weasel

Aardwolf

Suricate

^NCape fox

Natal long-fingered bat (NT, LC)

Cape serotine bat

Egyptian slit-faced bat

Geoffroy's horseshoe bat (NT, LC)

Darling's horseshoe bat (NT, LC)

Yellow house bat

Egyptian free-tailed bat

^N**South African hedgehog (NT, LC)**

Reddish-grey musk shrew

Tiny musk shrew

Lesser red musk shrew

Swamp musk shrew

Least dwarf shrew

Lesser dwarf shrew

Cape/Desert hare

Scrub/Savannah hare

Vervet monkey

Chacma baboon

Tete veld rat

Namaqua rock mouse

Common mole-rat

Grey climbing mouse

Woodland dormouse

Porcupine

Large-eared mouse

Multimammate mouse

Desert pygmy mouse

White-tailed rat (EN)

Angoni vlei rat

Vlei rat

Springhare

Striped mouse

Pouched mouse

Kreb's fat mouse

Highveld gerbil

Bushveld gerbil

Greater cane rat

Cape ground squirrel

Rock elephant shrew

Aardvark

Reptiles:

Puff adder

Rhombic night adder

Cape cobra

Mozambique spitting cobra

Rinkhals

Highveld garter snake

Spotted harlequin snake

Striped harlequin snake (NT)

Boomslang

Southern stiletto snake

Short-snouted whip snake

Kalahari sand snake

Western stripe-bellied sand snake

Crossed whip snake

Spotted skaapsteker

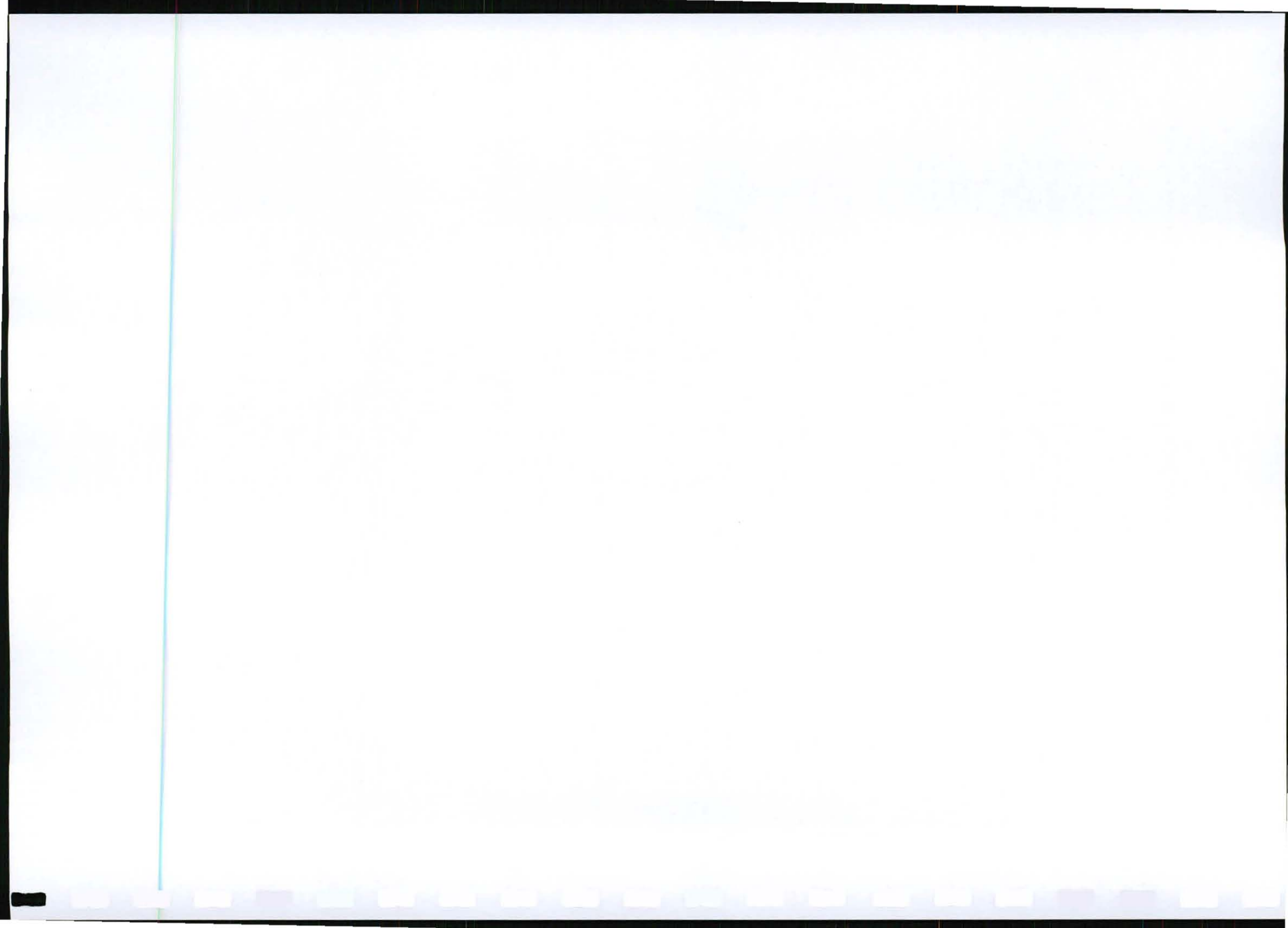
Striped skaapsteker

Herald snake

Black-headed centipede eater

Brown house snake

Aurora house snake



Common brown water snake
Mole snake
Sundevall's shovel-snout
Common slug-eater
Common wolf snake
Common egg-eater
Delalande's beaked blind snake
Bibron's blind snake
Peter's worm snake

Distant's ground agama
Southern rock agama
Common flap-necked chameleon
Rock monitor
Water monitor
Holub's sandveld lizard
Spotted sandveld lizard
Spotted sand lizard
Common rough-scaled lizard
Thin-tailed legless skink
Spotted-neck snake-eyed skink
Cape skink
Montane speckled skink
Variable skink
Transvaal girdled lizard
Yellow-throated plated lizard
Cape dwarf gecko
Cape gecko

Marsh terrapin
Kalahari tent tortoise

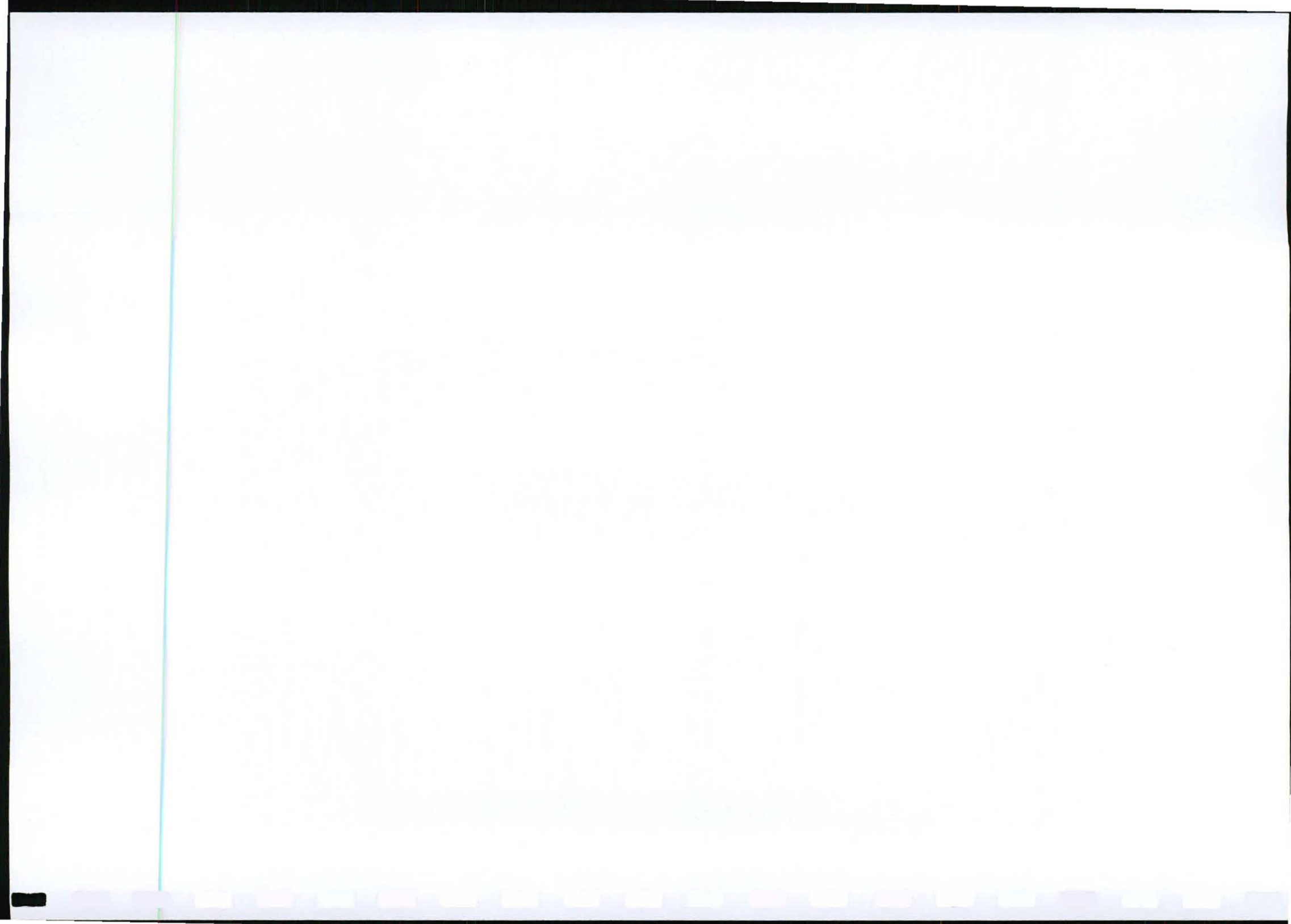
Amphibians

Bushveld Rain Frog
Eastern olive toad
Guttural toad
Western olive toad
Raucous toad
Southern pygmy toad
Bubbling kassina
Snoring puddle frog
Common platanna
Boettger's caco
Common river frog
Cape river frog
^NGiant bullfrog
Striped stream frog
Tremolo sand frog
Natal sand frog
Tandy's sand frog

Birds:

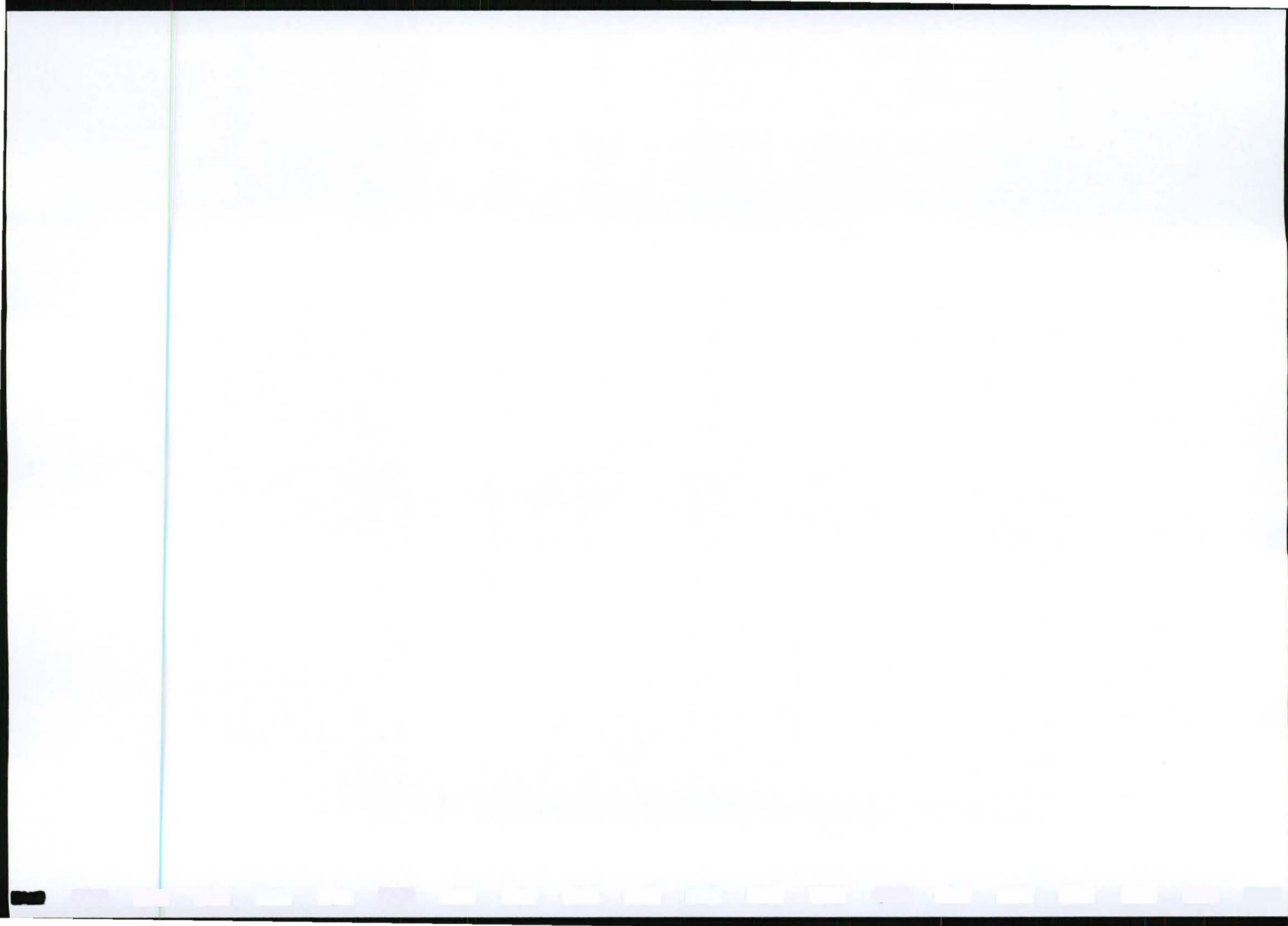
Abdim's Stork
African Black Duck
African Crake

African Cuckoo
African Fish Eagle
African Hoopoe
African Jacana
African Marsh Harrier (VU)
African Marsh Warbler
African Pied Wagtail
African Rail
African Sedge Warbler
African Spoonbill
Alpine Swift
Anteating Chat
Ashy Tit
Baillon's Crake
Banded Martin
Barn Owl
Barthroated Apalis
Bittern (CR)
Black Crake
Black Crow
Black Egret
Black Harrier (VU)
Black Kite
Black Sparrowhawk
^N**Black Stork (NT)**
Black Sunbird
Black Swift
Black Widowfinch
Blackcheeked Waxbill
Blackchested Prinia
Blackcollared Barbet
Blackcrowned Night Heron
Blackeyed Bulbul
Blackheaded Heron
Blacknecked Grebe
Blackshouldered Kite
Blacksmith Plover
Blacktailed Godwit
Blackthroated Canary
Blackwinged Pratincole (NT)
Blackwinged Stilt
^N**Blue Crane (VU)**
Blue Waxbill
Bluebilled Firefinch
Bluecheeked Bee-eater
Bokmakierie
Booted Eagle
Bronze Mannikin
Brownhooded Kingfisher
Brownthroated Martin
Brubru
Buffy Pipit
Burchell's Coucal



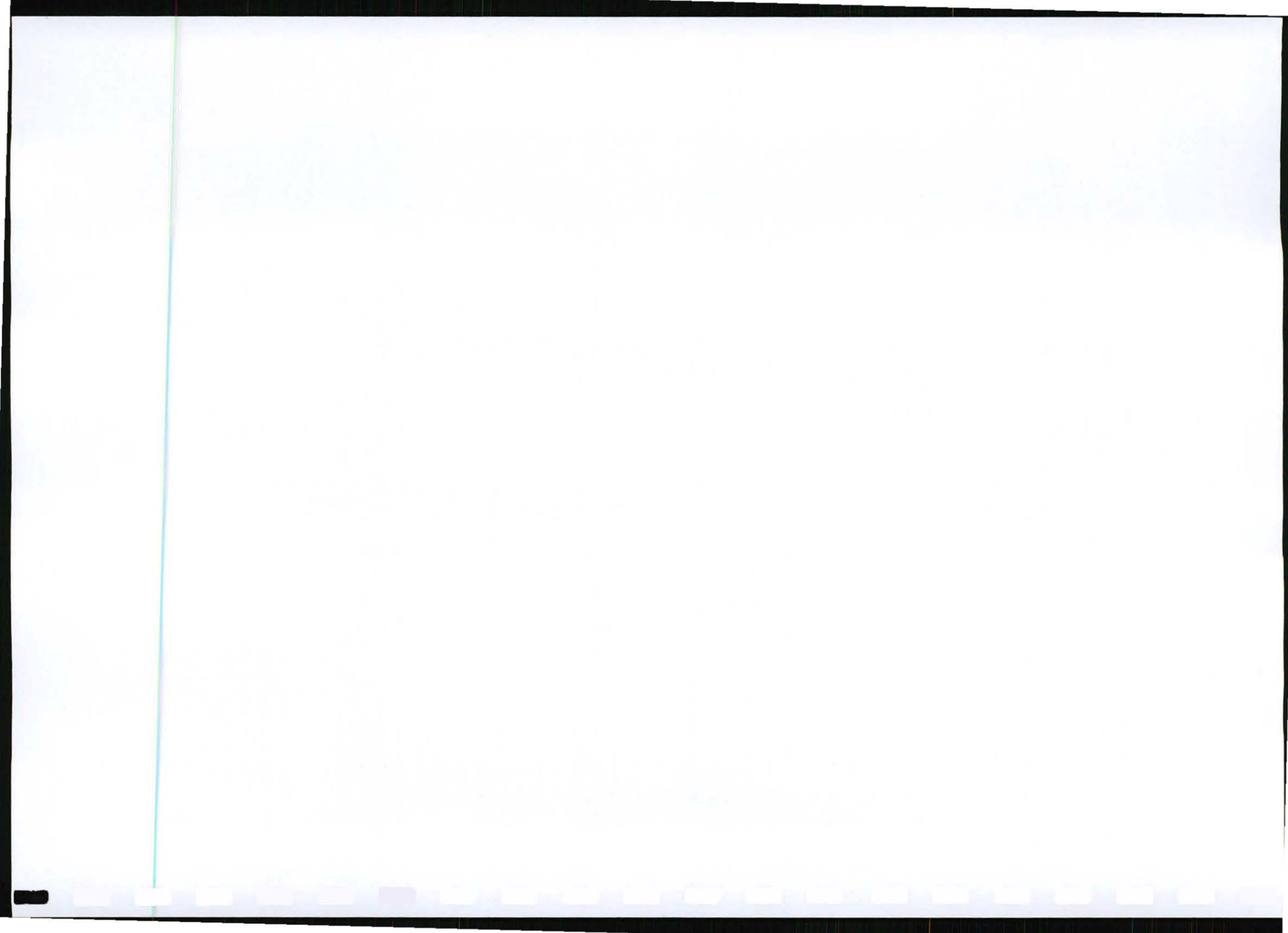
Burchell's Courser
 Cape Bunting
 Cape Penduline Tit
 Cape Reed Warbler
 Cape Robin
 Cape Shoveller
 Cape Sparrow
 Cape Teal
 Cape Turtle Dove
^NCape Vulture (VU)
 Cape Wagtail
 Cape Weaver
 Cape White-eye
 Capped Wheatear
 Cardinal Woodpecker
 Caspian Plover
Caspian Tern (NT)
 Cattle Egret
 Chestnutbacked Finchlark
Chestnutbanded Plover (NT)
 Chinspot Batis
 Cloud Cisticola
 Common Moorhen
 Common Quail
 Common Sandpiper
 Common Waxbill
 Crested Barbet
 Crimsonbreasted Shrike
 Crowned Plover
 Cuckoofinch
 Curlew
 Curlew Sandpiper
 Dabchick
 Darter
 Desert Cisticola
 Diederik Cuckoo
 Doublebanded Courser
 Eastern Clapper Lark
 Eastern Longbilled Lark
 Eastern Redfooted Kestrel
 Egyptian Goose
 Ethiopian Snipe
 Eurasian Bee-eater
 Eurasian Cuckoo
 Eurasian Golden Oriole
 Eurasian Marsh Harrier
 Eurasian Marsh Warbler
 Eurasian Nightjar
 Eurasian Redstart
 Eurasian Roller
 Eurasian Sedge Warbler
 Eurasian Swallow
 Eurasian Swift

Fairy Flycatcher
 Familiar Chat
 Fantailed Cisticola
 Fawncoloured Lark
 Feral Pigeon
 Fierynecked Nightjar
 Fiscal Flycatcher
 Fiscal Shrike
 Forktailed Drongo
 Fulvous Duck
 Gabar Goshawk
 Garden Warbler
 Giant Eagle Owl
 Giant Kingfisher
 Glossy Ibis
 Glossy Starling
 Golden Bishop
 Goldenbreasted Bunting
 Goldentailed Woodpecker
 Goliath Heron
^NGrass Owl (VU)
 Grassveld Pipit
 Great Crested Grebe
 Great Reed Warbler
 Great Spotted Cuckoo
 Great White Egret
 Greater Doublecollared Sunbird
Greater Flamingo (NT)
 Greater Honeyguide
 Greater Kestrel
 Greater Striped Swallow
 Greenbacked Heron
 Greenshank
 Grey Heron
 Grey Hornbill
 Grey Lourie
 Grey Plover
 Greybacked Finchlark
 Greyheaded Gull
 Groundscraper Thrush
 Gymnogene
 Hadedda Ibis
 Hamerkop
 Harlequin Quail
 Helmeted Guineafowl
 Honey Buzzard
 Horus Swift
 Hottentot Teal
 House Martin
 House Sparrow
 Icterine Warbler
 Indian Myna
 Jackal Buzzard



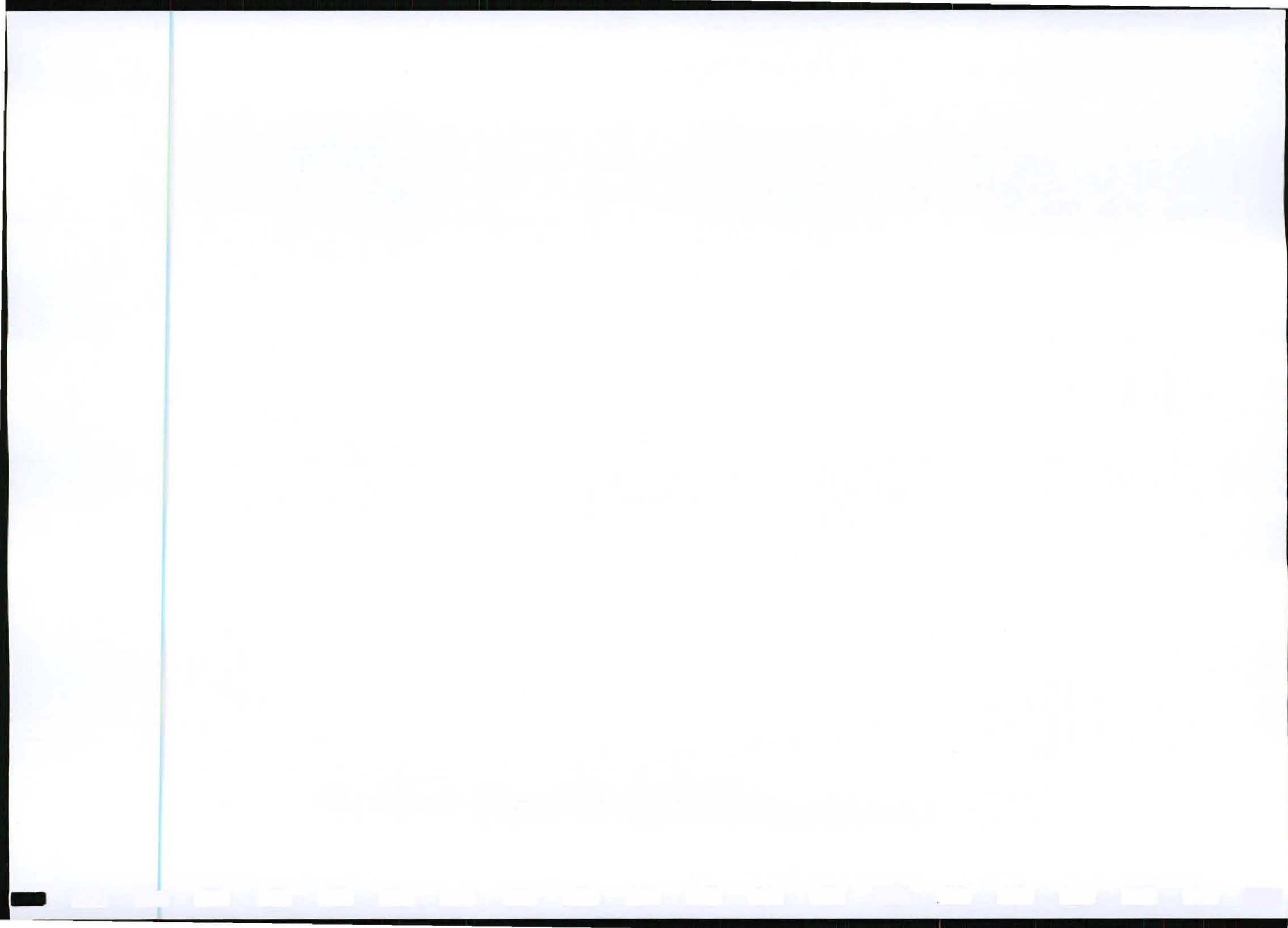
Jacobin Cuckoo
 Jameson's Firefinch
 Kalahari Robin
 Karoo Thrush
 Kittlitz's Plover
 Klaas's Cuckoo
 Knobbilled Duck
 Kurrichane Buttonquail
Lanner Falcon (NT)
 Larklike Bunting
 Laughing Dove
 Lazy Cisticola
Lesser Flamingo (NT)
 Lesser Grey Shrike
 Lesser Honeyguide
NLesser Kestrel (VU)
 Levillant's Cisticola
 Lilacbreasted Roller
 Little Bee-eater
 Little Bittern
 Little Egret
 Little Sparrowhawk
 Little Stint
 Little Swift
 Longbilled Crombec
 Longbilled Pipit
 Longtailed Shrike
 Longtailed Widow
 Maccoa Duck
 Malachite Kingfisher
 Malachite Sunbird
Marabou Stork (NT)
 Marico Flycatcher
 Marsh Owl
 Marsh Sandpiper
NMartial Eagle (VU)
 Masked Weaver
 Melba Finch
Melodious Lark (NT)
 Mocking Chat
 Montagu's Harrier
 Mountain Chat
 Namaqua Dove
 Namaqua Sandgrouse
 Natal Francolin
 Neddicky
 Old World Painted Snipe
Old World Painted Snipe (NT)
 Orange River Francolin
 Orange River White-eye
 Orangebreasted Waxbill
 Orangethroated Longclaw
 Osprey

Ostrich
Pallid Harrier (NT)
 Palm Swift
 Paradise Flycatcher
 Paradise Whydah
 Pearlbreasted Swallow
NPeregrine Falcon (NT)
 Pied Avocet
 Pied Barbet
 Pied Crow
 Pied Kingfisher
 Pied Starling
NPinkbacked Pelican (VU)
 Pinkbilled Lark
 Pintailed Whydah
 Plainbacked Pipit
 Pirit Batis
 Purple Gallinule
 Purple Heron
 Purple Roller
 Quail Finch
 Rameron Pigeon
 Rattling Cisticola
 Red Bishop
 Redbacked Shrike
 Redbilled Firefinch
 Redbilled Quelea
 Redbilled Teal
 Redbilled Woodhoopoe
 Redbreasted Swallow
 Redcapped Lark
 Redchested Cuckoo
 Redchested Flufftail
 Redcollared Widow
 Redeyed Bulbul
 Redeyed Dove
 Redfaced Mousebird
 Redheaded Finch
 Redknobbed Coot
 Redthroated Wryneck
 Redwinged Starling
 Reed Cormorant
 Ringed Plover
 Rock Bunting
 Rock Kestrel
 Rock Martin
 Rock Pigeon
 Roseringed Parakeet
 Ruddy Turnstone
 Ruff
 Rufouscheeked Nightjar
 Rufouseared Warbler
 Rufousnaped Lark



Sabota Lark
Sacred Ibis
Sand Martin
Sanderling
Scalyfeathered Finch
Scimitar-billed Woodhoopoe
Secretarybird (NT)
Shaft-tailed Whydah
Sharp-billed Honeyguide
Sociable Weaver
South African Cliff Swallow
South African Shelduck
Southern Grey-headed Sparrow
Southern Pochard
Speckled Mousebird
Spike-heeled Lark
Spotted Crake
Spotted Dikkop
Spotted Eagle Owl
Spotted Flycatcher
Spur-winged Goose
Squacco Heron
Steel-blue Widowfinch
Steppe Buzzard
Stonechat
Streaky-headed Canary
Swainson's Francolin
Swallow-tailed Bee-eater
Tawny-flanked Prinia
Temminck's Courser
Three-banded Plover
Threestreaked Tchagra
Titbabbler
Violet-eared Waxbill
Wailing Cisticola
Wattled Plover
Wattled Starling
Western Red-footed Kestrel
Whimbrel
Whiskered Tern
White Pelican (NT)
White Stork
White-backed Duck
White-backed Mousebird
White-backed Vulture (VU)
White-bellied Korhaan (VU)
White-bellied Sunbird
White-breasted Cormorant
White-browed Sparrowweaver
White-faced Duck
White-faced Owl
White-fronted Bee-eater
White-rumped Swift

Whitethroat
Whitethroated Canary
Whitethroated Robin
Whitethroated Swallow
Whitewing Korhaan
Whitewing Tern
Whitewing Widow
Willow Warbler
Wood Sandpiper
Yellow Canary
Yellow Wagtail
Yellow-bellied Eremomela
Yellow-billed Duck
Yellow-billed Egret
Yellow-billed Kite
Yellow-billed Stork (NT)
Yellow-eyed Canary
Yellow-throated Sparrow



**Appendix 6: Species protected under the National Environmental Management:
Biodiversity Act, 2004 (Act 10 of 2004)**

(as updated in R. 1187, 14 December 2007)

CRITICALLY ENDANGERED SPECIES

Reptilia

Loggerhead sea turtle
Leatherback sea turtle
Hawksbill sea turtle

Aves

Wattled crane
Blue swallow
Egyptian vulture
Cape parrot

Mammalia

Riverine rabbit
Rough-haired golden mole

Flora

Adenium swazicum
Aloe pillansii
Diaphananthe millarii
Dioscorea ebutsniorum (= sp. nov., not yet described)
Encephalartos aemulans
Encephalartos brevifoliolatus
Encephalartos cerinus
Encephalartos dolomiticus
Encephalartos heenanii
Encephalartos hirsutus
Encephalartos inopinus
Encephalartos latifrons
Encephalartos middelburgensis
Encephalartos nubimontanus
Encephalartos woodii

ENDANGERED SPECIES

Reptilia

Green turtle
Giant girdled lizard
Olive ridley turtle
Geometric tortoise

Aves

Blue crane
Grey crowned crane
Saddle-billed stork
Bearded vulture
White-backed vulture
Cape vulture
Hooded vulture

Pink-backed pelican
Pel's fishing owl
Lappet-faced vulture

Mammalia

Robust golden mole
Tsessebe
Black rhinoceros
Mountain zebra
African wild dog
Gunning's golden mole
Oribi
Red squirrel
Four-toed elephant-shrew

Flora

Angraecum africae (no such species!)
Encephalartos arenarius
Encephalartos cupidus
Encephalartos horridus
Encephalartos laevifolius
Encephalartos lebomboensis
Encephalartos msinganus
Jubaeopsis caffra
Siphonochilus aethiopicus
Warburgia salutaris
Newtonia hilderbrandtii

VULNERABLE SPECIES

Aves

White-headed vulture
Tawny eagle
Kori bustard
Black stork
Southern banded snake eagle
Blue korhaan
Taita falcon
Lesser kestrel
Peregrine falcon
Bald ibis
Ludwig's bustard
Martial eagle
Bataleur
Grass owl

Mammalia

Cheetah
Samango monkey
Giant golden mole
Giant rat
Bontebok
Tree hyrax

Roan antelope
Pangolin
Juliana's golden mole
Suni
Large-eared free-tailed bat
Lion
Leopard
Blue duiker

Flora

Aloe albida
Encephalartos cycadifolius
Encephalartos eugene-maraisii
Encephalartos ngovanus
Merwillia plumbea
Zantedeschia jucunda

PROTECTED SPECIES

Amphibia

Giant bullfrog
African bullfrog

Reptilia

Gaboon adder
Namaqua dwarf adder
Smith's dwarf chameleon
Armadillo girdled lizard
Nile crocodile
African rock python

Aves

Southern ground hornbill
African marsh harrier
Denham's bustard
Jackass penguin

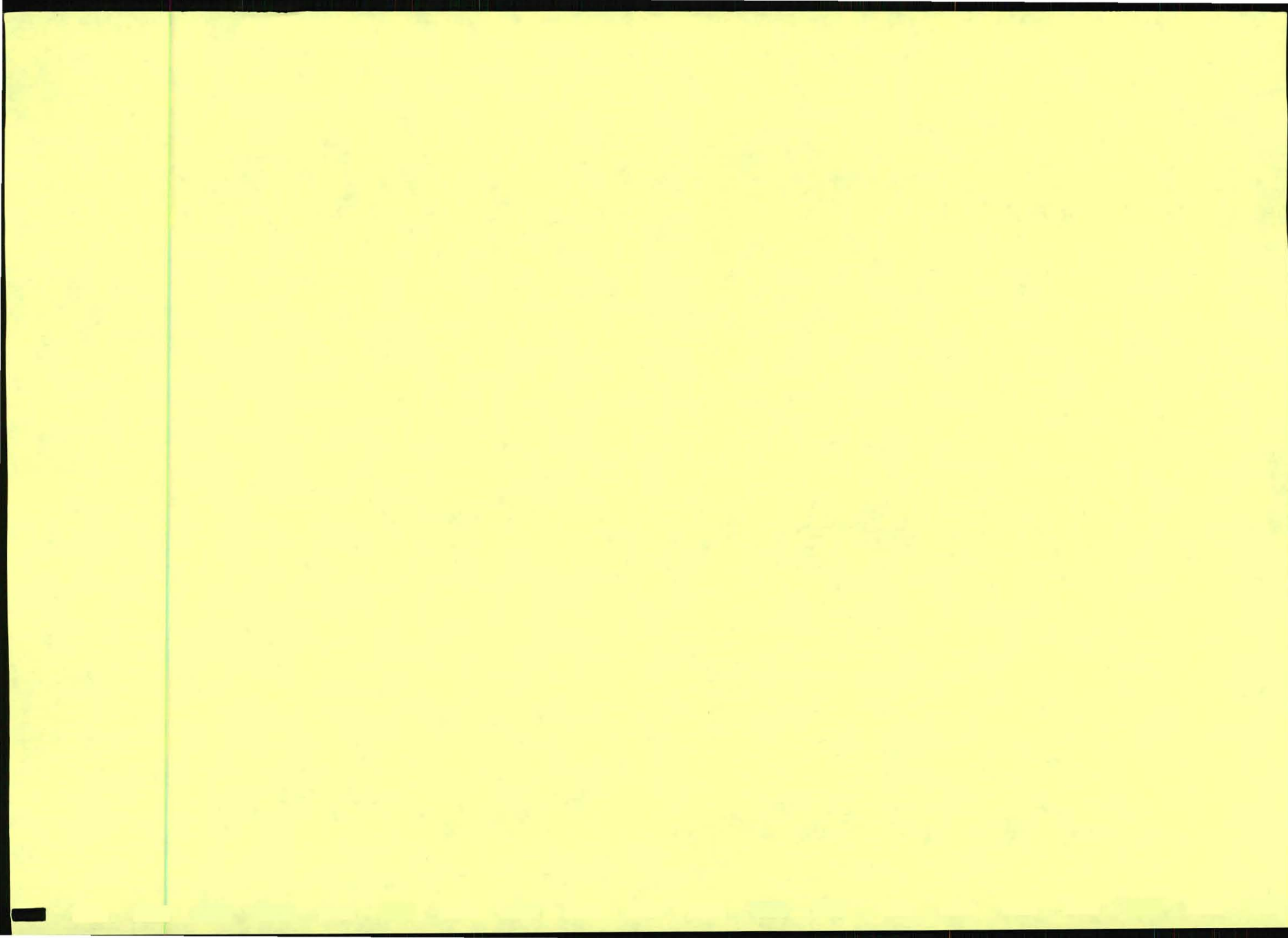
Mammalia

Cape clawless otter
South African hedgehog
White rhinoceros
Black wildebeest
Spotted hyaena
Black-footed cat
Brown hyaena
Serval
African elephant
Spotted-necked otter
Honey badger
Sharpe's grysbok
Reedbuck
Cape fox

Flora

Adenia wilmsii
Aloe simii
Clivia mirabilis
Disa macrostachya
Disa nubigena
Disa physodes
Disa procera
Disa sabulosa
Encephelartos altensteinii
Encephelartos caffer
Encephelartos dyerianus
Encephelartos frederici-guilielmi
Encephelartos ghellinckii
Encephelartos humilis
Encephelartos lanatus
Encephelartos lehmannii
Encephelartos longifolius
Encephelartos natalensis
Encephelartos paucidentatus
Encephelartos princeps
Encephelartos senticosus
Encephelartos transvenosus
Encephelartos trispinosus
Encephelartos umbeluziensis
Encephelartos villosus
Euphorbia clivicola
Euphorbia meloformis
Euphorbia obesa
Harpagophytum procumbens
Harpagophytum zeyherii
Hoodia gordonii
Hoodia currorii
Protea odorata
Stangeria eriopus

Appendix G:
Soil and Agricultural Potential Study





SCOPING PHASE REPORT

SOIL, LAND USE, LAND CAPABILITY AND AGRICULTURAL POTENTIAL SURVEY:

PROPOSED KABI VAALKOP PV SOLAR ENERGY FACILITY NEAR ORKNEY IN THE NORTH WEST PROVINCE

January 16th, 2012

Compiled by:

J.H. van der Waals

(PhD Soil Science, Pr.Sci.Nat)

Member of:

Soil Science Society of South Africa (SSSSA)

Soil Science Society of America (SSSA)

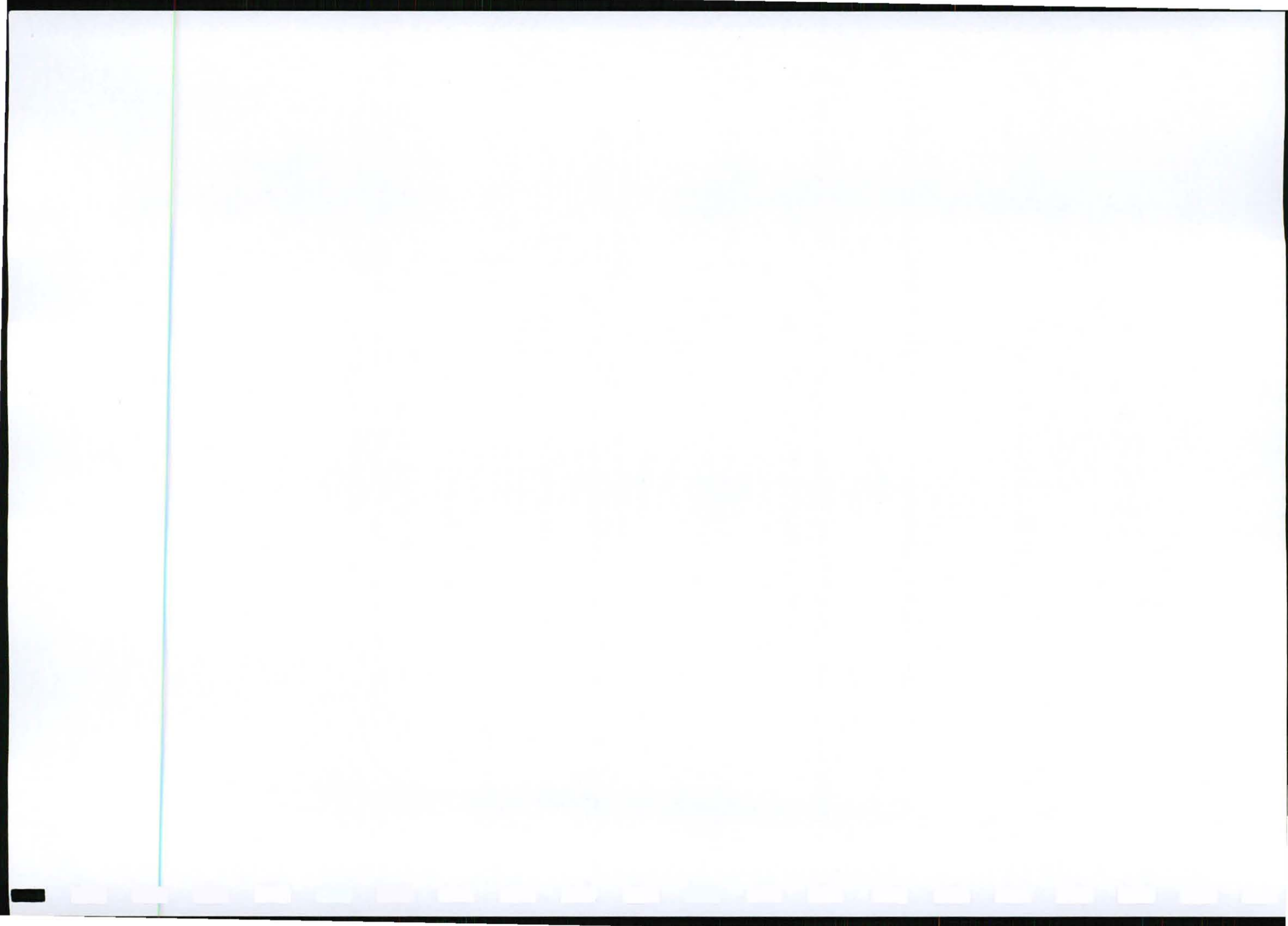
Accredited member of:

South African Soil Surveyors Organisation (SASSO)

Registered with:

The South African Council for Natural Scientific Professions

Registration number: 400106/08



DECLARATION

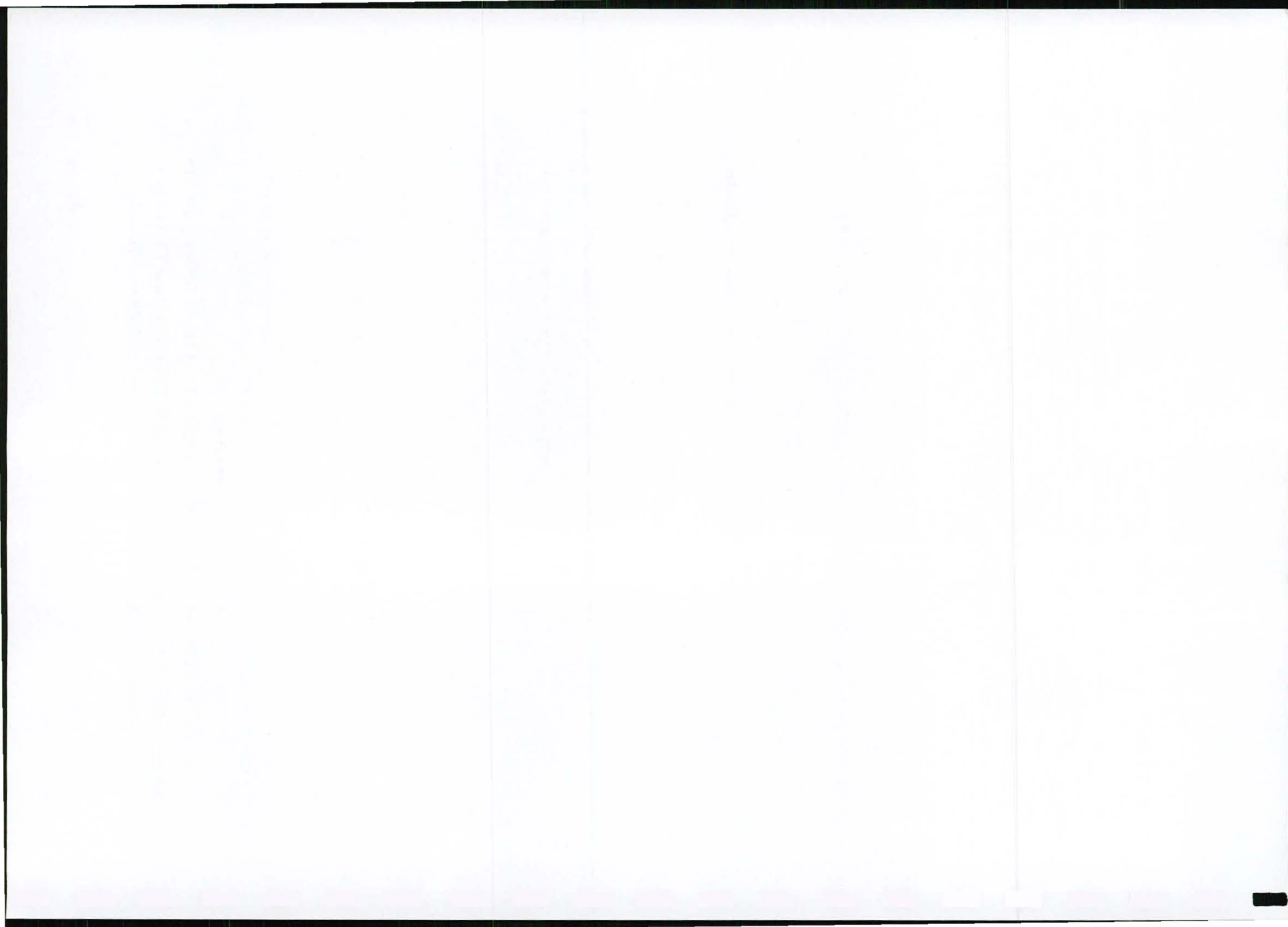
I, Johan Hilgard van der Waals, declare that I –

- 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.

J.H. VAN DER WAALS
TERRA SOIL SCIENCE

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SCOPING PHASE SOIL, LAND USE, LAND CAPABILITY AND AGRICULTURAL POTENTIAL SURVEY – PROPOSED KABI VAALKOP PV SOLAR ENERGY FACILITY NEAR ORKNEY IN THE NORTH WEST PROVINCE

1. TERMS OF REFERENCE

Terra Soil Science (TSS) was commissioned by Savannah Environmental (Pty) Ltd to undertake a scoping level soil, land use, land capability and agricultural potential survey for the proposed Kabi Vaalkop PV Solar Energy Facility near Orkney in the North West Province.

2. INTRODUCTION

A scoping level soil, land use, land capability and agricultural potential survey was conducted for the proposed Kabi Vaalkop PV Solar Energy Facility near Orkney in the North West Province.

3. DESCRIPTION OF THE SURVEY AREA

3.1 Survey Area Boundary

The survey area lies between 26° 53' 57" and 26° 56' 10" south and 26° 42' 22" and 26° 44' 32" east approximately 6 km south east of the city of Klerksdorp in the North West Province (**Figure 1**).

3.2 Survey Area Physical Features

The survey area lies on level to undulating terrain between 1320 and 1340 m above mean sea level. The geology consists mainly of dolomite and chert with a dominance of shallow red soils.

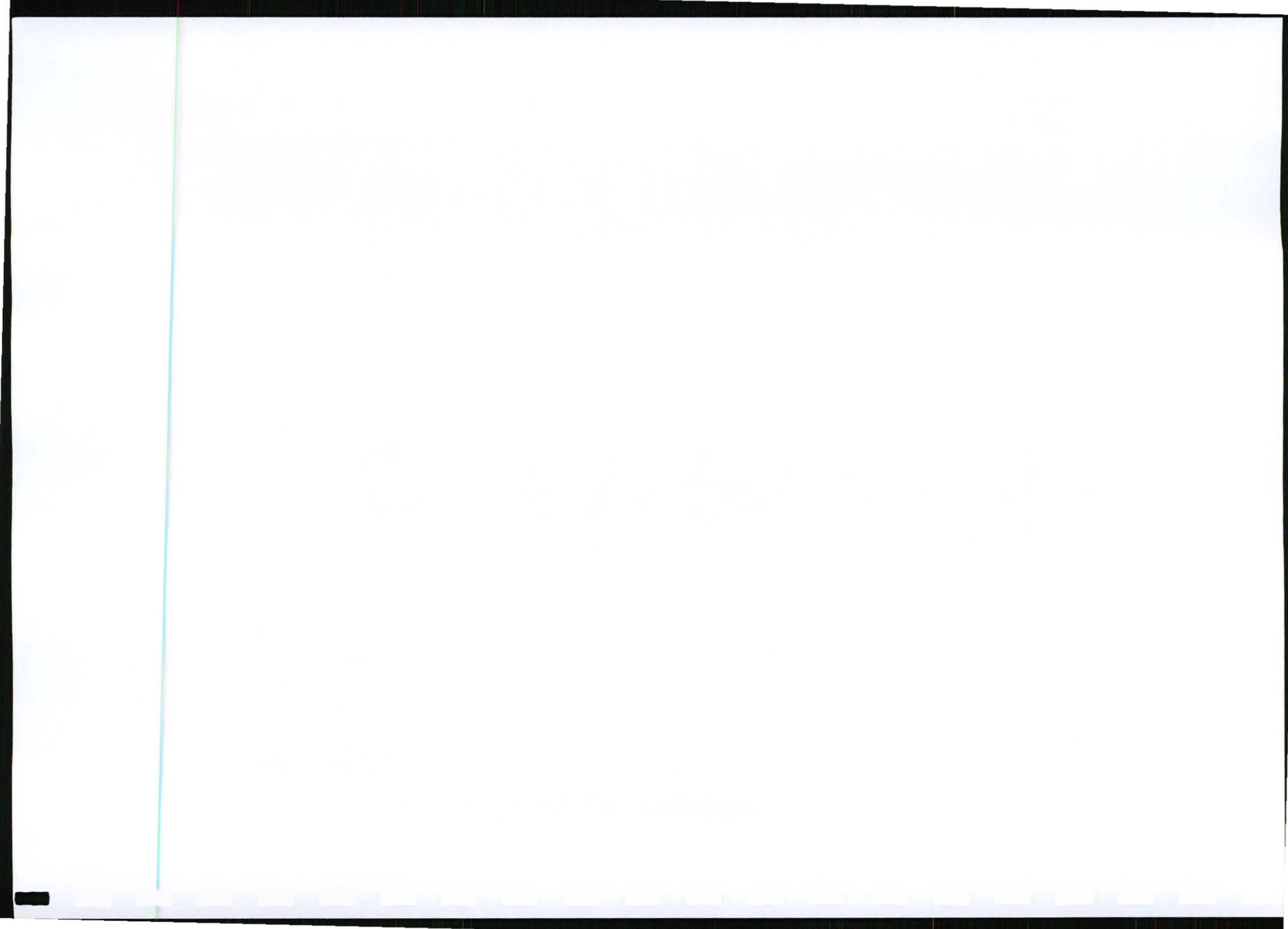
4. SOIL, LAND CAPABILITY, LAND USE SURVEY AND AGRICULTURAL POTENTIAL SURVEY

4.1 Method of Soil, Land Capability, Land Use Survey and Agricultural Potential Survey

The scoping soil, land capability, land use and agricultural potential surveys were conducted in two phases.

4.1.1 Phase 1: Land Type Data

Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC). The land type data is presented at a scale of 1:250 000 and entails the division of land into land types, typical terrain cross sections for the land



4.1.2 Phase 2: Aerial Photograph Interpretation and Land Use Mapping

The most up to date aerial photographs of the site were obtained from Google Earth. The image was used to interpret aspects such as land use and land cover as well as historic land uses such as cultivation.

4.2 Soil, Land Capability, Land Use and Agricultural Potential Survey Results

4.2.1 Phase 1: Land Type Data

The site falls into the **Bc23** and **Fa13** land types (Land Type Survey Staff, 1972 - 2006). (Refer to **Figure 2** for the land type map of the area). Below follows a brief description of the land types in terms of soils, land capability, land use and agricultural potential.

Land Type Bc23

Soils: Bc land types denote areas where eutrophic red apedal soils dominate the landscape. The soils in upland positions are predominantly shallow and rocky with apedal soil material occurring throughout. Lowland positions are dominated by structured soils with and without swelling properties.

Land capability and land use: Predominantly extensive grazing but due to the proximity of mining activities the land tends to lie fallow. Due to the level terrain soil erosion is not a major factor but the soils are susceptible to such if the terrain is physically disturbed.

Agricultural potential: Low potential due to the shallow nature of most of the soils. The rainfall is adequate for dryland cropping (**Figure 3**) but the soils are limiting in terms of such land uses.

Land Type Fa13

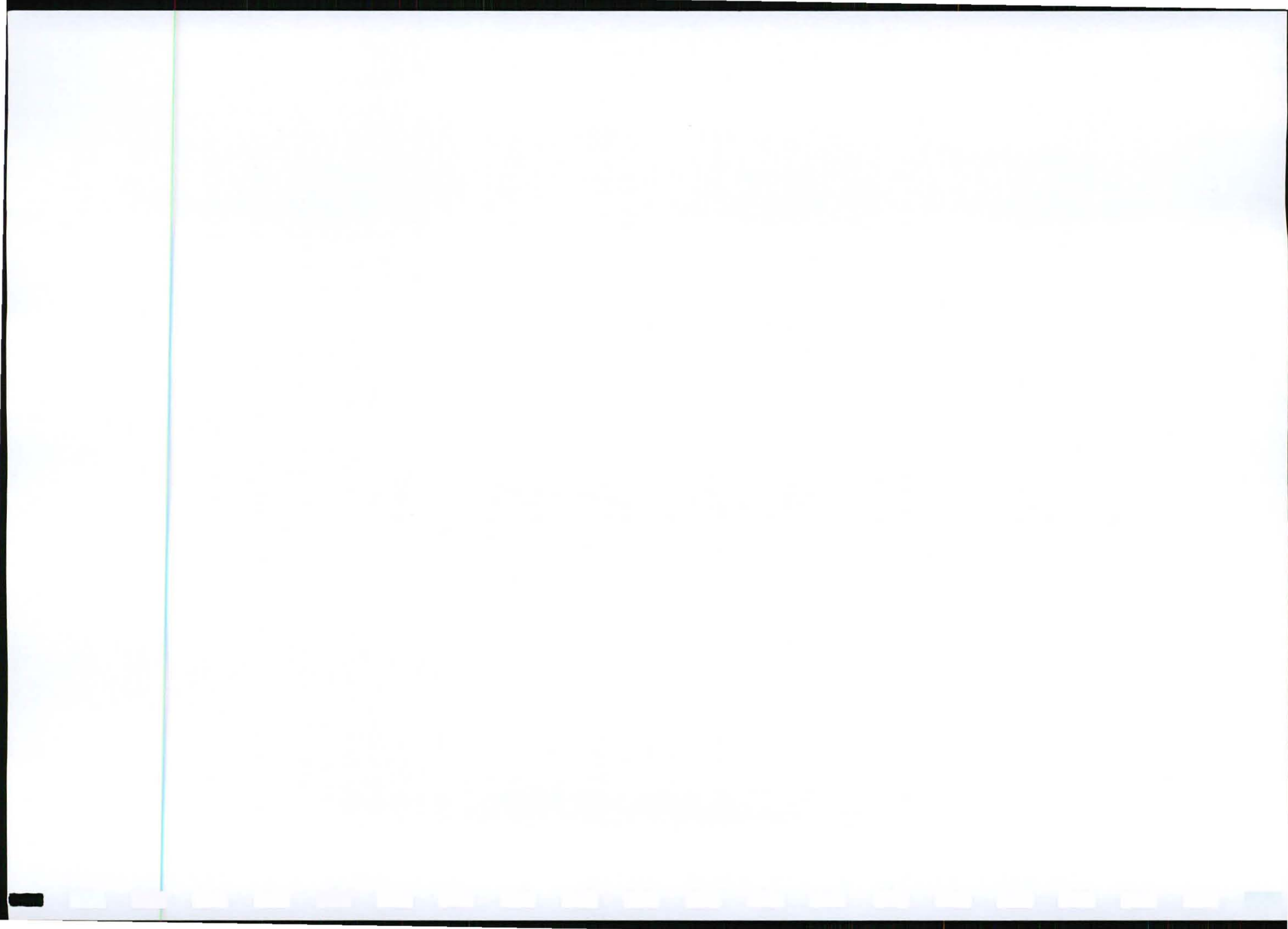
Soils: Fa land types denote areas where shallow soils dominate and where lime is not encountered regularly. Due to the dominance of dolomite and chert the soils are either shallow and rocky or deep red apedal (structureless). Convex positions in the landscape tend to be dominated by the shallow soils and concave positions by the deeper red soils.

Land capability and land use: The land capability and land use is determined by the soils with the shallow soils being utilised for extensive grazing and the deeper soils occasionally being used for rainfed and irrigated crop production. Soil erosion is not a major factor but the soils are susceptible to such if the terrain is physically disturbed.

Agricultural potential: The agriculture potential is generally low due to the dominance of shallow soils but pockets of high potential soil may occur that are then utilised for rainfed or irrigated crop production. The rainfall is adequate for dryland crop production (**Figure 3**).

4.2.2 Phase 2: Aerial Photograph Interpretation and Land Use/Capability Mapping

The interpretation of the Google Earth image yielded one land use namely possible extensive grazing (**Figure 4**). The land capability of the site mimics the land use and is classified as "grazing". The land use is termed "possible" extensive grazing as the proximity of mining



activities and urban areas generally precludes the area from being grazed due to theft and other challenges.

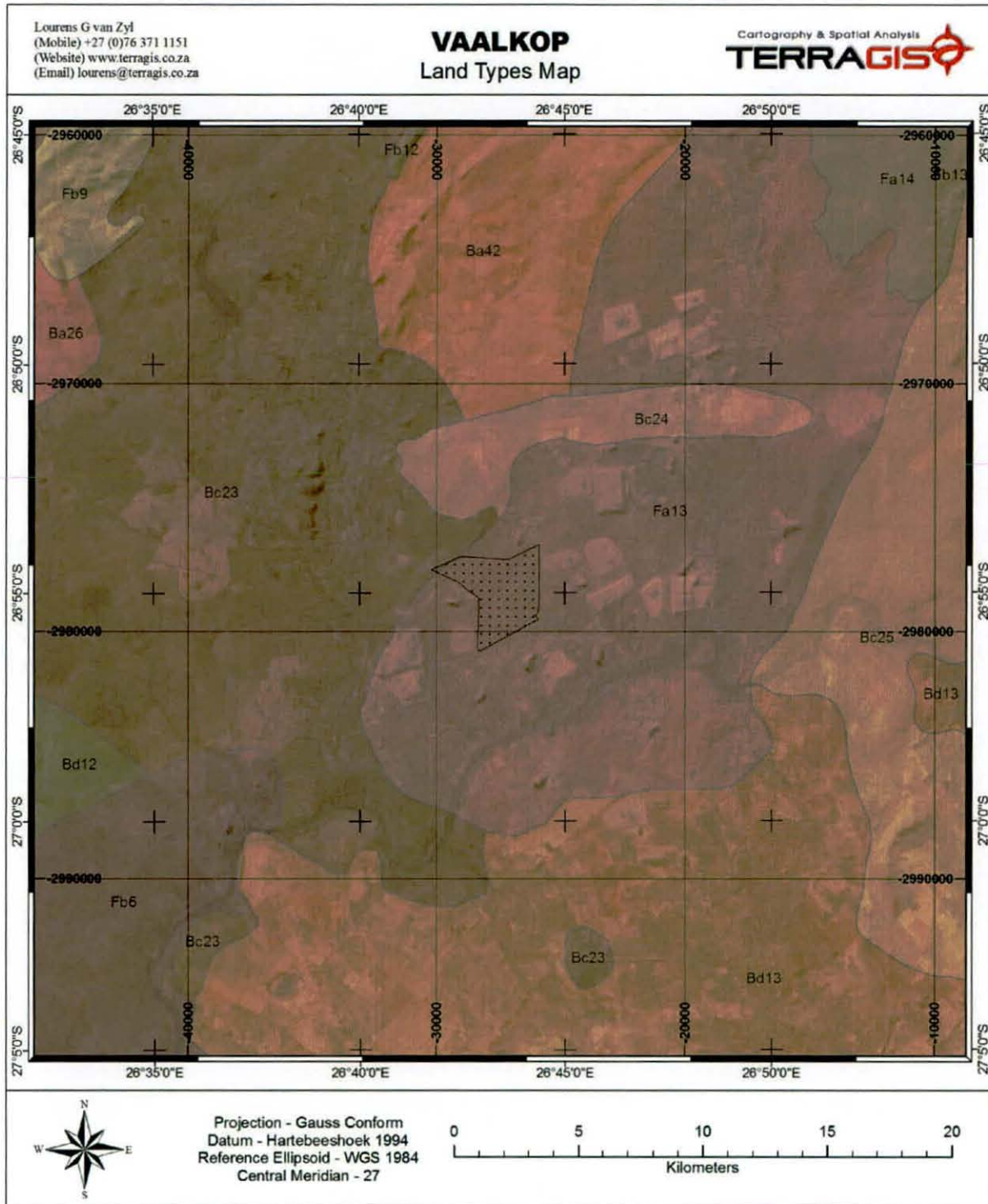
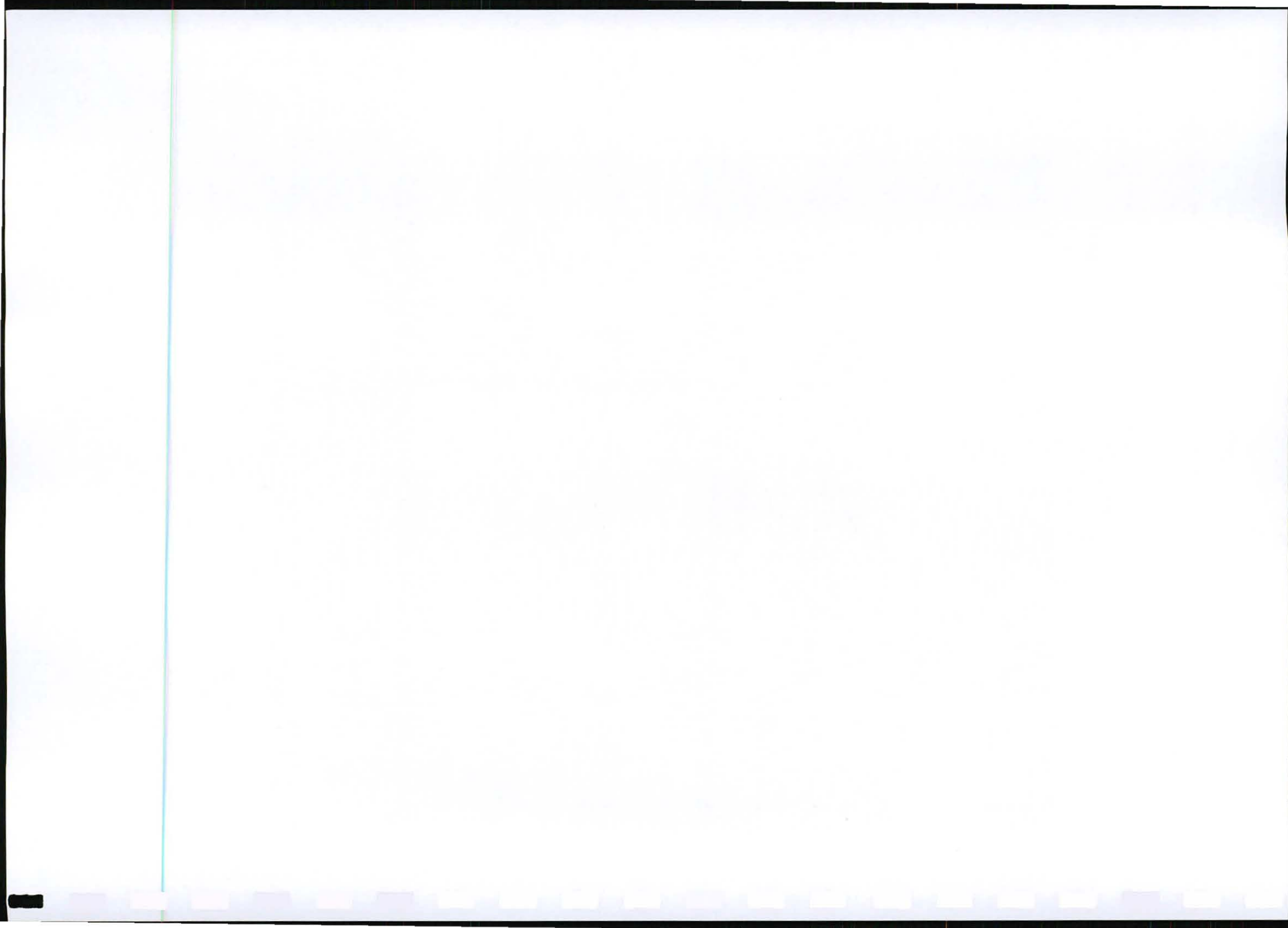


Figure 2 Land type map of the survey site with location of development phases



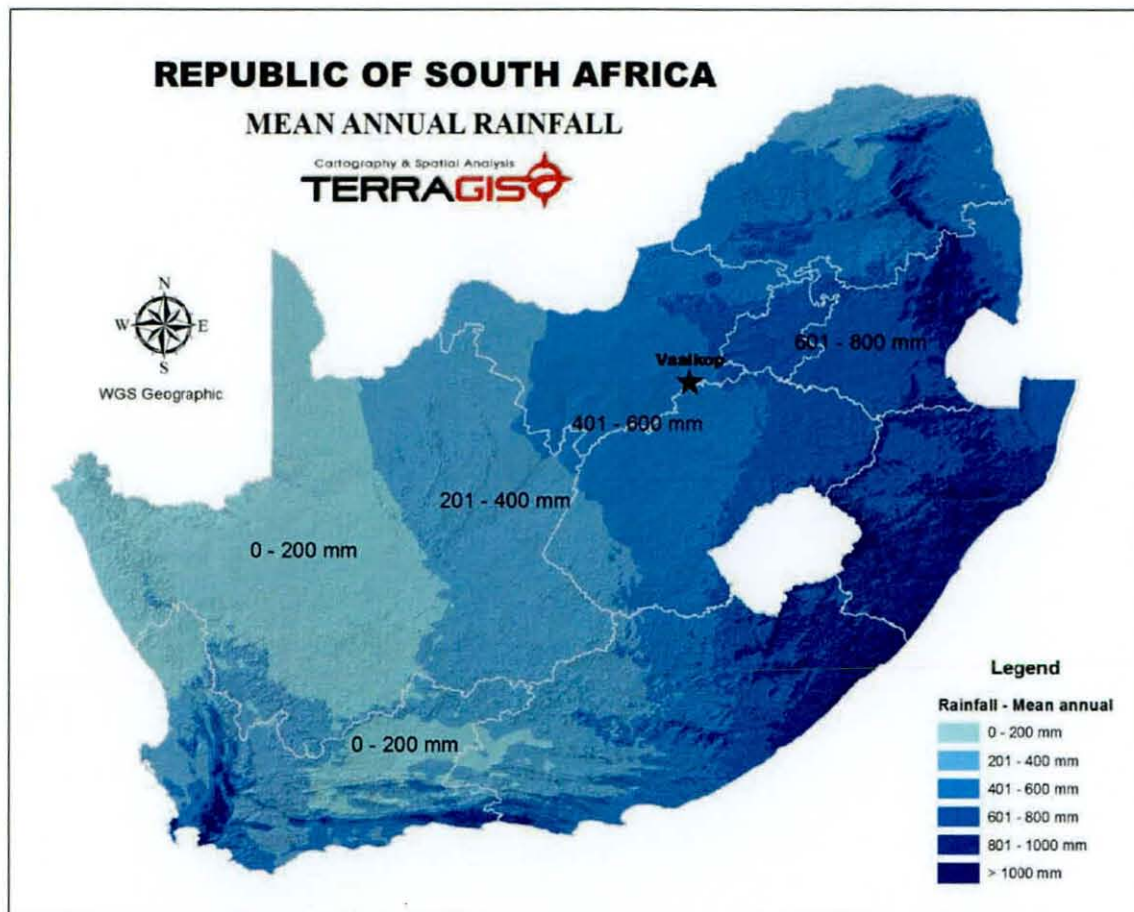


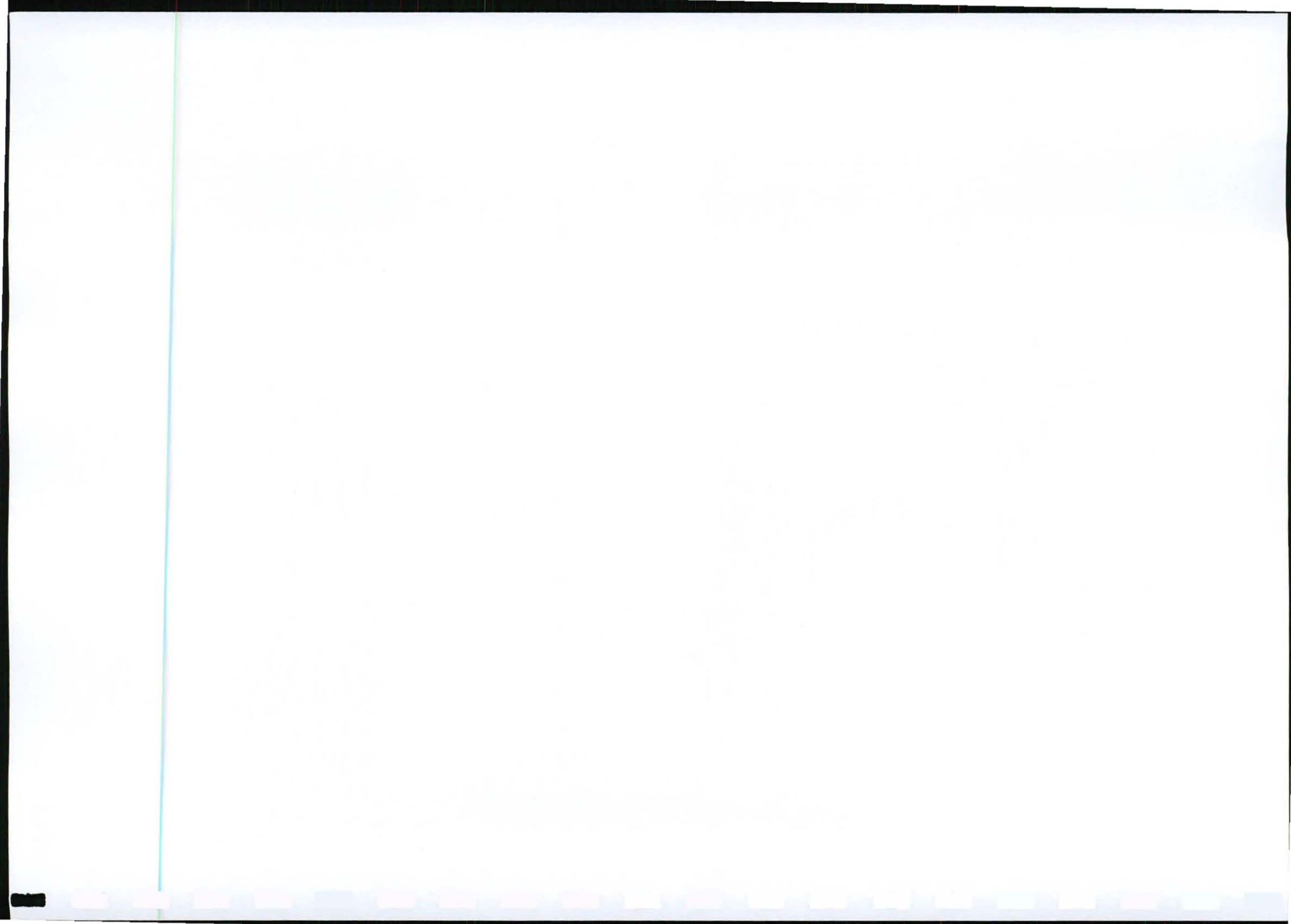
Figure 3 Rainfall map of South Africa indicating the survey site

5. INTERPRETATION OF SOIL, LAND CAPABILITY AND LAND USE SURVEY RESULTS

The interpretation of the land use and land capability results yielded a number of aspects that are of importance to the project.

5.1 Agricultural Potential

The agricultural potential of the site is low and limited to extensive grazing mainly due to the dominance of shallow and rocky soils. The deeper soils that occur sporadically throughout can be used for rainfed and irrigated crop production, even though these land uses do not occur regularly due to the soil constraints and human pressures (theft, traffic and urban and mining and uses). Irrigated agriculture can pose risks in the form of accelerated sinkhole formation – a distinct risk in the area.



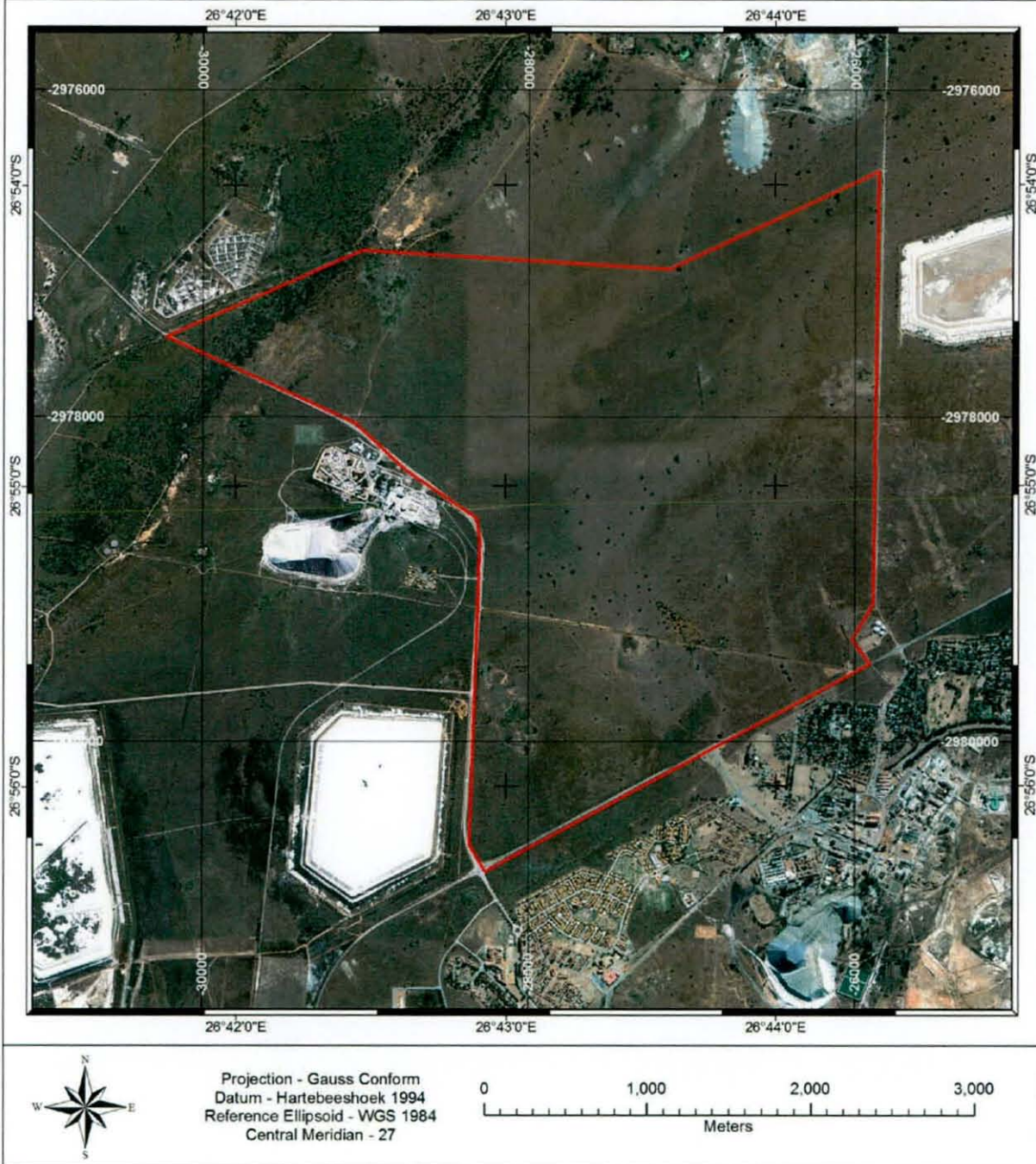
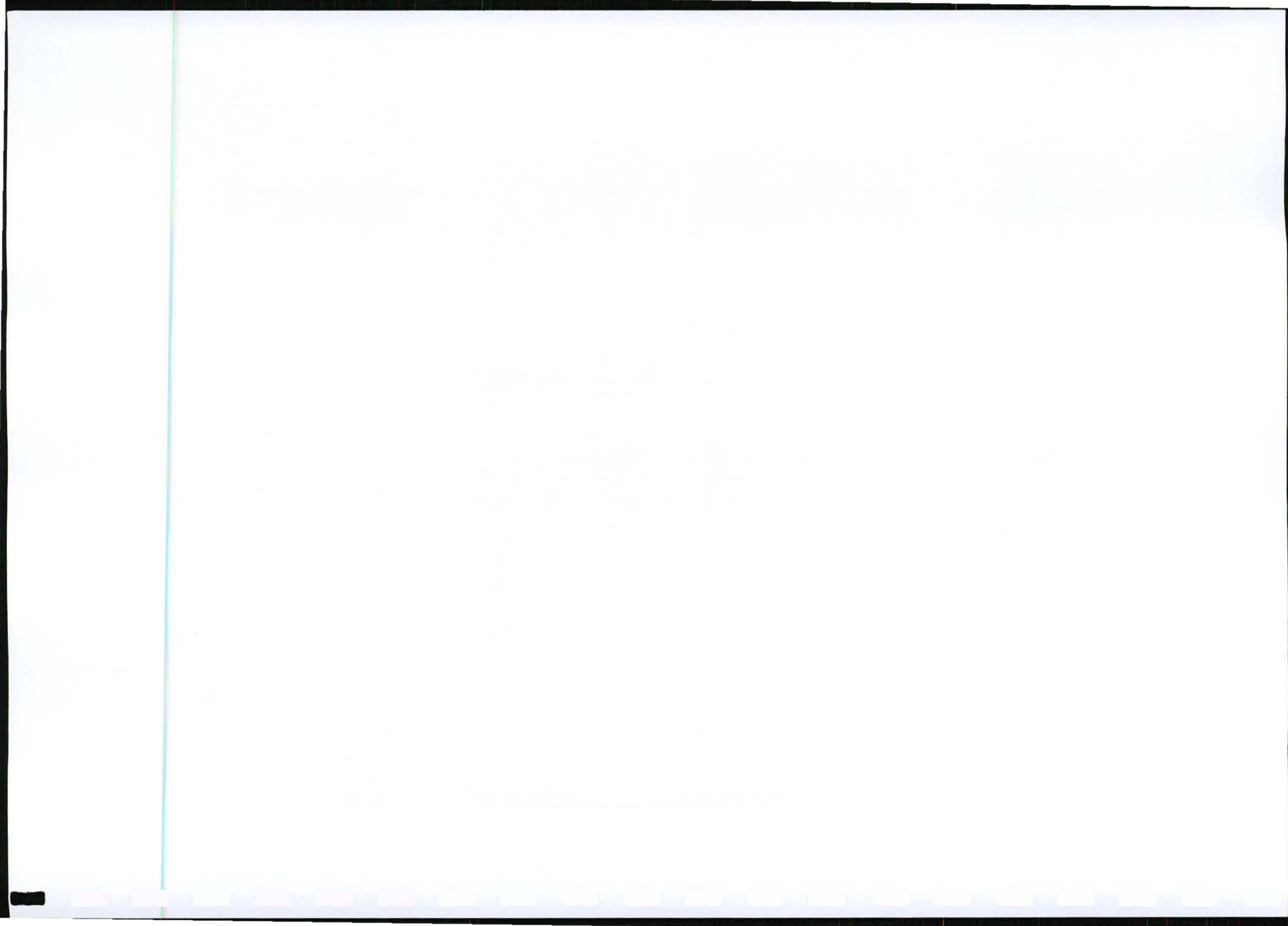


Figure 4 Land use on the survey site

5.2 Overall Soil Impacts

The overall impacts of the proposed solar facility on agriculture will be low due to the low agricultural potential of the site. The rocks that occur in the soils are loose and therefore pose very little risk to the development of a solar PV facility. The soils tend to be very homogenous in terms of the types and sizes of rocks as well as colour and texture of the finer material.



Physical soil disturbances can therefore be mitigated if the infrastructure is to be removed in the future at some point.

Impacts on the soils such as dust generation are considered more problematic than other forms of degradation and will have to be addressed in more detail in the EIA process. Soil erosion is considered to be of low risk due to the level nature of the terrain as well as the well-drained nature of the soils. Prevention of erosion can be done through the implementation of adequate mitigation and prevention methods. Storm water run-off will have to be managed to prevent erosion and degradation on site.

The establishment of a solar PV facility on the site means that shadow will increase on the soil surface with a subsequent decrease in evaporation losses. Under such conditions grass production for grazing purposes can be considered as there are distinct carbon sequestration benefits through increasing soil organic carbon levels in the soils. The grasses will also contribute to the stabilisation of the soils against erosion pressures from rainfall and storm water.

6. ANTICIPATED SOIL / LAND USE / AGRICULTURE IMPACTS

The following impacts are expected for the proposed development:

6.1 Physical Soil Disturbance Due To Construction Activities

Nature of Impact: Direct impacts are associated with the soils along the constructed roads as well as on the PV panel construction sites. Indirect impacts could arise in the form of soil erosion and degradation if storm water management is not planned and managed properly as it is generated on the roads and construction sites. Cumulative impacts are only considered to be problematic if the aforementioned storm water management is not instituted. Otherwise very limited cumulative impacts are expected due to the level terrain and relatively shallow nature of the soils.

Extent of Impact: The extent of this impact will be local in terms of the activity and will be associated with the activity only. Slightly larger, but still local in extent, impacts are expected if storm water runoff is not controlled.

Potential Significance of Identified Impacts: The potential significance of the identified impacts is low due to the potential for improvement of soil organic carbon levels under PV panels.

Potentially Significant Impacts to be assessed in EIA Phase: The potentially significant impacts to be assessed in the EIA phase will be limited to the classification of the soils as well as assessment of slopes and storm water impacts. These parameters will provide an indication to the project engineers regarding the erosion risk as well as inform the mitigation measures to be implemented on the site.

6.2 Impacts on Current Land Use Due To Construction Activities

The current land use is limited to extensive grazing.

Nature of Impact: Direct impacts are associated with the constructed roads as well as the PV panel construction sites. Indirect impacts could arise in the form of land use changes due to soil erosion and degradation if storm water management is not planned and managed properly as it is generated on the roads and construction sites. Cumulative impacts are only considered to be problematic if the aforementioned storm water management is not instituted. Otherwise very limited cumulative impacts are expected due to the low intensity land uses practiced on the site. The potential for positive impacts exist if these aspects are included in the design parameters of the PV panels and stands.

Extent of Impact: The extent of this impact will be local in terms of the activity and will be associated with the activity only. Slightly larger, but still local in extent, impacts are expected if storm water runoff is not controlled.

Potential Significance of Identified Impacts: The potential significance of the identified impacts is low due to the potential for improvement of soil organic carbon levels under PV panels.

Potentially Significant Impacts to be assessed in EIA Phase: The potentially significant impacts to be assessed in the EIA phase will be limited to the determination of, in a broad sense, the carrying capacity of the site in general and specific sections of the site.

6.3 Impacts on Agricultural Potential Due To Construction Activities

The agriculture potential of the site is low due to a range of biophysical constraints.

Nature of Impact: Direct impacts are considered to be small due to the low agricultural potential. Significant indirect and/or cumulative impacts are considered to be improbable due to the low potential on the entire site.

Extent of Impact: The extent of this impact will be local in terms of the activity and will be associated with the activity only. Slightly larger, but still local in extent, impacts are expected if storm water runoff is not controlled. The impacts are considered to be low due to the low agricultural baseline of the site.

Potential Significance of Identified Impacts: The potential significance of the identified impacts is low due to the widespread occurrence of natural soil degradation on the site related to arid conditions, low plant cover and intensive rainfall events.

Potentially Significant Impacts to be Assessed in EIA Phase: The potentially significant impacts to be assessed in the EIA phase will be limited to the determination of the agricultural potential of the soils as well as the probability that they will be impacted.

7. CONCLUSIONS AND RECOMMENDATIONS

It is concluded that the proposed development of a solar energy facility on the site will not have large impacts on the current land use of the broader area. This is mainly due to the low agricultural potential that results from the dominance of rocky soils. Long-term detrimental impacts are not expected but adequate mitigation and management measures have to be put in place to address storm water runoff. The main aspects that will have to be managed on the site are dust generation during the construction process as well as potential soil erosion.

The potential exists for an improvement in the organic carbon status of soils if adequate measures are taken during the planning and design stage of the project to accommodate for increased grass growth under the panels. Due to the increased shade and subsequent decreased evaporation losses of water from the site there is a distinct possibility of improving the soils through adequate pasture management. Increased plant biomass underneath PV panels poses a risk though and these aspects have to be addressed in the planning and design phase.

The impacts on the site need to be viewed in relation to the opencast mining of coal in areas of high potential soils – such as the Eastern Highveld. With this comparison in mind the impact of a solar energy facility is negligible compared to the damaging impacts of coal mining – for a similar energy output. Therefore, in perspective, the impacts of the proposed facility can be motivated as necessary in decreasing the impacts in areas where agriculture potential plays a more significant role.

A detailed site visit will have to be conducted as part of the EIA level investigation and the following parameters should be investigated:

- » Soil distribution (classification) on the site;
- » Extent of degradation due to current land use (such as overgrazing);
- » Erosion status and erodibility of the soils on the site; and
- » Mitigation measures to arrest current impacts and manage future impacts associated with the development.

8. LIMITATIONS / GAPS IN KNOWLEDGE

The following limitations, or gaps in knowledge, exist for the proposed activity on the site

- » Soil distribution (classification) on the site (to be generated during the EIA phase);
- » Extent of degradation due to current land use (to be generated during the EIA phase);
- » Erosion status and erodibility of the soils on the site (to be generated during the EIA phase); and
- » Design specifications and layout of proposed development. This detail will guide the specific impacts to be assessed as well as the proposed mitigation measures.

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