Basic Assessment for the Proposed Development of the Supporting Electrical Infrastructure to the Kuruman Wind Energy Facilities, Kuruman, Northern Cape Province

Draft Basic Assessment Report

APPENDIX B:

Specialist Reports (including TOR)

- Ecology Impact Assessment (Terrestrial Ecology including fauna and flora)
- Bird Impact Assessment
- Bat Impact Assessment
- Freshwater Impact Assessment
- Geohydrological Impact Assessment
- Visual Impact Assessment
- Heritage Impact Assessment
- Palaeontological Impact Assessment
- Soils and Agricultural Potential Assessment
- Socio-Economic Impact Assessment
- Transportation Impact Assessment

Fauna and Flora Terrestrial Ecological Specialist Study

Basic Assessment for the Proposed Development of the Grid Connection for the Kuruman Wind Farm, Northern Cape Province: BASIC ASSESSMENT REPORT

Report prepared for:

CSIR – Environmental Management Services

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August 2018

EXECUTIVE SUMMARY

Mulilo Renewable Project Developments (Pty) Ltd is proposing the development of the Kuruman WEF Facility (WEF) located near Kuruman in the Northern Cape Province. As part of this development, a grid connection is required. Mulilo has appointed 3Foxes Biodiversity Solutions to provide a Terrestrial Ecological (Fauna and Flora) specialist basic assessment study as part of the Basic Assessment process. The purpose of the Terrestrial Biodiversity Assessment Report is to describe and detail the ecological features of the proposed site; provide an assessment of the ecological sensitivity of the site and identify and assess the likely impacts associated with the proposed development of the proposed power lines. A full field assessment as well as a desktop review of the available ecological information for the area was conducted in order to identify and characterise the ecological features of the site. Impacts are assessed for the construction, operation, and decommissioning phases of the development. Cumulative impacts on the broader area are also considered and assessed. A variety of avoidance and mitigation measures associated with each identified impact are recommended to reduce the likely impact of the development,

The Grid Connection route alternatives for the Kuruman WEF Project fall within three vegetation types. Kuruman Mountain Bushveld which is associated with the rocky hills of the wind farm site as well as several other rocky hills along the route from the site to the Sekgame Substation. The plains north of the site to the Kuruman substation as well as the plains along the route towards Kathu consist of Kuruman Thornveld. The final section of the route towards the Sekgame Substation consists of Kathu Bushveld. All of these vegetation types are of least concern and have not been significantly impacted by transformation to date. The abundance of plant species of conservation concern within the affected area is low and the overall impact of the development on vegetation would be low. There are however several areas of high protected tree density, mostly *Acacia erioloba* and to a lesser extent *Acacia haematoxylon* and these would be impacted by the development, but as they are common in the area, their local populations would not be significantly impacted. .

In terms of fauna, the abundance of species of concern at the site is generally low and the power line would not be likely to impact any populations of any species of concern to a noticeable degree. Only Alternative 2 to the Kuruman Substation would impact on a CBA, while the other two routes are restricted to ESAs and other natural areas of low significance. Due to the low footprint of the power line, a significant impact on CBAs and ESAs is not likely.

In terms of cumulative impact, the contribution of the power line would be very low as the servitude is cleared of larger woody vegetation, but the grass layer remains intact and is still available to most species. As a result, the overall contribution and cumulative impact of the power line is not considered highly significant.

The sensitivity mapping that was conducted indicates that the majority of the routes are within areas of natural vegetation that are considered medium low sensitivity, with occasional areas of

medium and medium high sensitivity areas associated with rocky hills or areas of high protected tree density. Alternative 2 is restricted to the low-lying areas the lower foothills of the Kuruman WEF 1 area and the only feature of significance along the route are some areas of high Acacia erioloba density. Similarly, Alternative 3, the link from Kuruman WEF 1 to Kuruman WEF 2 is restricted largely to the low lying areas with occasional stretches of high tree density. Alternative 1 is the longest and as a result, has the highest diversity of features. There are a few short sections of high sensitivity areas along this route, the wetland area within Lohatla in particular as well as some steep section of rocky hills towards the Kuruman WEF 2 area. Overall, the power line routes are well-directed within the lower sensitivity areas and no significant changes to the routing can be recommended. With mitigation, the impact of the power line would be low and no significant impacts to any features or species of high significance can be expected. .

Overall, the three alternatives for the Kuruman WEF Grid Connection are likely to generate low impacts on fauna and flora and no high residual impacts on any species or habitats are likely. As a result, the development of either of the power line alternatives can be supported from a terrestrial ecology perspective and are not opposed.

SHORT CV/SUMMARY OF EXPERTISE – SIMON TODD

Simon Todd is Director and principal scientist at 3Foxes Biodiversity Solutions and has over 20 years of experience in biodiversity measurement, management and assessment. He has provided specialist ecological input on more than 200 different developments distributed widely across the country, but with a focus on the three Cape provinces. This includes input on the Wind and Solar SEA (REDZ) as well as the Eskom Grid Infrastructure (EGI) SEA and Karoo Shale Gas SEA. He is on the National Vegetation Map Committee as representative of the Nama and Succulent Karoo Biomes. Simon Todd is a recognised ecological expert and is a past chairman and current deputy chair of the Arid-Zone Ecology Forum. He is registered with the South African Council for Natural Scientific Professions (No. 400425/11).

Skills & Primary Competencies

- Research & description of ecological patterns & processes in Nama Karoo, Succulent Karoo, Thicket, Arid Grassland, Fynbos and Savannah Ecosystems.
- Ecological Impacts of land use on biodiversity
- Vegetation surveys & degradation assessment & mapping
- Long-term vegetation monitoring
- Faunal surveys & assessment.
- GIS & remote sensing

Tertiary Education:

- 1992-1994 – BSc (Botany & Zoology), University of Cape Town
- 1995 – BSc Hons, Cum Laude (Zoology) University of Natal
- 1996-1997- MSc, Cum Laude (Conservation Biology) University of Cape Town

Employment History

- 2009 – Present – Sole Proprietor of Simon Todd Consulting, providing specialist ecological services for development and research.
- 2007 Present – Senior Scientist (Associate) – Plant Conservation Unit, Department of Botany, University of Cape Town.

- 2004-2007 – Senior Scientist (Contract) – Plant Conservation Unit, Department of Botany, University of Cape Town
- 2000-2004 – Specialist Scientist (Contract) - South African National Biodiversity Institute
- 1997 – 1999 – Research Scientist (Contract) – South African National Biodiversity Institute

A selection of recent work is as follows:

Strategic Environmental Assessments

Co-Author. Chapter 7 - Biodiversity & Ecosystems - Shale Gas SEA. CSIR 2016.

Co-Author. Chapter 1 Scenarios and Activities – Shale Gas SEA. CSIR 2016.

Co-Author – Ecological Chapter – Wind and Solar SEA. CSIR 2014.

Co-Author – Ecological Chapter – Eskom Grid Infrastructure SEA. CSIR 2015.

Contributor – Ecological & Conservation components to SKA SEA. CSIR 2017.

Recent Specialist Ecological Studies in the Vicinity of the Current Site

- Kathu Solar PV Facility. Fauna and Flora EIA Process. Cape EAPrac 2015.
- Mogobe Solar PV Facility. Fauna and Flora EIA Proces. Cape EAPrac 2015.
- Logoko Solar PV Facility. Fauna and Flora EIA Proces. Cape EAPrac 2015.
- RE Capital 10 Solar Power Plant, Postmasburg. Fauna and Flora EIA Proces. Cape EAPrac 2015.
- Walk-through study of Kumba Iron Ore expansion area at Dingleton, Northern Cape. MSA Group. 2017.
- Adams PV Project – EIA process and follow-up vegetation survey. Aurora Power Solutions. 2016.
- Mamatwane Compilation Yard. Fauna and Flora EIA process. ERM. 2013.
- Olifantshoek-Emil 132kV power line. Fauna and Flora BA process. Savannah Environmental 2017.

SPECIALIST DECLARATION

I, ..Simon Todd..., as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

-
- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist: S Todd. ______________________________

Name of Specialist: ____Simon Todd______________________

Date: ____10 July 2018____________________________

LIST OF ABBREVIATIONS

DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
SCC	Species of conservation concern
CBA	Critical Biodiversity Area
ESA	Ecological Support Area
NFEPA	National Freshwater Ecosystem Priority Assessment
NPAES	National Protected Area Expansion Strategy
NC-DENC	Northern Cape Department of Environment and Nature Conservation

COMPLIANCE WITH THE APPENDIX 6 OF THE 2017 EIA REGULATIONS

Requirements of Appendix 6 – GN R326 EIA Regulations 7 April 2017	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page *iii*
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page *v*
c) an indication of the scope of, and the purpose for which, the report was prepared;	P5
(cA) an indication of the quality and age of base data used for the specialist report;	P9-10
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	P38-
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	P10
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.1
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	P39
g) an identification of any areas to be avoided, including buffers;	P39
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	P39
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	P9
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 1.3
k) any mitigation measures for inclusion in the EMPr;	Section 1.6
l) any conditions for inclusion in the environmental authorisation;	
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 1.6
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	P56-57
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	See Main EIA report
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	See Main EIA report
q) any other information requested by the competent authority.	
2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	

TABLE OF CONTENTS

LIST OF FIGURES

SPECIALIST FAUNA AND FLORA EIA STUDY

1.1. INTRODUCTION AND METHODOLOGY

1.1.1. Scope and Objectives

Mulilo Renewable Project Developments (Pty) Ltd has appointed CSIR to undertake the required Environmental Impact Assessment process for the proposed Kuruman Phase 1 and Phase 2 Wind Energy Facility (WEFs) located southwest of Kuruman in the Northern Cape Province. As part of these developments a grid connection is required, which is being authorised separately from the WEFs. As part of the required studies for the required Basic Assessment process for the grid connection, CSIR has appointed 3Foxes Biodiversity Solutions to provide a specialist Terrestrial Biodiversity BA Study of the proposed powerline development.

The purpose of the Terrestrial Biodiversity Assessment Report is to describe and detail the ecological features of the proposed site; provide an assessment of the ecological sensitivity of the site and identify and assess the likely impacts associated with the proposed development of the site as a wind energy facility. A full field assessment as well as a desktop review of the available ecological information for the area is used to identify and characterise the ecological features of the site. This information is used to derive an ecological sensitivity map that presents the ecological constraints for development. Impacts are assessed for the construction, operation, and decommissioning phases of the development. Cumulative impacts on the broader area are also considered and assessed. A variety of avoidance and mitigation measures associated with each identified impact are recommended to reduce the likely impact of the development, which should be included in the Environmental Management Programme (EMPr) for the development. The full scope of the study is detailed below and is in accordance with Appendix 6 - GN R326 of the EIA Regulations of 2014 as amended (which came into effect on 7 April 2017).

1.1.2. Terms of Reference

The study includes the following activities:

- a description of the environment that may be affected by a specific activity and the manner in which the environment may be affected by the proposed project;
- a description and evaluation of environmental issues and potential impacts (including assessment of direct, indirect and cumulative impacts) that have been identified;
- a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts;
- an indication of the methodology used in determining the significance of potential environmental impacts;
- an assessment of the significance of direct indirect and cumulative impacts of the development;
- a description and comparative assessment of all alternatives including cumulative impacts;

- recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the EMPr;
- an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;
- a description of any assumptions uncertainties, limitations and gaps in knowledge; and
- an environmental impact statement which contains:
    - a summary of the key findings of the environmental impact assessment;
    - an assessment of the positive and negative implications of the proposed activity; and
    - a comparative assessment of the positive and negative implications of identified alternatives.

General Considerations for the study included the following:

- Disclose any gaps in information (and limitations in the study) or assumptions made.
- Identify recommendations for mitigation measures to minimise impacts.
- Outline additional management guidelines.
- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the EMPr for faunal or flora related issues.
- The assessment of the potential impacts of the development and the recommended mitigation measures provided have been separated into the following project phases:
    - Planning and Construction
    - Operational
    - Decommissioning

1.1.3. Assessment Approach

This assessment is conducted according to Appendix 6 – GN R326 EIA Regulations, as amended in terms of the National Environmental Management Act (Act 107 of 1998) as amended (NEMA), as well as best-practice guidelines and principles for biodiversity assessment as outlined by Brownlie (2005) and De Villiers *et al*. (2005).

In terms of NEMA, this assessment demonstrates how the proponent intends to comply with the principles contained in Section 2 of NEMA, which amongst other things, indicates that environmental management should:

- (In order of priority) aim to: avoid, minimise or remedy disturbance of ecosystems and loss of biodiversity (Figure 1);
- Avoid degradation of the environment;
- Avoid jeopardising ecosystem integrity;
- Pursue the best practicable environmental option by means of integrated environmental management;
- Protect the environment as the people’s common heritage;
- Control and minimise environmental damage; and

- Pay specific attention to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic or stressed ecosystems.

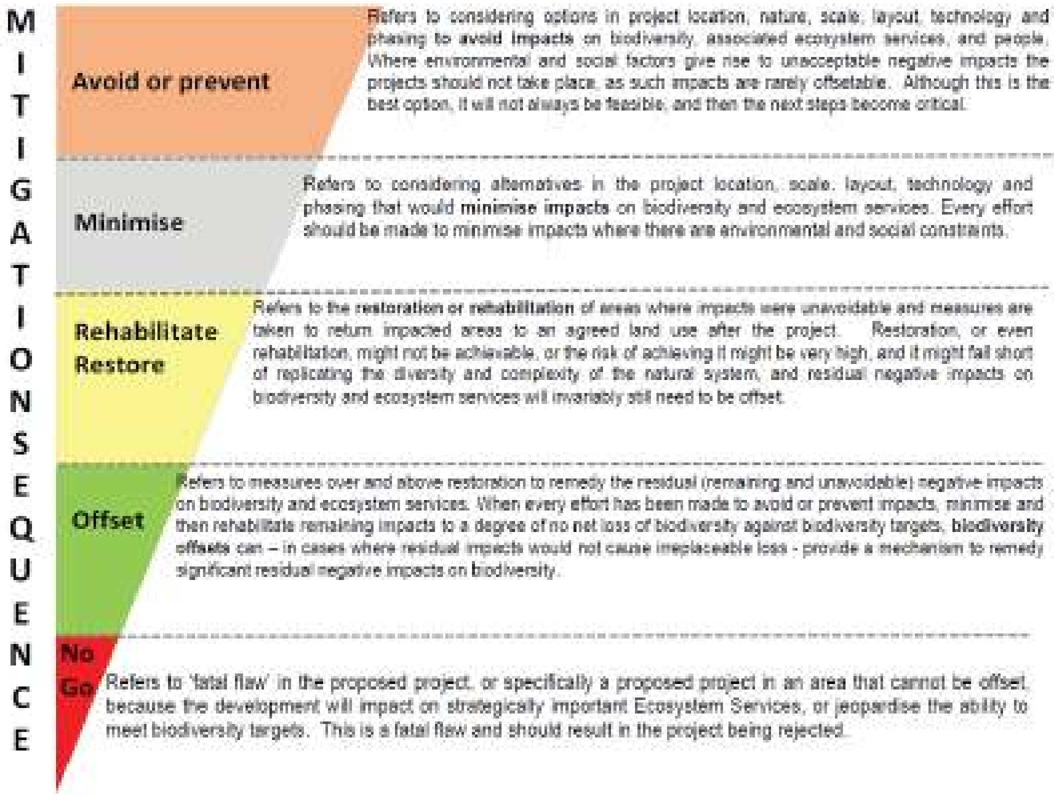

Figure 1. The mitigation hierarchy that is used to guide the study in terms of the priority of different mitigation and avoidance strategies.

Furthermore, in terms of best practice guidelines as outlined by Brownlie (2005) and De Villiers et al. (2005), a precautionary and risk-averse approach should be adopted for projects which may result in substantial detrimental impacts on biodiversity and ecosystems, especially the irreversible loss of habitat and ecological functioning in threatened ecosystems or designated sensitive areas: i.e. Critical Biodiversity Areas (CBAs) (as identified by systematic conservation plans, Biodiversity Sector Plans or Bioregional Plans) and Freshwater Ecosystem Priority Areas.

In order to adhere to the above principles and best-practice guidelines, the following approach forms the basis for the study approach and assessment philosophy:

- The study includes data searches, desktop studies, site walkovers / field survey of the property and baseline data collection, including:
    - A description of the broad ecological characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or

patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

In terms of **pattern**, the following will be identified or described:

Community and ecosystem level

- The main vegetation type, its aerial extent and interaction with neighbouring types, soils or topography;
- Threatened or vulnerable ecosystems (*cf. SA vegetation map/National Spatial Biodiversity Assessment, fine-scale systematic conservation plans, etc*).

Species level

- Species of Conservation Concern (SCC) (giving location if possible using GPS)
- The viability of an estimated population size of the SCC that are present (including the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70-100% confident, Medium 40-70% confident, low 0-40% confident)
- The likelihood of other RDB species, or SCC, occurring in the vicinity (include degree of confidence).

Fauna

- Describe and assess the terrestrial fauna present in the area that will be affected by the proposed development.
- Conduct a faunal assessment that can be integrated into the ecological study.
- Describe the existing impacts of current land use as they affect the fauna.
- Clarify SSC and that are known to be:
    - endemic to the region;
    - that are considered to be of conservational concern;
    - that are in commercial trade (CITES listed species); or
    - are of cultural significance.
- Provide monitoring requirements as input into the EMPr for faunal related issues.

Other pattern issues

- Any significant landscape features or rare or important vegetation associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity.
- The extent of alien plant cover of the site, and whether the infestation is the result of prior soil disturbance such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites).
- The condition of the site in terms of current or previous land uses.

In terms of **process**, the following will be identified and/or described:

- The key ecological “drivers” of ecosystems on the site and in the vicinity, such as fire.
- Any mapped spatial component of an ecological process that may occur at the site or in its vicinity (i.e. *corridors* such as watercourses, upland-lowland gradients, migration routes,

coastal linkages or inland-trending dunes, and *vegetation boundaries* such as edaphic interfaces, upland-lowland interfaces or biome boundaries).

- Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
- Furthermore, any further studies that may be required during or after the EIA process will be outlined.
- All relevant legislation, permits and standards that would apply to the development will be identified.
- The opportunities and constraints for development will be described and shown graphically on an aerial photograph, satellite image or map delineated at an appropriate level of spatial accuracy.

1.1.4. Assumptions and Limitations

The current study is based on a detailed field assessment as well as a desktop study, which serves to reduce the limitations and assumptions required for the study. The site was visited in the wet season in mid-summer when the vegetation was in an excellent condition for sampling. As a result, the plant species lists obtained for the site are considered reliable and comprehensive. While there are likely some species present at the site which were not observed, this is likely a minority of species and it is unlikely that there are any plant habitats or communities present which were not observed As such, there are no significant limitations with regards to the vegetation assessment for the site.

In terms of fauna, camera trapping for larger mammals, Sherman trapping for small mammals and searches for reptiles and amphibians was conducted. This provides a comprehensive characterization of the faunal community of the site. Although some fauna are difficult to observe in the field, their potential presence at the site was evaluated based on the literature and available databases. In order to ensure a conservative approach in this regard, the species lists derived for the site from the literature were obtained from an area significantly larger than the study site. As a result, there are no significant limitations with regards to the faunal assessment at the site.

1.1.5. Source of Information

Data sources from the literature consulted and used where necessary in the study includes the following:

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina and Rutherford 2006 and 2012 update) as well as the National List of Threatened Ecosystems (2011), where relevant.
- Information on plant and animal species recorded for the area was extracted from the new Plants of South Africa (POSA) database hosted by the South African National Biodiversity Institute (SANBI). Data was extracted for a significantly larger area than the study area, but this is necessary to ensure a conservative approach as well as counter the fact that the site itself has not been well sampled in the past.

- The IUCN conservation status of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2017).

Habitats & Ecosystems:

- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment, NFEPA (Nel et al. 2011).
- Important protected areas expansion areas were extracted from the Northern Cape Protected Areas Expansion Strategy (NC-NPAES 2017).
- Critical Biodiversity Areas in the study area were obtained from the Northern Cape Conservation Plan (Oosthuysen & Holness 2016).

Fauna:

- Lists of mammals, reptiles and amphibians which are likely to occur at the site were derived based on distribution records from the literature and the ADU databases http://vmus.adu.org.za.
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, EWT & SANBI (2016) and Skinner and Chimimba (2005) for mammals.
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the site.
- The conservation status of mammals is based on the IUCN Red List Categories (EWT/SANBI 2016), while reptiles are based on the South African Reptile Conservation Assessment (Bates et al. 2013) and amphibians on Minter et al. (2004) as well as the IUCN (2017).

1.1.6. Field Assessment

The power line route was sampled over a number of days from 19-22 February 2018. The route from the Kuruman Phase 2 site to the Sekgame Substation near Kathu was sampled on the 19th of February and the remaining sections through the sites themselves as well as to the Kuruman substation were sampled from the 20th to the 22nd. During the field assessment, the routes were followed as closely as possible and all features along the route were observed and mapped where necessary. Particular attention was paid to the presence of sensitive features along the route, such as wetlands, drainage features and the presence of habitats and species of conservation concern. In addition, the work along the power line routes themselves, the information collected from the wider wind farm sites was also used to inform the study. This includes small mammal and camera trapping on the wind farm sites. Some parts of the route towards the Sekagame substation have also been sampled by the consultant for other projects and this information is also used where appropriate.

1.1.7. Sensitivity Mapping and Assessment

An ecological sensitivity map of the site was produced by integrating the information collected on-site with the available biodiversity information available in the literature and various spatial databases. This includes delineating the habitat units identified along the power line route in the field and assigning sensitivity values to the units based on their vegetation composition, faunal habitat or conservation value and the potential presence of SCC.

The sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **Low** – Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of development can proceed within these areas with little ecological impact.
- **Medium**- Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high impact may occur due to the high flora or faunal habitat value, sensitivity or important ecological role of the area. These areas may contain, or be important habitat for, SCC or provide important ecological services such as water flow regulation or forage provision. Development within these areas is generally undesirable and should proceed with caution as additional specific mitigation and avoidance is usually required to reduce impacts within these areas to acceptable levels. High sensitivity areas are also usually more sensitive to cumulative impact and the total developed footprint within these areas should be kept low.
- **No-Go/Very High** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are considered to be no-go areas from a developmental perspective and should be avoided.

In some situations, areas were also classified between the above categories, such as Medium/High, where it was deemed that an area did not fit well into a certain category but rather fell most appropriately **between** two sensitivity categories. There are however <u>no sensitivities</u> that are identified as “Medium to High” or similar ranged categories because this adds uncertainty to the mapping as it is not clear if an area falls at the bottom or top of such a range.

1.2. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO ECOLOGICAL IMPACTS

The project is described in full in the main BA report and this information is not repeated in full here. Three options are being considered, dependent on which wind energy facility gets built and which options are considered viable or are authorized. It is however important to note that Alternative 3 is not a stand-alone option and also requires that Alternative 2 is authorized. As such,

Alternative 1

Kuruman Phase 1 substation (C) to Ferrum substation (A) C – B – A This is the preferred 132kV overhead line should both Phase 1 and 2 WEFs be constructed. However, in the event that the Phase 2 WEF is not constructed, this line will only be considered if Alternative 2 is not recommended/authorised. For the location of the letters refered to see Figure 2 below.

Alternative 2

Kuruman Phase 1 substation (C) to Segame substation (D) C – D In the event that only Phase 1 WEF is constructed, Alternative 1 would be too expensive and therefore Alternative 2 (C – D) would be the preferred route.

Alternative 3

Kuruman Phase 1 substation (C) to Kuruman phase 2 substation (B) C – B Alternative 3 would be required if only Phase 2 WEF is constructed. The complete 132kV line would require authorisation of Alternative 2 (C – D) and Alternative 3 (C – B).

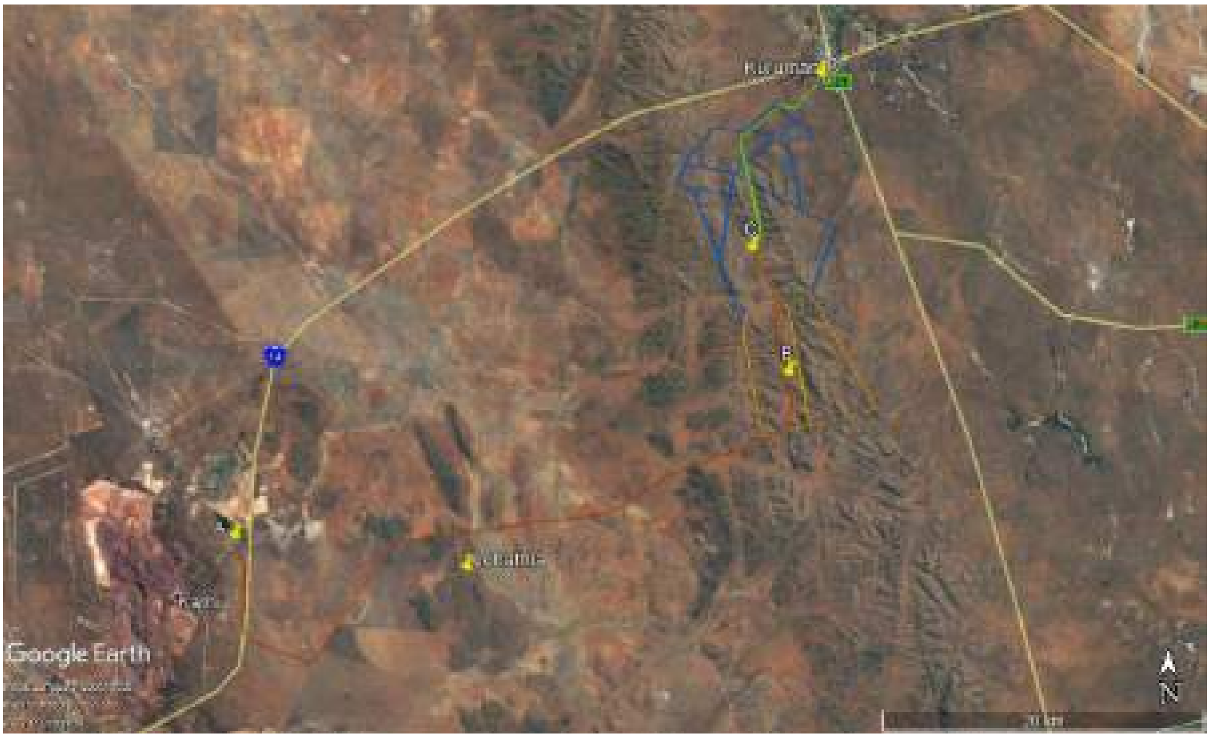

Figure 2. Layout of the three grid connection options being considered, showing the starting and ending points of each alternative with the corresponding letters as in the description above.

1.3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

1.3.1. Vegetation Types

According to the national vegetation map (Mucina & Rutherford 2006/2012), there are there vegetation types along the power line routes. Kuruman Mountain Bushveld which is associated with the rocky hills of the wind farm site as well as several other rocky hills along the route from the site to the Sekgame Substation. The plains north of the site to the Kuruman substation as well as the plains along the route towards Kathu consist of Kuruman Thornveld. The final section of the route towards the Sekgame Substation consists of Kathu Bushveld (Figure 3).

Kuruman Mountain Bushveld is not widely distributed and has a total mapped extent of 4360 km^2 which is a narrow range for an arid vegetation type. It is distributed in the Northern Cape and North-West Provinces from Asbestos Mountains southwest and northwest of Griekwastad, along the Kuruman Hills north of Danielskuil, passing west of Kuruman and re-emerging as isolated hills at Makhubung and around Pomfret. This vegetation unit is associated with rolling hills with gentle to moderate slopes and hill pediment areas and typically consists of an open shrubveld. Soils are shallow sandy soils of the Hutton form and the most common land type is Ib with lesser amounts of Ae, Ic and Ag. Kuruman Mountain Bushveld has been little impacted by transformation and is classified as Least Threatened, but is not currently conserved within any formal conservation areas. One vegetation-type endemic species *Euphorbia planiceps* is known from Kuruman Mountain Bushveld.

The majority of the plains of the power line route, except towards Kathu, are mapped as Kuruman Thornveld. This is also a restricted vegetation type which occupies 5794 km^2 of the Northern Cape and North West Provinces from the vicinity of Postmasburg and Danielskuil in the south, extending via Kuruman to Tsineng and Dewar in the North. It has been little impacted by transformation and more than 98% of the original extent is still intact and it is classified as Least Threatened. This vegetation unit occupies flat rocky plains and sloping hills with a very well developed, closed shrub layer and well-developed tree stratum usually consisting of *Acacia erioloba*. The most important land types are Ae, Ai, Ag and Ah with Hutton soil form. The only endemic taxon known from this vegetation type is *Gnaphalium englerianum*.

Kathu Bushveld occupies an area of 7 443 km^2 and extends from around Kathu and Dibeng in the south through Hotazel and to the Botswana border between Van Zylsrus and McCarthysrus. In terms of soils the vegetation type is associated with aeolian red sand and surface calcrete and deep sandy soils of the Hutton and Clovelly soil forms. The main land types are Ah and Ae with some Ag. The Kathu Bushveld vegetation type is still largely intact and less than 2% has been transformed by mining activity and it is classified as Least Threatened. It is, however, poorly conserved and does not currently fall within any formal conservation areas. Although no endemic species are restricted to this vegetation type a number of Kalahari endemics are known to occur in this vegetation type such as *Acacia luederitzii* var *luederitzii, Anthephora argentea*, *Megaloprotachne albescens*, *Panicum kalaharense* and *Neuradopsis bechuanensis*.

Although species lists of the above vegetation types are provided in Mucina & Rutherford (2006), these are not repeated here. The actual vegetation as observed along the power line routes is rather described in detail in the next section and provides a much more reliable indication of the species and habitats present than the broad scale vegetation map.

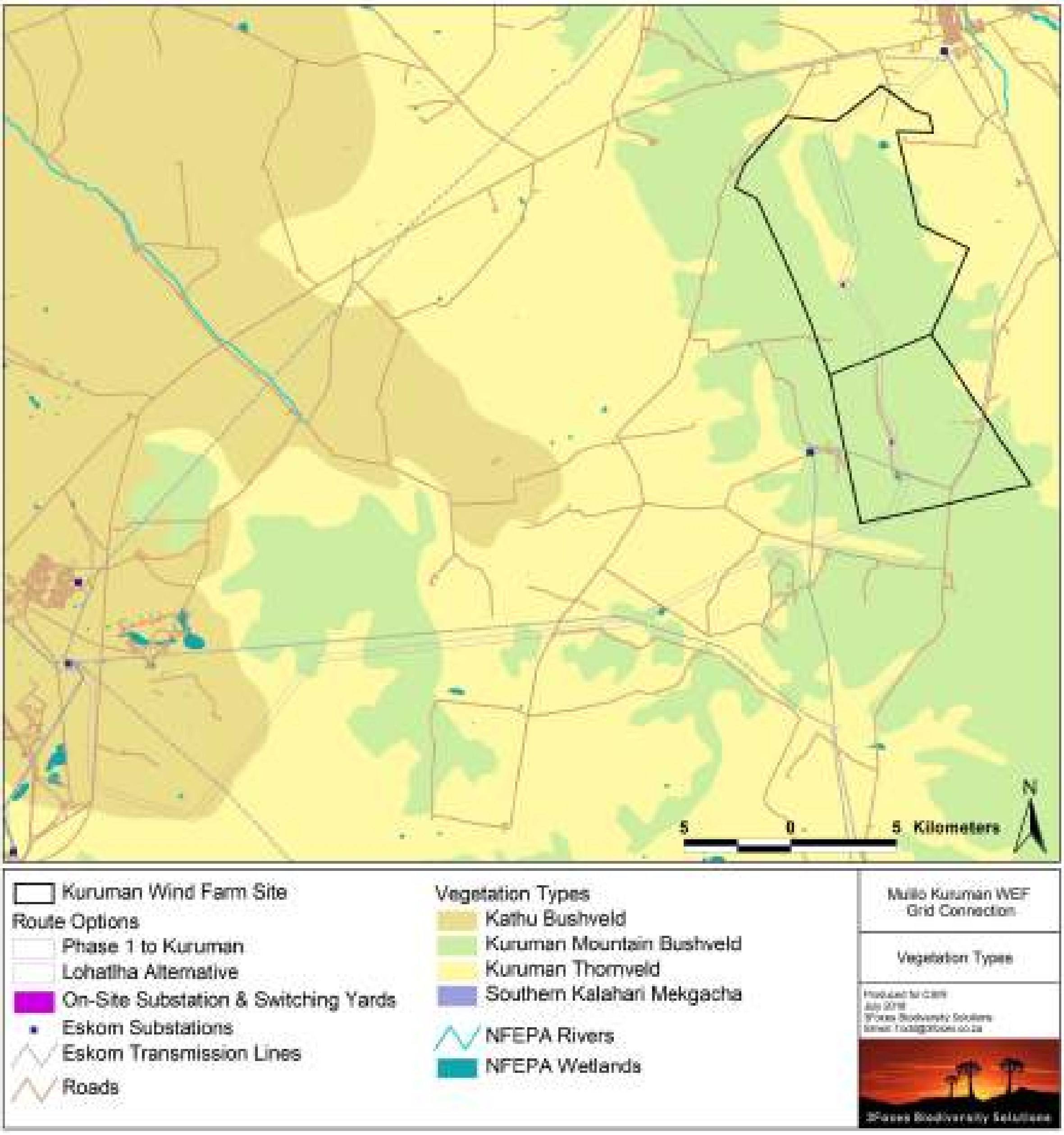

Figure 3. Vegetation map (Mucina and Rutherford 2006 and 2012 Powrie Update) of the Kuruman WEF Grid Connection study area and surrounds.

1.3.2. Fine-Scale Vegetation Description

The power line routes are described below, with species lists and photographs showing important and typical features along the routes.

Kuruman WEF 1 Substation to Kuruman Substation (Alternative 2)

The on-site substation is located on a sandy plain between some low hills, within the Kuruman Thornveld vegetation type. From here is traverses the lower slopes of some rocky hills classified as Kuruman Mountain Bushveld, before traversing the sandy plains again all the way to the Kuruman substation. There are no highly sensitive features along the route and no wetlands or major drainage lines. There are however several sections of the route where the abundance of protected tree species is quite high and the required clearing beneath the power line will certainly impact some individuals particularly of *Acacia erioloba* and to a lesser extent *Acacia haematoxylon*.

Figure 4. Vegetation of the plains, at the location of the Kuruman 1 on-site substation, showing a relatively dense shrub layer dominated by *Tarchonanthus camphoratus* and *Olea europea* subsp. *africana* with occasional *Acacia haematoxylon*.

Typical and dominant species observed within the Kuruman Thornveld vegetation areas include *Acacia erioloba*, *Acacia mellifera* subsp. *detinens*, *Grewia flava*, *Tachonanthus camphoratus*, *Gymnosporia buxifolia*, *Acacia hebeclada* subsp. *hebeclada*, *Searsia lancea*, *Acacia haematoxylon*, *Olea europea* subsp. *africana*, *Monechma divaricatum*, *Ehretia alba*, *Gnidia polycephala*, *Pentzia calcarea*, *Senna italica*, *Aristida meridionalis*, *A.stipitata* subsp. *stipitata*, *Eragrostis lehmannniana*, *Cynodon dactylon*, *Enneapogon scoparius*, *Schmidtia pappophoroides*, *Themeda triandra* and *Asparagus capensis*.

The vegetation of the rocky hills is dominated by a well-developed grass layer with a variable tree and shrub layer. Common and dominant trees and large shrubs include *Searsia lancea*, *Diospyros austro-africana*, *Euclea crispa*, *Olea europea* subsp. *africana*, *Searsia pyroides*, *Searsia tridactyla*, *Searsia ciliata*, *Tarchonanthus camphoratus*, *Lantana rugosa*, *Lebeckia macrantha*, and *Wahlenbergia nodosa*. The grass layer is dominated by grasses such as *Heteropogon contortus*, *Eragrostis chloromelas*, *E.nindensis*, *Cymbopogon caesius*, *Aristida meridionalis*, *Aristida congesta*, *Melinis repens*, *Bulbostylis burchellii*, *Anthephora pubescens*, *Themeda triandra*, *Brachiaria nigropedata*, *Trichoneura grandiglumis* and *Schizachyrium sanguineum*. Forbs and low shrubs that occur within the grass layer include *Chrysocoma cilliata*, *Chascanum hederaceum*, *Anthospermum rigidum*, *Striga elegans*, *Hermannia tomentosa*, *Dicoma schinzii*, *Corchorus asplenifolius*, *Monsonia angustifolia* and *Melhania virescens*.

Figure 5. Looking back towards the Kuruman WEF site along the Alternative 2 power line route from near to the Kuruman Substation. The density of *Acacia erioloba* in this area is high and significant numbers would need to be cleared along the power line servitude.

Kuruman WEF 1 Substation to Kuruman 2 Substation (Alternative 3)

Although the majority of the route from the Kuruman 1 Substation to the Kuruman 2 Substation is mapped as being Kuruman Mountain Bushveld, in reality, the majority of the route is through areas that are in fact Kuruman Thornveld and dominated by species associated with the open plains of the site as described above. Once the power line enters the Kuruman 2 WEF area, it passes through a valley with a high abundance of *Acacia erioloba* and other trees that is considered fairly high sensitivity and the final routing should be placed along the western site of the existing access road to minimise impact on the woody vegetation in the valley bottom. The substation itself is located in an area that is fairly degraded and is not considered highly sensitive, although there are a few *Acacia erioloba* trees present that would likely be lost.

Figure 6. The Alternative 3 route passes through this flat-bottomed valley with a high tree density and should be routed carefully to minimise impact on protected trees.

Figure 7. The Kuruman WEF 2 substation site that is the termination of Alternative 3. This area is considered to the fairly degraded, but some *Acacia erioloba* are present and may be affected.

Kuruman WEF 2 Substation to Sekgame Substation (Alternative 1)

The route from the Kuruman WEF Substation to the Sekgame Substation passes through quite a few different habitats and environments. Although the Kuruman 2 Substation site and power line route through the site to the south is mapped as falling within the Kuruman Mountain Bushveld vegetation type, in reality, the majority of the route is through this area is in fact Kuruman Thornveld. Once the route leaves the site the majority of the route through the Lohatlha area consists of Kuruman Thornveld with occasional areas of Kuruman Mountain Bushveld on the rocky hills. There are however some areas between the Kuruman WEF 2 site and Lohatlha area that are quite degraded as a result of bush encroachment with *Acacia mellifera* and *Tarchonanthus camphoratus*. Within the Lohatlha area the route passes over a wetland feature with a small earth dam. The wetland appears to be locally important and is a potential breeding site for the Giant Bullfrog and while some other Toad species were observed breeding in the wetland, no Bullfrogs were present. Impact to the wetland should be avoided and the pylons should be spaced so as to avoid any impact to the drainage line and wetland. The abundance of protected trees along this section of the route is also fairly high with several areas of high *Acacia erioloba* and *Acacia haematoxylon* density. Towards Kathu along the western boundary of Lohatlha the vegetation shifts to Kathu Bushveld, which in some areas is largely similar to Kuruman Thornveld, but there are however several areas on shallow soils which tend to be dominated by either *Acacia mellifera* or *Tarchonanthus camphoratus*. These are considered to be lower sensitivity on account of their lower ecological value and degraded nature which leads to the dominance of these species.

Figure 8. The wetland feature that is present along the power line route within Lohatlha. This is a sensitive area that should be avoided as much as possible.

Common and dominant trees and shrubs within the Kuruman Thornveld areas include *Acacia erioloba*, *Acacia mellifera* subsp. *detinens*, *Ziziyphus mucronta*, *Grewia flava*, *Tachonanthus camphoratus*, *Gymnosporia buxifolia*, *Acacia hebeclada* subsp. *hebeclada*, *Searsia lancea*, *Searsia ciliata*, *Searsia burchellii*, *Olea europea* subsp. *africana*, *Lebeckia macrantha*, *Diospyros austro-africana*, *Diospyros lycioides* and *Lycium schizocalyx*. Low shrubs include *Monechma divaricatum*, *Ehretia alba*, *Gnidia polycephala*, *Pentzia calcarea*, *Lycium cinereum*, *Chrysocoma ciliata* and *Selago mixta*. Forbs present include *Elephantorrhiza elephantina*, *Corchorus asplenifolius* and *Solanum incanum*. Grasses include *Aristida meridionalis*, *A.stipitata* subsp. *stipitata*, *Diheteropogon amplectens, Eragrostis lehmannniana*, *Pogonathria squarrosa*, *Cynodon dactylon*, *Cymbopogon pospischilii*, *Melinis repens*, *Enneapogon scoparius*, *Schmidtia pappophoroides*, *Themeda triandra, Heteropogon contortus*, *Anthephora pubescens* and *Panicum kalaharense*.

Figure 9. Looking west along the Alternative 1 power line route within the Lohatlha area showing plains of Kurumand Thornveld and rocky hill of Kuurman Mountain Bushveld in the distance.

The vegetation of the rocky hills is variable and depends on the elevation and how weathered the underlying rock is, with higher elevation rocky areas being dominated by grasses with relatively few trees and the lower elevation rocky hills being dominated by woody vegetation. Common and dominant trees and large shrubs include *Searsia lancea*, *Diospyros austro-africana*, *Euclea crispa*, *Olea europea* subsp. *africana*, *Searsia pyroides*, *Searsia tridactyla*, *Searsia ciliata*, *Tarchonanthus camphoratus*, *Buddleja saligna*, *Lantana rugosa*, *Lebeckia macrantha*, *Ehretia alba* and *Wahlenbergia nodosa*. The grass layer is dominated by grasses such as *Diheteropogon amplectens, Heteropogon contortus*, *Eragrostis chloromelas*, *E.nindensis*, *Fingerhutia africana*, *Aristida stipitata*, *Eustachys paspaloides*, *Oropetium capense*, *Cymbopogon excavatus*, *Aristida meridionalis*, *Aristida congesta*, *Melinis repens*, *Bulbostylis burchellii*, *Anthephora pubescens*, *Themeda triandra*, *Brachiaria nigroperata*, *Brachiaria serrata, Enneapogon scoparius, Triraphis andropogonoides*, *Trichoneura grandiglumis* and *Schizachyrium sanguineum*. Forbs and low shrubs that occur within the grass layer include *Chrysocoma cilliata*, *Felicia clavipilosa*, *Pentzia calcarea*, *Asparagus suaveolens*, *Portulaca kermesina*, *Sutera griquensis*, *Chascanum hederaceum*, *Rhynchosia confusa*, *Anthospermum rigidum*, *Hermannia tomentosa*, *Helichrysum nudifolium*, *Helichrysum zeyheri*, *Dicoma schinzii*, *Gomphocarpus fruticosus*, *Gazania krebsiana*, *Corchorus asplenifolius*, *Melhania virescens* and *Solanum incanum*.

Within the Kathu Bushveld, the areas dominated *Tarchonanthus camphoratus* are considered somewhat degraded and part from the overwhelming dominance of *Tarchonanthus*, other tall shrubs and trees present including *Zizyphus mucronata*, *Gymnosporia buxifolia*, *Acacia erioloba*, *Acacia karroo*, *Acacia mellifera* subsp. *detinens*, *Searsia ciliata*, *Ehretia rigida* subsp. *rigida*, *Diospyros lycioides* subsp. *lycioides* and *Grewia flava*. The grass layer is dominated by species such as *Aristida meridionalis, Aristida stipitata* subsp. *stipitata*, *Cymbopogon popischilli, Cynodon dactylon, Enneapogon cenchroides, Eragrostis lehmanniana, Eragrostis nindensis, Pogonarthria squarrosa*, *Schmidtia pappophoroides, Stipagrostis uniplumis* var. *uniplumis* and Aristida *congesta* subsp. *congesta*. Common low shrubs include *Asparagus laricinus*, *Asparagus retrofractus*, *Chrysocoma ciliata*, *Felicia muricata* subsp. c*inerascens*, *Pentzia calcarea*, *Acacia hebeclada*, *Hermannia tomentosa*, *Gnidia polycephala* and *Lantana rugosa*. Forbs were abundant at the time of the field assessment and common species present include *Dicoma schinzii*, *Geigeria ornativa*, *Elephantorrhiza elephantina*, *Indigofera daleoides* var. *daleoides* and *Gisekia pharnacioides* var. *pharnacioides*.

Figure 10. Poor condition Kathu Bushveld dominated by Tarchnanthus camphoratus along the final section of the Alternative 1 power line route towards Kathu.

Within the less degraded areas, which can usually be recognised by their more open nature and predominance of *Acacia erioloba* within an open grassland, typical and dominant species include *Acacia erioloba*, *Zizyphus mucronata*, with a variable tall shrub layer consisting of *Tarchonanthus camphoratus*, *Acacia haematoxylon*, *Gymnosporia buxifolia*, *Searsia ciliata*, *Ehretia rigida* subsp. *rigida*, *Diospyros lycioides* subsp. *lycioides* and *Grewia flava*. Dominant and characteristic species within the grass layer include *Schmidtia pappophoroides*, *Aristida meridionalis, Aristida stipitata* subsp. *stipitata*, *Stipagrostis uniplumis* var. *uniplumis*, *Stipagrostis obtusa*, *Cynodon dactylon, Enneapogon desvauxii, Eragrostis lehmanniana,* and *Aristida congesta* subsp. *congesta*.

Figure 11. Good condition Kathu Bushveld dominated by *Acacia erioloba* and *Acacia haematoxylon* with a well-developed grass layer.

1.3.3. Listed and Protected Plant Species

Based on the SANBI POSA database as well as the fieldwork that has been conducted in the area, the abundance of species of conservation concern in the area is low. The abundance of protected tree species is however high in many parts of the affected areas. *Boscia albitrunca* is occasional along the route and very few trees would be affected and those along the route can probably all be avoided. The abundance of *Acacia erioloba* and *Acacia haematoxylon* is high in many areas and while *Acacia haematoxylon* is shorter and sometimes tolerated in the power line servitudes, it is likely that hundreds of *Acacia erioloba* will need to be cleared along the servitude. However as this species is very common in the area, this would not be a significant impact on the local population.

1.3.4. Faunal Communities

1.3.4.1. Mammals

According to the MammalMap database, over 40 mammals are known from the broad area. Species which can be confirmed present include Kudu, Common Duiker, Steenbok, Cape Hare, Chacma Baboon, Rock Hyrax, Yellow Mongoose, Small Spotted Genet, Warthog, Aardwolf, Aardvark, African Wildcat, Caracal, Black-backed Jackal, Cape Porcupine, Smith's Red Rock Rabbit, Springhare, Suricate and Slender Mongoose. Small mammals trapped or observed in the area include the South African Pouched Mouse, Namaqua Rock Mouse, Four-striped Mouse, Desert Pygmy Mouse, Chestnut Climbing Mouse, Hairy-footed Gerbil, Bushveld Gerbil and Multimammate Mouse (**Figure 12**). There are also a number of larger mammals present in the area which are considered to be part of the local farming enterprises including Eland, Gemsbok, Giraffe, Red Hartebeest, Burchells Zebra, Cape Mountain Zebra, Blesbok, Waterbuck, Springbok, Impala, Blue Wildebeest, Black Wildebeest and the introduced Fallow Deer and Barbary Sheep.

Species of conservation concern that may occur in the area includes the Southern African Hedgehog *Atelerix frontalis* (NT) as well as Ground Pangolin *Smutsia temminckii* (VU). It is likely that the Hedgehog is present in the area as the habitat is broadly suitable and it is also possible that the Pangolin is present in the area, but this species occurs at a low density the extent of habitat loss for this species would be low. The Mountain Reedbuck *Redunca fulvorufula fulvorufula* is currently classified as *Endangered* and is confirmed present on the higher ground of the wind farm site. However, as the habitat of this species is the high-lying ridges that would be little impacted by the power line development, a direct impact on the Mountain Reedbuck as a result of the development is not likely.

Important habitats for mammals along the power line route include occasional rocky outcrops which provide shelter and habitat for rock-dwelling species and densely-vegetated lowlands along drainage lines which provide cover for numerous species. For most mammals, the major impact of development would be some disturbance during the construction phase and a small amount of habitat loss equivalent to the footprint of the power line. It is unlikely that any species would be significantly compromised by the construction and operation of the power line and long-term impacts on mammals are likely to be low after mitigation.

Figure 12. Small mammals trapped in the area include from top left, the Pouched Mouse, Multimammate Mouse, Bushveld Gerbil and Hairy-footed Gerbil.

1.3.4.2. Reptiles

Based on the ReptileMap database records for the area (Appendix 3), approximately 40 reptiles are known to occur in the area. No reptile species of concern have however been recorded from the area, which can be explained by the ubiquitous nature and broad distribution of the habitats present in the area. Within the study area, the rocky hills are likely to have a greater diversity of reptiles than the plains. Species observed in the area (**Figure 13**) include Ground Agama, Boomslang, Cape Gecko, Rock Monitor, Spotted Sand Lizard, Variegated Skink, Variable Skink, Speckled Rock Skink and Leopard Tortoise. There are no habitats of particular concern for reptiles at the site which would be impacted by the development and the species and habitats present are all widely distributed. As a result, the overall impacts of the development on reptiles are likely to be of local significance only and there are no species with a very narrow distribution range or of high conservation concern present at the site which may be compromised by the power line development.

Figure 13. Reptiles observed at the site include from bottom left, Cape Gecko, Spotted Sand Lizard, Boomslang and Leopard Tortoise.

1.3.4.3. Amphibians

The only feature of significance for amphibians observed along the power line route is the wetland within Lohatlha. This clearly a locally important feature as other amphibian breeding sites in the area are rare. Across the majority of the routes, there are few other amphibian breeding opportunities apart from occasional farm dams Some species such as Bushveld Rain Frogs are independent of water and not dependent on water for breeding purposes and are certainly present within the lowlands of area. No listed species are known from the area. The Giant Bullfrog occurs widely in the Savannah Biome but there are no records from the vicinity of the Kuruman area, suggesting that this species does not occur in the area. The observed wetland is considered suitable for this species, but there was water in the wetland at the time of the site visit and there were no Bullfrogs or tadpoles present, suggesting that it is not present at the site. The only species observed in the area was the Tremelo Sand Frog although some of the other toad species such as Olive Toad are also likely to be present. Given the paucity of important amphibian habitats at the site and the low diversity of amphibians, a significant impact on frogs is not likely.

1.3.5. Critical Biodiversity Areas

The CBA map for the wider area around the study site is illustrated below in **Figure 14**. The northern parts of the route from near the Kuruman WEF 1 Substation to the Kuruman Substation site (Alternative 3) fall within a Tier 2 CBA which forms a buffer area around the Billy Duvenhage Nature Reserve. As the footprint within the CBA would be low, a significant impact on any ecological processes within the CBA is highly unlikely. In addition, the area already has a lot of roads and human activity with the result that the additional power line would generate significant additional impact in the area.

Several section of the route fall within Ecological Support Areas associated with the ridges and rocky hills of the area. Large tracts of the route especially in the South are also classified as *other natural areas*, which have not been identified as being of high importance for broad scale biodiversity maintenance. It is highly unlikely that the power line would compromise the functioning of the ESAs due to their low terrestrial footprint. As a result, the overall impact of the development on ESAs is considered to be low and a long-term significant impact is unlikely. In addition, the site does not fall within an area identified as being a priority conservation expansion area under the Northern Cape Protected Area Expansion Strategy (NCPAES) Focus Area (2017).

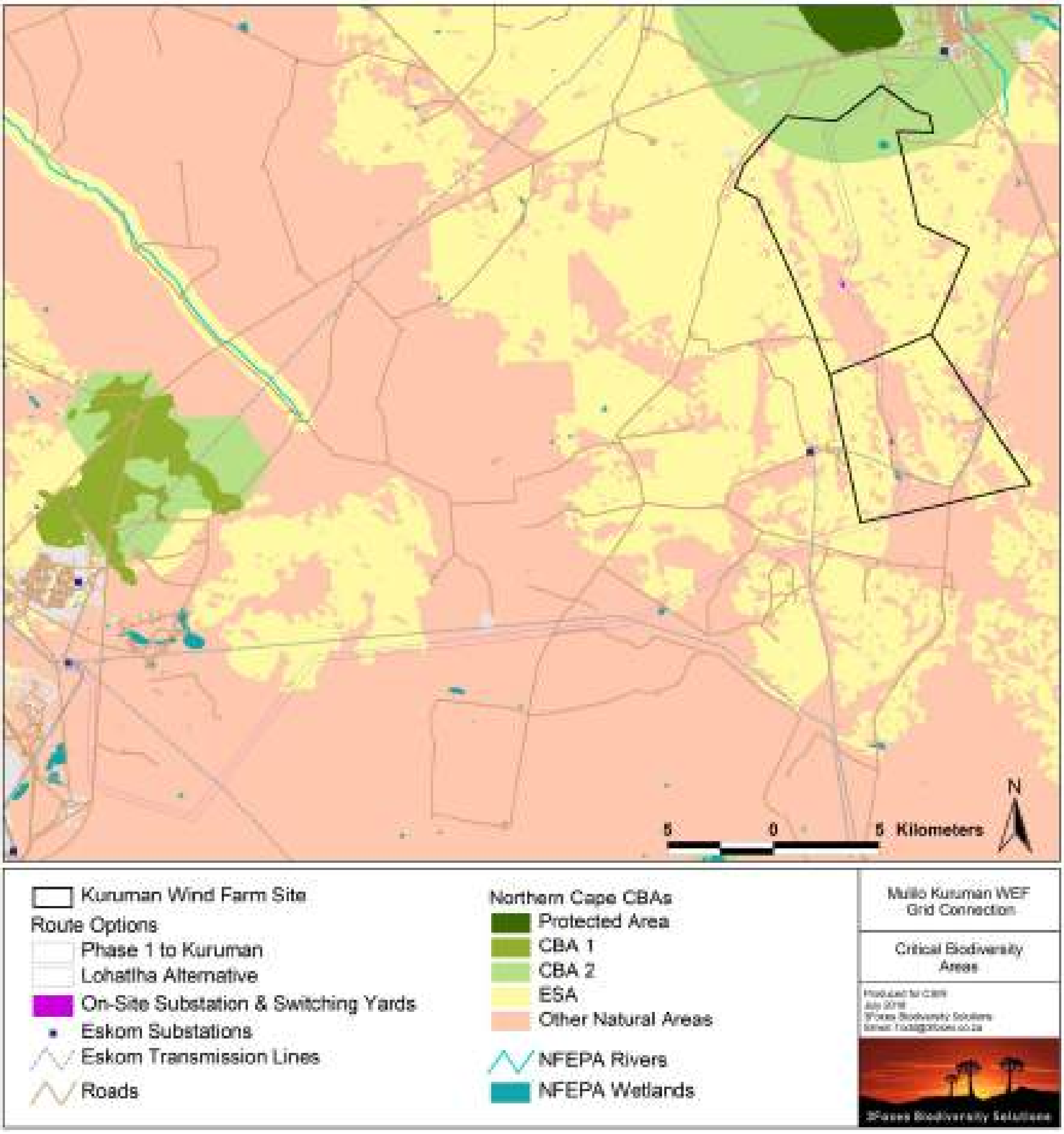

Figure 14. Critical Biodiversity Areas map for the study area, showing that the site does not contain and CBAs but does contain a fairly large proportion of Ecological Support Areas.

1.3.6. Cumulative Impacts

As the power line is associated with the Kuruman WEFs and would not be built without the generating component, it is appropriate to consider the cumulative impacts of the power line in conjunction with the wind farm itself.

There are a number of proposed solar energy facilities in the broad area around the Kuruman WEF site (**Figure 15**). However all of these are on the plains habitat and there are no registered wind farm projects in the vicinity of the current site that would affect the same Kuruman Mountain Bushveld vegetation type. In addition, the Kuruman Mountain Bushveld habitat type is still largely intact and has not been significantly impacted by transformation. As a result, the contribution of the current development to cumulative impact would be relatively low and is estimated at less than 100ha in total. This would not significantly impact the remaining extent of Kuruman Mountain Bushveld or Kuruman Thornveld. The contribution of the power line to cumulative impact would be low. While some woody vegetation would be cleared for the servitude, most species are still able to use these areas and they do not significantly reduce the available habitat for most species. As a result, the overall contribution of the power line to impact in the area is considered to be low.

Figure 15. Map of other renewable energy developments in the wide area around the affected Kuruman WEF Phase 2 properties indicated in blue. All existing projects are solar PV projects restricted to the plains of the area.

1.3.7. Site Sensitivity & Results of the Field Study

The ecological sensitivity map for the study area is illustrated below in Figure 16. The majority of the routes are within areas of natural vegetation that are considered medium low sensitivity, with occasional areas of medium and medium high sensitivity areas associated with rocky hills or areas of high protected tree density. Alternative 2 is restricted to the low-lying areas the lower foothills of the Kuruman WEF 1 area and the only feature of significance along the route are some areas of high *Acacia erioloba* density. Similarly, Alternative 3, the link from Kuruman WEF 1 to Kuruman WEF 2 is restricted largely to the low lying areas with occasional stretches of high tree density. Alternative 1 is the longest and as a result, has the highest diversity of features. There are a few short sections of high sensitivity areas along this route, the wetland area within Lohatla in particular as well as some steep section of rocky hills towards the Kuruman WEF 2 area. Overall, the power line routes are well-directed within the lower sensitivity areas and no significant changes to the routing can be recommended. With mitigation, the impact of the power line would be low and no significant impacts to any features or species of high significance can be expected.

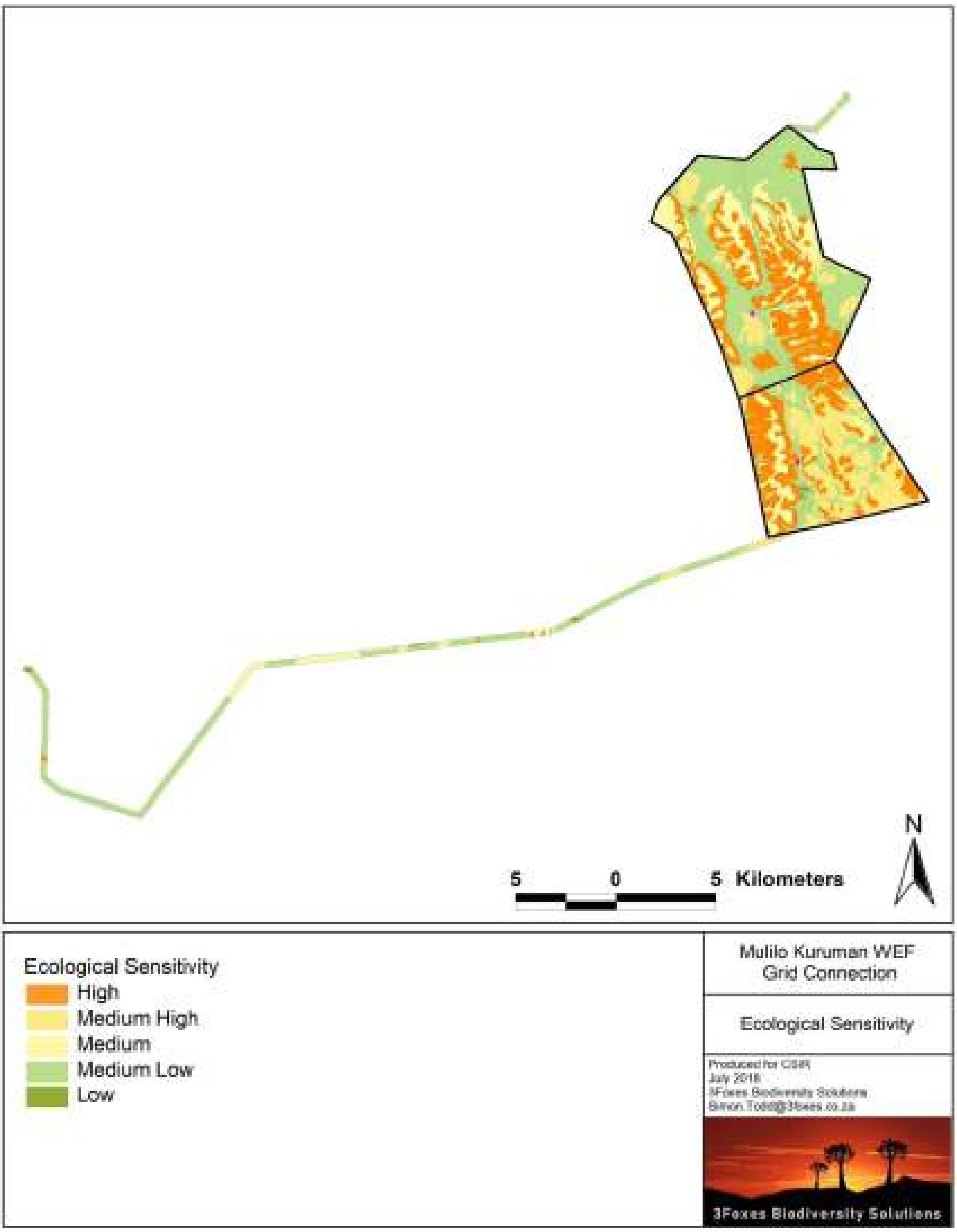

Figure 16. Ecological sensitivity map for the grid connection corridor. The routes generally stick to the lower lying areas which are mostly considered medium low or medium sensitivity.

1.4. IDENTIFICATION OF KEY ISSUES

1.4.1. Identification of Potential Impacts

The primary source of impact associated with the development would be disturbance during the construction phase and a small amount of habitat loss and occasional disturbance during the operational phase. The following activities are identified as being potentially associated with the development:

1.4.1.1. Construction Phase

- Impacts on vegetation and protected tree species
- Direct and indirect faunal impacts

1.4.1.2. Operational Phase

- Increased soil erosion
- Increased alien plant invasion
- Impacts on fauna due to operation
- Impacts on Critical Biodiversity Areas and ESAs

1.4.1.3. Decommissioning Phase

- Increased alien plant invasion
- Increased soil erosion
- Direct and indirect impacts on fauna

1.4.1.4. Cumulative impacts

- Cumulative impacts on habitat loss and broad-scale ecological processes

1.5. ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

An assessment of the likely impacts associated with the development, is provided below

1.5.1. Construction Phase Impact 1. Impacts on vegetation and plant species of conservation concern

- The abundance of plant species of concern at the site is very low, although there are three protected tree species present that would be impacted by the development to a greater or lesser degree. It is likely that several hundreds or more *Acacia erioloba* and *Acacia haematoxylon* trees would be affected by the development, especially Alternative 1 given its length. Due to the low current levels of impact on the affected vegetation types, the significance of this impact is considered to be of low magnitude and of local significance only.

Without mitigation this impact would be of **Moderate** potential significance.

Essential mitigation measures include:

- No development of turbines, roads of other infrastructure within identified no-go areas.
- Avoid impact to the wetland features within Alternative 1's routing.
- Pre-construction walk-through of the development footprint to further refine the pylon positions and further reduce impacts on sensitive habitats and protected species through micro-siting of the pylons and service roads.

With the implementation of the suggested mitigation the impact on vegetation would be reduced to a **Low** significance.

1.5.2. Construction Phase Impact 2. Direct and indirect faunal impacts

The construction of the development will result in some habitat loss, noise and disturbance along the route. This will lead to direct and indirect disturbance of resident fauna. Some slow-moving or retiring species such as many reptiles would likely not be able to escape the construction machinery and would be killed. There are also several species present at the site which are vulnerable to poaching and there is a risk that these species may be targeted. This impact would be caused by the presence and operation of construction machinery and personnel on the site. This impact would however be short-lived and restricted to the construction phase, with significantly lower levels of disturbance during the operational phase.

Without mitigation this impact is likely to be of **Moderate** significance.

Essential mitigation measures would include:

- Avoidance of identified areas of high fauna importance.
- Search and rescue for reptiles and other vulnerable species during construction, before areas are cleared.
- Limiting access to the site and ensuring that construction staff and machinery remain within the demarcated construction areas during the construction phase.
- Environmental induction for all staff and contractors on-site.

With the implementation of the suggested mitigation the construction Phase Impact on fauna can likely be reduced to **Low Significance**.

1.5.3. Operational Phase Impact 1. Increased Soil Erosion

Parts of the route are one steep slopes or sandy soils that are vulnerable to erosion and the disturbance created during construction will increase erosion risk at the site and specific mitigation would be required to manage erosion risk in these vulnerable areas.

Without mitigation, this impact would potentially be of **Moderate significance**.

Essential mitigation measures would include:

- Avoiding areas of high erosion vulnerability as much as possible.
- Using barriers, geotextiles, active rehabilitation and other measures during and after construction to minimise soil movement at the site.

With the effective implementation of the mitigation measures, it is likely that this impact can be reduced to an acceptable, **Low significance**.

1.5.4. Operational Phase Impact 2. Increased Alien Plant Invasion

There are already several alien species present on the site such as *Prosopis glandulosa* and disturbance created during construction would leave the site vulnerable to further alien plant invasion, especially along the access roads and other areas which receive additional run-off.

Without mitigation this impact would likely be of **Moderate to Low Significance**.

Essential mitigation measures would include:

- Alien management plan to be implemented during the operational phase of the development, which makes provision for regular alien clearing and monitoring.
- Rehabilitation of disturbed areas that are not regularly used after construction.

With the effective implementation of the mitigation measures, it is likely that this impact can be reduced to a **Low Significance**.

1.5.5. Operational Phase Impact 3. Operational Impacts on Fauna

Maintenance activities along the power line route may deter some sensitive fauna from the area or impact directly on wildlife within the servitude.

Without mitigation this impact would likely be of **Low Significance**.

Essential mitigation measures would include:

- Open space management plan for the development, which makes provision for favourable management of the facility and the surrounding area for fauna.
- Limiting access to the site to staff and contractors only.
- Appropriate design of roads and other infrastructure where appropriate to minimise faunal impacts and allow fauna to pass through or underneath these features.
- No electrical fencing within 30cm of the ground as tortoises become stuck against such fences and are electrocuted to death.

With the effective implementation of the mitigation measures, it is likely that this impact can be reduced to a **Low Significance**.

1.5.6. Operational Phase Impact 4. Impacts on Critical Biodiversity Areas and ESAs

A part of the power line to the Kuruman Substation is within a CBA 2 while large sections of the routes are within Ecological Support Areas. With mitigation, a long-term significant impact on CBAs and ESAs is not likely. As such impacts on CBA, ESAs and associated ecological processes are considered to be low.

Without mitigation this impact would likely be of **Low Significance**.

Essential mitigation measures would include:

- Minimise the development footprint as far as possible, which includes locating temporary-use areas such as construction camps and lay-down areas in previously disturbed areas.
- Avoid impact to restricted and specialised habitats such as large rocky outcrops.

With the effective implementation of the mitigation measures, it is likely that this impact will be reduced to a **Low Significance**.

1.5.7. Decommissioning Phase Impact 1. Increased Soil Erosion

As already described, the site has steep slopes that are vulnerable to erosion. Decommissioning will remove the hard infrastructure from the site, generating disturbance and leaving areas that are unvegetated and vulnerable to erosion.

Without mitigation, this impact would potentially be of **Moderate significance**.

Essential mitigation measures would include:

- Revegetation of cleared areas with monitoring and follow-up to ensure that rehabilitation is successful.
- Using net barriers, geotextiles, active rehabilitation and other measures during and after decommissioning to minimise sand movement at the site.

With the effective implementation of the mitigation measures, it is likely that this impact can be reduced to an acceptable, **Low significance**.

1.5.8. Decommissioning Phase Impact 2. Increased Alien Plant Invasion

There are already some alien species present on the site such as *Prosopis* and disturbance created during decommissioning would leave the site vulnerable to further alien plant invasion.

Without mitigation this impact would likely be of **Moderate Significance**.

Essential mitigation measures would include:

- Alien management plan to be implemented during the decommissioning phase of the development, which makes provision for regular alien clearing and monitoring for up 5 years after decommissioning.
- Rehabilitation of disturbed areas that have been generated by decommissioning.

With the effective implementation of the mitigation measures, it is likely that this impact can be reduced to a **Low Significance**.

1.5.9. Cumulative Impact 1. Cumulative habitat loss and impact on broad-scale ecological processes

There are several other renewable energy developments in the wider area and along with the current development, these would contribute to cumulative impacts on habitat loss and fragmentation and negative impact on broad-scale ecological processes such as dispersal and climate change resilience. However, not all of the developments in the area would impact on the same ridge habitat as the current development and overall, the current levels of cumulative development impact in the wider area is relatively low. The specific contribution of the current development would be low.

Without mitigation, this impact is likely to be of **Moderate to Low Significance.**

Essential mitigation measures would include:

- Minimise the current development footprint as much as possible and rehabilitate cleared areas after construction.
- Ensure that management of the facility occurs in a biodiversity-conscious manner in accordance with an open-space management plan for the facility.

With the effective implementation of the mitigation measures, it is likely that this impact will be reduced to a **Low Significance**.

1.6. IMPACT ASSESSMENT SUMMARY

The assessment of impacts and recommendation of mitigation measures as discussed above are collated in Table 1-1 to 1-4 below. Impacts are assessed for the construction, operational and decommissioning phases of the development as well as for overall cumulative impacts.

Table 1-1 Impact assessment summary table for the Construction Phase

CONSTRUCTION PHASE													
Direct impacts													
Impact on vegetation													
Impact pathway Habitat Loss	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**	**Significance of residual risk/impact (after mitigation)**	**Ranking of impact/ risk**	**Confidence level**
Alternative 1	-	Local	Long-term	Moderate	Very Likely	Moderate	Moderate	Moderate Risk (3)	Partly	Partly	Low	4	High
Alternative 2	-	Local	Long-term	Moderate	Very Likely	Moderate	Moderate	Low Risk (2)	Partly	Partly	Low	3	High
Alternative 3	-	Local	Long-term	Moderate	Very Likely	Moderate	Moderate	Low Risk (2)	Partly	Partly	Low	3	High

Suggested Mitigation:

- No development of turbines, roads or other infrastructure within No-Go areas as has been achieved under the assessed layout.
- Preconstruction walk-through with follow-up search and rescue of the development footprint to further refine the layout and reduce impacts on protected species through micro-siting of the turbines and access roads.
- Demarcate all areas to be cleared with construction tape or other appropriate and effective means. However caution should be exercised to avoid using material that might entangle fauna.

Faunal Impacts due to construction													
Impact pathway Habitat Loss	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**	**Significance of residual risk/impact (after mitigation)**	**Ranking of impact/ risk**	**Confidence level**

Alternative 1	**-**	**Local**	**Short-term**	**Moderate**	**Likely**	**High**	**Moderate**	**Moderate Risk (3)**	**Partly**	**Partly**	**Low**	**3**	**High**
Alternative 2	**-**	**Local**	**Short-term**	**Moderate**	**Likely**	**High**	**Moderate**	**Moderate Risk (3)**	**Partly**	**Partly**	**Low**	**2**	**High**
Alternative 3	**-**	**Local**	**Short-term**	**Moderate**	**Likely**	**High**	**Moderate**	**Moderate Risk (3)**	**Partly**	**Partly**	**Low**	**2**	**High**

Suggested Mitigation:

- Avoidance of identified areas of high faunal importance at the design stage as has been achieved with the current layout.
- Ensure that lay-down and other temporary infrastructure is within medium- or low- sensitivity areas, preferably previously transformed areas if possible.
- Search and rescue for reptiles and other vulnerable species during construction, before areas are cleared.
- During construction any fauna directly threatened by the construction activities should be removed to a safe location by the ECO or other suitably qualified person.
- Environmental induction for all staff and contractors on-site.
- All construction vehicles should adhere to a low speed limit (40km/h for cars and 30km/h for trucks) to avoid collisions with susceptible species such as snakes and tortoises and rabbits or hares.

Table 1-2 Impact assessment summary table for the Operational Phase

OPERATIONAL PHASE													
Direct impacts													
Increased soil erosion													
Impact pathway Disturbance	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**	**Significance of residual risk/impact (after mitigation)**	**Ranking of impact/ risk**	**Confidence level**
Alternative 1	**-**	**Local**	**Long-term**	**Moderate**	**Likely**	**Moderate**	**Moderate**	**Moderate Risk (3)**	**Yes**	**Yes**	**Low**	**4**	**High**
Alternative 2	**-**	**Local**	**Long-term**	**Moderate**	**Likely**	**Moderate**	**Moderate**	**Moderate Risk (3)**	**Yes**	**Yes**	**Low**	**3**	**High**
Alternative 3	**-**	**Local**	**Long-term**	**Moderate**	**Likely**	**Moderate**	**Moderate**	**Moderate Risk (3)**	**Yes**	**Yes**	**Low**	**3**	**High**

Suggested Mitigation:

- Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan.
- All roads and other hardened surfaces should have runoff control features which redirect water flow and dissipate any energy in the water which may pose an erosion risk.
- Regular monitoring for erosion after construction to ensure that no erosion problems have developed as result of the disturbance, as per the Erosion Management and Rehabilitation Plans for the project.
- All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.
- All cleared areas should be revegetated with indigenous perennial species from the local area.
- Avoid areas of high erosion vulnerability as much as possible.

Increased alien plant invasion

Impact pathway Disturbance	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Significance of residual risk/impact (after mitigation)	Ranking of impact/ risk	Confidence level
Alternative 1	-	Local	Medium-term	Moderate	Likely	Moderate	Moderate	Moderate Risk (3)	Yes	Yes	Low	4	High
Alternative 2	-	Local	Medium-term	Moderate	Likely	Moderate	Moderate	Low Risk (2)	Yes	Yes	Low	2	High
Alternative 3	-	Local	Medium-term	Moderate	Likely	Moderate	Moderate	Low Risk (2)	Yes	Yes	Low	23	High

Suggested Mitigation:

- Alien management plan to be implemented during the operational phase of the development, which makes provision for regular alien clearing and monitoring.
- Wherever excavation is necessary, topsoil should be set aside and replaced after construction to encourage natural regeneration of the local indigenous species.
- Regular alien clearing should be conducted, as needed, using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.

Operational impacts on fauna

Impact pathway Noise and Disturbance	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Significance of residual risk/impact (after mitigation)	Ranking of impact/ risk	Confidence level
Alternative 1	-	Local	Long-term	Low	Likely	High	Moderate	Low Risk (2)	Partly	Largely	Low	2	High
Alternative 2	-	Local	Long-term	Low	Likely	High	Moderate	Low Risk (2)	Partly	Largely	Low	2	High
Alternative 3	-	Local	Long-term	Low	Likely	High	Moderate	Low Risk (2)	Partly	Largely	Low	2	High

Suggested Mitigation:

- Vegetation clearing along the power line servitude should be kept to the minimum possible.
- All vehicles using the servitude should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such as snakes and tortoises.

Impacts on Critical Biodiversity Areas and ESAs

Impact pathway Habitat loss and disturbance	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Significance of residual risk/impact (after mitigation)	Ranking of impact/ risk	Confidence level
Alternative 1	-	Local	Long-term	Low	Unlikely	Moderate	Moderate	Low Risk (2)	Partly	Partly	Low	2	High
Alternative 2	-	Local	Long-term	Low	Unlikely	Moderate	Moderate	Low Risk (2)	Partly	Partly	Low	2	High
Alternative 3	-	Local	Long-term	Low	Unlikely	Moderate	Moderate	Very Low Risk (1)	Partly	Partly	Very Low	1	High

Suggested Mitigation:

- Minimise the development footprint as far as possible, which includes locating temporary-use areas such as construction camps and lay-down areas in previously disturbed areas.
- Avoid impact to restricted and specialised habitats such as drainage areas and rocky outcrops
- Ensure that operational phase noise and disturbance is minimised as far as possible.

Table 1-3 Impact assessment summary table for the Decommissioning Phase

DECOMMISSIONING PHASE													
Direct impacts													
Increased soil erosion													
Impact pathway Habitat loss and disturbance	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Significance of residual risk/impact (after mitigation)	Ranking of impact/ risk	Confidence level
Alternative 1	-	Local	Medium-term	Moderate	Likely	Moderate	Moderate	Moderate Risk (3)	Yes	Yes	Low	3	High
Alternative 2	-	Local	Medium-term	Moderate	Likely	Moderate	Moderate	Moderate Risk (3)	Yes	Yes	Low	2	High
Alternative 3	-	Local	Medium-term	Moderate	Likely	Moderate	Moderate	Moderate Risk (3)	Yes	Yes	Low	2	High
Suggested Mitigation: • All hard infrastructure should be removed and the footprint areas rehabilitated with locally-sourced perennial species. • The use of net barriers, geotextiles, active rehabilitation and other measures after decommissioning to minimise sand movement and enhance revegetation at the site. • Monitoring of rehabilitation success at the site for at least 5 years after decommissioning. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques.													
Increased alien plant invasion													
Impact pathway Habitat loss and disturbance	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Significance of residual risk/impact (after mitigation)	Ranking of impact/ risk	Confidence level

Alternative 1	**-**	**Local**	**Long-term**	**Moderate**	**Likely**	**Moderate**	**Moderate**	**Moderate Risk (3)**	**Yes**	**Yes**	**Low**	**3**	**High**
Alternative 2	**-**	**Local**	**Long-term**	**Moderate**	**Likely**	**Moderate**	**Moderate**	**Low Risk (2)**	**Yes**	**Yes**	**Low**	**2**	**High**
Alternative 3	**-**	**Local**	**Long-term**	**Moderate**	**Likely**	**Moderate**	**Moderate**	**Low Risk (2)**	**Yes**	**Yes**	**Low**	**2**	**High**

Suggested Mitigation:

- Alien management plan to be implemented during the decommissioning phase of the development, which makes provision for regular alien clearing and monitoring for at least 5 years after decommissioning.
- Active rehabilitation and revegetation of previously disturbed areas with indigenous species selected from the local environment.
- Wherever excavation is necessary for decommissioning, topsoil should be set aside and replaced after decommissioning activities are complete to encourage natural regeneration of the local indigenous species.
- Regular monitoring for alien plants within the disturbed areas for at least two years after decommissioning or until alien invasives are no longer a problem at the site.
- Regular alien clearing should be conducted using the best-practice methods for the species concerned. The use of herbicides should be avoided as far as possible.

Table 1-4 Impact assessment summary table for Cumulative Impacts

Cumulative Impacts														
Cumulative habitat loss and impact on broad scale ecological processes														
Impact pathway	**Status**	**Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of impact**	**Irreplaceability of receiving environment/ resource**	**Significance of impact/risk = consequence x probability (before mitigation)**	**Can impact be avoided?**	**Can impact be managed or mitigated?**		**Significance of residual risk/impact (after mitigation)**	**Ranking of impact/ risk**	**Confidence level**
Habitat loss and disturbance	**-**	**Regional**	**Long-term**	**Moderate**	**Likely**	**Low**	**Moderate**	**Moderate Risk (3)**	**Partly**	**Partly**		**Low**	**4**	**High**

Suggested Mitigation:

- Minimise the development footprint as far as possible.
- The facility should be managed in a biodiversity-conscious manner in accordance with an open-space management plan for the facility.

1.7. CONCLUSIONS AND RECOMMENDATIONS

The Grid Connection route alternatives for the Kuruman WEF Project fall within three vegetation types. Kuruman Mountain Bushveld which is associated with the rocky hills of the wind farm site as well as several other rocky hills along the route from the site to the Sekgame Substation. The plains north of the site to the Kuruman substation as well as the plains along the route towards Kathu consist of Kuruman Thornveld. The final section of the route towards the Sekgame Substation consists of Kathu Bushveld. All of these vegetation types are of least concern and have not been significantly impacted by transformation to date. The abundance of plant species of conservation concern within the affected area is low and the overall impact of the development on vegetation would be low. There are however several areas of high protected tree density, mostly *Acacia erioloba* and to a lesser extent *Acacia haematoxylon* and these would be impacted by the development, but as they are common in the area, their local populations would not be significantly impacted.

In terms of fauna, the abundance of species of concern at the site is generally low and the power line would not be likely to impact any populations of any species of concern to a noticeable degree. Alternative 2 and 3 to the Kuruman Substation would impact on a CBA, while the other two routes are restricted to ESAs and other natural areas of low significance. Due to the low footprint of the power line, a significant impact on CBAs and ESAs is not likely.

In terms of cumulative impact, the contribution of the power line would be very low as the servitude is cleared of larger woody vegetation, but the grass layer remains intact and is still available to most species. As a result, the overall contribution and cumulative impact of the power line is not considered highly significant.

The sensitivity mapping that was conducted indicates that the majority of the routes are within areas of natural vegetation that are considered medium low sensitivity, with occasional areas of medium and medium high sensitivity areas associated with rocky hills or areas of high protected tree density. Alternative 2 is restricted to the low-lying areas the lower foothills of the Kuruman WEF 1 area and the only feature of significance along the route are some areas of high *Acacia erioloba* density. Similarly, Alternative 3, the link from Kuruman WEF 1 to Kuruman WEF 2 is restricted largely to the low lying areas with occasional stretches of high tree density. Alternative 1 is the longest and as a result, has the highest diversity of features. There are a few short sections of high sensitivity areas along this route, the wetland area within Lohatla in particular as well as some steep section of rocky hills towards the Kuruman WEF 2 area. Overall, the power line routes are well-directed within the lower sensitivity areas and no significant changes to the routing can be recommended. With mitigation, the impact of the power line would be low and no significant impacts to any features or species of high significance can be expected. .

Overall, the three alternatives for the Kuruman WEF Grid Connection are likely to generate low impacts on fauna and flora and no high residual impacts on any species or habitats is likely. As a result, the development of either of the power line alternatives can be supported from a terrestrial ecology perspective and are not opposed.

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1.9. APPENDICES

1.9.1. Appendix 1. List of Plants

List of plant species known from the broad area around the Kuruman WEF Grid Connection based on the SANBI POSA database. .

Family	Genus	Species	Rank	Subspecies	IUCN	Family	Genus	Species	Rank	Subspecies	IUCN
Acanthaceae	*Barleria*	*lichtensteiniana*				Acanthaceae	*Barleria*	*macrostegia*			
Acanthaceae	*Glossochilus*	*burchellii*				Acanthaceae	*Hypoestes*	*forskaolii*			
Acanthaceae	*Justicia*	*divaricata*				Acanthaceae	*Barleria*	*bechuanensis*			LC
Acanthaceae	*Barleria*	*media*				Acanthaceae	*Justicia*	*australis*			
Acanthaceae	*Justicia*	*incana*				Acanthaceae	*Justicia*	*puberula*			
Aizoaceae	*Nananthus*	*aloides*			LC	Aizoaceae	*Plinthus*	*sericeus*			LC
Aizoaceae	*Trianthema*	*parvifolia*	var.	*parvifolia*	LC	Aizoaceae	*Trichodiadema*	*pomeridianum*			LC
Aizoaceae	*Prepodesma*	*orpenii*				Aizoaceae	*Ruschia*	*calcarea*			DD
Amaranthaceae	*Aerva*	*leucura*			LC	Amaranthaceae	*Amaranthus*	*thunbergii*			LC
Amaranthaceae	*Chenopodium*	*hederiforme*	var.	*undulatum*	LC	Amaranthaceae	*Hermbstaedtia*	*fleckii*			LC
Amaranthaceae	*Hermbstaedtia*	*odorata*	var.	*albi-rosea*	NE	Amaranthaceae	*Hermbstaedtia*	*odorata*	var.	aurantiaca	NE
Amaranthaceae	*Hermbstaedtia*	*odorata*	var.	*odorata*	NE	Amaranthaceae	*Pupalia*	*lappacea*	var.	lappacea	LC
Amaranthaceae	*Salsola*	*rabieana*			LC	Amaranthaceae	*Salsola*	*tuberculata*			LC
Amaranthaceae	*Sericorema*	*remotiflora*			LC	Amaranthaceae	*Achyranthes*	*aspera*	var.	pubescens	Alien
Amaranthaceae	*Achyranthes*	*aspera*	var.	*aspera*	Alien	Amaranthaceae	*Amaranthus*	*hybridus*	subsp.	hybridus	Alien
Amaranthaceae	*Atriplex*	*semibaccata*			Alien invasive	Amaranthaceae	*Dysphania*	*cristata*			Alien invasive
Amaryllidaceae	*Nerine*	*laticoma*			LC	Amaryllidaceae	*Strumaria*	*gemmata*			LC
Anacampserotaceae	*Avonia*	*albissima*				Anacampserotaceae	*Anacampseros*	*filamentosa*	subsp.	filamentosa	
Anacardiaceae	*Searsia*	*ciliata*				Anacardiaceae	*Searsia*	*lancea*			
Anacardiaceae	*Searsia*	*dregeana*				Anacardiaceae	*Searsia*	*tridactyla*			
Apiaceae	*Afrosciadium*	*magalismontanum*			LC	Apiaceae	*Berula*	*thunbergii*			LC
Apiaceae	*Deverra*	*burchellii*			LC	Apocynaceae	*Brachystelma*	*circinatum*			LC
Apocynaceae	*Gomphocarpus*	*fruticosus*	subsp.	*fruticosus*	LC	Apocynaceae	*Gomphocarpus*	*tomentosus*	subsp.	tomentosus	LC
Apocynaceae	*Piaranthus*	*decipiens*			LC	Araliaceae	*Hydrocotyle*	*verticillata*			LC

Asparagaceae	*Asparagus*	*cooperi*			LC	Asparagaceae	*Asparagus*	*laricinus*			LC
Asparagaceae	*Asparagus*	*nelsii*			LC	Asparagaceae	*Asparagus*	*suaveolens*			LC
Asphodelaceae	*Aloe*	*bergeriana*			DD	Asphodelaceae	*Aloe*	*claviflora*			LC
Asphodelaceae	*Aloe*	*grandidentata*			LC	Asphodelaceae	*Bulbine*	*abyssinica*			LC
Asphodelaceae	*Bulbine*	*frutescens*			LC	Asphodelaceae	*Trachyandra*	*laxa*	var.	laxa	LC
Aspleniaceae	*Asplenium*	*adiantum-nigrum*	var.	*adiantum-nigrum*	LC	Aspleniaceae	*Asplenium*	*cordatum*			LC
Asteraceae	*Amphiglossa*	*triflora*			LC	Asteraceae	*Arctotis*	*leiocarpa*			LC
Asteraceae	*Athrixia*	*phylicoides*			LC	Asteraceae	*Chrysocoma*	*ciliata*			LC
Asteraceae	*Cineraria*	*vallis-pacis*			LC	Asteraceae	*Dicoma*	*anomala*	subsp.	gerrardii	LC
Asteraceae	*Dicoma*	*schinzii*			LC	Asteraceae	*Dimorphotheca*	*cuneata*			LC
Asteraceae	*Erlangea*	*misera*			LC	Asteraceae	*Felicia*	*clavipilosa*	subsp.	clavipilosa	LC
Asteraceae	*Felicia*	*filifolia*	subsp.	*filifolia*	LC	Asteraceae	*Felicia*	*muricata*	subsp.	muricata	LC
Asteraceae	*Felicia*	*muricata*	subsp.	*cinerascens*	LC	Asteraceae	*Foveolina*	*dichotoma*			LC
Asteraceae	*Gazania*	*krebsiana*	subsp.	*arctotoides*	LC	Asteraceae	*Gazania*	*krebsiana*	subsp.	serrulata	LC
Asteraceae	*Geigeria*	*brevifolia*			LC	Asteraceae	*Geigeria*	*filifolia*			LC
Asteraceae	*Geigeria*	*ornativa*	subsp.	*ornativa*	LC	Asteraceae	*Helichrysum*	*argyrosphaerum*			LC
Asteraceae	*Helichrysum*	*caespititium*			LC	Asteraceae	*Helichrysum*	*cerastioides*	var.	cerastioides	LC
Asteraceae	*Helichrysum*	*lineare*			LC	Asteraceae	*Helichrysum*	*nudifolium*	var.	nudifolium	LC
Asteraceae	*Helichrysum*	*spiciforme*			LC	Asteraceae	*Helichrysum*	*zeyheri*			LC
Asteraceae	*Hirpicium*	*echinus*			LC	Asteraceae	*Kleinia*	*longiflora*			LC
Asteraceae	*Leysera*	*tenella*			LC	Asteraceae	*Nidorella*	*hottentotica*			LC
Asteraceae	*Nolletia*	*ciliaris*			LC	Asteraceae	*Osteospermum*	*microphyllum*			LC
Asteraceae	*Osteospermum*	*muricatum*	subsp.	*muricatum*	LC	Asteraceae	*Pegolettia*	*retrofracta*			LC
Asteraceae	*Pentzia*	*argentea*			LC	Asteraceae	*Pentzia*	*calcarea*			LC
Asteraceae	*Pteronia*	*mucronata*			LC	Asteraceae	*Pulicaria*	*scabra*			LC
Asteraceae	*Rosenia*	*humilis*			LC	Asteraceae	*Senecio*	*consanguineus*			LC
Asteraceae	*Senecio*	*inaequidens*			LC	Asteraceae	*Tarchonanthus*	*camphoratus*			LC
Asteraceae	*Tolpis*	*capensis*			LC	Asteraceae	*Ursinia*	*nana*	subsp.	nana	LC
Asteraceae	*Dicoma*	*kurumanii*			LC	Asteraceae	*Eriocephalus*	*glandulosus*			LC

Asteraceae	*Gnaphalium*	*englerianum*			LC	Asteraceae	*Osteospermum*	*leptolobum*			LC
Asteraceae	*Pentzia*	*quinquefida*			LC	Asteraceae	*Pteronia*	*glauca*			LC
Asteraceae	*Senecio*	*burchellii*			LC	Asteraceae	*Tarchonanthus*	*obovatus*			LC
Asteraceae	*Bidens*	*pilosa*			Alien	Asteraceae	*Zinnia*	*peruviana*			Alien
Asteraceae	*Sonchus*	*oleraceus*			Alien invasive	Aytoniaceae	*Plagiochasma*	*rupestre*	var.	rupestre	
Bignoniaceae	*Catophractes*	*alexandri*			LC	Bignoniaceae	*Rhigozum*	*obovatum*			LC
Bignoniaceae	*Rhigozum*	*trichotomum*			LC	Boraginaceae	*Anchusa*	*riparia*			LC
Boraginaceae	*Ehretia*	*alba*			LC	Boraginaceae	*Heliotropium*	*ovalifolium*			LC
Boraginaceae	*Heliotropium*	*strigosum*			LC	Brassicaceae	*Erucastrum*	*strigosum*			LC
Brassicaceae	*Heliophila*	*suavissima*			LC	Brassicaceae	*Brassica*	*tournefortii*			Alien invasive
Bryaceae	*Bryum*	*apiculatum*				Bryaceae	*Rosulabryum*	*capillare*			
Campanulaceae	*Wahlenbergia*	*androsacea*			LC	Campanulaceae	*Wahlenbergia*	*denticulata*	var.	transvaalensis	LC
Campanulaceae	*Wahlenbergia*	*nodosa*			LC	Caryophyllaceae	*Dianthus*	*namaensis*	var.	dinteri	
Caryophyllaceae	*Pollichia*	*campestris*				Celastraceae	*Gymnosporia*	*buxifolia*			LC
Celastraceae	*Putterlickia*	*pyracantha*			LC	Celastraceae	*Putterlickia*	*saxatilis*			LC
Cleomaceae	*Cleome*	*angustifolia*	subsp.	*diandra*	LC	Cleomaceae	*Cleome*	*conrathii*			NT
Cleomaceae	*Cleome*	*kalachariensis*			LC	Cleomaceae	*Cleome*	*oxyphylla*	var.	oxyphylla	LC
Colchicaceae	*Ornithoglossum*	*vulgare*				Commelinaceae	*Commelina*	*africana*	var.	lancispatha	LC
Commelinaceae	*Commelina*	*africana*	var.	*barberae*	LC	Commelinaceae	*Commelina*	*livingstonii*			LC
Convolvulaceae	*Evolvulus*	*alsinoides*			LC	Convolvulaceae	*Ipomoea*	*obscura*	var.	obscura	LC
Convolvulaceae	*Ipomoea*	*suffruticosa*			LC	Convolvulaceae	*Seddera*	*suffruticosa*			LC
Convolvulaceae	*Xenostegia*	*tridentata*	subsp.	*angustifolia*		Crassulaceae	*Crassula*	*capitella*	subsp.	nodulosa	
Crassulaceae	*Crassula*	*lanceolata*	subsp.	*transvaalensis*	LC	Crassulaceae	*Kalanchoe*	*brachyloba*			
Crassulaceae	*Kalanchoe*	*lanceolata*				Crassulaceae	*Kalanchoe*	*rotundifolia*			
Crassulaceae	*Crassula*	*subaphylla*	var.	*subaphylla*		Cucurbitaceae	*Acanthosicyos*	*naudinianus*			LC
Cucurbitaceae	*Citrullus*	*lanatus*			LC	Cucurbitaceae	*Coccinia*	*sessilifolia*			LC
Cucurbitaceae	*Cucumis*	*africanus*			LC	Cucurbitaceae	*Kedrostis*	*africana*			LC
Cucurbitaceae	*Cucumis*	*heptadactylus*			LC	Cyperaceae	*Bulbostylis*	*burchellii*			LC

Cyperaceae	*Bulbostylis*	*humilis*			LC	Cyperaceae	*Cladium*	*mariscus*	subsp.	jamaicense	LC
Cyperaceae	*Cyperus*	*bellus*			LC	Cyperaceae	*Cyperus*	*fulgens*			LC
Cyperaceae	*Cyperus*	*longus*	var.	*tenuiflorus*	NE	Cyperaceae	*Cyperus*	*margaritaceus*	var.	margaritaceus	LC
Cyperaceae	*Cyperus*	*marginatus*			LC	Cyperaceae	*Cyperus*	*marlothii*			LC
Cyperaceae	*Cyperus*	*sphaerospermus*			LC	Cyperaceae	*Scleria*	*dregeana*			LC
Cyperaceae	*Kyllinga*	*alba*			LC	Cyperaceae	*Afroscirpoides*	*dioeca*			
Cyperaceae	*Cyperus*	*capensis*			LC	Dipsacaceae	*Scabiosa*	*columbaria*			LC
Ebenaceae	*Diospyros*	*austro-africana*	var.	*microphylla*		Ebenaceae	*Diospyros*	*lycioides*	subsp.	lycioides	
Ebenaceae	*Euclea*	*crispa*	subsp.	*ovata*		Ebenaceae	*Euclea*	*undulata*			
Elatinaceae	*Bergia*	*pentheriana*			LC	Equisetaceae	*Equisetum*	*ramosissimum*	subsp.	ramosissimum	LC
Euphorbiaceae	*Croton*	*gratissimus*	var.	*gratissimus*	LC	Euphorbiaceae	*Euphorbia*	*spartaria*			LC
Euphorbiaceae	*Euphorbia*	*duseimata*			LC	Euphorbiaceae	*Euphorbia*	*juttae*			LC
Euphorbiaceae	*Euphorbia*	*rhombifolia*			LC	Euphorbiaceae	*Euphorbia*	*peplus*			Alien
Fabaceae	*Bolusia*	*acuminata*			LC	Fabaceae	*Calobota*	*cuspidosa*			LC
Fabaceae	*Chamaecrista*	*biensis*			LC	Fabaceae	*Chamaecrista*	*mimosoides*			LC
Fabaceae	*Crotalaria*	*leubnitziana*			LC	Fabaceae	*Crotalaria*	*podocarpa*			LC
Fabaceae	*Crotalaria*	*spartioides*			LC	Fabaceae	*Crotalaria*	*sphaerocarpa*	subsp.	sphaerocarpa	LC
Fabaceae	*Crotalaria*	*virgultalis*			LC	Fabaceae	*Elephantorrhiza*	*elephantina*			LC
Fabaceae	*Indigofera*	*alternans*	var.	*alternans*	LC	Fabaceae	*Indigofera*	*comosa*			LC
Fabaceae	*Indigofera*	*daleoides*	var.	*daleoides*	NE	Fabaceae	*Indigofera*	*flavicans*			LC
Fabaceae	*Indigofera*	*hololeuca*			LC	Fabaceae	*Indigofera*	*sessilifolia*			LC
Fabaceae	*Indigofera*	*vicioides*	var.	*vicioides*	LC	Fabaceae	*Leobordea*	*divaricata*			LC
Fabaceae	*Lessertia*	*frutescens*	subsp.	*frutescens*	LC	Fabaceae	*Lotononis*	*crumanina*			LC
Fabaceae	*Lotononis*	*divaricata*			NE	Fabaceae	*Lotononis*	*laxa*			LC
Fabaceae	*Melolobium*	*calycinum*			LC	Fabaceae	*Melolobium*	*macrocalyx*	var.	macrocalyx	LC
Fabaceae	*Otoptera*	*burchellii*			LC	Fabaceae	*Parkinsonia*	*africana*			LC
Fabaceae	*Ptycholobium*	*biflorum*	subsp.	*biflorum*	LC	Fabaceae	*Requienia*	*pseudosphaerosperma*			LC
Fabaceae	*Requienia*	*sphaerosperma*			LC	Fabaceae	*Rhynchosia*	*confusa*			NE
Fabaceae	*Rhynchosia*	*holosericea*			LC	Fabaceae	*Rhynchosia*	*totta*	var.	venulosa	

Fabaceae	*Rhynchosia*	*totta*	var.	*rigidula*		Fabaceae	*Rhynchosia*	*totta*	var.	totta	LC
Fabaceae	*Senegalia*	*hereroensis*			LC	Fabaceae	*Senegalia*	*mellifera*	subsp.	detinens	LC
Fabaceae	*Senna*	*italica*	subsp.	*arachoides*	LC	Fabaceae	*Tephrosia*	*burchellii*			LC
Fabaceae	*Tephrosia*	*lupinifolia*			LC	Fabaceae	*Tephrosia*	*purpurea*	subsp.	leptostachya	NE
Fabaceae	*Vachellia*	*erioloba*			LC	Fabaceae	*Vachellia*	*haematoxylon*			LC
Fabaceae	*Vachellia*	*hebeclada*	subsp.	*hebeclada*	LC	Fabaceae	*Vachellia*	*karroo*			LC
Fabaceae	*Vigna*	*unguiculata*	subsp.	*unguiculata*	NE	Fabaceae	*Argyrolobium*	*incanum*			LC
Fabaceae	*Melolobium*	*exudans*			LC	Fabaceae	*Medicago*	*laciniata*	var.	laciniata	Alien
Fabaceae	*Melilotus*	*albus*			Alien	Fabaceae	*Caesalpinia*	*gilliesii*			Alien invasive
Fissidentaceae	*Fissidens*	*erosulus*				Gentianaceae	*Chironia*	*palustris*	subsp.	palustris	LC
Geraniaceae	*Monsonia*	*angustifolia*			LC	Geraniaceae	*Pelargonium*	*myrrhifolium*	var.	myrrhifolium	LC
Gisekiaceae	*Gisekia*	*africana*	var.	*africana*	LC	Hyacinthaceae	*Albuca*	*seineri*			
Hyacinthaceae	*Albuca*	*tortuosa*				Hyacinthaceae	*Dipcadi*	*marlothii*			
Iridaceae	*Babiana*	*bainesii*			LC	Iridaceae	*Gladiolus*	*permeabilis*	subsp.	edulis	LC
Iridaceae	*Moraea*	*polystachya*			LC	Iridaceae	*Psilosiphon*	*sandersonii*	subsp.	sandersonii	
Juncaceae	*Juncus*	*exsertus*			LC	Juncaceae	*Juncus*	*rigidus*			LC
Lamiaceae	*Leonotis*	*pentadentata*			LC	Lamiaceae	*Mentha*	*aquatica*			LC
Lamiaceae	*Salvia*	*disermas*			LC	Lamiaceae	*Stachys*	*burchelliana*			LC
Lamiaceae	*Salvia*	*stenophylla*				Lentibulariaceae	*Utricularia*	*gibba*			LC
Limeaceae	*Limeum*	*arenicolum*			LC	Limeaceae	*Limeum*	*fenestratum*	var.	fenestratum	LC
Limeaceae	*Limeum*	*sulcatum*	var.	*sulcatum*	LC	Limeaceae	*Limeum*	*aethiopicum*	var.	intermedium	NE
Limeaceae	*Limeum*	*aethiopicum*	var.	*aethiopicum*	NE	Limeaceae	*Limeum*	*viscosum*	subsp.	transvaalense	LC
Lobeliaceae	*Lobelia*	*erinus*			LC	Lobeliaceae	*Lobelia*	*thermalis*			LC
Lophiocarpaceae	*Lophiocarpus*	*polystachyus*			LC	Loranthaceae	*Septulina*	*ovalis*			LC
Loranthaceae	*Tapinanthus*	*oleifolius*			LC	Malpighiaceae	*Sphedamnocarpus*	*pruriens*	subsp.	pruriens	LC
Malpighiaceae	*Triaspis*	*hypericoides*	subsp.	*hypericoides*	LC	Malvaceae	*Abutilon*	*dinteri*			LC
Malvaceae	*Abutilon*	*rehmannii*			LC	Malvaceae	*Corchorus*	*asplenifolius*			LC
Malvaceae	*Corchorus*	*pinnatipartitus*			LC	Malvaceae	*Grewia*	*flava*			LC
Malvaceae	*Hermannia*	*bicolor*			LC	Malvaceae	*Hermannia*	*comosa*			LC

Malvaceae	*Hermannia*	*geniculata*			LC	Malvaceae	*Hermannia*	*linnaeoides*			LC
Malvaceae	*Hermannia*	*stellulata*			LC	Malvaceae	*Hermannia*	*tomentosa*			LC
Malvaceae	*Melhania*	*burchellii*			LC	Malvaceae	*Melhania*	*prostrata*			LC
Malvaceae	*Melhania*	*virescens*			LC	Malvaceae	*Pavonia*	*burchellii*			LC
Malvaceae	*Sida*	*chrysantha*			LC	Malvaceae	*Sida*	*cordifolia*	subsp.	cordifolia	LC
Malvaceae	*Waltheria*	*indica*			LC	Malvaceae	*Hermannia*	*quartiniana*			LC
Malvaceae	*Hermannia*	*linearifolia*			LC	Malvaceae	*Hibiscus*	*marlothianus*			LC
Menispermaceae	*Antizoma*	*angustifolia*			LC	Molluginaceae	*Suessenguthiella*	*scleranthoides*			LC
Nymphaeaceae	*Nymphaea*	*nouchali*	var.	*caerulea*		Oleaceae	*Olea*	*europaea*	subsp.	cuspidata	
Orobanchaceae	*Alectra*	*pumila*			LC	Orobanchaceae	*Striga*	*bilabiata*	subsp.	bilabiata	LC
Orobanchaceae	*Striga*	*elegans*			LC	Orobanchaceae	*Striga*	*gesnerioides*			LC
Oxalidaceae	*Oxalis*	*depressa*			LC	Oxalidaceae	*Oxalis*	*lawsonii*			LC
Oxalidaceae	*Oxalis*	*corniculata*			Alien invasive	Papaveraceae	*Argemone*	*ochroleuca*	subsp.	ochroleuca	Alien invasive
Passifloraceae	*Adenia*	*repanda*			LC	Pedaliaceae	*Ceratotheca*	*triloba*			LC
Pedaliaceae	*Harpagophytum*	*procumbens*	subsp.	*procumbens*	NE	Pedaliaceae	*Sesamum*	*capense*			LC
Phyllanthaceae	*Phyllanthus*	*loandensis*			LC	Phyllanthaceae	*Phyllanthus*	*maderaspatensis*			LC
Phyllanthaceae	*Phyllanthus*	*parvulus*	var.	*parvulus*	LC	Phyllanthaceae	*Phyllanthus*	*pentandrus*			LC
Plantaginaceae	*Veronica*	*anagallis-aquatica*			LC	Poaceae	*Agrostis*	*lachnantha*	var.	lachnantha	LC
Poaceae	*Andropogon*	*chinensis*			LC	Poaceae	*Andropogon*	*eucomus*			LC
Poaceae	*Andropogon*	*schirensis*			LC	Poaceae	*Anthephora*	*argentea*			LC
Poaceae	*Anthephora*	*pubescens*			LC	Poaceae	*Aristida*	*congesta*	subsp.	congesta	LC
Poaceae	*Aristida*	*congesta*	subsp.	*barbicollis*	LC	Poaceae	*Aristida*	*engleri*	var.	ramosissima	LC
Poaceae	*Aristida*	*meridionalis*			LC	Poaceae	*Aristida*	*mollissima*	subsp.	mollissima	LC
Poaceae	*Aristida*	*stipitata*	subsp.	*stipitata*	LC	Poaceae	*Aristida*	*stipitata*	subsp.	spicata	LC
Poaceae	*Aristida*	*stipitata*	subsp.	*graciliflora*	LC	Poaceae	*Aristida*	*vestita*			LC
Poaceae	*Brachiaria*	*marlothii*			LC	Poaceae	*Brachiaria*	*nigropedata*			LC
Poaceae	*Brachiaria*	*serrata*			LC	Poaceae	*Bromus*	*pectinatus*			LC
Poaceae	*Cenchrus*	*ciliaris*			LC	Poaceae	*Chrysopogon*	*serrulatus*			LC
Poaceae	*Coelachyrum*	*yemenicum*			LC	Poaceae	*Cymbopogon*	*caesius*			LC

Poaceae	*Cymbopogon*	*pospischilii*			NE	Poaceae	*Cynodon*	*dactylon*			LC
Poaceae	*Digitaria*	*eriantha*			LC	Poaceae	*Digitaria*	*polyphylla*			LC
Poaceae	*Digitaria*	*seriata*			LC	Poaceae	*Diheteropogon*	*amplectens*	var.	amplectens	LC
Poaceae	*Eleusine*	*coracana*	subsp.	*africana*	LC	Poaceae	*Elionurus*	*muticus*			LC
Poaceae	*Enneapogon*	*cenchroides*			LC	Poaceae	*Enneapogon*	*desvauxii*			LC
Poaceae	*Enneapogon*	*scoparius*			LC	Poaceae	*Eragrostis*	*capensis*			LC
Poaceae	*Eragrostis*	*chloromelas*			LC	Poaceae	*Eragrostis*	*curvula*			LC
Poaceae	*Eragrostis*	*echinochloidea*			LC	Poaceae	*Eragrostis*	*gummiflua*			LC
Poaceae	*Eragrostis*	*homomalla*			LC	Poaceae	*Eragrostis*	*lehmanniana*	var.	lehmanniana	LC
Poaceae	*Eragrostis*	*micrantha*			LC	Poaceae	*Eragrostis*	*nindensis*			LC
Poaceae	*Eragrostis*	*obtusa*			LC	Poaceae	*Eragrostis*	*pallens*			LC
Poaceae	*Eragrostis*	*procumbens*			LC	Poaceae	*Eragrostis*	*rigidior*			LC
Poaceae	*Eragrostis*	*trichophora*			LC	Poaceae	*Eragrostis*	*viscosa*			LC
Poaceae	*Eustachys*	*paspaloides*			LC	Poaceae	*Fingerhuthia*	*africana*			LC
Poaceae	*Hemarthria*	*altissima*			LC	Poaceae	*Heteropogon*	*contortus*			LC
Poaceae	*Hyparrhenia*	*anamesa*			LC	Poaceae	*Imperata*	*cylindrica*			LC
Poaceae	*Megaloprotachne*	*albescens*			LC	Poaceae	*Melinis*	*nerviglumis*			LC
Poaceae	*Melinis*	*repens*	subsp.	*grandiflora*	LC	Poaceae	*Melinis*	*repens*	subsp.	repens	LC
Poaceae	*Oropetium*	*capense*			LC	Poaceae	*Panicum*	*coloratum*			LC
Poaceae	*Panicum*	*kalaharense*			LC	Poaceae	*Panicum*	*maximum*			LC
Poaceae	*Panicum*	*stapfianum*			LC	Poaceae	*Pogonarthria*	*squarrosa*			LC
Poaceae	*Schizachyrium*	*sanguineum*			LC	Poaceae	*Schmidtia*	*pappophoroides*			LC
Poaceae	*Setaria*	*sphacelata*	var.	*torta*	LC	Poaceae	*Sporobolus*	*acinifolius*			LC
Poaceae	*Sporobolus*	*fimbriatus*			LC	Poaceae	*Stipagrostis*	*amabilis*			LC
Poaceae	*Stipagrostis*	*hirtigluma*	subsp.	*patula*	LC	Poaceae	*Stipagrostis*	*uniplumis*	var.	neesii	LC
Poaceae	*Stipagrostis*	*uniplumis*	var.	*uniplumis*	LC	Poaceae	*Themeda*	*triandra*			LC
Poaceae	*Tragus*	*berteronianus*			LC	Poaceae	*Tragus*	*koelerioides*			LC
Poaceae	*Tragus*	*racemosus*			LC	Poaceae	*Tricholaena*	*monachne*			LC
Poaceae	*Trichoneura*	*grandiglumis*			LC	Poaceae	*Triraphis*	*andropogonoides*			LC

Poaceae	*Triraphis*	*schinzii*			LC	Poaceae	*Urelytrum*	*agropyroides*			LC
Poaceae	*Eragrostis*	*amabilis*			LC	Poaceae	*Leptochloa*	*fusca*			LC
Poaceae	*Cynodon*	*incompletus*			LC	Poaceae	*Eragrostis*	*pseudobtusa (x)*			NE
Poaceae	*Eragrostis*	*barrelieri*			Alien	Poaceae	*Eragrostis*	*mexicana*	subsp.	virescens	Alien
Poaceae	*Paspalum*	*dilatatum*			Alien	Polygalaceae	*Polygala*	*leptophylla*	var.	leptophylla	LC
Polygonaceae	*Oxygonum*	*alatum*	var.	*alatum*	LC	Polygonaceae	*Oxygonum*	*dregeanum*	subsp.	canescens	NE
Polygonaceae	*Persicaria*	*lapathifolia*			Alien	Polygonaceae	*Rumex*	*crispus*			Alien invasive
Portulacaceae	*Portulaca*	*quadrifida*				Pottiaceae	*Syntrichia*	*ammonsiana*			
Pteridaceae	*Actiniopteris*	*radiata*			LC	Pteridaceae	*Cheilanthes*	*eckloniana*			LC
Pteridaceae	*Cheilanthes*	*multifida*	var.	*multifida*	LC	Pteridaceae	*Pellaea*	*calomelanos*	var.	calomelanos	LC
Pteridaceae	*Cheilanthes*	*hirta*	var.	*brevipilosa*	LC	Ranunculaceae	*Clematis*	*brachiata*			LC
Rhamnaceae	*Helinus*	*spartioides*			LC	Ricciaceae	*Riccia*	*albolimbata*			
Ricciaceae	*Riccia*	*okahandjana*				Rosaceae	*Rubus*	*rosifolius*			Alien
Rubiaceae	*Anthospermum*	*rigidum*	subsp.	*rigidum*	LC	Rubiaceae	*Anthospermum*	*rigidum*	subsp.	pumilum	LC
Rubiaceae	*Galium*	*capense*	subsp.	*capense*	LC	Rubiaceae	*Kohautia*	*caespitosa*	subsp.	brachyloba	LC
Rubiaceae	*Vangueria*	*infausta*	subsp.	*infausta*	LC	Ruscaceae	*Eriospermum*	*corymbosum*			LC
Santalaceae	*Thesium*	*resedoides*			LC	Santalaceae	*Viscum*	*rotundifolium*			
Scrophulariaceae	*Aptosimum*	*elongatum*			LC	Scrophulariaceae	*Aptosimum*	*indivisum*			LC
Scrophulariaceae	*Aptosimum*	*marlothii*			LC	Scrophulariaceae	*Buddleja*	*saligna*			LC
Scrophulariaceae	*Chaenostoma*	*halimifolium*			LC	Scrophulariaceae	*Jamesbrittenia*	*atropurpurea*	subsp.	atropurpurea	LC
Scrophulariaceae	*Jamesbrittenia*	*atropurpurea*	subsp.	*pubescens*	LC	Scrophulariaceae	*Jamesbrittenia*	*aurantiaca*			LC
Scrophulariaceae	*Jamesbrittenia*	*integerrima*			LC	Scrophulariaceae	*Peliostomum*	*leucorrhizum*			LC
Scrophulariaceae	*Selago*	*mixta*			LC	Scrophulariaceae	*Sutera*	*griquensis*			LC
Solanaceae	*Lycium*	*hirsutum*			LC	Solanaceae	*Lycium*	*schizocalyx*			LC
Solanaceae	*Solanum*	*campylacanthum*	subsp.	*panduriforme*	LC	Solanaceae	*Solanum*	*catombelense*			LC
Solanaceae	*Solanum*	*retroflexum*			LC	Solanaceae	*Solanum*	*supinum*	var.	supinum	LC
Solanaceae	*Solanum*	*tomentosum*	var.	*tomentosum*	LC	Solanaceae	*Withania*	*somnifera*			LC
Solanaceae	*Solanum*	*nigrum*			Alien	Tecophilaeaceae	*Cyanella*	*lutea*			
Theophrastaceae	*Samolus*	*valerandi*			LC	Thymelaeaceae	*Lasiosiphon*	*burchellii*			LC

Thymelaeaceae	*Lasiosiphon*	*polycephalus*			LC	Verbenaceae	*Chascanum*	*adenostachyum*			
Verbenaceae	*Chascanum*	*hederaceum*	var.	*hederaceum*		Verbenaceae	*Chascanum*	*pinnatifidum*	var.	pinnatifidum	
Verbenaceae	*Lantana*	*rugosa*				Verbenaceae	*Verbena*	*brasiliensis*			Alien invasive
Zygophyllaceae	*Roepera*	*lichtensteiniana*				Zygophyllaceae	*Roepera*	*pubescens*			
Zygophyllaceae	*Tribulus*	*terrestris*			LC	Zygophyllaceae	*Tribulus*	*zeyheri*	subsp.	zeyheri	LC

1.9.2. Appendix 2. List of Mammals

List of Mammals known from the broad area around the Kuruman WEF Grid Connection site, based on the MammalMap Database (http://vmus.adu.org.za), with species confirmed present at the site indicated in **bold.**

Family	Scientific name	Common name	Red list category
Bathyergidae	***Cryptomys hottentotus***	**Southern African Mole-rat**	**Least Concern**
Bovidae	*Aepyceros melampus*	Impala	Least Concern
Bovidae	*Alcelaphus buselaphus caama*	Red Hartebeest	Least Concern
Bovidae	*Connochaetes gnou*	Black Wildebeest	Least Concern
Bovidae	*Kobus ellipsiprymnus*	Waterbuck	Least Concern
Bovidae	*Oryx gazella*	Gemsbok	Least Concern
Bovidae	***Sylvicapra grimmia***	**Bush Duiker**	**Least Concern**
Bovidae	*Taurotragus oryx*	Common Eland	Least Concern
Canidae	***Canis mesomelas***	**Black-backed Jackal**	**Least Concern**
Cercopithecidae	***Papio ursinus***	**Chacma Baboon**	**Least Concern**
Erinaceidae	*Atelerix frontalis*	Southern African Hedgehog	Near Threatened
Felidae	*Felis nigripes*	Black-footed Cat	Least Concern
Herpestidae	***Cynictis penicillata***	**Yellow Mongoose**	**Least Concern**
Herpestidae	***Suricata suricatta***	**Meerkat**	**Least Concern**
Hystricidae	***Hystrix africaeaustralis***	**Cape Porcupine**	**Least Concern**
Leporidae	***Lepus capensis***	**Cape Hare**	**Least Concern**
Leporidae	*Lepus saxatilis*	Scrub Hare	Least Concern
Leporidae	***Pronolagus rupestris***	**Smith's Red Rock Hare**	**Least Concern**
Macroscelididae	*Elephantulus myurus*	Eastern Rock Elephant Shrew	Least Concern
Macroscelididae	*Elephantulus rupestris*	Western Rock Elephant Shrew	Least Concern
Macroscelididae	*Macroscelides proboscideus*	Short-eared Elephant Shrew	Least Concern
Muridae	*Aethomys chrysophilus*	Red Veld Aethomys	Least Concern
Muridae	***Aethomys namaquensis***	**Namaqua Rock Mouse**	**Least Concern**
Muridae	*Desmodillus auricularis*	Cape Short-tailed Gerbil	Least Concern
Muridae	***Gerbilliscus leucogaster***	**Bushveld Gerbil**	**Data Deficient**
Muridae	***Mastomys coucha***	**Southern African Mastomys**	**Least Concern**
Muridae	*Mus (Nannomys) minutoides*	Southern African Pygmy Mouse	Least Concern
Muridae	*Otomys auratus*	Southern African Vlei Rat	
Muridae	*Parotomys brantsii*	Brants's Whistling Rat	Least Concern
Muridae	***Rhabdomys pumilio***	**Xeric Four-striped Grass Rat**	**Least Concern**
Mustelidae	*Ictonyx striatus*	Striped Polecat	Least Concern
Nesomyidae	***Saccostomus campestris***	**Southern African Pouched Mouse**	**Least Concern**
Orycteropodidae	***Orycteropus afer***	**Aardvark**	**Least Concern**

Pedetidae	***Pedetes capensis***	**South African Spring Hare**	**Least Concern**
Procaviidae	***Procavia capensis***	**Cape Rock Hyrax**	**Least Concern**
Sciuridae	***Xerus inauris***	**South African Ground Squirrel**	**Least Concern**
Soricidae	*Crocidura cyanea*	Reddish-gray Musk Shrew	Data Deficient
Soricidae	*Crocidura hirta*	Lesser Red Musk Shrew	Data Deficient
Suidae	***Phacochoerus africanus***	**Common Warthog**	**Least Concern**

1.9.3. Appendix 3. List of Reptiles

List of Reptiles known from the vicinity of the Kuruman WEF Grid Connection site, based on records from the ReptileMap database. Conservation status is from Bates *et al*. 2013.

Family	Scientific name	Common name	Red list category
Agamidae	***Agama aculeata aculeata***	**Common Ground Agama**	**Least Concern**
Agamidae	*Agama atra*	Southern Rock Agama	Least Concern
Amphisbaenidae	*Zygaspis quadrifrons*	Kalahari Dwarf Worm Lizard	Least Concern
Chamaeleonidae	*Chamaeleo dilepis dilepis*	Common Flap-neck Chameleon	Least Concern
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	Least Concern
Colubridae	***Dispholidus typus typus***	**Boomslang**	**Least Concern**
Colubridae	*Telescopus semiannulatus semiannulatus*	Eastern Tiger Snake	Least Concern
Cordylidae	*Karusasaurus polyzonus*	Karoo Girdled Lizard	Least Concern
Elapidae	*Aspidelaps scutatus scutatus*	Speckled Shield Cobra	Least Concern
Gekkonidae	*Lygodactylus capensis capensis*	Common Dwarf Gecko	Least Concern
Gekkonidae	***Pachydactylus capensis***	**Cape Gecko**	**Least Concern**
Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	Least Concern
Lacertidae	*Heliobolus lugubris*	Bushveld Lizard	Least Concern
Lacertidae	*Meroles squamulosus*	Common Rough-scaled Lizard	Least Concern
Lacertidae	*Nucras intertexta*	Spotted Sandveld Lizard	Least Concern
Lacertidae	*Pedioplanis lineoocellata lineoocellata*	Spotted Sand Lizard	Least Concern
Lacertidae	*Pedioplanis namaquensis*	Namaqua Sand Lizard	Least Concern
Lamprophiidae	*Aparallactus capensis*	Black-headed Centipede-eater	Least Concern
Lamprophiidae	*Atractaspis bibronii*	Bibron's Stiletto Snake	Least Concern
Lamprophiidae	*Atractaspis duerdeni*	Duerden's Stiletto Snake	Least Concern
Lamprophiidae	*Boaedon capensis*	Brown House Snake	Least Concern
Lamprophiidae	*Lycophidion capense capense*	Cape Wolf Snake	Least Concern
Lamprophiidae	*Psammophis brevirostris*	Short-snouted Grass Snake	Least Concern
Lamprophiidae	*Psammophis trinasalis*	Fork-marked Sand Snake	Least Concern
Lamprophiidae	*Pseudaspis cana*	Mole Snake	Least Concern
Leptotyphlopidae	*Leptotyphlops scutifrons scutifrons*	Peters' Thread Snake	
Pelomedusidae	*Pelomedusa subrufa*	Central Marsh Terrapin	Least Concern
Pythonidae	*Python natalensis*	Southern African Python	Least Concern
Scincidae	*Panaspis wahlbergi*	Wahlberg's Snake-eyed Skink	Least Concern
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	Least Concern
Scincidae	*Trachylepis spilogaster*	Kalahari Tree Skink	Least Concern
Scincidae	*Trachylepis sulcata sulcata*	Western Rock Skink	Least Concern

Scincidae	***Trachylepis variegata***	**Variegated Skink**	**Least Concern**
Testudinidae	*Psammobates oculifer*	Serrated Tent Tortoise	Least Concern
Testudinidae	***Stigmochelys pardalis***	**Leopard Tortoise**	**Least Concern**
Typhlopidae	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	Least Concern
Varanidae	*Varanus albigularis albigularis*	Rock Monitor	Least Concern
Viperidae	*Bitis arietans arietans*	Puff Adder	Least Concern

1.9.4. Appendix 4. List of Amphibians

List of Amphibians known from the vicinity of the Kuruman WEF Grid Connection site, based on records from the FrogMap database. Conservation status is from Minter et al. 2004.

Family	Scientific name	Common name	Red list
Brevicepitidae	*Breviceps adspersus*	Bushveld Rain Frog	Least Concern
Bufonidae	*Sclerophrys garmani*	Olive Toad	Least Concern
Bufonidae	*Sclerophrys gutturalis*	Guttural Toad	Least Concern
Bufonidae	*Sclerophrys poweri*	Power's Toad	Least Concern
Hyperoliidae	*Kassina senegalensis*	Bubbling Kassina	Least Concern
Pyxicephalidae	*Amietia delalandii*	Delalande's River Frog	Least Concern
Pyxicephalidae	*Cacosternum boettgeri*	Common Caco	Least Concern
Pyxicephalidae	*Tomopterna cryptotis*	Tremelo Sand Frog	Least Concern

BIRD IMPACT ASSESSMENT:

Basic Assessment for the proposed development of supporting electrical infrastructure to the proposed Kuruman Phase 1 and Phase 2 Wind Energy Facilities near Kuruman in the Northern Cape : BA REPORT

Report prepared for:

CSIR – Environmental Management Services

P O Box 17001

Congella, Durban, 4013

South Africa

Report prepared by:

Chris van Rooyen – Chris van Rooyen Consulting

30 Roosevelt Street

Mill Street, Cape Town, 8010

South Africa

05 July 2018

SPECIALIST EXPERTISE

Curriculum vitae: Chris van Rooyen

Profession/Specialisation	:	Avifaunal Specialist
Highest Qualification	:	BA LLB
Nationality	:	South African
Years of experience	:	22 years

Key Experience

Chris van Rooyen has twenty-two years' experience in the assessment of avifaunal interactions with industrial infrastructure. He was employed by the Endangered Wildlife Trust as head of the Eskom-EWT Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has consulted in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. He also has extensive project management experience and he has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author and/or co-author of 17 conference papers, co-author of two book chapters, several research reports and the current best practice guidelines for avifaunal monitoring at wind farm sites. He has completed around 130 power line assessments; and has to date been employed as specialist avifaunal consultant on more than 50 renewable energy generation projects. He has also conducted numerous risk assessments on existing power lines infrastructure. He also works outside the electricity industry and he has done a wide range of bird impact assessment studies associated with various residential and industrial developments. He serves on the Birds and Wind Energy Specialist Group which was formed in 2011 to serve as a liaison body between the ornithological community and the wind industry.

Key Project Experience

Bird Impact Assessment Studies for Solar Energy Plants:

1. Concentrated Solar Power Plant, Upington, Northern Cape.
2. Globeleq De Aar and Droogfontein Solar PV Pre- and Post-construction avifaunal monitoring
3. JUWI Kronos PV project, Copperton, Northern Cape
4. Sand Draai CSP project, Groblershoop, Northern Cape
5. Biotherm Helena PV Project, Copperton, Northern Cape
6. Biotherm Letsiao CSP Project, Aggeneys, Northern Cape
7. Biotherm Enamandla PV Project, Aggeneys, Northern Cape
8. Biotherm Sendawo PV Project, Vryburg, North-West
9. Biotherm Tlisitseng PV Project, Lichtenburg, North-West
10. JUWI Hotazel Solar Park Project, Hotazel, Northern Cape
11. Veld Solar One Project, Aggeneys, Northern Cape
12. Brypaal Solar Power Project, Kakamas, Northern Cape

Bird Impact Assessment Studies for the following overhead line projects:

1. Chobe 33kV Distribution line
2. Athene - Umfolozi 400kV
3. Beta-Delphi 400kV
4. Cape Strengthening Scheme 765kV
5. Flurian-Louis-Trichardt 132kV
6. Ghanzi 132kV (Botswana)
7. Ikaros 400kV
8. Matimba-Witkop 400kV
9. Naboomspruit 132kV
10. Tabor-Flurian 132kV
11. Windhoek - Walvisbaai 220 kV (Namibia)
12. Witkop-Overyssel 132kV
13. Breyten 88kV

14. Adis-Phoebus 400kV
15. Dhuva-Janus 400kV
16. Perseus-Mercury 400kV
17. Gravelotte 132kV
18. Ikaros 400 kV
19. Khanye 132kV (Botswana)
20. Moropule – Thamaga 220 kV (Botswana)
21. Parys 132kV
22. Simplon –Everest 132kV
23. Tutuka-Alpha 400kV
24. Simplon-Der Brochen 132kV
25. Big Tree 132kV
26. Mercury-Ferrum-Garona 400kV
27. Zeus-Perseus 765kV
28. Matimba B Integration Project
29. Caprivi 350kV DC (Namibia)
30. Gerus-Mururani Gate 350kV DC (Namibia)
31. Mmamabula 220kV (Botswana)
32. Steenberg-Der Brochen 132kV
33. Venetia-Paradise T 132kV
34. Burgersfort 132kV
35. Majuba-Umfolozi 765kV
36. Delta 765kV Substation
37. Braamhoek 22kV
38. Steelpoort Merensky 400kV
39. Mmamabula Delta 400kV
40. Delta Epsilon 765kV
41. Gerus-Zambezi 350kV DC Interconnector: Review of proposed avian mitigation measures for the Okavango and Kwando River crossings
42. Giyani 22kV Distribution line
43. Liqhobong-Kao 132/11kV distribution power line, Lesotho
44. 132kV Leslie – Wildebeest distribution line
45. A proposed new 50 kV Spoornet feeder line between Sishen and Saldanha
46. Cairns 132kv substation extension and associated power lines
47. Pimlico 132kv substation extension and associated power lines
48. Gyani 22kV
49. Matafin 132kV
50. Nkomazi_Fig Tree 132kV
51. Pebble Rock 132kV
52. Reddersburg 132kV
53. Thaba Combine 132kV
54. Nkomati 132kV
55. Louis Trichardt – Musina 132kV
56. Endicot 44kV
57. Apollo Lepini 400kV
58. Tarlton-Spring Farms 132kV
59. Kuschke 132kV substation
60. Bendstore 66kV Substation and associated lines
61. Kuiseb 400kV (Namibia)
62. Gyani-Malamulele 132kV
63. Watershed 132kV
64. Bakone 132kV substation
65. Eerstegoud 132kV LILO lines
66. Kumba Iron Ore: SWEP - Relocation of Infrastructure
67. Kudu Gas Power Station: Associated power lines
68. Steenberg Booysendal 132kV
69. Toulon Pumps 33kV
70. Thabatshipi 132kV

71. Witkop-Silica 132kV
72. Bakubung 132kV
73. Nelsriver 132kV
74. Rethabiseng 132kV
75. Tilburg 132kV
76. GaKgapane 66kV
77. Knobel Gilead 132kV
78. Bochum Knobel 132kV
79. Madibeng 132kV
80. Witbank Railway Line and associated infrastructure
81. Spencer NDP phase 2 (5 lines)
82. Akanani 132kV
83. Hermes-Dominion Reefs 132kV
84. Cape Pensinsula Strengthening Project 400kV
85. Magalakwena 132kV
86. Benficosa 132kV
87. Dithabaneng 132kV
88. Taunus Diepkloof 132kV
89. Taunus Doornkop 132kV
90. Tweedracht 132kV
91. Jane Furse 132kV
92. Majeje Sub 132kV
93. Tabor Louis Trichardt 132kV
94. Riversong 88kV
95. Mamatsekele 132kV
96. Kabokweni 132kV
97. MDPP 400kV Botswana
98. Marble Hall NDP 132kV
99. Bokmakiere 132kV Substation and LILO lines
100. Styldrift 132kV
101. Taunus – Diepkloof 132kV
102. Bighorn NDP 132kV
103. Waterkloof 88kV
104. Camden – Theta 765kV
105. Dhuva – Minerva 400kV Diversion
106. Lesedi –Grootpan 132kV
107. Waterberg NDP
108. Bulgerivier – Dorset 132kV
109. Bulgerivier – Toulon 132kV
110. Nokeng-Fluorspar 132kV
111. Mantsole 132kV
112. Tshilamba 132kV
113. Thabamoopo - Tshebela – Nhlovuko 132kV
114. Arthurseat 132kV
115. Borutho 132kV MTS
116. Volspruit - Potgietersrus 132kV
117. Neotel Optic Fibre Cable Installation Project: Western Cape
117. Matla-Glockner 400kV
118. Delmas North 44kV
119. Houwhoek 11kV Refurbishment
120. Clau-Clau 132kV
121. Ngwedi-Silwerkrans 134kV
122. Nieuwehoop 400kV walk-through
123. Booysendal 132kV Switching Station
124. Tarlton 132kV
125. Medupi - Witkop 400kV walk-through
126. Germiston Industries Substation
127. Sekgame 132kV

128. Botswana – South Africa 400kV Transfrontier Interconnector
129. Syferkuil – Rampheri 132kV
130. Queens Substation and associated 132kV powerlines
131. Oranjemond 400kV Transmission line
132. Aries – Helios – Juno walk-down

Professional affiliations

I work under the supervision of and in association with Albert Froneman (MSc Conservation Biology) (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003.

SPECIALIST DECLARATION

I, Chris van Rooyen, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Chris van Rooyen

Signature of the specialist: ______________________________

Name of Specialist: Chris van Rooyen Consulting

Date: 23 July 2018

EXECUTIVE SUMMARY

This report comprises the Bird Impact Assessment for the supporting electrical infrastructure associated with the proposed Kuruman Phase 1 and Phase 2 Wind Energy Facilities. The study area is situated in the savanna biome. The first 30km of the proposed alignment runs southwards from Kuruman through the two proposed Kuruman WEFs and then swings westwards towards Kathu. The first section runs through a series of parallel ridges with a general south-east to north-west orientation, known as the Kuruman Mountains, interspersed with broad valleys. The ridges consist of gentle slopes covered in short grassland with an open shrub layer, and a few exposed rocky ridges. The valleys are covered in tall grassland on red Kalahari sands with scattered trees. The next 40km runs in a south-westerly direction towards Kathu through open plains with a few low ridges. The vegetation consists of open shrub savanna with scattered large trees, and a well-developed grass layer.

It is estimated that a total of 220 species belonging to 84 families could potentially occur in the greater study area (see Appendix 2). Of these, 176 species belonging to 67 families could potentially be affected by displacement through disturbance and habitat destruction, 35 species belonging to 12 families could be impacted through collision mortality with the powerline, and 5 species belonging to 2 families could be impacted by mortality through electrocution.

The following environmental sensitivities were identified in the study area:

- High sensitivity: Surface water which attracts many powerline sensitive species, including Red Data Martial Eagle, Tawny Eagle, Verreaux's Eagle, Abdim's Stork, Cape Vulture, White-backed Vulture and Kori Bustard. This creates a collision risk as it becomes a focal point of bird activity when surface water is available with a high likelihood of interaction with the powerline.
- Medium sensitivity: The whole study area is classified as moderately sensitive as it constitutes mainly natural savanna. The natural savanna supports sparse numbers of Red Data Martial Eagle, Tawny Eagle and Kori Bustard which are at risk of displacement and powerline collisions anywhere in the study area, with a medium likelihood of interaction with the powerline. Cape Vultures and White-backed Vultures are occasional visitors.

The following potential pre-mitigation impacts were identified:

Construction Phase

- Potential impact 1: Displacement of Red Data avifauna due to disturbance associated with the construction of the powerline and on-site substation.
- Potential impact 2: Displacement of Red Data avifauna due to habitat transformation associated with the construction of the powerline and on-site substation.

Operational Phase

- Potential impact 3: Mortality of Red Data avifauna due to collisions with the earthwire of the proposed 132kV line.
- Potential impact 4: Electrocution of Red Data avifauna on the proposed 132kV line.

Decommissioning Phase

- Potential impact 5: Displacement of Red Data avifauna due to disturbance associated with the de-commissioning of the powerline and on-site substation.

Cumulative Impacts

- Cumulative impact 1: Displacement of Red Data avifauna due to disturbance associated with the construction of the powerline, service road and on-site substation.
- Cumulative impact 2: Displacement of Red Data avifauna due to habitat transformation associated with the construction of the powerline, service road and on-site substation.
- Mortality of Red Data avifauna due to collisions with the earthwire of the proposed 132kV line.

The risk ratings for the impacts associated with the various phases of the project are as follows:

Phase	**Average Impact Significance - pre mitigation**	**Average Impact Significance - post mitigation**
Construction	4 (Low)	5 (Very low)
Operational	4 (Low)	5 (Very low)
Decommissioning	4 (Low)	5 (Very low)
Nature of Impact		**Overall Impact Significance**
Cumulative - Operational	3 (Moderate)	4 (Low)
Overall Average	3.75 (Moderate to Low)	4.75 (Low to Very low)

The following key management actions and mitigation measures are proposed to reduce the impact of the proposed facility:

<u>Mitigation measures to address the Construction Phase impacts</u>

- No off-road driving must be allowed.
- Maximum use of existing roads.
- Measures to control noise and dust must be applied according to best practice.
- Access to be restricted to the rest of the property outside the construction footprint.
- The appointed Environmental Control Officer (ECO) must be trained by an avifaunal specialist to identify the potential priority species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.
- Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes, to identify any nests/breeding/roosting activity of Red Data species. The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.
- The recommendations of the ecological specialist studies must be strictly implemented, especially as far as limitation of the construction footprint, retention of natural vegetation and rehabilitation of transformed areas is concerned.
- Large trees should be retained as much as possible as they serve as potential roosting and breeding habitat for a variety of birds, including raptors.
- Audits must be performed by an external rehabilitation specialist to assess the success of the rehabilitation programme and recommend changes or additions to the programme if need be.

<u>Mitigation measures to address the Operational Phase impacts</u>

- High risk sections of power line requiring marking with bird flight diverters must be identified by a qualified avifaunal specialist during the walk-through phase of the project, once the alignment has been finalized.

- Where power line marking is required, bird flight diverters must be installed on the full span length on each of the conductors according to the Eskom Guidelines (see Appendix 5).
- Light and dark colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung. In specific instances, i.e. high risk waterbodies (to be identified during the walk-through phase), the new experimental PLP LED (light emitting diode) BFD is recommended to increase the efficacy of the device during low light conditions for waterbirds.
- The line must be inspected once a quarter by a qualified avifaunal specialist for one year to establish if there are any additional areas where bird flight diverters are required.
- It is strongly recommended that the DT 7649 vulture-friendly structure is employed.

Decommissioning Phase

- No off-road driving must be allowed.
- Maximum use must be made of existing roads.
- Measures to control noise and dust must be applied according to industry best practice.
- Restricted access to the rest of the property must be maintained.
- The appointed Environmental Control Officer (ECO) must be trained by an avifaunal specialist to identify the potential priority species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of staff to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), de-commissioning activities within 500m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.
- Prior to de-commissioning, an avifaunal specialist should conduct a site walkthrough, covering the power line, to identify any nests/breeding/roosting activity of Red Data species, the results of which may inform the final de-commissioning schedule in close proximity to that specific area, including scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.

EA Condition Recommendations

The following recommendations should be included as conditions in the EA:

- Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes, to identify any nests/breeding/roosting activity of Red Data species.
- Large trees should be retained as much as possible as they serve as potential roosting and breeding habitat for a variety of birds, including raptors.
- Annual audits must be performed by an external rehabilitation specialist for three years to assess the success of the rehabilitation programme and recommend changes or additions to the programme if need be.
- High risk sections of power line requiring marking with bird flight diverters must be identified by a qualified avifaunal specialist during the walk-through phase of the project, once the alignment has been finalized.
- The line must be inspected once a quarter by a qualified avifaunal specialist for one year to establish if there are any additional areas where bird flight diverters are required.

The proposed Kuruman 132kV grid connection should have a low to very low impact on avifauna, provided the management recommendations listed in this report are strictly implemented. No fatal flaws were identified from an avifaunal perspective – it is therefore recommended that the project is authorised to go ahead.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Pg 1-5
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Pg 5
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.1
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 1.3 and 1.6
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.1 and Appendix 3,4
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.1
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1.3
g) an identification of any areas to be avoided, including buffers;	Section 1.3
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 1.3
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.1
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Sections 1.5 and 1.6
k) any mitigation measures for inclusion in the EMPr;	Sections 1.5 and 1.8
l) any conditions for inclusion in the environmental authorisation;	Section 1.8
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 1.7
n) a reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 1.8
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 1.1
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	None were received
q) any other information requested by the competent authority.	Not applicable
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Not applicable

CONTENTS Toc520087710

LIST OF FIGURES

LIST OF TABLES

List of Abbreviations

AEWA	Africa – Eurasia Waterbird Agreement
BA	Basic Assessment
BLSA	BirdLife South Africa
EWT	Endangered Wildlife Trust
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
IBA	Important Bird Area
IUCN	International Union for the Conservation of Nature
kV	Kilovolt
NEMA	National Environmental Management Act (Act 107 of 1998, as amended)
REDZ	Renewable Energy Development Zone (REDZ).
SABAP 1	Southern African Bird Atlas Project 1
SABAP 2	Southern African Bird Atlas Project 2

Glossary

Definitions	
Pentad	A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km.
Greater study area	The area which comprises the pentads where the study area is located.
Study area	The area comprising the proposed alignments with a 2km buffer around it.

BIRD IMPACT ASSESSMENT

1.1. INTRODUCTION AND METHODOLOGY

1.1.1 Scope and Objectives

Mulilo Renewable Project Developments (Pty) Ltd (hereafter, “Mulilo”) appointed the Council of Scientific and Industrial Research (hereafter, “CSIR”) to undertake the following processes in terms of the Environmental Impact Assessment (EIA) Regulations, 2014, as amended:

- An EIA process for the proposed development of the **Kuruman Wind Energy Facility (WEF) Phase 1**;
- An EIA process for the proposed development of the **Kuruman WEF Phase 2**; and
- A Basic Assessment process for the proposed **development of supporting electrical infrastructure** to the two WEFs.

This report is only concerned with the Basic Assessment process for the proposed development of supporting electrical infrastructure to the two WEFs, namely a 132kV grid connection powerline.

Please refer to the table below (Table 1) for an outline of the components associated with the powerline. See Figure 1 for the location of the proposed powerline.

Table 1: Project components

Supporting electrical infrastructure	
Eskom Metering Station	Footprint: 2 ha Height: 15 m Two collector substations will be constructed
Transmissions lines	• Alternative 1: 132kV overhead line from the Kuruman WEF Substation Phase 1 to the Ferrum Substation (56.8 km line) in the event that both wind farms are constructed. • Alternative 2: 132kV overhead line from the Kuruman WEF Phase 1 Substation to the Segame Substation (14 km line) in the event that only WEF Phase 1 is constructed. • Alternative 3: 132kV overhead line from the Kuruman WEF Phase 2 Substation to Segame Substation (22 km line) in the event that only WEF Phase 2 is constructed. Height: 15m Width of service road below line(s): Jeep track Pole design: Steel monopole with stand – off insulators (DT 7611 or double circuit variants) or Delta suspension DT 7649
Eskom substation	A new switching station would have to be constructed next to the existing Eskom substation, for the project to connect into it.

Figure 1: The location of the proposed 132kV grid connection with 2km buffer.

1.1.2 Terms of Reference

The terms of reference for this assessment report are as follows:

- Describe the affected environment and avifauna in the greater study area, with a particular focus on regionally and globally Red Data species;
- Identify and discuss potential impacts of the proposed project on regionally and globally Red Data avifauna during construction and operation;
- Identify information gaps and limitations;
- Discuss and assess the potential impacts of the proposed powerline on birds;
- Suggest mitigation measures to reduce the potential impacts, and
- Identify actions to be included in the construction and operational Environmental Management Plans.

1.1.3 Approach and Methodology

- Bird distribution data of the South African Bird Atlas 2 (SABAP2) was obtained from the Animal Demography Unit of the University of Cape Town, as a means to ascertain which species occur within the greater study area. The greater study area comprises a total of 18 pentads (see Figure 2). A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 kms. From 30 November 2007 to 27 April 2018, 81 full protocol cards (i.e. surveys lasting a minimum of two hours or more each) have been completed for this area. An additional 44 ad hoc protocol cards (surveys lasting less than two hours but still yielding valuable data) and 348 incidental records were completed for this area.
- The national threatened status of all species was determined with the use of the most recent edition of the Red Data Book of Birds of South Africa (Taylor *et al.* 2015), and the latest authoritative summary of southern African bird biology (Hockey *et al.* 2005).
- The global threatened status of all species was determined by consulting the (2018.1) IUCN Red Data of Threatened Species (http://www.iucnredlist.org/).

- A classification of the vegetation types in the study area was obtained from the Atlas of Southern African Birds 1 (SABAP1) and the National Vegetation Map compiled by the South African National Biodiversity Institute (Mucina & Rutherford 2006).
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015) was consulted for information on potentially relevant Important Bird Areas (IBAs).
- The website of the Coordinated Waterbird Count (CWAC) project of the ADU was interrogated to establish if there are any potentially relevant important waterbodies which could be of relevance to the study.
- Information on potentially relevant areas included in the National Protected Areas Expansion Strategy was obtained from the South Africa National Biodiversity Institute (SANBI) website.
- Information on potentially relevant protected areas was sourced from the Protected Areas Database from the Department of Environmental Affairs (DEA).
- Satellite imagery from Google Earth was used in order to view the broader development area on a landscape level and to help identify sensitive bird habitat.
- A key source of information on avifaunal abundance and species diversity was the 12-months pre-construction monitoring which was conducted in the period September 2015 to January 2017 at the two WEF sites.
- A site visit to the area was conducted on 28 – 30 March 2018 to get additional first-hand impressions of the avifaunal habitat along the proposed alignments.

Figure 2: The SABAP2 pentads where the study area is located.

1.1.4 Assumptions and Limitations

The following assumptions and limitations are applicable to this study:

- From 30 November 2007 to 27 April 2018, 81 full protocol cards (i.e. surveys lasting a minimum of two hours or more each) have been completed for this area. An additional 44 ad hoc protocol cards (surveys lasting less than two hours but still yielding valuable data) and 348 incidental records were completed for this area. This is a comprehensive dataset which provides a reasonably accurate snapshot of the avifauna which could occur in the study area. For purposes of completeness, the list of species that could be encountered was supplemented with personal observations, general knowledge of the area, SABAP1 records (Harrison *et al.* 1997), and data from the pre-construction monitoring.

- Conclusions in this study are based on experience of these and similar species in different parts of South Africa. Bird behaviour can never be entirely reduced to formulas that will be valid under all circumstances. However, power line and substation impacts can be predicted with a fair amount of certainty, based on a robust global body of research stretching back over several decades.
- The precautionary principle was therefore applied throughout. The World Charter for Nature, which was adopted by the UN General Assembly in 1982, was the first international endorsement of the precautionary principle (http://www.unep.org). The principle was implemented in an international treaty as early as the 1987 Montreal Protocol and, among other international treaties and declarations, is reflected in the 1992 Rio Declaration on Environment and Development. Principle 15 of the 1992 Rio Declaration states that: "in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall be not used as a reason for postponing cost-effective measures to prevent environmental degradation."
- The greater study area was defined as the area which comprises the pentads where the study area is located. The study area was defined as the area comprising the proposed alignments with a 2km buffer around it.
- It is important to note that the assessment is made on the status quo as it is currently in the study area. A possible change in land use in the broader development area is not taken into account because the extent and nature of future developments are unknown at this stage. It is however highly unlikely that the land use will change in the foreseeable future.
- Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 50km radius. The existing and proposed developments that were taken into consideration for cumulative impacts are listed in Table 14.
- The report focused on the potential impact of the proposed infrastructure on nationally and/or globally threatened (Red Data) avifauna. These species serve as surrogates for a wide range of non-threatened avifauna which could also potentially be impacted by the powerline. The proposed mitigation measures will also effectively mitigate for the non-threatened avifauna.

1.1.5 Source of Information

The following are the primary sources of information used to compile the report:

- Bird distribution data of the South African Bird Atlas 2 (SABAP 2).
- The Eskom Red Data Book of Birds of South Africa (Taylor *et al.* 2015).
- Robert's Birds of Southern Africa, seventh edition (Hockey *et al.* 2005).
- IUCN Red Data of Threatened Species (2018.1) (http://www.iucnredlist.org/).
- Atlas of Southern African Birds 1 (SABAP1) (Harrison *et al.* 1997).
- The National Vegetation Map compiled by the South African National Biodiversity Institute (SANBI) (Mucina & Rutherford 2006).
- The Important Bird and Biodiversity Areas of South Africa (Marnewick *et al.* 2015).
- The Coordinated Waterbird Count (CWAC) project of the ADU (http://cwac.adu.org.za/).
- The National Protected Areas Expansion Strategy from the Department of Environmental Affairs (DEA).
- The Protected Areas Database from the Department of Environmental Affairs (DEA).
- Renewable Energy EIA Application Database for SA from the Department of Environmental Affairs (DEA).
- Google Earth.
- The 12-months pre-construction monitoring which was conducted from September 2015 to January 2017 at the two Kuruman WEFs.
- A total of 134 bird impact assessment studies compiled by the authors for potential wind energy facilities throughout South Africa since 2011.

1.2. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO AVIFAUNAL IMPACTS

The following aspects of the proposed project have relevance for avifauna:

- The proposed collector substations (displacement due to disturbance and habitat transformation)
- The powerline construction (displacement due to disturbance and habitat destruction)
- The powerline design (mortality due to electrocution)
- The powerline route (mortality due to collisions)

1.3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

1.3.1 Baseline description of the receiving environment

1.3.1.1 Important Bird Areas

The study area is not located in an Important Bird Area. The border of the closest Important Bird Area (IBA), the Spitskop Dam IBA SA028, is located approximately 120km away to the south-east of the study area (Marnewick *et al.* 2015). It is therefore not expected that the proposed powerline will have any impact on the avifauna in an IBA.

1.3.1.2 CWAC sites

The Animal Demography Unit (ADU) launched the Coordinated Waterbird Counts (CWAC) project in 1992 as part South Africa's commitment to International waterbird conservation. This is being done by means of a programme of regular mid-summer and mid-winter censuses at a large number of South African wetlands, known as CWAC sites.

The closest CWAC site is the Pudu Farm Dam, which is situated approximately 32km from the study area at its closest point. Due to the distance from the study area, no impacts on waterbirds at the Pudu Farm Dam is envisaged.

1.3.1.3 Protected Areas

The closest protected area to the study area is the 1 131ha Billy Duvenhage Nature Reserve outside of Kuruman, where 115 bird species have been recorded (Olivier & Olivier 2005). This protected area falls outside the greater study area. The habitat in the reserve is primarily Kuruman Thornveld, which consists of a well-developed, closed shrub layer and well-developed open tree stratum consisting of *Vachellia erioloba* (Mucina & Rutherford 2005).

1.3.1.4 Biomes and vegetation types

SABAP1 recognises six primary vegetation divisions within South Africa, namely (1) Fynbos (2) Succulent Karoo (3) Nama Karoo (4) Grassland (5) Savanna and (6) Forest (Harrison *et al.* 1997). The criteria used by the authors to amalgamate botanically defined vegetation units, or to keep them separate were (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations. It is important to note that no new vegetation unit boundaries were created, with use being made only of previously published data.

The study area is situated in the savanna biome. The first 30km of the proposed alignment runs southwards from Kuruman through the two proposed WEFs and then swings westwards towards Kathu. This section consists of a series of parallel ridges with a general south-east to north-west orientation, known as the Kuruman Mountains, interspersed with broad valleys. The ridges consist of gentle slopes covered in short grassland with an open shrub layer, and a few exposed rocky ridges. The valleys are covered in tall grassland on red Kalahari sands with scattered trees. Two vegetation types are found in this section, namely Kuruman Mountain Bushveld and Kuruman Thornveld (Mucina & Rutherford 2006). The next 40km runs in a south-westerly direction towards Kathu through open plains with a few low ridges. The vegetation consists of open shrub savanna with scattered large trees, and a well-developed grass layer. The vegetation types are mostly Kuruman Mountain Bushveld and Kuruman Thornveld (Mucina & Rutherford 2006). The section of the study area around Kathu also contains Kathu Bushveld. Kathu Bushveld is characterised by medium-tall tree layer with *Acacia erioloba* in places, but mostly open and including *Boscia albitrunca* as the prominent trees. The shrub layer is generally most important with, for example, *A. mellifera*, *Diospyros lycioides* and *Lycium hirsutum* (Mucina & Rutherford 2006).

Kuruman normally receives about 266mm of rain per year, with most rainfall occurring during summer. It receives the lowest rainfall (0mm) in June and the highest (58mm) in February. The monthly distribution of average daily maximum temperatures ranges from 17.5°C in June to 32.6°C in January. The region is the coldest during June when the mercury drops to 0°C on average during the night. Kathu normally receives about 240mm of rain per year, with most rainfall occurring mainly during summer. It receives the lowest rainfall (0mm) in June and the highest (55mm) in February. The average midday temperatures for Kathu range from 18°C in June to 33°C in January. The region is the coldest during July when the mercury drops to 0.2°C on average during the night (http://www.saexplorer.co.za).

1.3.1.5 Habitat classes and avifauna in the study area

Whilst the distribution and abundance of the bird species in the study area can largely be explained by the description of the biomes and vegetation types above, it is as important to examine the modifications which have changed the natural landscape, and which may have an effect on the distribution of avifauna. These are sometimes evident at a much smaller spatial scale than the biome or vegetation types and are determined by a host of factors such as topography, land use and man-made infrastructure.

The bird habitat classes that were identified in the study area, are discussed below.

- Woodland

This habitat class is described above under 1.3.1.4.

It is estimated that at least 67 bird families comprising 156 species could occur in woodland in the greater study area. Red Data species which could occur in the study area are Kori Bustard, Martial Eagle, Tawny Eagle, Verreaux's Eagle (slopes), Cape Vulture, White-backed Vulture and African Rock Pipit (slopes).

- Waterbodies

Surface water is of specific importance to avifauna in this semi-arid study area. The study area contains many boreholes with water troughs and a number of small, man-made farm dams. There is one large dam on the outskirts of Kathu.

It is estimated that at least 41 bird families comprising 103 species could be attracted to surface water in the greater study area. These include Red Data Martial Eagle, Kori Bustard, Abdim's Stork, Cape Vulture, White-backed Vulture and Verreaux's Eagle.

- Grassland

The study area contains fairly expansive areas of grassland, particularly on the crests of the Kuruman Mountains and in areas cleared for crops in the past. There is also a natural pan near Kathu which consists mainly of grassland.

It is estimated that at least 25 bird families comprising 53 species could be attracted to grassland in the greater study area. These include Red Data Kori Bustard, Cape Vulture, White-backed Vulture and Abdim's Stork.

- High voltage lines and telephone lines

High voltage lines are an important potential roosting and breeding substrate for large raptors in the study area (Van Rooyen 2006). There are several existing high voltage lines crossing the study area, ranging from 66kV to 400kV.

It is estimated that at least 15 families comprising 32 species could be attracted to these powerlines, as well as a number of smaller reticulation lines and telephone lines. These lines are used as perches by species such as Lesser Kestrel, Jackal Buzzard, Steppe Buzzard, Black-chested Snake-Eagle, Greater Kestrel, and the Red Data Martial Eagle, Tawny Eagle, Cape Vulture, White-backed Vulture and Verreaux's Eagle.

- Alien trees

There are a number of stand-alone alien trees in the study area, as well as small stands, mostly around farmsteads and boreholes. These consists mainly of Eucalyptus trees.

It is estimated that at least 9 bird families comprising 23 species could be attracted to alien trees in the greater study area. These include Red Data Martial Eagle, Tawny Eagle, Cape Vulture, White-backed Vulture and Verreaux's Eagle.

See Appendix 1 for examples of the habitat in the study area.

1.3.1.6 Avifauna in the study area

It is estimated that a total of 220 species belonging to 83 families could potentially occur in the greater study area (see Appendix 2). Of these, 176 species belonging to 67 families could potentially be affected by displacement through disturbance and habitat destruction, 35 species belonging to 13 families could be impacted through collision mortality with the powerline, and 5 species belonging to two families could be impacted by mortality through electrocution.

Table 2 below lists the Red Data species that could potentially be impacted by the powerline.

Table 2: Red Data species potentially occurring in the study area

CR = Critically endangered
EN = Endangered
VU = Vulnerable
NT = Near threatened
LC = Least concern

				Status		Habitat class						Impact		
Species	**Taxnomic name**	**Family**	**SABAP2 Reporting rate**	**Status (Global)**	**Status (SA)**	**Slopes**	**Grassland**	**Woodland**	**Surface water**	**Powerlines**	**Alien trees**	**Electrocution**	**Collision**	**Displacement**
Eagle, Verreaux's	*Aquila verreauxii*	Raptors	1.23	LC	VU	x			x	x	x	x	x	x
Bustard, Kori	*Ardeotis kori*	Bustards	1.23	NT	NT		x	x	x				x	x
Pipit, African Rock	*Anthus crenatus*	Pipits	1.23	LC	NT	x	x							X
Stork, Abdim's	*Ciconia abdimii*	Storks	1.23	LC	NT		x		x				x	X
Eagle, Martial	*Polemaetus bellicosus*	Raptors	1.23	VU	EN			x	x	x	x	x	x	X
Eagle, Tawny	*Aquila rapax*	Raptors	1.23	LC	EN			x	x	x	x	x	x	X
Vulture, Cape*	*Gyps coprotheres*	Vultures	0	EN	EN	x	x	x	x	x	x	x	x	
Vulture, White-backed*	*Gyps africanus*	Vultures	0	CR	CR	x	x	x	x	x	x	x	x	

*Occasional visitor

1.3.1.7 Site sensitivities

The following site sensitivities from a potential powerline related impact were identified in the course of the field investigations:

- High sensitivity: Surface water which attracts many powerline sensitive species, including Red Data Martial Eagle, Tawny Eagle, Verreaux's Eagle, Abdim's Stork, Cape Vulture, White-backed Vulture and Kori Bustard. This creates a collision risk as it becomes a focal point of bird activity when surface water is available with a high likelihood of interaction with the powerline.
- Medium sensitivity: The whole study area is classified as moderately sensitive as it constitutes mainly natural savanna. The natural savanna supports sparse numbers of Red Data Martial Eagle, Tawny Eagle and Kori Bustard which are at risk of displacement and powerline collisions anywhere in the study area, with a medium likelihood of interaction with the powerline. Cape Vultures and White-backed Vultures are occasional visitors.

See Figure 3 for a sensitivity map of the study area.

Figure 3: Sensitivity map of the study area

1.4. APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

1.4.1 Agreements and conventions

Table 3 below lists agreements and conventions which South Africa is party to and which is relevant to the conservation of avifauna (BirdLife International 2018).

Table 3: Agreements and conventions which South Africa is party to and which is relevant to the conservation of avifauna

Convention name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: The conservation of biological diversity The sustainable use of the components of biological diversity The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	As an environmental treaty under the aegis of the United Nations Environment Programme, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global

Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

1.4.2 National legislation

- Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right –
(a) to an environment that is not harmful to their health or well-being; and
(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
(i) prevent pollution and ecological degradation;
(ii) promote conservation; and
(iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

- The National Environmental Management Act 107 of 1998

The National Environmental Management Act 107 of 1998 (as amended) (NEMA) creates the legislative framework for environmental protection in South Africa and is aimed at giving effect to the environmental right in the Constitution. It sets out a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated.

NEMA also provides that a wide variety of listed developmental activities (via the promulgation of the EIA Regulations (2014, as amended), which may significantly affect the environment, may be performed only after an EIA has been done and authorisation has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

- The National Environmental Management: Biodiversity Act 10 of 2004 and the Threatened or Protected Species Regulations, February 2007

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management: Biodiversity Act (Act 10 of 2004, as amended) read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 sets out the objectives of the Act, and they are aligned with the objectives of the Convention on Biological Diversity, which are the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits of the use of genetic resources. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals (as noted in Table 7 above). The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

1.4.3 Best Practice Guidelines

The latest edition of the South African *"Best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa" (*Jenkins, A.R., Van Rooyen, C.S., Smallie, J.J., Anderson, M.D., & A.H. Smit. 2011) were followed for the pre-construction monitoring at the two Kuruman WEFs. This document was published by the Endangered Wildlife Trust (EWT) and Birdlife South Africa (BLSA) in March 2011, and subsequently revised in 2011, 2012 and 2015.

There is no stand-alone document in South Africa which summarises the current best practices when it comes to bird impact assessment studies for powerlines.

1.4.4 Key Issues Identified During the BA Phase

The key avifaunal issues identified during the BA Process are:

- Displacement of Red Data avifauna due to disturbance associated with the construction of the powerline and on-site substations.
- Displacement of Red Data avifauna due to habitat transformation associated with the construction of the powerline and on-site substations.
- Mortality of Red Data avifauna due to collisions with the earthwire of the proposed 132kV line.
- Electrocution of Red Data avifauna on the proposed 132kV line and on-site substation.

No stakeholder comments have been received to date on the potential impacts of the proposed powerline on avifauna.

1.4.5 Identification of Potential Impacts

The potential impacts identified during the BA are:

<u>Construction Phase</u>

- Potential impact 1: Displacement of Red Data avifauna due to disturbance associated with the construction of the powerline and on-site substation.
- Potential impact 2: Displacement of Red Data avifauna due to habitat transformation associated with the construction of the powerline and on-site substation.

Operational Phase

- Potential impact 3: Mortality of Red Data avifauna due to collisions with the earthwire of the proposed 132kV line.
- Potential impact 4: Electrocution of Red Data avifauna on the proposed 132kV line.

Decommissioning Phase

- Potential impact 5: Displacement of Red Data avifauna due to disturbance associated with the de-commissioning of the powerline and on-site substation.

Cumulative Impacts

- Cumulative impact 1: Displacement of Red Data avifauna due to disturbance associated with the construction of the powerline, service road and on-site substation.
- Cumulative impact 2: Displacement of Red Data avifauna due to habitat transformation associated with the construction of the powerline, service road and on-site substation.
- Mortality of Red Data avifauna due to collisions with the earthwire of the proposed 132kV line.

1.5. ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

Negative impacts on avifauna by electricity infrastructure generally take two main forms namely electrocution and collisions (Ledger & Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs & Ledger 1986b; Ledger, Hobbs & Smith, 1992; Verdoorn 1996; Kruger & Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000; Van Rooyen 2004; Jenkins et al. 2010). Displacement due to habitat destruction and disturbance associated with the construction of the electricity infrastructure is another impact that could potentially impact on avifauna.

1.5.1 Results of the Field Study

The key source of information on avifaunal abundance and species diversity was the 12-months pre-construction monitoring which was conducted in the period September 2015 to January 2017 at the two WEF sites. Surveys were conducted seasonally and data was collected by means of drive transect and walk transects, vantage point (VP) watches, focal point counts and incidental sightings.

- Kuruman WEF Phase 1

An estimated 201 species could potentially occur in the study area, of which 133 were recorded at the WEF development area during pre-construction monitoring. The results of the transect counts indicate a moderate diversity of avifauna at both the WEF development area and the control site. While this is to be expected to some extent of a fairly arid area such as this, the very low numbers or absence of some species e.g. Northern Black Korhaan is an indication that the avian populations might be under pressure from external factors, e.g. hunting. Flight activity of priority species at the WEF development area was also very low, with a passage rate of 0.05 birds/hour. See Appendix 3 for a list of species recorded during surveys at the Kuruman WEF Phase 1 development.

- Kuruman WEF Phase 2

An estimated 166 species could potentially occur in the study area, of which 136 were recorded at the WEF development area during pre-construction monitoring. The results of the transect counts indicate a moderate diversity of avifauna at both the WEF development area and the control site. While this is to be expected to some extent of a fairly arid area such as this, the very low numbers or absence of some species e.g. Northern Black Korhaan is an indication that the avian populations might be under pressure from external factors, e.g. hunting. Flight activity of priority species at the WEF development area was moderate, with a passage rate of 0.32 birds/hour. The vast majority of flights were Lesser Kestrels. See Appendix 4 for a list of species recorded during surveys at the Kuruman WEF Phase 2 development.

1.5.2 Potential impact 1: Displacement of Red Data species due to disturbance (Construction Phase)

- Nature of the impact

Some birds could be displaced due to disturbance during the construction phase of the powerline and substations. While this is usually temporary, if it results in the interruption of a breeding cycle, at the critical time, could result in the death of the eggs or nestlings. In the case of slow reproducing species with long breeding seasons, e.g. large eagles, the interruption of a single breeding season could have a more marked effect than for smaller, fast reproducing species, e.g. passerines, which can more easily lay a replacement clutch. Some sensitive species might also abandon a specific breeding site permanently due to disturbance. This is particularly the case with large raptor such as Martial Eagle and Tawny Eagle which could be breeding in large trees or on powerlines in the study area.

- Significance of impact without mitigation measures

Table 4 below provides a breakdown of the potential pre-mitigation displacement risks per Red Data species due to disturbance in the study area.

Table 4: Red Data species pre-mitigation displacement risk table: Disturbance

Species	**Magnitude of risk: pre-mitigation**	**Potential high-risk habitat/localities in the study area**
Eagle, Martial	Medium	Woodland, alien trees and powerlines
Eagle, Verreaux's	Very low	Slopes
Tawny Eagle	Low	Woodland, alien trees and powerlines
Abdim's Stork	Very low	Dams and grassland
African Rock Pipit	Very low	Slopes
Kori Bustard	Low	Woodland and grassland

The overall pre-mitigation risk of displacement of Red Data species due to disturbance is rated as Low

- Proposed mitigation measures

A site-specific Construction Environmental Management Plan (CEMPr) must be implemented, which gives appropriate and detailed description of how construction activities must be conducted. All contractors are to adhere to the CEMPr and should apply good environmental practice during construction. The CEMPr must specifically include the following:

- No off-road driving;
- Maximum use of existing roads;
- Measures to control noise
- Restricted access to the rest of the property;
- The appointed Environmental Control Officer (ECO) must be trained by an avifaunal specialist to identify the potential priority species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may

include the training of construction staff to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.

- Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes, to identify any nests/breeding/roosting activity of Red Data species. The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.

- Significance of impact with mitigation measures

Table 5 below provides a breakdown of the potential post-mitigation displacement risks per Red Data species due to disturbance in the study area.

Table 5: Red Data species post-mitigation displacement risk table: Disturbance

Species	**Magnitude of risk: post-mitigation**	**Potential high-risk habitat/localities in the study area**
Eagle, Martial	Low	Woodland, alien trees and powerlines
Eagle, Verreaux's	Very low	Slopes
Tawny Eagle	Low	Woodland, alien trees and powerlines
Abdim's Stork	Very low	Dams and grassland
African Rock Pipit	Very low	Slopes
Kori Bustard	Low	Woodland and grassland

The overall post-mitigation risk of displacement of Red Data species due to disturbance is rated as Very Low

1.5.3 Potential impact 2: Displacement of Red Data avifauna due to habitat transformation associated with the construction of the powerline and on-site substation (Construction Phase)

- Nature of the impact

During the construction of power lines and substations, some habitat destruction and transformation inevitably takes place. This happens with the construction of access roads, the clearing of servitudes and the levelling of substation yards. In some habitats, servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line, which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude and/or substations through transformation of habitat, which could result in temporary or permanent displacement.

However, the results of habitat transformation may be subtler. Whereas the actual footprint of the development be small in absolute terms, the effects of the habitat fragmentation may be more significant. For example, Shaw (2013) found that Ludwig's Bustard generally avoid the immediate proximity of roads within a 500m buffer. This means that power lines and roads also cause loss and fragmentation of the habitat used by the population in addition to the potential direct mortality. The physical encroachment increases the disturbance and barrier effects that contribute to the overall habitat fragmentation effect of the infrastructure (Raab *et al*. 2010). It has been shown that fragmentation of natural grassland in Mpumalanga (in that case by afforestation) has had a detrimental impact on the densities and diversity of grassland species (Alan *et al*. 1997). In contrast to the findings of the studies above, it is notable that Strugnell (2017) did not find any significant displacement of large terrestrial species, and Denham's Bustard in particular, at the Kouga wind

Farm, in the Eastern Cape. This indicates that there may be significant interspecies variation with regard to displacement thresholds, even for closely related species.

Both proposed on-site substations will be situated in valley bottoms in open woodland. From an avifaunal impact perspective, the impact will be low, as the actual footprint is small (2 ha) and there is ample similar habitat available within the immediate surroundings, which means that the displacement impact on Red Data species should be minimal.

In the case of the powerline itself, the vegetation clearing in the servitude should not be very extensive, as the vegetation consists mostly of grass and shrubs.

- Significance of impact without mitigation measures

Table 6 below provides a breakdown of the potential pre-mitigation displacement risks per Red Data species due to habitat transformation in the study area.

Table 6: Red Data species pre-mitigation displacement risk table: Habitat transformation

Species	**Magnitude of risk: pre-mitigation**	**Potential high-risk habitat/localities in the study area**
Eagle, Martial	Low	Woodland, alien trees and powerlines
Eagle, Verreaux's	Very low	Slopes
Tawny Eagle	Low	Woodland, alien trees and powerlines
Abdim's Stork	Very low	Dams and grassland
African Rock Pipit	Very low	Slopes
Kori Bustard	Low	Woodland and grassland

The overall pre-mitigation risk of displacement of Red Data species due to habitat transformation is rated as Low.

- Proposed mitigation measures

The proposed mitigation measures to reduce the impact of displacement due to habitat transformation are as follows:

- The recommendations of the ecological specialist studies must be strictly implemented, especially as far as limitation of the construction footprint, retention of natural vegetation and rehabilitation of transformed areas is concerned.
- Large trees should be retained as much as possible as they serve as potential roosting and breeding habitat for a variety of birds, including raptors.
- Annual audits must be performed by an external rehabilitation specialist for three years to assess the success of the rehabilitation programme and recommend changes or additions to the programme if need be.

- Significance of impact with mitigation measures

Table 7 below provides a breakdown of the potential post-mitigation displacement risks per Red Data species due to habitat transformation in the study area.

Table 7: Red Data species post-mitigation displacement risk table: Habitat transformation

Species	**Magnitude of risk: post-mitigation**	**Potential high-risk habitat/localities in the study area**
Eagle, Martial	Low	Woodland, alien trees and powerlines
Eagle, Verreaux's	Very low	Slopes

Tawny Eagle	Low	Woodland, alien trees and powerlines
Abdim's Stork	Very low	Dams and grassland
African Rock Pipit	Very low	Slopes
Kori Bustard	Low	Woodland and grassland

The overall post-mitigation risk of displacement of Red Data species due to habitat transformation is rated as Very Low.

1.5.4 Potential impact 3: Mortality of Red Data avifauna due to collisions with the earthwire of the proposed 132kV line (Operational Phase).

- Nature of the impact

Collisions are probably the biggest single threat posed by power lines to birds in southern Africa (van Rooyen 2004; Shaw 2013). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004; Anderson 2001; Shaw 2013).

In her PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with power lines:

"The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini et al. 2005, Jenkins et al. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the low-resolution and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin 2011, Martin et al. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown et al. 1987, Henderson et al. 1996).

Topography and weather conditions affect how birds use the landscape. Power lines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with power lines that they can see but do not have enough flight control to avoid (Brown et al. 1987, APLIC 1994).

The technical aspects of power line design and siting also play a big part in collision risk. Grouping similar power lines on a common servitude or locating them along other features such as tree lines, are both approaches thought to reduce risk (Bevanger 1994). In general, low lines with short span lengths (i.e. the distance between two adjacent pylons) and flat conductor configurations are thought to be the least dangerous (Bevanger 1994, Jenkins et al. 2010). On many higher voltage lines, there is a thin earth (or ground) wire above the conductors, protecting the system from lightning strikes. Earth wires are widely accepted to cause the majority of collisions on power lines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown *et al*. 1987, Faanes 1987, Bevanger 1994)."

As mentioned by Shaw (2013) in the extract above, several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and power line configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as power lines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is essential to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin & Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with power lines i.e. Kori Bustards, Blue Cranes and White Storks. In all species the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35° respectively are sufficient to render the birds blind in the direction of travel; in storks, head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and power lines. These findings have applicability to species outside of these families especially raptors (Accipitridae) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes and are also known to be vulnerable to power line collisions.

Thus, visual field topographies which have evolved primarily to meet visual challenges associated with foraging may render certain bird species particularly vulnerable to collisions with human artefacts, such as power lines and wind turbines that extend into the otherwise open airspace above their preferred habitats. For these species placing devices upon power lines to render them more visible may have limited success since no matter what the device the birds may not see them. It may be that in certain situations it may be necessary to distract birds away from the obstacles or encourage them to land nearby (for example by the use of decoy models of conspecifics, or the provision of sites attractive for roosting) since increased marking of the obstacle cannot be guaranteed to render it visible if the visual field configuration prevents it being detected. Perhaps most importantly, the results indicate that collision mitigation may need to vary substantially for different collision prone species, taking account of species specific behaviours, habitat and foraging preferences, since an effective all-purpose marking device is probably not realistic if some birds do not see the obstacle at all (Martin & Shaw 2010).

Quantifying the impact of collisions in terms of the likely number of birds that will be impacted, is very difficult because such a huge number of variables play a role in determining the risk, for example weather, rainfall, wind, age, flocking behaviour, power line height, light conditions, topography, population density and so forth. However, from incidental record keeping by the Endangered Wildlife Trust: Wildlife & Energy Programme it is possible to give a measure of what species are susceptible to collision impacts (Figure 4). This only gives a measure of the general susceptibility of the species to power line collisions, and not an absolute measurement for any specific line.

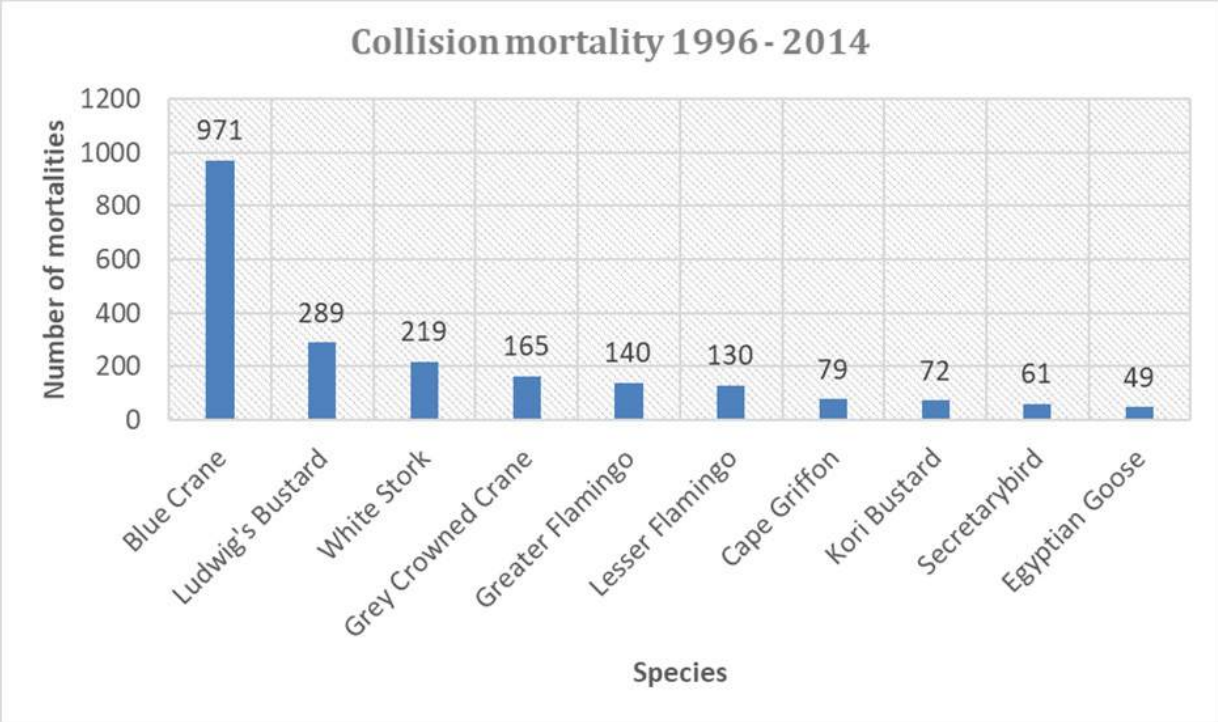

Figure 4: The top ten collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom-EWT Strategic Partnership central incident register 1996 - 2014 (EWT unpublished data).

- Significance of impact without mitigation measures

Table 8 below provides a breakdown of the potential pre-mitigation mortality risks per Red Data species due to collision with the earthwire of the proposed 132kV line in the study area.

Table 8: Red Data species pre-mitigation mortality risk table: Powerline collisions

Species	**Magnitude of risk: pre-mitigation**	**Potential high-risk habitat/localities in the study area**
Eagle, Martial	Low	Woodland, alien trees and powerlines
Eagle, Verreaux's	Very low	Slopes
Tawny Eagle	Very low	Woodland, alien trees and powerlines
Abdim's Stork	Very low	Surface water and grassland
African Rock Pipit	Very low	Slopes
Kori Bustard	Medium	Woodland and grassland
Cape Vulture	Low	All habitats
White-backed Vulture	Low	All habitats

The overall pre-mitigation risk of mortality of Red Data species due to powerline collisions is rated as Low.

- Proposed mitigation measures

Despite speculation that line marking might be ineffective for some species due to differences in visual fields and behaviour, or have only a small reduction in mortality in certain situations for certain species, particularly bustards (Martin & Shaw 2010; Barrientos *et al*. 2012; Shaw 2013), it is generally accepted that marking a line with PVC spiral type Bird Flight Diverters (BFDs) can reduce the collision mortality rates (Sporer *et al*. 2013; Barrientos et al. 2012, Alonso & Alonso 1999; Koops & De Jong 1982). Even bustards have been found to benefit from powerline marking

(Raab *et al.* 2012). Regardless of statistical significance, a slight mortality reduction may be very biologically relevant in areas, species or populations of high conservation concern (e.g. Ludwig's Bustard) (Barrientos *et al*. 2012).

Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. A recent study reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease in bird collisions. At unmarked lines, there were 0.21 deaths/1000 birds (n = 339,830) that flew among lines or over lines. At marked lines, the mortality rate was 78% lower (n = 1,060,746) (Barrientos et al. 2011). Koops and De Jong (1982) found that the spacing of the BFDs was critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5 metres, whereas using the same devices at 10 metre intervals only reduces the mortality by 57%. In an experiment in the Karoo, the Endangered Wildlife Trust found that the application of Bird Flappers significantly reduced the mortality of Blue Cranes, although the effect was less marked with Ludwig's Bustard (C. Hoogstad pers.comm 2017) .

Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important, as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al.* 2010).

The following mitigation measures are proposed:

- High risk sections of power line must be identified by a qualified avifaunal specialist during the walk-through phase of the project, once the alignment has been finalized.
- Where power line marking is required, bird flight diverters must be installed on the full span length on each of the conductors according to the Eskom Guidelines (see Appendix 5).
- Light and dark colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung. In specific instances, i.e. high risk waterbodies (to be identified during the walk-through phase), the new experimental PLP LED (light emitting diode) BFD is recommended to increase the efficacy of the device during low light conditions for waterbirds.
- The line must be inspected once a quarter by a qualified avifaunal specialist for one year to establish if there are any additional areas where bird flight diverters are required.

- Significance of impact with mitigation measures

Table 9 below provides a breakdown of the potential post-mitigation mortality risks per Red Data species due to collision with the earthwire of the proposed 132kV line in the study area.

Table 9: Red Data species post-mitigation mortality risk table: Powerline collisions

Species	**Magnitude of risk: post-mitigation**	**Potential high-risk habitat/localities in the study area**
Eagle, Martial	Very low	Woodland, alien trees and powerlines
Eagle, Verreaux's	Very low	Slopes
Tawny Eagle	Very low	Woodland, alien trees and powerlines
Abdim's Stork	Very low	Dams and grassland
African Rock Pipit	Very low	Slopes
Kori Bustard	Low	Woodland and grassland
Cape Vulture	Very low	All habitats
White-backed Vulture	Very low	All habitats

The overall post-mitigation risk of mortality of Red Data species due to powerline collisions is rated as Very Low.

1.5.5 Potential impact 4: Electrocution of Red Data avifauna on the proposed 132kV (Operational Phase)

- Nature of the impact

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). Electrocution risk is strongly influenced by the power line voltage and design of the pole structure and mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energized components on smaller distribution lines, or energized and earthed components.

Potential structure types are a steel monopole with stand – off insulators (DT 7611 or double circuit variants) or Delta suspension DT 7649 (see Appendix 6).

- Significance of impact without mitigation measures

The only species that could conceivably be at risk of electrocution on the 132kV structures, are large raptors or vultures. Vultures do not occur regularly in the area, although Cape Vulture *Gyps coprotheres* and White-backed Vulture *Gyps africanus* can occur sporadically (VulPro unpublished data 2018). The proposed structures do not pose a significant electrocution risk to solitary large eagles, but the steel monopole with stand – off insulators (DT 7611 or double circuit variants) can pose an electrocution risk to vultures if they congregate in numbers on a pole. In such an instance, they might attempt to perch on the stand-off insulators, which may lead them to bridge the air gap between the live conductor and the earthed steel pole. Such an occurrence is likely to be a very rare occurrence, and only likely to happen when they descend to a carcass in the vicinity of the powerline.

Table 10 below provides a breakdown of the potential pre-mitigation mortality risks per Red Data species due to electrocution with the earthwire of the proposed 132kV line in the study area.

Table 10: Red Data species pre-mitigation mortality risk table: Electrocutions

Species	Magnitude of risk: pre-mitigation	Potential high-risk habitat/localities in the study area
Eagle, Martial	Very low	Woodland, alien trees and powerlines
Eagle, Verreaux's	Very low	Slopes
Tawny Eagle	Very low	Woodland, alien trees and powerlines
Abdim's Stork	Very low	Dams and grassland
African Rock Pipit	Very low	Slopes
Kori Bustard	Very low	Woodland and grassland
Cape Vulture	Medium	In the vicinity of a carcass
White-backed Vulture	Medium	In the vicinity of a carcass

The pre-mitigation significance of this impact is rated to be Medium - Low.

- Proposed mitigation measures

It is strongly recommended that the DT 7649 vulture-friendly structure is employed.

- Significance of impact with mitigation measures

Table 11 below provides a breakdown of the potential post-mitigation mortality risks per Red Data species due to electrocution with the earthwire of the proposed 132kV line in the study area.

Table 11: Red Data species pre-mitigation mortality risk table: Electrocutions

Species	Magnitude of risk: post-mitigation	Potential high-risk habitat/localities in the study area
Eagle, Martial	Very low	Woodland, alien trees and powerlines
Eagle, Verreaux's	Very low	Slopes
Tawny Eagle	Very low	Woodland, alien trees and powerlines
Abdim's Stork	Very low	Dams and grassland
African Rock Pipit	Very low	Slopes
Kori Bustard	Very low	Woodland and grassland
Cape Vulture	Very low	In the vicinity of a carcass
White-backed Vulture	Very low	In the vicinity of a carcass

The significance of the potential impact can be reduced to very low through the employment of a vulture friendly design.

1.5.6 Potential impact 5: Displacement of Red Data avifauna due to disturbance associated with the de-commissioning of the powerline and on-site substation (De-commissioning Phase).

- Nature of the impact

Some birds could be displaced due to disturbance during the de-commissioning phase of the powerline and substations. While this is usually temporary, if it results in the interruption of a breeding cycle, at the critical time, could result in the death of the eggs or nestlings. In the case of slow reproducing species with long breeding seasons, e.g. large eagles, the interruption of a single breeding season could have a more marked effect than for smaller, fast reproducing species, e.g. passerines, which can more easily lay a replacement clutch. Some sensitive species might also abandon a specific breeding site permanently due to disturbance. This is particularly the case with large raptor such as Martial Eagle and Tawny Eagle which could be breeding in large trees or on powerlines in the study area.

- Significance of impact without mitigation measures

Table 12 below provides a breakdown of the potential pre-mitigation displacement risks per Red Data species due to disturbance in the study area.

Table 12: Red Data species pre-mitigation displacement risk table: De-commissioning

Species	Magnitude of risk: pre-mitigation	Potential high-risk habitat/localities in the study area
Eagle, Martial	Medium	Woodland, alien trees and powerlines
Eagle, Verreaux's	Very low	Slopes
Tawny Eagle	Low	Woodland, alien trees and powerlines
Abdim's Stork	Very low	Dams and grassland
African Rock Pipit	Very low	Slopes
Kori Bustard	Low	Woodland and grassland

The overall pre-mitigation risk of displacement of Red Data species due to de-commissioning is rated as Low

- Proposed mitigation measures

A site-specific Environmental Management Plan (EMPr) must be implemented, which gives appropriate and detailed description of how de-commissioning activities must be conducted. All contractors are to adhere to the EMPr and should apply good environmental practice during construction. The EMPr must specifically include the following:

- No off-road driving;
- Maximum use of existing roads;
- Measures to control noise
- Restricted access to the rest of the property;
- The appointed Environmental Control Officer (ECO) must be trained by an avifaunal specialist to identify the potential priority species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of staff to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), de-commissioning activities within 500m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.
- Prior to de-commissioning, an avifaunal specialist should conduct a site walkthrough, covering the power line, to identify any nests/breeding/roosting activity of Red Data species, the results of which may inform the final de-commissioning schedule in close proximity to that specific area, including scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.

- Significance of impact with mitigation measures

Table 13 below provides a breakdown of the potential post-mitigation displacement risks per Red Data species due to disturbance in the study area.

Table 13: Red Data species post-mitigation displacement risk table: De-commissioning

Species	**Magnitude of risk: post-mitigation**	**Potential high-risk habitat/localities in the study area**
Eagle, Martial	Low	Woodland, alien trees and powerlines
Eagle, Verreaux's	Very low	Slopes
Tawny Eagle	Low	Woodland, alien trees and powerlines
Abdim’s Stork	Very low	Dams and grassland
African Rock Pipit	Very low	Slopes
Kori Bustard	Low	Woodland and grassland

The overall post-mitigation risk of displacement of Red Data species due to de-commissioning is rated as Very Low

1.5.7 Cumulative Impacts

Table 14 lists the renewable energy applications which are currently registered with DEA within a 50km radius around the proposed WEF:

Table 14: Renewable energy facilities proposed within a 50km radius around the proposed WEF

Name	DEA reference number	Status	Was a bird impact assessment study compiled?	Recommendations pertaining specifically to bird impacts
Keren Energy Whitebank Solar Plant On Farm Whitebank 379, Kuruman, Northern Cape Province	14/12/16/3/3/1/475	Approved	Unknown, no reports were found on the internet	Unknown
Solar farm for Bestwood, Kgalagadi District Municipality, NC	12/12/20/1906	Approved	Yes. The findings were that the project should have minimal impact on Red Data avifauna	None listed in the EIA report
Kathu Solar PV Energy Facility	14/12/16/3/3/2/911	Approved	Yes.	• A "Bird Friendly" structure, with a bird perch (as per standard Eskom guidelines) should be used for the tower infrastructure. • All relevant perching surfaces should be fitted with bird guards and perch guards as deterrents (Hunting, 2002). • Installation of artificial bird space perches and nesting platforms, at a safe distance from energised components (Goudie, 2006; Prinsen et al., 2012). • Mark sections of line in high sensitivity areas with anti-collision marking devices (diurnal and nocturnal diverters) to increase the visibility of the power line and reduce likelihood of collisions. Marking devices should be spaced 10 m apart. • The line marking devices include spiral vibration dampers, strips, Bird Flight Diverters, bird flappers, aerial marker spheres, ribbons, tapes, flags and aviation balls (Prinsen et al., 2012). • Construction of the power line in close proximity to the existing line will reduce the cumulative impacts and collision risk. • The power line route should

Name	DEA reference number	Status	Was a bird impact assessment study compiled?	Recommendations pertaining specifically to bird impacts
				be scanned at least twice a month for the first year after construction to identify any locations of high impact. All mortalities along the power line route should be recorded and if there are any sites where repeated mortalities occur there should be additional mitigation implemented, such as the fitting of additional bird flappers.
75 MW AEP Legoko Photovoltaic Solar Facility	14/12/16/3/3/2/819	Approved	No, only an ecological report	None
75 MW AEP Mogobe Photovoltaic Solar Facility	14/12/16/3/3/2/820	Approved	No, only an ecological report	None
Kalahari Solar Power Project	12/12/20/1994/AM4	Approved	No, only an ecological report	• Avoiding the removal of Acacia trees that have breeding raptors present until the conclusion of the breeding season at the end of November; • Raptor-proofing all open reservoirs, dams or ponds to allow birds to drink and bathe, preventing drowning, and thus contributing to raptor conservation • Bird-unsafe electrical servitudes must be modified by Eskom to insulate dangerous live components, and to cut a gap in the earth wire – perch deterrents can also be installed to keep birds away from the dangerous areas on the structure.
San Solar Energy Facility	14/12/16/3/3/2/273/AM1	Approved	No, only an ecological report	Fit power-lines with suitable reflectors to enhance their visibility to birds, and fit pylons with suitable deterring structures to discourage birds from perching on such structures
115 Megawatt (MW) Boitshoko Solar Power	14/12/16/3/3/2/935	Approved	Yes	All new transmission lines be marked with bird diverters, as they go up. The priority areas -

Name	DEA reference number	Status	Was a bird impact assessment study compiled?	Recommendations pertaining specifically to bird impacts
Plant				those with the highest mortality rate - should be considered first. There are three classes of mitigation for the PV panels: (i) move them well away from highly sensitive bird area (especially pans or other well-used bird areas), or (ii) employ bird-diverters to deter birds mistaking the panels for open water. If, in the post-construction monitoring, hornbills are found to attack their own reflections in the panels, and smash them, then covering the affected panels with a fine wire mesh is recommended. It is also recommended that Boitshoko install video cameras above some panels for postconstruction monitoring of any mortality of birds in the vicinity, through direct observation and carcass searches in a systematic and regular fashion.
25MW Kathu2 Solar Energy Facility, Northern Cape Province	12/12/20/1858/2/AM2	Approved	No information on this project as available on the internet	No information on this project as available on the internet
Sishen Solar Farm	12/12/20/1977	Lapsed/ withdrawn	N/A	N/A
150mw Adams Photo-Voltaic Solar Energy Facility	12/12/20/2567	Approved	No, only an ecological report	None
Proposed renewable energy generation project on Portion 1 of the Farm Shirley No. 367, Kuruman RD, Gamagara Local Municipality, Shirley Solar Park	14/12/16/3/3/2/616	Approved	No, only an ecological report	The high-risk sections of the power line should be marked with a suitable anti-collision marking device on the earth wire as per the Eskom guidelines

- Nature of the impact

A cumulative impact, in relation to an activity, is the impact of an activity that may not be significant on its own but may become significant when added to the existing and potential impacts arising from similar or other activities in the area.

There are currently no wind energy facilities planned within a 50km radius around the proposed Kuruman WEFs, but at least 11 solar PV facilities. The primary potential long-term impacts of the grid connections associated with these facilities are:

- Displacement of Red Data avifauna due to disturbance associated with the construction of the powerline, service road and on-site substation.
- Displacement of Red Data avifauna due to habitat transformation associated with the construction of the powerline, service road and on-site substation.
- Mortality of Red Data avifauna due to collisions with the earthwire of the proposed 132kV line.

- Significance of impact without mitigation measures

Based on the information that could be sourced on the renewable energy projects in Table 14, these projects would result in an additional 50km – 70km of 132kV voltage lines being constructed within a 50km radius around the proposed Kuruman WEFs. The area currently contains at least 600km of high voltage lines within the 50km radius. The Kuruman WEF grid connection could potentially add another 70km to this figure. Renewable projects would therefore add approximately 120km – 140km of to the existing high voltage grid, which increases the total high voltage grid to 720km – 740km within the 50km radius around the Kuruman WEFs. The Kuruman WEF grid connection would increase the combined high voltage grid (i.e. existing and future renewable energy grid connections) by around 10-11%. The cumulative impact of this increase is likely to be of Moderate significance.

- Proposed mitigation measures

The mitigation measures listed below, or variations of them, are recommended at all the proposed renewable energy grid connections:

- Use of bird-friendly pole designs.
- Marking of powerlines with Bird Flight Diverters.
- Reducing the footprint of the infrastructure.

- Significance of impact with mitigation measures

The implementation of the mitigation measures listed in the previous bullet should reduce the cumulative impact of the Kuruman WEF grid connection to Low.

1.6. IMPACT ASSESSMENT SUMMARY

The assessment of impacts and recommendation of mitigation measures as discussed above and collated in Table 15 to 18 below.

Table 15. Impact assessment summary table for the Construction Phase

Impact pathway	Nature of potential impact/risk	Status[1]	Extent[2]	Duration[3]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
AVIFAUNA															
CONSTRUCTION PHASE															
Direct Impacts															
Impact 1: Displacement of Red Data avifauna due to disturbance associated with the construction of the powerline and on-site substations.	Some birds could be displaced due to disturbance during the construction phase of the powerline and substations.	Negative	Site	Short term	Moderate	Likely	High	Low	Low	No	Yes, to some extent	- No off-road driving; - Maximum use of existing roads; - Measures to control noise - Restricted access to the rest of the property; - The appointed Environmental Control Officer (ECO) must be trained by an avifaunal specialist to identify the potential priority species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed. - Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes, to identify any nests/breeding/roosting activity of Red Data species. The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.	Very low	5	Medium

[1] Status: Positive (+) ; Negative (-)
[2] Site; Local (<10 km); Regional (<100); National; International
[3] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Impact pathway	Nature of potential impact/risk	Status[1]	Extent[2]	Duration[3]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
Impact 2: Displacement of Red Data avifauna due to habitat transformation associated with the construction of the powerline and on-site substation	During the construction of power lines and substations, some habitat destruction and transformation inevitably takes place. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude and/or substations through transformation of habitat, which could result in temporary or permanent displacement.	Negative	Site	Medium term	Moderate	Likely	High	Low	Low	No	Yes	• The recommendations of the ecological specialist studies must be strictly implemented, especially as far as limitation of the construction footprint, retention of natural vegetation and rehabilitation of transformed areas is concerned. • Large trees should be retained as much as possible as they serve as potential roosting and breeding habitat for a variety of birds, including raptors. • Audits must be performed by an external rehabilitation specialist to assess the success of the rehabilitation programme and recommend changes or additions to the programme if need be.	Very low	5	High

Table 16. Impact assessment summary table for the Operational Phase

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
AVIFAUNA															
OPERATIONAL PHASE															
Direct Impacts															
Impact 3: Mortality of Red Data avifauna due to collisions with the earthwire of the proposed 132kV line	Large, heavy-bodied birds are prone to collisions with the earthwire of the high voltage lines	Negative	Local	Long term	Moderate	Likely	High	Low	Low	No	Yes	- High risk sections of power line must be identified by a qualified avifaunal specialist during the walk-through phase of the project, once the alignment has been finalized. - Where power line marking is required, bird flight diverters must be installed on the full span length on each of the conductors according to the Eskom Guidelines (see Appendix 5). - Light and dark colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung. In specific instances, i.e. high risk waterbodies (to be identified during the walk-through phase), the new experimental PLP LED (light emitting diode) BFD is recommended to increase the efficacy of the device during low light conditions for waterbirds. - The line must be inspected once a quarter by a qualified avifaunal specialist for one year to establish if there are any additional areas where bird flight diverters are required.	Very low	5	Medium
impact 4: Electrocution of Red Data avifauna on the proposed 132kV	Electrocution when a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components. Electrocution risk is strongly influenced by the power line voltage and design of the pole structure and mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energized components on smaller distribution lines, or energized and earthed components.	Ngeative	Local	Long term	Moderate	Likely	High	Low	Low	Yes	Yes	It is strongly recommended that the DT 7649 vulture-friendly structure is employed (see Appendix 6)	Very low	5	High

Table 17. Impact assessment summary table for the Decommissioning Phase

Impact pathway	Nature of potential impact/risk	Status[4]	Extent[5]	Duration[6]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
AVIFAUNA															
DECOMMISSIONING PHASE															
Direct Impacts															
impact 5: Displacement of Red Data avifauna due to disturbance associated with the de-commissioning of the powerline and on-site substation	Some birds could be displaced due to disturbance during the de-commissioning phase of the powerline and substations	Negative	Site	Short term	Moderate	Likely	High	Low	Low	No	Yes, to some extent	- No off-road driving; - Maximum use of existing roads; - Measures to control noise - Restricted access to the rest of the property; - The appointed Environmental Control Officer (ECO) must be trained by an avifaunal specialist to identify the potential priority species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of staff to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), de-commissioning activities within 500m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed. - Prior to de-commissioning, an avifaunal specialist should conduct a site walkthrough, covering the power line, to identify any nests/breeding/roosting activity of Red Data species, the results of which may inform the final de-commissioning schedule in close proximity to that specific area, including scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.	Very low	5	Medium

[4] Status: Positive (+) ; Negative (-)
[5] Site; Local (<10 km); Regional (<100); National; International
[6] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Table 18. Cumulative impact assessment summary table

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
AVIFAUNA															
CUMULATIVE IMPACTS															
A cumulative impact, in relation to an activity, is the impact of an activity that may not be significant on its own but may become significant when added to the existing and potential impacts arising from similar or other activities in the area.	Displacement of Red Data avifauna due to disturbance associated with the construction of the powerline, service road and on-site substation. Displacement of Red Data avifauna due to habitat transformation associated with the construction of the powerline, service road and on-site substation. Mortality of Red Data avifauna due to collisions with the earthwire of the proposed 132kV line.	Negative	Regional	Long term	Substantial	Very likely	High	Low	Moderate	No	Yes, to some extent	- Use of bird-friendly pole designs. - Marking of powerlines with Bird Flight Diverters. - Reducing the footprint of the infrastructure.	Low	4	Medium

1.7. INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAM

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
A. DESIGN PHASE					
A.1. AVIFAUNA					
Electrocution of Red Data avifauna on the 132kV powerline	Avoid mortality of Red Data avifauna	▪ It is strongly recommended that the DT 7649 vulture-friendly structure is employed (see Appendix 6)	▪ Incorporate into the design of the powerline	▪ Once during the design phase	▪ Proponent's design team
B. CONSTRUCTION PHASE					
B.1. AVIFAUNA					
Displacement of Red Data avifauna due to disturbance	Avoid displacement of Red Data avifauna	▪ No off-road driving; ▪ Maximum use of existing roads; ▪ Measures to control noise ▪ Restricted access to the rest of the property; ▪ The appointed Environmental Control Officer (ECO) must be trained by an avifaunal specialist to identify the potential priority species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a	▪ Frequent inspections to ensure compliance with the EMPr ▪ Walk-through through a combination of walking and driving	▪ Weekly or bi-weekly ▪ Once before construction commences	▪ Construction Manager ▪ ECO ▪ Avifaunal specialist

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed. ▪ Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes, to identify any nests/breeding/roosting activity of Red Data species. The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating			

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.			
Displacement of Red Data avifauna due to habitat transformation associated with the construction of the powerline and on-site substation	Avoid displacement of Red Data avifauna	▪ The recommendations of the ecological specialist studies must be strictly implemented, especially as far as limitation of the construction footprint, retention of natural vegetation and rehabilitation of transformed areas is concerned. ▪ Large trees should be retained as much as possible as they serve as potential roosting and breeding habitat for a variety of birds, including raptors. ▪ Audits must be performed by an external rehabilitation specialist to assess the success of the rehabilitation programme and recommend changes or additions to the programme if need be.	▪ Frequent inspections to ensure compliance with the EMPr ▪ Site inspection	▪ Weekly or bi-weekly ▪ Once a year	▪ Construction Manager ▪ ECO ▪ Appointed rehabilitation specialist ▪
Mortality of Red Data avifauna due to collisions with the	Avoid mortality of Red Data avifauna	▪ High risk sections of power line must be identified by a qualified	▪ Walk-through through a combination of walking and driving	▪ Once before construction	▪ Facility Operational Manager ▪ Facility Environmental Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
earthwire of the proposed 132kV line.		avifaunal specialist during the walk-through phase of the project, once the alignment has been finalized. ▪ Where power line marking is required, bird flight diverters must be installed on the full span length on each of the conductors according to the Eskom Guidelines (see Appendix 5). ▪ Light and dark colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung. In specific instances, i.e. high-risk waterbodies (to be identified during the walk-through phase), the new experimental PLP LED (light emitting diode) BFD is recommended to increase the efficacy of the device during low light conditions for waterbirds.	▪ Marking of earthwire with Bird Flight Diverters	starts when the pole positions have been finalised. ▪ Marking to happen before the line becomes operational, as soon as the conductors have been strung.	▪ Appointed avifaunal specialist

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
C. OPERATIONAL PHASE					
C.1. AVIFAUNA					
Mortality of Red Data avifauna due to collisions with the earthwire of the proposed 132kV line.	Avoid mortality of Red Data avifauna	▪ Where power line marking is required, bird flight diverters must be installed on the full span length on each of the conductors according to the Eskom Guidelines (see Appendix 5).	▪ The line must be inspected once a quarter by a qualified avifaunal specialist for one year to establish if there are any additional areas where bird flight diverters are required.	▪ Once a quarter	▪ Eskom Management ▪ Appointed avifaunal specialist.
D. DE-COMMISSIONING PHASE					
D.1. AVIFAUNA					
Displacement of Red Data avifauna due to disturbance	Avoid displacement of Red Data avifauna	▪ No off-road driving; ▪ Maximum use of existing roads; ▪ Measures to control noise ▪ Restricted access to the rest of the property; The appointed Environmental Control Officer (ECO) must be trained by an avifaunal specialist to identify the potential priority species as well as the signs that indicate possible	▪ Frequent inspections to ensure compliance with the EMPr ▪ Walk-through using a combination of walking and driving	▪ Weekly or bi-weekly ▪ Once before construction	▪ Project Manager ▪ ECO ▪ Avifaunal specialist

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
		breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of staff to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), de-commissioning activities within 500m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed. ▪ Prior to de-commissioning, an avifaunal specialist should conduct a site walkthrough, covering the power line, to identify any nests/breeding/roosting activity of Red Data species, the results of which may inform the final de-commissioning schedule in close		commences	

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		proximity to that specific area, including scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.			

1.8. CONCLUSION AND RECOMMENDATIONS

The study area is situated in the savanna biome. The first 30km of the proposed alignment runs southwards from Kuruman through the two proposed Kuruman WEFs and then swings westwards towards Kathu. The first section runs through a series of parallel ridges with a general south-east to north-west orientation, known as the Kuruman Mountains, interspersed with broad valleys. The ridges consist of gentle slopes covered in short grassland with an open shrub layer, and a few exposed rocky ridges. The valleys are covered in tall grassland on red Kalahari sands with scattered trees. The next 40km runs in a south-westerly direction towards Kathu through open plains with a few low ridges. The vegetation consists of open shrub savanna with scattered large trees, and a well-developed grass layer.

It is estimated that a total of 220 species belonging to 84 families could potentially occur in the greater study area (see Appendix 2). Of these, 176 species belonging to 67 families could potentially be affected by displacement through disturbance and habitat destruction, 35 species belonging to 12 families could be impacted through collision mortality with the powerline, and 5 species belonging to 2 families could be impacted by mortality through electrocution.

The following environmental sensitivities were identified in the study area:

- High sensitivity: Surface water which attracts many powerline sensitive species, including Red Data Martial Eagle, Tawny Eagle, Verreaux's Eagle, Abdim's Stork, Cape Vulture, White-backed Vulture and Kori Bustard. This creates a collision risk as it becomes a focal point of bird activity when surface water is available with a high likelihood of interaction with the powerline.
- Medium sensitivity: The whole study area is classified as moderately sensitive as it constitutes mainly natural savanna. The natural savanna supports sparse numbers of Red Data Martial Eagle, Tawny Eagle and Kori Bustard which are at risk of displacement and powerline collisions anywhere in the study area, with a medium likelihood of interaction with the powerline. Cape Vultures and White-backed Vultures are occasional visitors.

The following potential pre-mitigation impacts were identified:

<u>Construction Phase</u>

- Potential impact 1: Displacement of Red Data avifauna due to disturbance associated with the construction of the powerline and on-site substation.
- Potential impact 2: Displacement of Red Data avifauna due to habitat transformation associated with the construction of the powerline and on-site substation.

<u>Operational Phase</u>

- Potential impact 3: Mortality of Red Data avifauna due to collisions with the earthwire of the proposed 132kV line.
- Potential impact 4: Electrocution of Red Data avifauna on the proposed 132kV line.

<u>Decommissioning Phase</u>

- Potential impact 5: Displacement of Red Data avifauna due to disturbance associated with the de-commissioning of the powerline and on-site substation.

Cumulative Impacts

- Cumulative impact 1: Displacement of Red Data avifauna due to disturbance associated with the construction of the powerline, service road and on-site substation.
- Cumulative impact 2: Displacement of Red Data avifauna due to habitat transformation associated with the construction of the powerline, service road and on-site substation.
- Mortality of Red Data avifauna due to collisions with the earthwire of the proposed 132kV line.

The risk ratings for the impacts associated with the various phases of the project are as follows:

Phase	**Average Impact Significance - pre mitigation**	**Average Impact Significance - post mitigation**
Construction	4 (Low)	5 (Very low)
Operational	4 (Low)	5 (Very low)
Decommissioning	4 (Low)	5 (Very low)
Nature of Impact		**Overall Impact Significance**
Cumulative - Operational	3 (Moderate)	4 (Low)
Overall Average	3.75 (Moderate to Low)	4.75 (Low to Very low)

The following key management actions and mitigation measures are proposed to reduce the impact of the proposed facility:

Mitigation measures to address Construction Phase impacts

- No off-road driving must be allowed.
- Maximum use of existing roads.
- Measures to control noise and dust must be applied according to best practice.
- Access to be restricted to the rest of the property outside the construction footprint.
- The appointed Environmental Control Officer (ECO) must be trained by an avifaunal specialist to identify the potential priority species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of construction staff to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), construction activities within 500m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.
- Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes, to identify any nests/breeding/roosting activity of Red Data species. The results of which may inform the final construction schedule in close proximity to that specific area, including abbreviating construction time, scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.
- The recommendations of the ecological specialist studies must be strictly implemented, especially as far as limitation of the construction footprint, retention of natural vegetation and rehabilitation of transformed areas is concerned.
- Large trees should be retained as much as possible as they serve as potential roosting and breeding habitat for a variety of birds, including raptors.
- Audits must be performed by an external rehabilitation specialist to assess the success of the rehabilitation programme and recommend changes or additions to the programme if need be.

Mitigation measures to address Operational Phase impacts

- High risk sections of power line requiring marking with bird flight diverters must be identified by a qualified avifaunal specialist during the walk-through phase of the project, once the alignment has been finalized.
- Where power line marking is required, bird flight diverters must be installed on the full span length on each of the conductors according to the Eskom Guidelines (see Appendix 5).
- Light and dark colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung. In specific instances, i.e. high risk waterbodies (to be identified during the walk-through phase), the new experimental PLP LED (light emitting diode) BFD is recommended to increase the efficacy of the device during low light conditions for waterbirds.
- The line must be inspected once a quarter by a qualified avifaunal specialist for one year to establish if there are any additional areas where bird flight diverters are required.
- It is strongly recommended that the DT 7649 vulture-friendly structure is employed.

Mitigation measures to address Decommissioning Phase impacts

- No off-road driving must be allowed.
- Maximum use must be made of existing roads.
- Measures to control noise and dust must be applied according to industry best practice.
- Restricted access to the rest of the property must be maintained.
- The appointed Environmental Control Officer (ECO) must be trained by an avifaunal specialist to identify the potential priority species as well as the signs that indicate possible breeding by these species. The ECO must then, during audits/site visits, make a concerted effort to look out for such breeding activities of Red Data species, and such efforts may include the training of staff to identify Red Data species, followed by regular questioning of staff as to the regular whereabouts on site of these species. If any of the Red Data species are confirmed to be breeding (e.g. if a nest site is found), de-commissioning activities within 500m of the breeding site must cease, and an avifaunal specialist is to be contacted immediately for further assessment of the situation and instruction on how to proceed.
- Prior to de-commissioning, an avifaunal specialist should conduct a site walkthrough, covering the power line, to identify any nests/breeding/roosting activity of Red Data species, the results of which may inform the final de-commissioning schedule in close proximity to that specific area, including scheduling activities around avian breeding and/or movement schedules, and lowering levels of associated noise.

The proposed Kuruman 132kV grid connection should have a low to very low impact on avifauna, provided the management recommendations listed in this report are strictly implemented. No fatal flaws were identified from an avifaunal perspective – it is therefore recommended that the project is authorised to go ahead.

1.8.1 EA Condition Recommendations

The following recommendations should be included as conditions in the EA:

- Prior to construction, an avifaunal specialist should conduct a site walkthrough, covering the final road and power line routes, to identify any nests/breeding/roosting activity of Red Data species.
- Large trees should be retained as much as possible as they serve as potential roosting and breeding habitat for a variety of birds, including raptors.

- Audits must be performed by an external rehabilitation specialist once a year to assess the success of the rehabilitation programme and recommend changes or additions to the programme if need be.
- High risk sections of power line requiring marking with bird flight diverters must be identified by a qualified avifaunal specialist during the walk-through phase of the project, once the alignment has been finalized.
- The line must be inspected once a quarter by a qualified avifaunal specialist for one year to establish if there are any additional areas where bird flight diverters are required.
- It is strongly recommended that the DT 7649 vulture-friendly structure is employed.

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APPENDIX 1: BIRD HABITAT

Figure 1: Typical shrub savanna west in the study area west of the Kuruman mountains

Figure 2: Typical open savanna in the valleys in between the Kuruman mountains

Figure 3: A large Eucalyptus in the study area

Figure 4: Grassland in the Kuruman mountains

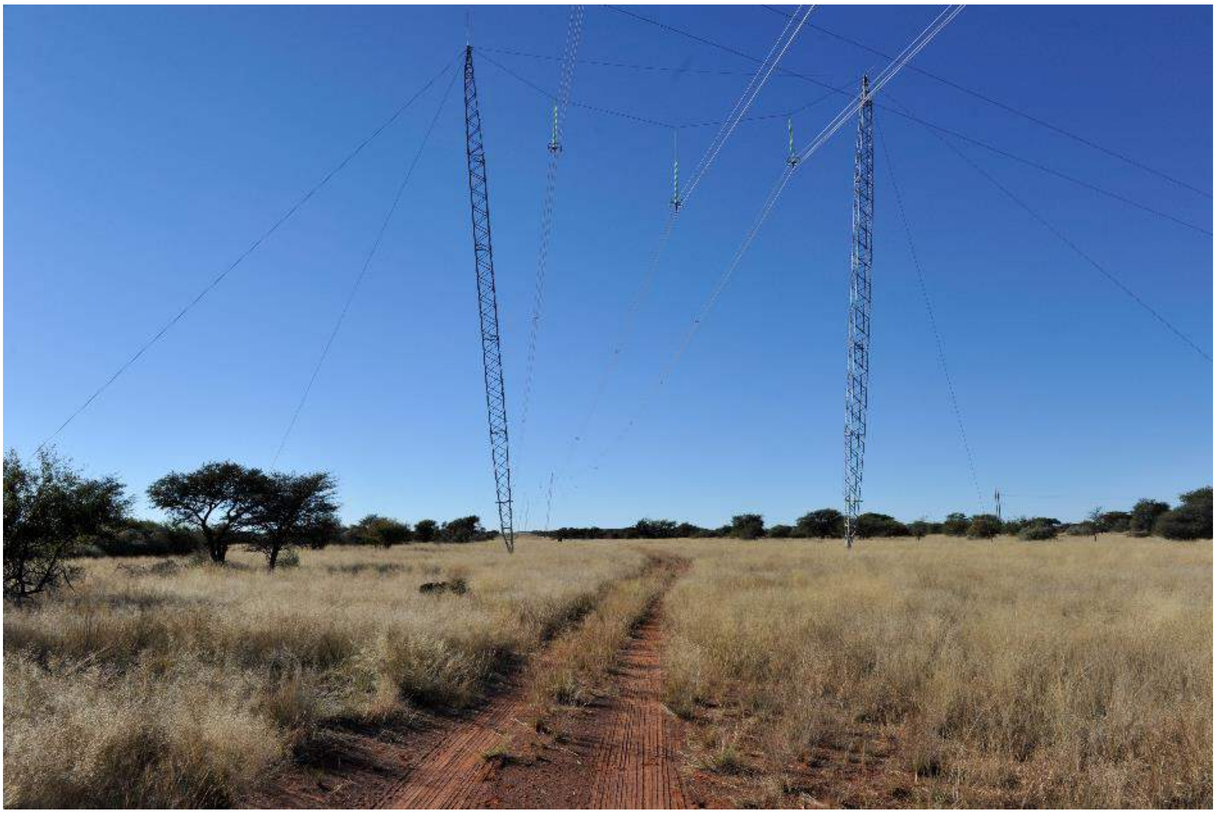


Figure 5: Existing high voltage lines in the study area


Figure 6: A large pan near Ferrum Substation.


Figure 7: Boreholes with water trough are an important source of surface water.


Figure 8: An example of grassland on the slopes of the Kuruman mountains.

APPENDIX 2: SPECIES LIST FOR GREATER STUDY AREA

CR = Critically endangered
EN = Endangered
VU = Vulnerable
NT = Near threatened
LC = Least concern

Species	Taxnomic name	Family	SABAP2 Reporting rate	Status		Habitat class						Impact		
				Status (Global)	Status (SA)	Slopes	Grassland	Woodland	Surface water	Powerlines	Alien trees	Electrocution	Collision	Displacement
Eagle, Verreaux's	*Aquila verreauxii*	Raptors	1.23	LC	VU	x			x	x	x	x	x	x
Bustard, Kori	*Ardeotis kori*	Bustards	1.23	NT	NT		x	x	x				x	x
Pipit, African Rock	*Anthus crenatus*	Pipits	1.23	LC	NT	x	x							x
Stork, Abdim's	*Ciconia abdimii*	Storks	1.23	LC	NT		x		x				x	x
Eagle, Martial	*Polemaetus bellicosus*	Raptors	1.23	VU	EN			x	x	x	x	x	x	x
Eagle, Tawny	*Aquila rapax*	Raptors	1.23	LC	EN			x	x	x	x	x	x	x
Cape Vulture	*Gyps coprotheres*	Vultures	0	EN	EN	x	x	x	x	x	x	x	x	
White-backed Vulture	*Gyps africanus*	Vultures	0	CR	CR	x	x	x	x	x	x	x	x	
Babbler, Southern Pied	*Turdoides bicolor*	Babblers	24.69					x						x
Barbet, Acacia Pied	*Tricholaema leucomelas*	Barbets	64.2					x						x
Barbet, Black-collared	*Lybius torquatus*	Barbets	8.64					x						x
Barbet, Crested	*Trachyphonus vaillantii*	Barbets	32.1					x						x
Batis, Pririt	*Batis pririt*	Batisses	40.74					x						x
Bee-eater, European	*Merops apiaster*	Bee-eaters	48.15					x		x				x
Bee-eater, Swallow-tailed	*Merops hirundineus*	Bee-eaters	33.33					x						x
Bee-eater, White-fronted	*Merops bullockoides*	Bee-eaters	4.94					x						x
Bishop, Southern Red	*Euplectes orix*	Bishops	14.81						x					x
Buffalo-weaver, Red-billed	*Bubalornis niger*	Weavers	18.52					x	x					x
Bulbul, African Red-eyed	*Pycnonotus nigricans*	Bulbuls	97.53					x						x
Bunting, Cape	*Emberiza capensis*	Buntings	11.11					x	x					x
Bunting, Cinnamon-breasted	*Emberiza tahapisi*	Buntings	18.52					x	x					x
Bunting, Golden-breasted	*Emberiza flaviventris*	Buntings	34.57					x	x					x
Bunting, Lark-like	*Emberiza impetuani*	Buntings	11.11					x	x					x
Buttonquail,	*Turnix sylvaticus*	Buttonquails	2.47				x	x						x

Species	Taxnomic name	Family	SABAP2 Reporting rate	Status		Habitat class						Impact		
				Status (Global)	Status (SA)	Slopes	Grassland	Woodland	Surface water	Powerlines	Alien trees	Electrocution	Collision	Displacement
Kurrichane														
Buzzard, Jackal	*Buteo rufofuscus*	Raptors	3.7			x	x	x	x	x	x			x
Buzzard, Steppe	*Buteo vulpinus*	Raptors	3.7				x	x	x	x	x			x
Canary, Black-throated	*Crithagra atrogularis*	Canaries	41.98					x	x					x
Canary, White-throated	*Crithagra albogularis*	Canaries	1.23					x	x					x
Canary, Yellow	*Crithagra flaviventris*	Canaries	60.49					x	x					x
Chat, Anteating	*Myrmecocichla formicivora*	Chats	35.8				x	x						x
Chat, Familiar	*Cercomela familiaris*	Chats	38.27					x						x
Cisticola, Desert	*Cisticola aridulus*	Cisticolas	19.75					x						x
Cisticola, Grey-backed	*Cisticola subruficapilla*	Cisticolas	11.11					x						x
Cisticola, Levaillant's	*Cisticola tinniens*	Cisticolas	2.47						x					x
Cisticola, Rattling	*Cisticola chiniana*	Cisticolas	1.23											x
Cisticola, Tinkling	*Cisticola rufilatus*	Cisticolas	8.64				x							x
Cisticola, Zitting	*Cisticola juncidis*	Cisticolas	3.7				x	x						x
Coot, Red-knobbed	*Fulica cristata*	Coots	12.35						x				x	
Cormorant, Reed	*Phalacrocorax africanus*	Cormorants	9.88						x				x	
Coucal, Burchell's	*Centropus burchellii*	Coucals	1.23					x	x					x
Courser, Double-banded	*Rhinoptilus africanus*	Coursers	1.23				x	x						x
Courser, Temminck's	*Cursorius temminckii*	Coursers	1.23				x	x						x
Crake, Black	*Amaurornis flavirostris*	Crakes	1.23						x					
Crombec, Long-billed	*Sylvietta rufescens*	Warblers	23.46					x						x
Crow, Cape	*Corvus capensis*	Crows	1.23					x		x	x			x
Crow, Pied	*Corvus albus*	Crows	46.91					x		x	x			x
Cuckoo, African	*Cuculus gularis*	Cuckoos	9.88					x						x
Cuckoo, Black	*Cuculus clamosus*	Cuckoos	12.35					x						x
Cuckoo, Diderick	*Chrysococcyx caprius*	Cuckoos	18.52					x						x
Cuckoo, Jacobin	*Clamator jacobinus*	Cuckoos	6.17					x						x
Darter, African	*Anhinga rufa*	Darters	2.47					x	x				x	
Dove, Laughing	*Streptopelia senegalensis*	Doves	85.19				x	x	x	x	x			x
Dove, Namaqua	*Oena capensis*	Doves	40.74					x	x					x
Dove, Red-eyed	*Streptopelia semitorquata*	Doves	54.32					x	x		x			x

Species	Taxnomic name	Family	SABAP2 Reporting rate	Status		Habitat class						Impact		
				Status (Global)	Status (SA)	Slopes	Grassland	Woodland	Surface water	Powerlines	Alien trees	Electrocution	Collision	Displacement
Dove, Rock	*Columba livia*	Doves	16.05					x	x	x	x			x
Drongo, Fork-tailed	*Dicrurus adsimilis*	Drongos	51.85					x						x
Duck, Mallard	*Anas platyrhynchos*	Ducks	6.17						x				x	
Duck, White-faced	*Dendrocygna viduata*	Ducks	2.47						x				x	
Duck, Yellow-billed	*Anas undulata*	Ducks	8.64						x				x	
Eagle-owl, Spotted	*Bubo africanus*	Owls	6.17					x		x	x			x
Egret, Cattle	*Bubulcus ibis*	Egrets	24.69					x	x				x	
Egret, Little	*Egretta garzetta*	Egrets	1.23						x				x	
Eremomela, Yellow-bellied	*Eremomela icteropygialis*	Cisticolas	27.16					x						x
Falcon, Pygmy	*Polihierax semitorquatus*	Raptors	1.23					x						x
Finch, Red-headed	*Amadina erythrocephala*	Finches	13.58					x	x					x
Finch, Scaly-feathered	*Sporopipes squamifrons*	Finches	43.21					x	x					x
Firefinch, Red-billed	*Lagonosticta senegala*	Firefinches	6.17					x	x					x
Flycatcher, Chat	*Bradornis infuscatus*	Flycatchers	7.41					x						x
Flycatcher, Fairy	*Stenostira scita*	Flycatchers	7.41					x						x
Flycatcher, Fiscal	*Sigelus silens*	Flycatchers	70.37					x						x
Flycatcher, Marico	*Bradornis mariquensis*	Flycatchers	14.81					x						x
Flycatcher, Spotted	*Muscicapa striata*	Flycatchers	20.99					x						x
Francolin, Orange River	*Scleroptila levaillantoides*	Francolins	11.11					x						x
Goose, Egyptian	*Alopochen aegyptiacus*	Ducks	14.81						x				x	
Goose, Spur-winged	*Plectropterus gambensis*	Ducks	3.7						x				x	
Goshawk, Gabar	*Melierax gabar*	Raptors	9.88					x	x					x
Goshawk, Southern Pale Chanting	*Melierax canorus*	Raptors	25.93					x	x	x				x
Grebe, Little	*Tachybaptus ruficollis*	Grebes	6.17						x					
Greenshank, Common	*Tringa nebularia*	Waders	1.23						x					
Guineafowl, Helmeted	*Numida meleagris*	Guineafowl	53.09					x	x					x
Harrier-Hawk, African	*Polyboroides typus*	Raptors	1.23					x	x		x			x
Heron, Black-headed	*Ardea melanocephala*	Herons	2.47				x		x	x	x		x	
Heron, Grey	*Ardea cinerea*	Herons	2.47						x				x	

Species	Taxnomic name	Family	SABAP2 Reporting rate	Status		Habitat class						Impact		
				Status (Global)	Status (SA)	Slopes	Grassland	Woodland	Surface water	Powerlines	Alien trees	Electrocution	Collision	Displacement
Heron, Purple	*Ardea purpurea*	Herons	3.7						x				x	
Heron, Squacco	*Ardeola ralloides*	Herons	1.23						x				x	
Honeyguide, Greater	*Indicator indicator*	Honeyguides	3.7					x						x
Honeyguide, Lesser	*Indicator minor*	Honeyguides	1.23					x						x
Hoopoe, African	*Upupa africana*	Hoopoes	62.96					x						x
Hornbill, African Grey	*Tockus nasutus*	Hornbills	24.69					x						x
Hornbill, Southern Yellow-billed	*Tockus leucomelas*	Hornbills	14.81					x						x
Ibis, African Sacred	*Threskiornis aethiopicus*	Ibisses	12.35						x				x	
Ibis, Glossy	*Plegadis falcinellus*	Ibisses	2.47						x				x	
Ibis, Hadeda	*Bostrychia hagedash*	Ibisses	54.32					x	x	x	x		x	
Kestrel, Greater	*Falco rupicoloides*	Raptors	8.64				x			x	x			x
Kestrel, Rock	*Falco rupicolus*	Raptors	16.05			x	x	x		x	x			x
Kingfisher, Brown-hooded	*Halcyon albiventris*	Kingfishers	2.47					x						x
Kite, Black-shouldered	*Elanus caeruleus*	Raptors	1.23				x			x				x
Korhaan, Northern Black	*Afrotis afraoides*	Bustards	3.7				x	x					x	x
Korhaan, Red-crested	*Lophotis ruficrista*	Bustards	16.05					x					x	x
Lapwing, Blacksmith	*Vanellus armatus*	Lapwings	48.15						x					x
Lapwing, Crowned	*Vanellus coronatus*	Lapwings	27.16				x							x
Lark, Eastern Clapper	*Mirafra fasciolata*	Larks	18.52				x	x						x
Lark, Fawn-coloured	*Calendulauda africanoides*	Larks	28.4				x	x						x
Lark, Karoo Long-billed	*Certhilauda subcoronata*	Larks	8.64				x	x						x
Lark, Red-capped	*Calandrella cinerea*	Larks	4.94				x							x
Lark, Sabota	*Calendulauda sabota*	Larks	18.52					x						x
Lark, Spike-heeled	*Chersomanes albofasciata*	Larks	8.64				x	x						x
Martin, Banded	*Riparia cincta*	Martins	4.94						x					x
Martin, Brown-throated	*Riparia paludicola*	Martins	1.23						x					x
Martin, Rock	*Hirundo fuligula*	Martins	61.73			x		x						x
Masked-weaver, Southern	*Ploceus velatus*	Weavers	76.54					x	x					x

Species	Taxnomic name	Family	SABAP2 Reporting rate	Status		Habitat class						Impact		
				Status (Global)	Status (SA)	Slopes	Grassland	Woodland	Surface water	Powerlines	Alien trees	Electrocution	Collision	Displacement
Moorhen, Common	*Gallinula chloropus*	Moorhens	9.88						x					
Mousebird, Red-faced	*Urocolius indicus*	Mousebirds	60.49					x						x
Mousebird, Speckled	*Colius striatus*	Mousebirds	1.23					x						x
Mousebird, White-backed	*Colius colius*	Mousebirds	69.14					x						x
Myna, Common	*Acridotheres tristis*	Starlings	20.99							x				x
Neddicky	*Cisticola fulvicapilla*	Cisticolas	18.52					x						x
Night-Heron, Black-crowned	*Nycticorax nycticorax*	Night-Herons	2.47						x				x	
Nightjar, Rufous-cheeked	*Caprimulgus rufigena*	Nightjars	3.7					x						x
Ostrich, Common	*Struthio camelus*	Ostriches	11.11				x	x						x
Owl, Barn	*Tyto alba*	Owls	7.41					x		x	x			x
Owlet, Pearl-spotted	*Glaucidium perlatum*	Owls	11.11					x						x
Palm-swift, African	*Cypsiurus parvus*	Swifts	41.98					x						
Paradise-flycatcher, African	*Terpsiphone viridis*	Flycatchers	1.23					x						x
Penduline-tit, Cape	*Anthoscopus minutus*	Penduline-tits	17.28					x						x
Pigeon, Speckled	*Columba guinea*	Pigeons	41.98			x			x	x	x			x
Pipit, African	*Anthus cinnamomeus*	Pipits	19.75				x							x
Pipit, Buffy	*Anthus vaalensis*	Pipits	6.17				x							x
Pipit, Long-billed	*Anthus similis*	Pipits	9.88				x							x
Pipit, Plain-backed	*Anthus leucophrys*	Pipits	3.7				x							x
Plover, Kittlitz's	*Charadrius pecuarius*	Plovers	2.47											
Plover, Three-banded	*Charadrius tricollaris*	Plovers	7.41											
Prinia, Black-chested	*Prinia flavicans*	Cisticolas	64.2					x						x
Pytilia, Green-winged	*Pytilia melba*	Finches	28.4					x	x					x
Quail, Common	*Coturnix coturnix*	Quails	2.47				x	x						x
Quailfinch, African	*Ortygospiza atricollis*	Quailfinchs	9.88					x						x
Quelea, Red-billed	*Quelea quelea*	Queleas	17.28					x	x					x
Reed-warbler, African	*Acrocephalus baeticatus*	Warblers	4.94						x					x
Reed-warbler, Great	*Acrocephalus arundinaceus*	Warblers	1.23						x					x
Robin-chat, Cape	*Cossypha caffra*	Robin-chats	25.93					x						x

Species	Taxnomic name	Family	SABAP2 Reporting rate	Status		Habitat class						Impact		
				Status (Global)	Status (SA)	Slopes	Grassland	Woodland	Surface water	Powerlines	Alien trees	Electrocution	Collision	Displacement
Rock-thrush, Short-toed	*Monticola brevipes*	Rock-thrushes	8.64			x	x							x
Roller, Lilac-breasted	*Coracias caudatus*	Rollers	9.88					x		x				x
Roller, Purple	*Coracias naevius*	Rollers	7.41					x		x				x
Sandgrouse, Burchell's	*Pterocles burchelli*	Sandgrouse	2.47					x	x				x	x
Sandgrouse, Double-banded	*Pterocles bicinctus*	Sandgrouse	1.23					x	x				x	x
Sandgrouse, Namaqua	*Pterocles namaqua*	Sandgrouse	16.05					x	x				x	x
Sandpiper, Common	*Actitis hypoleucos*	Waders	1.23						x					
Sandpiper, Wood	*Tringa glareola*	Waders	2.47						x					
Scimitarbill, Common	*Rhinopomastus cyanomelas*	Scimitarbills	28.4					x						x
Scrub-robin, Kalahari	*Cercotrichas paena*	Scrub-robins	60.49					x						x
Scrub-robin, Karoo	*Cercotrichas coryphoeus*	Scrub-robins	3.7					x						x
Shelduck, South African	*Tadorna cana*	Ducks	4.94						x				x	
Shoveler, Cape	*Anas smithii*	Ducks	1.23						x				x	
Shrike, Crimson-breasted	*Laniarius atrococcineus*	Shrikes	69.14					x						x
Shrike, Lesser Grey	*Lanius minor*	Shrikes	13.58					x						x
Shrike, Red-backed	*Lanius collurio*	Shrikes	8.64					x						x
Sparrow, Cape	*Passer melanurus*	Sparrows	54.32				x	x	x	x				x
Sparrow, House	*Passer domesticus*	Sparrows	48.15					x	x	x				x
Sparrow, Southern Grey-headed	*Passer diffusus*	Sparrows	33.33					x	x					x
Sparrowlark, Grey-backed	*Eremopterix verticalis*	Sparrowlarks	1.23				x	x	x					x
Sparrow-weaver, White-browed	*Plocepasser mahali*	Weavers	71.6					x						x
Spurfowl, Red-billed	*Pternistis adspersus*	Francolins	13.58					x						x
Starling, Cape Glossy	*Lamprotornis nitens*	Starlings	75.31					x	x					x
Starling, Pale-winged	*Onychognathus nabouroup*	Starlings	23.46			x	x		x					x
Starling, Pied	*Spreo bicolor*	Starlings	2.47				x		x					x
Starling, Wattled	*Creatophora cinerea*	Starlings	8.64					x	x					x
Stilt, Black-winged	*Himantopus himantopus*	Waders	4.94						x					
Stint, Little	*Calidris minuta*	Waders	1.23						x					

Species	Taxnomic name	Family	SABAP2 Reporting rate	Status		Habitat class						Impact		
				Status (Global)	Status (SA)	Slopes	Grassland	Woodland	Surface water	Powerlines	Alien trees	Electrocution	Collision	Displacement
Stonechat, African	*Saxicola torquatus*	Chats	9.88				x							x
Sunbird, Dusky	*Cinnyris fuscus*	Sunbirds	17.28					x						x
Sunbird, Marico	*Cinnyris mariquensis*	Sunbirds	18.52					x						x
Swallow, Barn	*Hirundo rustica*	Swallows	25.93				x			x				x
Swallow, Greater Striped	*Hirundo cucullata*	Swallows	55.56				x		x	x				x
Swallow, Red-breasted	*Hirundo semirufa*	Swallows	1.23				x	x						x
Swallow, White-throated	*Hirundo albigularis*	Swallows	6.17						x					x
Swamphen, African Purple	*Porphyrio madagascariensis*	Swamphens	3.7						x					
Swamp-warbler, Lesser	*Acrocephalus gracilirostris*	Warblers	8.64						x					x
Swift, African Black	*Apus barbatus*	Swifts	1.23			x	x	x	x					
Swift, Alpine	*Tachymarptis melba*	Swifts	1.23			x	x	x	x					
Swift, Bradfield's	*Apus bradfieldi*	Swifts	7.41			x	x	x	x					
Swift, Common	*Apus apus*	Swifts	6.17			x	x	x	x					
Swift, Little	*Apus affinis*	Swifts	37.04			x	x	x	x					
Swift, White-rumped	*Apus caffer*	Swifts	28.4			x	x	x	x					
Tchagra, Brown-crowned	*Tchagra australis*	Shrikes	27.16					x						x
Teal, Cape	*Anas capensis*	Ducks	1.23						x				x	
Teal, Hottentot	*Anas hottentota*	Ducks	1.23						x				x	
Teal, Red-billed	*Anas erythrorhyncha*	Ducks	4.94						x				x	
Thick-knee, Spotted	*Burhinus capensis*	Thick-knees	17.28				x	x						x
Thrush, Groundscraper	*Psophocichla litsipsirupa*	Thrushes	58.02					x						x
Thrush, Karoo	*Turdus smithi*	Thrushes	53.09					x						x
Tit, Ashy	*Parus cinerascens*	Tits	32.1					x						x
Tit-babbler, Chestnut-vented	*Parisoma subcaeruleum*	Tit-babblers	74.07					x						x
Tit-babbler, Layard's	*Parisoma layardi*	Tit-babblers	8.64					x						x
Turtle-dove, Cape	*Streptopelia capicola*	Doves	82.72				x	x	x	x	x			x
Wagtail, Cape	*Motacilla capensis*	Wagtails	62.96				x		x					x
Warbler, Garden	*Sylvia borin*	Warblers	1.23					x						x
Warbler, Icterine	*Hippolais icterina*	Warblers	1.23					x						x
Warbler, Rufous-eared	*Malcorus pectoralis*	Warblers	6.17					x						x
Warbler, Sedge	*Acrocephalus schoenobaenus*	Warblers	1.23						x					x

Species	Taxnomic name	Family	SABAP2 Reporting rate	Status		Habitat class						Impact		
				Status (Global)	Status (SA)	Slopes	Grassland	Woodland	Surface water	Powerlines	Alien trees	Electrocution	Collision	Displacement
Warbler, Willow	*Phylloscopus trochilus*	Warblers	11.11					x						x
Waxbill, Black-faced	*Estrilda erythronotos*	Waxbills	16.05					x	x					x
Waxbill, Blue	*Uraeginthus angolensis*	Waxbills	3.7					x	x					x
Waxbill, Common	*Estrilda astrild*	Waxbills	7.41					x	x					x
Waxbill, Violet-eared	*Granatina granatina*	Waxbills	37.04					x	x					x
Weaver, Sociable	*Philetairus socius*	Weavers	16.05					x	x	x				x
Wheatear, Capped	*Oenanthe pileata*	Wheatears	2.47					x						x
Wheatear, Mountain	*Oenanthe monticola*	Wheatears	2.47			x		x						x
White-eye, Orange River	*Zosterops pallidus*	White-eyes	23.46					x						x
Whydah, Shaft-tailed	*Vidua regia*	Whydahs	17.28					x	x					x
Wood-hoopoe, Green	*Phoeniculus purpureus*	Wood-hoopoes	7.41					x						x
Woodpecker, Bearded	*Dendropicos namaquus*	Woodpeckers	3.7					x						x
Woodpecker, Bennett's	*Campethera bennettii*	Woodpeckers	2.47					x						x
Woodpecker, Cardinal	*Dendropicos fuscescens*	Woodpeckers	12.35					x						x
Woodpecker, Golden-tailed	*Campethera abingoni*	Woodpeckers	11.11					x						x
Wren-warbler, Barred	*Calamonastes fasciolatus*	Warblers	4.94					x						x
Bokmakierie	*Telophorus zeylonus*	Shrikes	23.46				x	x						x
Brubru	*Nilaus afer*	Shrikes	33.33					x						x
Fiscal, Common	*Lanius collaris*	Shrikes	45.68				x	x		x				x
Kestrel, Lesser	*Falco naumanni*	Raptors	0				x			x	x			x
Ruff	*Philomachus pugnax*	Waders	1.23						x					

APPENDIX 3: SPECIES RECORDED AT KURUMAN WEF PHASE 1

Species	Taxonomic Name
African Rock Pipit	*Anthus crenatus*
Black Harrier	*Circus maurus*
Black-chested Snake-Eagle	*Circaetus pectoralis*
Double-Banded Courser	*Rhinoptilus africanus*
Gabar Goshawk	*Melierax gabar*
Greater Kestrel	*Falco rupicoloides*
Grey-winged Francolin	*Scleroptila africanus*
Jackal Buzzard	*Buteo rufofuscus*
Kori Bustard	*Ardeotis kori*
Lesser Kestrel	*Falco naumanni*
Martial Eagle	*Polemaetus bellicosus*
Southern Pale Chanting Goshawk	*Melierax canorus*
Spotted Eagle-Owl	*Bubo africanus*
Verreaux's Eagle	*Aquila verreauxii*
Acacia Pied Barbet	*Tricholaema leucomelas*
African Black Swift	*Apus barbatus*
African Hoopoe	*Upupa africana*
African Palm-Swift	*Cypsiurus parvus*
African Pipit	*Anthus cinnamomeus*
African Quailfinch	*Ortygospiza atricollis*
African Red-eyed Bulbul	*Pycnonotus nigricans*
Alpine Swift	*Tachymarptis melba*
Amethyst Sunbird	*Chalcomitra amethystina*
Anteating Chat	*Myrmecocichla formicivora*
Ashy Tit	*Parus cinerascens*
Banded Martin	*Riparia cincta*
Barn Swallow	*Hirundo rustica*
Barred Wren-warbler	*Calamonastes fasciolatus*
Black Cuckoo	*Cuculus clamosus*
Black-chested Prinia	*Prinia flavicans*
Black-faced Waxbill	*Estrilda erythronotos*
Black-throated Canary	*Crithagra atrogularis*
Blue Waxbill	*Uraeginthus angolensis*
Bokmakierie	*Telophorus zeylonus*
Brown-crowned Tchagra	*Tchagra australis*
Brubru	*Nilaus afer*
Buffy Pipit	*Anthus vaalensis*
Cape Bunting	*Emberiza capensis*
Cape Glossy Starling	*Lamprotornis nitens*

Species	Taxonomic Name
Cape Penduline-Tit	*Anthoscopus minutus*
Cape Robin-chat	*Cossypha caffra*
Cape Sparrow	*Passer melanurus*
Cape Turtle-dove	*Streptopelia capicola*
Cape Wagtail	*Motacilla capensis*
Chat Flycatcher	*Bradornis infuscatus*
Chestnut-vented Tit-babbler	*Parisoma subcaeruleum*
Cinnamon-breasted Bunting	*Emberiza tahapisi*
Common Fiscal	*Lanius collaris*
Common Quail	*Coturnix coturnix*
Common Scimitarbill	*Rhinopomastus cyanomelas*
Common Swift	*Apus apus*
Crimson-breasted Shrike	*Laniarius atrococcineus*
Crowned Lapwing	*Vanellus coronatus*
Desert Cisticola	*Cisticola aridulus*
Diderick Cuckoo	*Chrysococcyx caprius*
Double-banded Sandgrouse	*Pterocles bicinctus*
Dusky Sunbird	*Cinnyris fuscus*
Eastern Clapper Lark	*Mirafra [apiata] fasciolata*
European Bee-eater	*Merops apiaster*
Fairy Flycatcher	*Stenostira scita*
Familiar Chat	*Cercomela familiaris*
Fawn-coloured Lark	*Calendulauda africanoides*
Fiscal Flycatcher	*Sigelus silens*
Fork-tailed Drongo	*Dicrurus adsimilis*
Gabar Goshawk	*Melierax gabar*
Golden-breasted Bunting	*Emberiza flaviventris*
Golden-tailed Woodpecker	*Campethera abingoni*
Greater Honeyguide	*Indicator indicator*
Greater Striped Swallow	*Hirundo cucullata*
Green-winged Pytilia	*Pytilia melba*
Grey-backed Cisticola	*Cisticola subruficapilla*
Grey-backed Sparrowlark	*Eremopterix verticalis*
Groundscraper Thrush	*Psophocichla litsipsirupa*
Hadeda Ibis	*Bostrychia hagedash*
Harlequin Quail	*Coturnix delegorguei*
Helmeted Guineafowl	*Numida meleagris*
House Sparrow	*Passer domesticus*
Kalahari Scrub-Robin	*Cercotrichas paena*
Karoo Eremomela	*Eremomela gregalis*
Karoo Long-billed Lark	*Certhilauda subcoronata*
Karoo Scrub-robin	*Cercotrichas coryphoeus*

Species	Taxonomic Name
Kurrichane Buttonquail	*Turnix sylvaticus*
Large-billed Lark	*Galerida magnirostris*
Lark-like Bunting	*Emberiza impetuani*
Laughing Dove	*Streptopelia senegalensis*
Layard's Tit-babbler	*Parisoma layardi*
Lesser Grey Shrike	*Lanius minor*
Little Swift	*Apus affinis*
Long-billed Crombec	*Sylvietta rufescens*
Long-billed Pipit	*Anthus similis*
Mountain Wheatear	*Oenanthe monticola*
Namaqua Dove	*Oena capensis*
Namaqua Sandgrouse	*Pterocles namaqua*
Neddicky	*Cisticola fulvicapilla*
Orange River Francolin	*Scleroptila levaillantoides*
Pale-winged Starling	*Onychognathus nabouroup*
Pied Crow	*Corvus albus*
Pied Starling	*Spreo bicolor*
Plain-backed Pipit	*Anthus leucophrys*
Pririt Batis	*Batis pririt*
Pygmy Falcon	*Polihierax semitorquatus*
Red-backed Shrike	*Lanius collurio*
Red-billed Quelea	*Quelea quelea*
Red-capped Lark	*Calandrella cinerea*
Red-crested Korhaan	*Lophotis ruficrista*
Red-faced Mousebird	*Urocolius indicus*
Red-headed Finch	*Amadina erythrocephala*
Red-winged Starling	*Onychognathus morio*
Rock Kestrel	*Falco rupicolus*
Rock Martin	*Hirundo fuligula*
Rufous-eared Warbler	*Malcorus pectoralis*
Sabota Lark	*Calendulauda sabota*
Scaly-feathered Finch	*Sporopipes squamifrons*
Shaft-tailed Whydah	*Vidua regia*
Short-toed Rock-thrush	*Monticola brevipes*
Sociable Weaver	*Philetairus socius*
Southern Grey-headed Sparrow	*Passer diffusus*
Southern Masked-Weaver	*Ploceus velatus*
Southern Yellow-billed Hornbill	*Tockus leucomelas*
Speckled Pigeon	*Columba guinea*
Spike-heeled Lark	*Chersomanes albofasciata*
Spotted Flycatcher	*Muscicapa striata*
Swallow-tailed Bee-eater	*Merops hirundineus*

Species	Taxonomic Name
Tinkling Cisticola	*Cisticola rufilatus*
Violet-eared Waxbill	*Granatina granatina*
Wattled Starling	*Creatophora cinerea*
White-backed Mousebird	*Colius colius*
White-browed Scrub-Robin	*Cercotrichas leucophrys*
White-browed Sparrow-weaver	*Plocepasser mahali*
white-rumped swift	*Apus caffer*
White-throated Canary	*Crithagra albogularis*
Yellow Canary	*Crithagra flaviventris*
Yellow-bellied Eremomela	*Eremomela icteropygialis*

APPENDIX 4: SPECIES RECORDED AT KURUMAN WEF PHASE 2

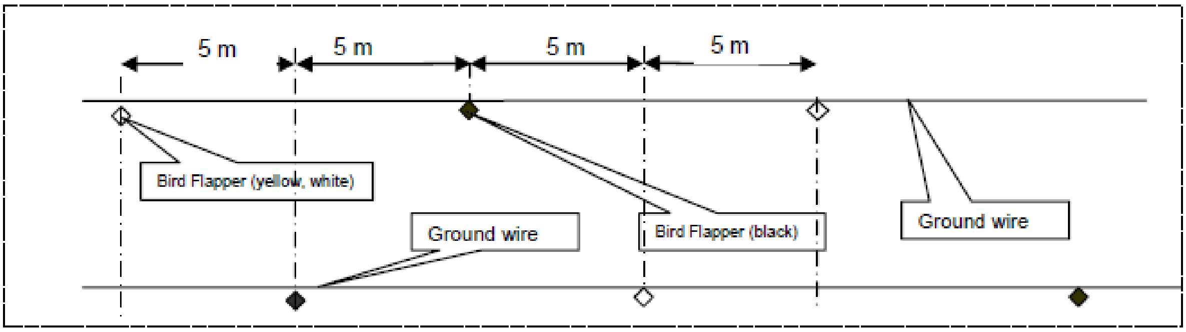
Species	Taxonomic name
African Rock Pipit	*Anthus crenatus*
Black Harrier	*Circus maurus*
Black-chested Snake-Eagle	*Circaetus pectoralis*
Gabar Goshawk	*Melierax gabar*
Greater Kestrel	*Falco rupicoloides*
Grey-winged Francolin	*Scleroptila africanus*
Jackal Buzzard	*Buteo rufofuscus*
Kori Bustard	*Ardeotis kori*
Lesser Kestrel	*Falco naumanni*
Ludwig's Bustard	*Neotis ludwigii*
Martial Eagle	*Polemaetus bellicosus*
Northern Black Korhaan	*Afrotis afraoides*
Southern Pale Chanting Goshawk	*Melierax canorus*
Spotted Eagle-Owl	*Bubo africanus*
Steppe Buzzard	*Buteo vulpinus*
Acacia Pied Barbet	*Tricholaema leucomelas*
African Black Swift	*Apus barbatus*
African Hoopoe	*Upupa africana*
African Palm-Swift	*Cypsiurus parvus*
African Pipit	*Anthus cinnamomeus*
African Quailfinch	*Ortygospiza atricollis*
African Red-eyed Bulbul	*Pycnonotus nigricans*
Alpine Swift	*Tachymarptis melba*
Amethyst Sunbird	*Chalcomitra amethystina*
Anteating Chat	*Myrmecocichla formicivora*
Ashy Tit	*Parus cinerascens*
Banded Martin	*Riparia cincta*
Barn Swallow	*Hirundo rustica*
Barred Wren-warbler	*Calamonastes fasciolatus*
Black Cuckoo	*Cuculus clamosus*
Black-chested Prinia	*Prinia flavicans*
Black-faced Waxbill	*Estrilda erythronotos*
Black-throated Canary	*Crithagra atrogularis*
Blue Waxbill	*Uraeginthus angolensis*
Bokmakierie	*Telophorus zeylonus*
Brown-crowned Tchagra	*Tchagra australis*
Brown-throated Martin	*Riparia paludicola*
Brubru	*Nilaus afer*
Buffy Pipit	*Anthus vaalensis*

Species	Taxonomic name
Cape Bunting	*Emberiza capensis*
Cape Glossy Starling	*Lamprotornis nitens*
Cape Penduline-tit	*Anthoscopus minutus*
Cape Robin-chat	*Cossypha caffra*
Cape Sparrow	*Passer melanurus*
Cape Turtle-dove	*Streptopelia capicola*
Cape Wagtail	*Motacilla capensis*
Capped Wheatear	*Oenanthe pileata*
Cattle Egret	*Bubulcus ibis*
Chat Flycatcher	*Bradornis infuscatus*
Chestnut-vented Tit-babbler	*Parisoma subcaeruleum*
Cinnamon-breasted Bunting	*Emberiza tahapisi*
Common Fiscal	*Lanius collaris*
Common Scimitarbill	*Rhinopomastus cyanomelas*
Common Swift	*Apus apus*
Crimson-breasted Shrike	*Laniarius atrococcineus*
Crowned Lapwing	*Vanellus coronatus*
Desert Cisticola	*Cisticola aridulus*
Diderick Cuckoo	*Chrysococcyx caprius*
Double-Banded Courser	*Rhinoptilus africanus*
Double-banded Sandgrouse	*Pterocles bicinctus*
Dusky Sunbird	*Cinnyris fuscus*
Eastern Clapper Lark	*Mirafra [apiata] fasciolata*
Egyptian Goose	*Alopochen aegyptiaca*
European Bee-eater	*Merops apiaster*
Fairy Flycatcher	*Stenostira scita*
Familiar Chat	*Cercomela familiaris*
Fawn-coloured Lark	*Calendulauda africanoides*
Fiscal Flycatcher	*Sigelus silens*
Gabar Goshawk	*Melierax gabar*
Golden-breasted Bunting	*Emberiza flaviventris*
Golden-tailed Woodpecker	*Campethera abingoni*
Greater Honeyguide	*Indicator indicator*
Greater Striped Swallow	*Hirundo cucullata*
Green-winged Pytilia	*Pytilia melba*
Grey Heron	*Ardea cinerea*
Grey-backed Cisticola	*Cisticola subruficapilla*
Grey-backed Sparrowlark	*Eremopterix verticalis*
Groundscraper Thrush	*Psophocichla litsipsirupa*
Hadeda Ibis	*Bostrychia hagedash*
Helmeted Guineafowl	*Numida meleagris*

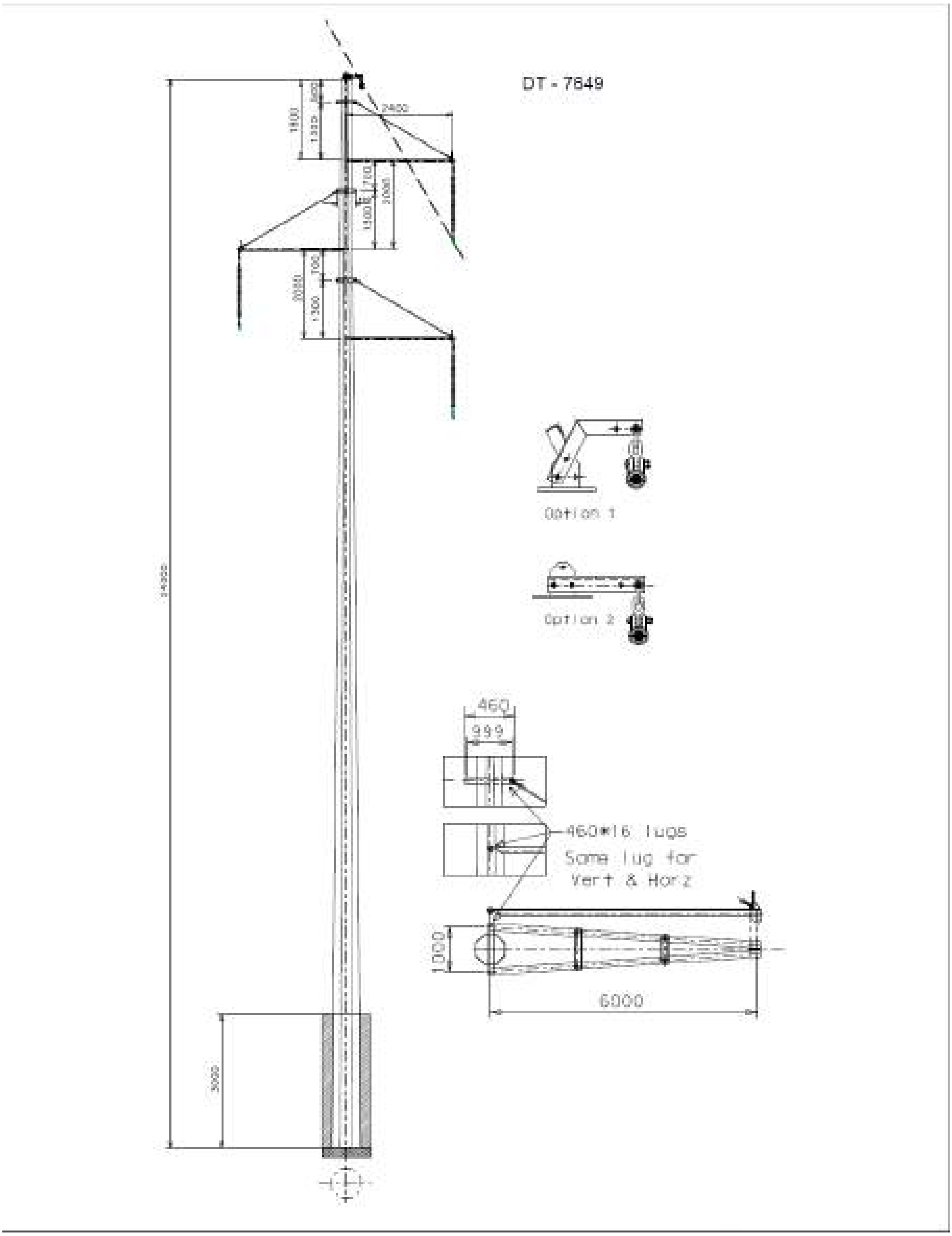
Species	Taxonomic name
House Sparrow	*Passer domesticus*
Kalahari Scrub-Robin	*Cercotrichas paena*
Karoo Eremomela	*Eremomela gregalis*
Karoo Long-billed Lark	*Certhilauda subcoronata*
Karoo Scrub-robin	*Cercotrichas coryphoeus*
Lark-like Bunting	*Emberiza impetuani*
Laughing Dove	*Streptopelia senegalensis*
Layard's Tit-babbler	*Parisoma layardi*
Lesser Grey Shrike	*Lanius minor*
Little Swift	*Apus affinis*
Long-billed Crombec	*Sylvietta rufescens*
Long-billed Pipit	*Anthus similis*
Mountain Wheatear	*Oenanthe monticola*
Namaqua Dove	*Oena capensis*
Namaqua Sandgrouse	*Pterocles namaqua*
Neddicky	*Cisticola fulvicapilla*
Orange River Francolin	*Scleroptila levaillantoides*
Pale-winged Starling	*Onychognathus nabouroup*
Pied Crow	*Corvus albus*
Plain-backed Pipit	*Anthus leucophrys*
Pririt Batis	*Batis pririt*
Pygmy Falcon	*Polihierax semitorquatus*
Red-backed Shrike	*Lanius collurio*
Red-billed Firefinch	*Lagonosticta senegala*
Red-billed Quelea	*Quelea quelea*
Red-crested Korhaan	*Lophotis ruficrista*
Red-faced Mousebird	*Urocolius indicus*
Red-headed Finch	*Amadina erythrocephala*
Red-winged Starling	*Onychognathus morio*
Rock Kestrel	*Falco rupicolus*
Rock Martin	*Hirundo fuligula*
Rufous-eared Warbler	*Malcorus pectoralis*
Sabota Lark	*Calendulauda sabota*
Scaly-feathered Finch	*Sporopipes squamifrons*
Shaft-tailed Whydah	*Vidua regia*
Short-toed Rock-thrush	*Monticola brevipes*
Sociable Weaver	*Philetairus socius*
Southern Grey-headed Sparrow	*Passer diffusus*
Southern Masked-weaver	*Ploceus velatus*
Southern Yellow-billed Hornbill	*Tockus leucomelas*
Speckled Pigeon	*Columba guinea*

Species	Taxonomic name
Spike-heeled Lark	*Chersomanes albofasciata*
Spotted Flycatcher	*Muscicapa striata*
Spotted Thick-knee	*Burhinus capensis*
Swallow-tailed Bee-eater	*Merops hirundineus*
Temminck's Courser	*Cursorius temminckii*
Tinkling Cisticola	*Cisticola rufilatus*
Violet-eared Waxbill	*Granatina granatina*
Wattled Starling	*Creatophora cinerea*
White-backed Mousebird	*Colius colius*
White-browed Sparrow-Weaver	*Plocepasser mahali*
White-rumped Swift	*Apus caffer*
White-throated Canary	*Crithagra albogularis*
White-throated Swallow	*Hirundo albigularis*
Yellow Canary	*Crithagra flaviventris*
Yellow-bellied Eremomela	*Eremomela icteropygialis*

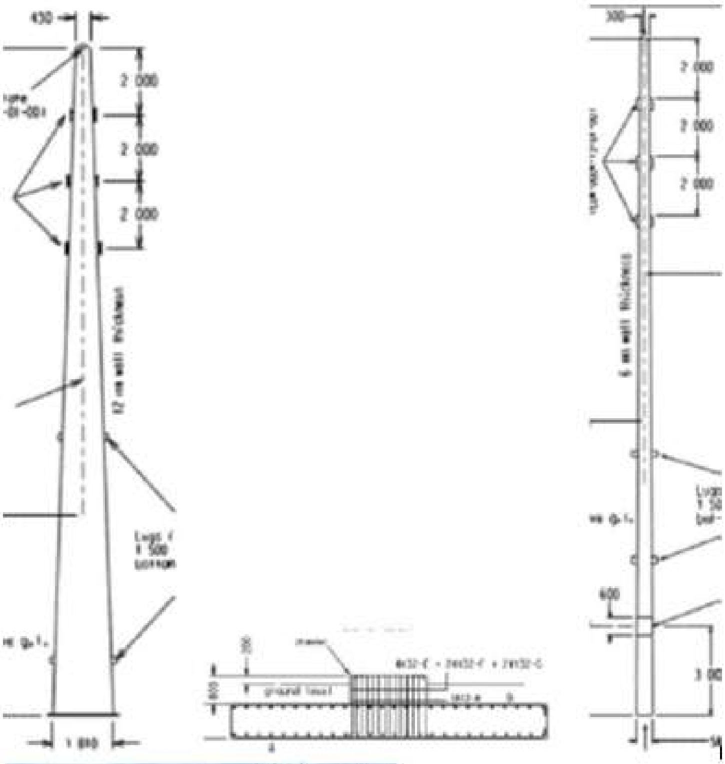
APPENDIX 5: ESKOM GUIDELINES FOR MARKING POWERLINES

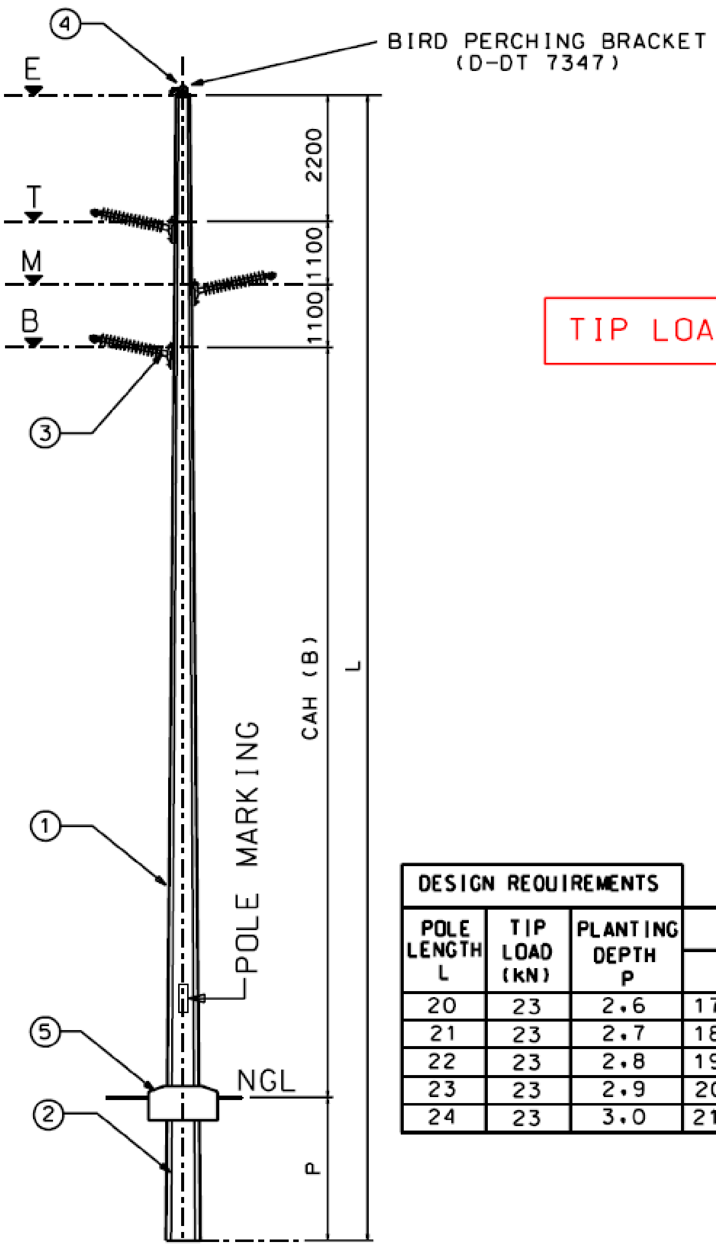


APPENDIX 6: PROPOSED POLE DESIGNS



STEEL MONOPOLE DOUBLE CIRCUIT





TIP LOAD = 23 kN

DESIGN REQUIREMENTS						
POLE LENGTH L	TIP LOAD (kN)	PLANTING DEPTH P	C A H (m AGL)			
			E	T	M	B
20	23	2.6	17.4	15.2	14.1	13.0
21	23	2.7	18.3	16.1	15.0	13.9
22	23	2.8	19.2	17.0	15.9	14.8
23	23	2.9	20.1	17.9	16.8	15.7
24	23	3.0	21.0	18.8	17.7	16.6

REV	REVISION DESCRIPTION	BY	CHKD	AUTH	DATE	PROJECT NO.
2	DRG SHT UPDATED. REFERENCES REV'D. GENERAL REVISION	SLR	RAB	AB	JUNE 2004	

Eskom Distribution

AUTH: A BEKKER
DATE: JAN 2004
CHKD: RAB
DATE: JAN 2004
DRAWN: LMP
DATE: NOV 1998

DISTRIBUTION TECHNOLOGY

RETICULATION/SUB-TRANSMISSION LINES
88/132KV S/C INTERMEDIATE STRUCTURE
GENERAL ARRANGEMENT

DRAWING	SET	SHEET	REVISION
D-DT 7611	2	1	2

A4L

BAT SPECIALIST INPUT:

Basic Assessment for the proposed development of supporting electrical infrastructure to the proposed Kuruman Phase 1 and Phase 2 Wind Energy Facilities near Kuruman in the Northern Cape : BA REPORT

Report prepared for:

CSIR – Environmental Management Services

P O Box 17001

Congella, Durban, 4013

South Africa

Report prepared by:

Kate MacEwan – Inkululeko Wildlife Services (Pty) Ltd

Cluster Box 333, Cotswold Downs Estate

Hillcrest, 3610, KZN

South Africa

September 2018

SPECIALIST EXPERTISE

Name:	**Kate Louise MacEwan (neé Pigott)**
Name of Firm:	Inkululeko Wildlife Services (Pty) Ltd
Position:	Senior Zoologist and Managing Director
Date of Birth:	28 April 1975
Nationality:	United States of America (South Africa - Place of Birth and Permanent Residence)
Languages:	English (mother tongue), Afrikaans

EDUCATIONAL QUALIFICATIONS

- B Sc Hons (Zoology) University of the Witwatersrand, Johannesburg (1998)
- B Sc University of the Witwatersrand, Johannesburg (1997)

MEMBERSHIPS IN PROFESSIONAL & CONSERVATION ORGANISATIONS

- South African Council for Natural Scientific Professions (PrSciNat) – Zoology and Environmental Science
- South African Bat Assessment Association Panel (SABAAP) – current Chairperson
- Zoological Society of Southern Africa (ZSSA)
- Gauteng & Northern Regions Bat Interest Group (GNorBIG) Research Committee Member
- BatsKZN
- Bat Conservation International (BCI)
- Endangered Wildlife Trust (EWT)
- Birdlife South Africa

KEY EXPERIENCE

- **Specialist Experience:**
  - Kate has over 20 years' experience as a practicing Environmental Scientist and Zoologist in the conservation and consulting industries. She has conducted numerous EIAs, EMPRs, faunal assessments within the Gauteng, North West, Limpopo, KZN and Mpumalanga Provinces of South Africa, with the study of Mammals and Bats (Chiroptera) being a key speciality.
  - She has conducted numerous Bat Specialist Assessments for various projects, e.g.
    - Long-term pre-construction bat monitoring projects and Bat Impact Assessments at more than 30 proposed wind farm sites in South Africa.
    - Long-term operational bat monitoring projects at 9 wind farm sites in South Africa.
    - Several Bat Impact Assessment for the collapsing of historic gold mines in the DRC, development of an automobile production factory near Pretoria, old mine adits containing bats at Pilanesburg Platinum Mine, North West Province.
    - Bat Management and Action Plan for a cave on a Driefontein Gold Mine,
  - She is Fall Arrest and Rope Access certified to climb to heights.
  - She has served on the Gauteng & Northern Regions Bat Interest Group (GNorBIG) executive committee for over 14 years. Her duties have included bat scientific research and educational talks to the public.
  - She is the current Chairperson for the South African Bat Assessment Advisory Panel (SABAAP).

- **Courses Completed:**
  - ***2014*** – Rope Access course
  - ***2013*** – South Africa Bat Assessment Advisory Panel – Bats and Wind Energy Workshop, Johannesburg, Gauteng
  - ***2012*** – Anabat Training Workshop, Greyton, Western Cape
  - ***2012*** – Fall Arrest and Rescue Accredited – qualified to climb at heights
  - ***2005 renewed in 2008***: SASS5 Accreditation with the National Department of Water Affairs and Forestry (DWAF)
  - ***2002****:* University of the Witwatersrand Masters Courses successfully completed: Savannah Ecology, Environmental Management, and Biogeochemistry.
  - ***2001***: Foundation course in Environmental Auditing - IEMA approved

Recent Conferences Presented At:

- ***2017*** – Southern African Bat Research Conference, Cape Town, South Africa (Scientific Committee, Presenter and Organising Committee)
- ***2016*** – International Bat Research Conference, Durban, South Africa (Presenter – Wind Energy & Bats)
- ***2015*** – Windaba, Cape Town, South Africa (Presenter – Wind Energy & Bats)

Publications

- Scholes RJ, Gureja N, Giannecchinni M, Dovie D, Wilson B, Davidson N, **Pigott K**, McLoughlin C, van der Velde K, Freeman A, Bradley S, Smart R, Ndala S 2001. The environment and vegetation of the flux measurement site near Skukuza, Kruger National Park. Koedoe 44:73–83
- Aronson, J., Richardson, K, **MacEwan, K**., Jacobs, D., Marais, W., Aiken, S, Taylor, P., Sowler, S. and Hein, C. 1st South African Good Practise Guidelines for Operational Monitoring for Bats at Wind Energy Facilities. South African Bat Assessment Advisory Panel.
- **MacEwan, K**. 2014. Bats and Wind Energy in South Africa. Article published in the March/ April 2014 edition of Footprint Limited magazine.
- **MacEwan, K.** 2016. Fruit bats and wind turbine fatalities in South Africa. African Bat Conservation News 42: 3-5.
- Sowler, S., Stoffberg, S., **MacEwan, K**., Aronson, J., Ramalho, R., Forssman, K., Lötter, C. 2016. South African Good Practice Guidelines for Surveying Bats at Wind Energy Facility Developments - Pre-construction: 4th Edition. South African Bat Assessment Association Guidelines.
- Primary author on the following 3 bat species accounts in Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa:
    - **MacEwan K**, Jacobs D, Schoeman C, Richards L, Cohen L, Monadjem A, Sethusa T, Taylor PJ. 2016. A conservation assessment of *Tadarida aegyptiaca*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.
    - **MacEwan K**, Schoeman C, Monadjem A, Cohen L, Jacobs D, Richards L, Sethusa T, Taylor PJ. 2016. A conservation assessment of *Miniopterus fraterculus*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.
    - **MacEwan K**, Richards LR, Cohen L, Jacobs D, Monadjem A, Schoeman C, Sethusa T, Taylor PJ. 2016. A conservation assessment of *Miniopterus natalensis*. In Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.
- Co-author on an additional 56 species accounts in Child MF, Roxburgh L, Do Linh San E, Raimondo D, Davies-Mostert HT, editors. The Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.
- **MacEwan, K**., Lotter, C., Pierce, M & Morgan, T. Bat Activity in South Africa Ecoregions. In Press

EMPLOYMENT EXPERIENCE

Managing Director & Senior Zoologist: Inkululeko Wildlife Services (Pty) Ltd (October 2014-present)

- Project management and fieldwork for numerous specialist bat and ecological assessments
- Tender and proposal compilation
- Administration and marketing
- Liaison with clients and government officials
- Financial management

Member & Senior Zoologist: Natural Scientific Services CC (October 2003-September 2014)

- Project management and fieldwork for numerous terrestrial and aquatic ecological assessments
- Project management for various Environmental Impact Assessments, Environmental Programme Reports and Water Use Licence applications for the Conservation, Mining, Waste and Industrial sectors.
- Remediation audits within the industrial sector
- Tender and proposal compilation

- Administration and marketing
- Liaison with clients and government officials
- Environmental Education

Environmental Scientist: Jones & Wagener Civil Engineers (March 2000-September 2003)

- Project management for various Environmental Impact Assessments, Environmental Programme Reports and Water Use Licence applications for the Mining, Waste and Industrial sectors
- Fieldwork for surface water quality and ecological assessments
- Tender and proposal compilation
- Liaison with clients and government officials

Area Manager (contract post): Working for Water – Kruger National Park (October 2000-January 2001)

- Management of Alien Plant Clearing operations; Project / Financial administration; People management

Zoo Keeper: Johannesburg Zoological Gardens (September 1998-March 2000)

- Husbandry of carnivores, pachyderms and ungulates; Rearing of injured or orphaned animals of all kinds; Environmental Education; Waste Management; People Management – employees and public

SPECIALIST DECLARATION

I, **Kate MacEwan**, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Name of Specialist: **Kate MacEwan**

Date: **27 September 2018**

EXECUTIVE SUMMARY

Mulilo Renewable Project Developments (Pty) Ltd intend on developing two wind energy facilities (WEFs) – Kuruman Phase 1 WEF and Kuruman Phase 2 WEF, approximately 8 km south west of Kuruman in the Northern Cape. These WEFs will require connection into the electrical grid. The proposed transmission line routes alternatives are as follows:

- Alternative 1: runs from the Kuruman Phase 1 substation to the Kuruman Phase 2 substation to the Ferrum substation (located in Kathu).
- Alternative 2: runs from Kuruman Phase 1 substation to Segame substation (located in Kuruman).
- Alternative 3: runs from Kuruman Phase 2 substation to Kuruman Phase 1 substation to the Segame substation (located in Kuruman).

A Basic Assessment (BA) Process, contemplated in terms of Regulation 19 and 20 of the Environmental Impact Assessment Regulations of 2014 (as amended in 2017), is required in order to obtain Environmental Authorisation for the development of 132kV overhead transmission line in support of the proposed WEFs, as required in terms of NEMA.

Mulilo has appointed the Council for Scientific and Industrial Research was appointed to undertake the BA Process, and as such, the CSIR have appointed Inkululeko Wildlife Services (Pty) Ltd (IWS) to provide the bat specialist input.

Bats, the second most diverse mammal group on the planet, warrant consideration and protection at the very least due to their economic value and the ecosystem services they provide, although tourism and biodiversity heritage value is also very important. The Northern Cape Nature Conservation Act, Act No 9 of 2009 recognizes 58 bat species as protected.

Whilst a bat specialist assessment is not required for input into all transmission line EA processes, there are certain development triggers for bat specialist assessments according to the South African Bat Assessment Association (SABAA). Due to the fact that the Kuruman area has extensive underlying dolomite geology (known for cave formation), the transmission line crosses over rocky outcrops and there is a known bat roost within 1.5 km of the Segame substation and another within 25 km of the transmission line routed to the Ferrum substation, the triggers for the Kuruman project are as follows:

- Potential disturbance or destruction of cave-type roosts, abandoned or defunct mines or underground structures and/ or natural cave systems
- Potential disturbance within 500 m of the above. Please note: this is a minimum distance and the specialist may need to assess a bigger area, depending on the size of the roost and the type of the development.
- Potential disturbance or destruction of natural rocky outcrops.
- The transmission line corridor may also intersect foraging areas of the cave roosting bats or migration routes of the cave roosting bats.

By conducting a desktop assessment of legislation, guidelines literature and spatial data, 3 days of fieldwork in August 2018 and landowner consultation, IWS was able to compile and bat sensitivity map and conduct a bat impact assessment for input into the BA.

Based on historical records and modelled distributions and IWS's knowledge, 13 bats have the potential to occur along the alternative transmission line routes, but vary in their likelihoods of occurrence. Two of the bats listed are Near Threatened species. However, it is not only conservation important or rare bats for which buffer zones, impact avoidance and mitigation measures should be implemented. All bats are particularly susceptible to anthropogenic changes because of their low reproductive rate, longevity, and high metabolic rates. Therefore, all of the 13 above species will be considered in the impact assessment.

Various roost small potential roosts, such as house roofs, water towers, ruins, rocky outcrops and trees were identified along the transmission line corridor. Larger cave type roosts were identified 10-60 km away from the corridor. Foraging habitats along the corridor area included natural bushveld, thornveld, rocky ridges, open water and wetlands.

The potential impacts to bats by the transmission lines during the construction phase could include roost disturbance and foraging habitat loss, alteration or disturbance associated with clearing the right of way (which is expected to continue into the operational phase) and sensory disturbance due to increased levels of noise and dust associated with heavy vehicles and other machinery. During the operational phase, bats could potentially be negatively impacted by collision with and electrocution by (fruit bats only) the transmission lines (but the likelihood is low) and electrocution at the sub-stations. Other potential impacts associated with the operational phase include health and behavioural impacts due to electromagnetic radiation emitted by the transmission lines, however, due to a lack of research in this area, there is a low confidence in this impact.

The significance of the different impacts pre-mitigation were assessed as having low to moderate significances. All impacts were reduced to a very low and low significance, on condition that the following mitigation measures are implemented:

- High sensitivity areas were considered to have high roosting and/ or foraging potential. These areas are potentially unsuited to development owing to the High bat importance. Where possible, transmission lines to avoid areas of high bat sensitivity. Overhead transmission lines may cross overhead of linear wetlands and rivers, as long as no ground infrastructure such as pylons, lay-down areas, sub-stations or construction camps are in these areas. All other areas of High bat sensitivity, especially trees and old and new buildings and their associated buffers should be avoided, where possible.
- Medium-High sensitivity areas have potential for medium-high significance impacts and should be avoided, where possible. Overhead transmission lines may cross overhead of these areas. Where possible, ground infrastructure such as pylons, lay-down areas, sub-stations or construction camps should avoid these areas. The exception would be for safety reasons in terms of pylon spacing.
- If any trees or buildings are demolished along the route, these should be thoroughly inspected for bat presence. If bats are present, they should be chased away before demolition. Each tree and/or building should be replaced with a bat box in an area near water and not intended for future development (contact: http://ecosolutions.co.za/products-services/bat-boxes)
- Make sure that new sub-stations, built for this project are bat-friendly. i.e. there should be no opportunity for roosting – no small gaps between electrical infrastructure and buildings and into roofs. No hanging spaces. High fencing to avoid fly throughs. Consult with a bat specialist during the design and construction phases.
- Awareness and education of contractors.

If all the mitigation and management measures described in the report are implemented, the residual impacts will likely be low and IWS does not object to the project. There are greater cumulative threats to bats in the area due to proposed wind energy developments, large scale mining operations and general habitat degradation.

LIST OF ABBREVIATIONS

BA	Basic Assessment
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CSIR	Council for Scientific and Industrial Research
DEA	Department of Environmental Affairs
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
GPS	Global Positioning System
IWS	Inkululeko Wildlife Services (Pty) Ltd
Mulilo	Mulilo Renewable Project Developments (Pty) Ltd
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NEM:BA	NEM: Biodiversity Act, 2004 (Act 10 of 2004)
NEPAD	New Partnership for Africa's Development
NFEPA	National Freshwater Ecosystem Priority Areas
SABAA	South African Bat Assessment Association
TOPS	Threatened and Protected Species
WEF	Wind Energy Facility

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	√ pages 1-3
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	√ page 4
c) an indication of the scope of, and the purpose for which, the report was prepared;	√ page 11
(cA) an indication of the quality and age of base data used for the specialist report;	√ pages 12-13
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	√ pages 24-27
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	√ page 12
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	√ pages 12
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	√ pages 13-17
g) an identification of any areas to be avoided, including buffers;	√ pages 21-23
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	√ pages 22-23
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	√ page 13
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, ~~including identified alternatives on the environment or activities;~~	√ pages 23-27
k) any mitigation measures for inclusion in the EMPr;	√ page 28-29
l) any conditions for inclusion in the environmental authorisation;	√ page 28-29
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	√ page 28-29
n) a reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	√ page 30
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	√ page 12
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	X
q) any other information requested by the competent authority.	N/A
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

TABLE OF CONTENTS

TABLES AND FIGURES

BAT SPECIALIST STUDY

1.1. INTRODUCTION AND METHODOLOGY

1.1.1. Scope and Objectives

Mulilo Renewable Project Developments (Pty) Ltd (Mulilo) intend on developing two wind energy facilities (WEFs) – Kuruman Phase 1 WEF and Kuruman Phase 2 WEF, approximately 8 km south west of Kuruman in the Northern Cape. These WEFs will require connection into the electrical grid. The proposed transmission line routes alternatives are as follows:

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- Potential disturbance or destruction of natural rocky outcrops.
- The transmission line corridor may also intersect foraging areas of the cave roosting bats or migration routes of the cave roosting bats.

1.1.2. Terms of Reference

The terms of reference provided to IWS by the CSIR for the bat specialist assessment was as follows:

- A single site visit including field surveys for the proposed transmission line alternatives.
- Screening of environmental sensitivities on site based on the site visit and other sources, to identify no-go areas for the transmission lines. Based on the screening, an environmental sensitivity map must be compiled by the specialist to identify the sensitive areas on site (low, medium and high or no-go areas). The proposed routing of the line will then be informed by these no-go areas.
- A draft specialist assessment report (the input complying with content requirements of Appendix 6 of the Environmental Impact Assessment (EIA) Regulations, 2014, as amended) to be included in the Draft BA Report; and

- A final specialist assessment report (the input complying with content requirements of Appendix 6 of the EIA Regulations, 2014, as amended) to be included in the Final BA Report.

1.1.3. Approach and Methodology

The approach to the Bat Impact Assessment included the following stages:

1.1.4. Desktop Review

Desktop research was based mainly on:

- Twelve month bat monitoring reports from the Kuruman Phase 1 and Phase 2 WEFs conducted by Animalia.
- IWS's roost database.
- Geological features.
- Bat Assessment for the Electricity Grid Infrastructure (EGI) Strategic Environmental Assessment (SEA).
- Landowner Interviews.
- Relevant publications.
- Recent Red Data bat species listings.
- Relevant legislation and policies.
- Communication with other bat scientists and interest groups in South Africa.

1.1.5. Spatial Data Used

Whilst various environmental parameters and spatial data sources were considered for the bat sensitivity spatial mapping exercise, only those parameters considered important for bats, as either important for roosting or foraging were selected and used. The relevant sensitive environmental spatial layers were selected on the maps and buffered according to defendable criteria.

1.1.6. Fieldwork

From the 7th to the 9th of August 2018, IWS conducted a field drive/ walk through assessment of the proposed route and of known and potential roosts within a 70 km radius of the line. Such an assessment and the season is appropriate for this type of development. The following field tasks were conducted:

- The majority of the proposed transmission line routes were driven and any important bat features were noted and photographed and GPS coordinates recorded. Where necessary, an inspection of the feature was conducted.
- Five known cave-type roosts were inspected - the Eye of Kuruman, Wonderwerk Cave, Soetfontein Cave and Boesmansgat Cave. We tried to revisit Blinklip Cave, but could not get hold of the landowner to gain access. However, IWS had investigated that cave in 2014.
- Where access was possible, old mine areas were visited.
- A SongMeter 2 (SM2) bat detector was left to record bat activity from sunset to sunrise outside of Boesmansgat Cave on the night of 8 August 2018.

1.1.7. Landowner consultation

Various landowners or representatives were contacted to gain access to land. In some cases landowners were able to provide additional information relevant to potential bat roosts.

In particular, IWS would like to thank Colonel Abie Wiid of the South African Defense Force for accompanying IWS through the Lohatla Training Base.

1.1.8. Data Analysis and Reporting

Information gathered during the desktop research and data collected during the fieldwork were analyzed and used in the bat sensitivity mapping and impact assessment.

1.1.9. Assumptions and Limitations

The following assumptions and limitations apply:

- Only a brief three day and two night assessment was conducted for this project, no baseline monitoring was undertaken as part of this assessment;
- Not all defunct mine tunnels where bats can congregate are known.
- Lack of data on the impacts of transmission lines on bats in South Africa.
- Bat roost data is limited to data voluntarily supplied by bat specialists and published literature. The co-ordinates provided by some of the published sources are old and/ or they are only provided in degrees and minutes, therefore there are potentially accuracy concerns.

1.1.10. Source of Information

In addition to information gained from landowners and published literature cited in text and the reference list, the following sources of information were used in the assessment:

- Animalia. 2018. Bat Specialist EIA Assessment for the Proposed Development of the Phase 1 Kuruman Wind Farm Facility, Kuruman, Northern Cape Province: EIA REPORT
- Animalia. 2018. Bat Specialist EIA Assessment for the Proposed Development of the Phase 1 Kuruman Wind Farm Facility, Kuruman, Northern Cape Province: EIA REPORT
- Terrestrial Ecoregions spatial data. 2012. The Nature Conservancy, Arlington, VA. Available at http://maps.tnc.org/files/shp/terr-ecoregions-TNC.zip
- Council for Geosciences SA spatial data. 1997. Geology wr90 shapefile and Geology_Geoscience shapefile. Limited metadata are available but date of creation is 1997. Four main lithologies were selected as relevant to bats in terms of roosting potential: Limestone, Dolomite, Arenite and Sedimentary and Extrusive rock.
- Roost databases from a collection of scientists, collated by the CSIR in 2017 and desktop refined by IWS IWS in 2018. Main sources were: Bats KZN database, Inkululeko Wildlife Services database, Herselman and Norton (1985), Wingate (1983), Rautenbach (1982), David Jacobs database, Animalia database.
- National Freshwater Ecosystem Priority Areas. 2011.
- wriall500_primary shapefile. Department of Water and Sanitation.
- 2016 for use in the National Bat Red Data listings (Child et al 2016).
- 2013 – 2014 South African National Land-Cover Dataset. Created by GeoterraImage for the DEA, Pretoria. Version 05, February 2015. Available at https://egis.environment.gov.za/data_egis/data_download/current or http://bgis.sanbi.org/Projects/Detail/44

1.2. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO BAT IMPACTS

It is well described that certain bird families are severely impacted by transmission lines (Jenkins, 2010), however, less is known about the impacts on bats, especially in SA. Of the literature which is available, it has been reported that certain fruit bat species (Pteropodidae) in Asian and Australasian countries have fallen victim to electrocution due to transmission lines (Martin 2011; Rajeshkumar et al 2013). This effect was exemplified in a study by Krystufek (2009) on Indian flying foxes (*Pteropus giganteus*) in the Sri Lankan Paradeniya Botanic Garden. The study revealed that dead bats were regularly found hanging on the transmission lines and that on one particular day as many as 74 carcasses were found over a 3 km stretch of transmission line.

Anecdotal evidence exists from Malawi, Zambia and possibly Windhoek of a handful of fruit bats being found dead below power lines due to possible electrocution or collision (Rachael Cooper-Bohannon, Bats Without Borders, *pers. Comm.* 30 November 2017).

It would only be fruit bats that have the potential for electrocution on power lines in SA, and only where parallel lines are closely spaced or where sagging on lines may occur. There is only one fruit bat that has the potential of occurring near the current project site - *Eidolon helvum* (the African Straw-colored Fruit Bat) and occurrence records are of individual bats, not large numbers (Monadjem et al 2010). Due to the small size of the insectivorous bats in South Africa, electrocution is unlikely on the transmission lines themselves, but possible at the sub-stations (Conrad Hoegstad, Endangered Wildlife Trust, *pers. comm*. 9 December 2015). Collision with transmission lines or pylons in high density bat areas (i.e. near a roost exit or in a bat flight path) is more likely than electrocution.

The potential impacts to bats during the construction phase could include roost disturbance and foraging habitat loss, disturbance or alteration associated with clearing the right of way (which is expected to continue into the operational phase) and sensory disturbance due to increased levels of noise and dust associated with heavy vehicles and other machinery. During the operational phase, bats could potentially be negatively impacted by collision with transmission lines and pylon infrastructure and electrocution at sub-stations. Other potential impacts associated with the operational phase include health and behavioural impacts due to electromagnetic radiation emitted by the transmission lines. Electromagnetic radiation is also said to have behavioural effects on bats and rats (Nicholls & Racey, 2007; Nicholls & Racey, 2009). The impacts suggested may be compounded if the transmission line is erected along bat migratory routes or high density roosting or foraging areas.

Mulilo intends on using steel monopole pylons (single or double circuit) for the transmission line. The height of the lines will be 15 m. This is in the flight height range of all of South African bat species (evidence of this fact is from over 42 bat monitoring projects for wind farm developments that IWS has performed over the last six years, where acoustic recordings of bats have been conducted at heights of 1m, 3 m, 10 m, 20 m, 40 m, 60 m, 80 m and 100 m above ground level). At the neighbouring proposed Kuruman WEF Phase 1 and Phase 2, where Animalia (2018) conducted 12 months of acoustic monitoring, the following five bat species were detected at heights of between ground level and above 60 m - *Eptesicus hottentotus* (Long-tailed Serotine), *Tadarida aegyptiaca* (Egyptian Free-tailed Bat), *Sauromys petrophilus* (Roberts Flat-headed Bat), *Neoromicia capensis* (Cape Serotine Bat) and *Miniopterus natalensis* (Natal Long-fingered Bat).

1.3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

Bat important features include buildings and building ruins, trees, rocky outcrops, old mines and caves for roosting and natural vegetation, irrigated crops, wetlands, rivers and water bodies for foraging.

1.3.1. Geology

Geology is a significant environmental parameter for bats (Kunz et al 2012), and many South African bats are crevice or hollow-roosting species (Monadjem et al 2010). Crevice roosting bats utilizing rock cracks, bridge expansion joints, under tree bar, etc. usually roost individually or in small groups, although they can congregate in larger numbers, especially in the eastern parts of the country. Hollow-roosting bats utilize larger hollows, such as caves, tunnels and roofs of houses. Solution caves are the most frequently occurring caves and such caves form in rock that is soluble, such as limestone, dolomite and salt. In South Africa, caves or karst formations are mostly associated with rocks such carbonate rocks like limestone and dolomite. A map of the geology along and adjacent to the transmission line is shown in Figure 1. Whilst there is no underlying dolomite along the corridor, it does feature prominently to the east and to a lesser extent in the south west.

Rocky outcrops and overhangs in the north eastern sections of the corridor can provide several potential small roosting spaces for bats.

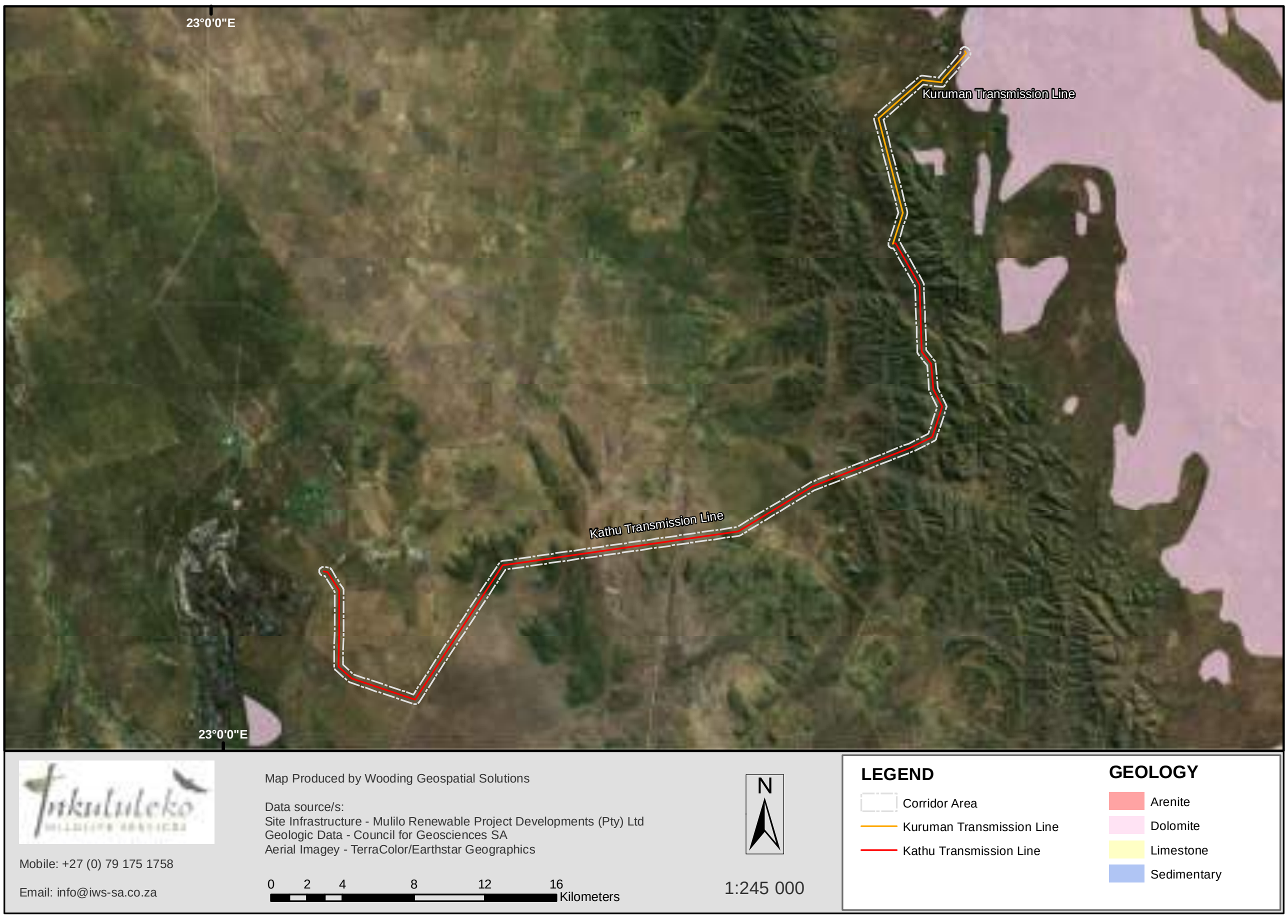

Figure 1. Geology along the transmission line corridor

1.3.2. Hydrology

There is strong support for the importance of rivers and riparian areas for bats as movement corridors, refuge areas, for drinking and for foraging (Serra-Cobo et al 2000; Akasaka et al 2009; Hagen & Sabo, 2012). Wetlands and dams provide drinking and foraging opportunities for bats.
In dryer climates, any water sources are important, including intermittent streams and rivers, as found on site.

Intermittent rivers and ephemeral streams are temporally dynamic ecosystems that can support a unique diversity of aquatic invertebrate fauna, including various stages of the life cycles of Caddisflies, Stoneflies, True flies, Bugs and Beetles (Stubbington et al 2017), all edible to bats in their flying adult form.

The hydrology along and adjacent to the transmission line is shown in Figure 2, including wetlands/ rivers identified by the wetland specialist on site and farm dams and reservoirs.

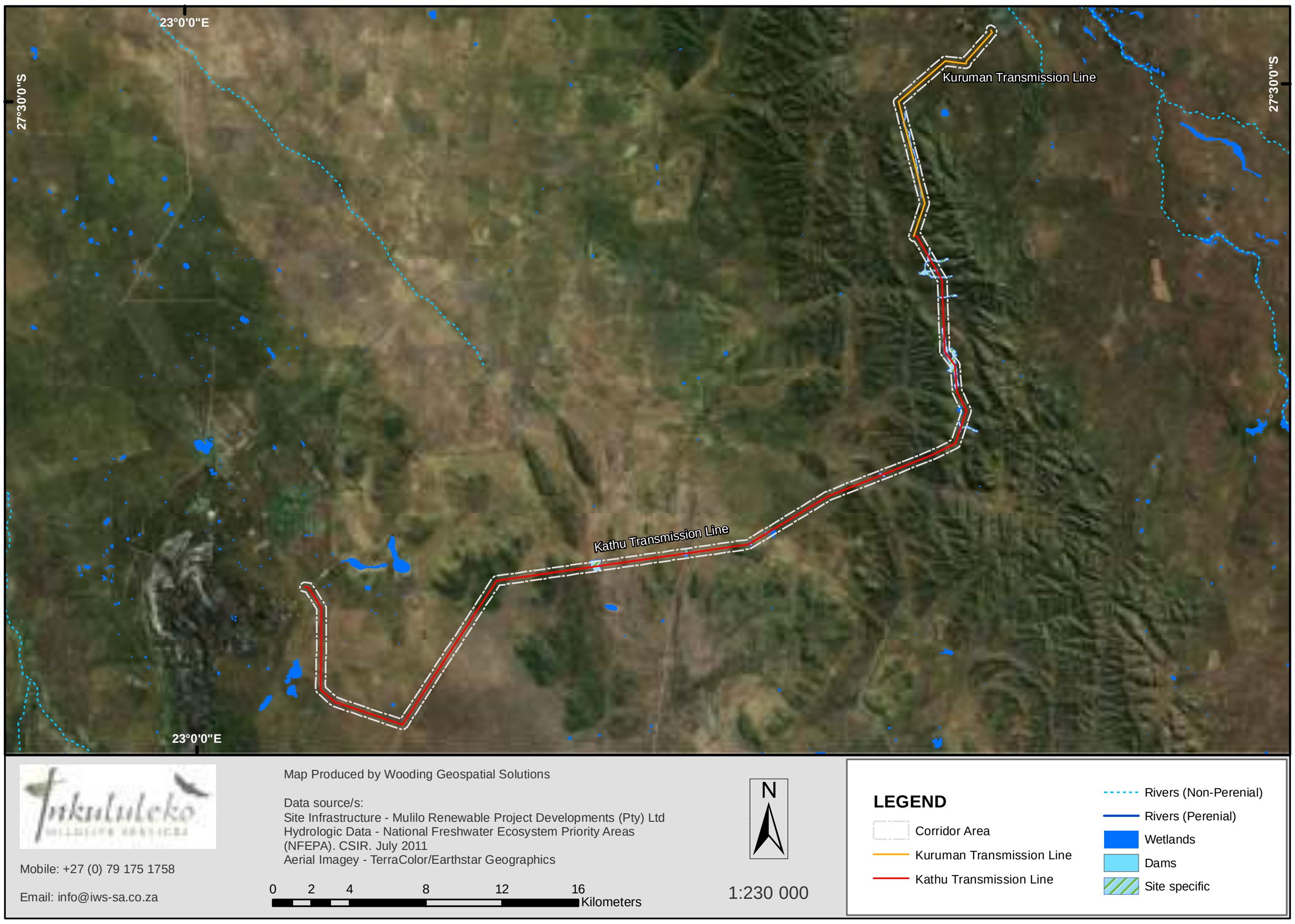

Figure 2. Hydrology along the transmission line corridor

1.3.3. Vegetation

Trees and heterogenic landscapes are important for bats (Heim et al 2015) especially in dry regions (Hacket et al 2013). The vegetation units along and adjacent to the transmission line is shown in Figure 3. Three vegetation types exist along the route – Kathu Bushveld, Kuruman Thornveld and Kuruman Mountain Bushveld. None of these are considered particularly sensitive to bats.

Terrestrial Ecoregions are large units of land containing a geographically distinct assemblage of species, natural communities, and environmental conditions (WWF, 2014). The Ecoregion concept is similar to the Biome concept, incorporating both vegetation communities and climate. There is evidence to suggest that bats might adapt to local environmental conditions at a Biome level (Miller-Butterworth et al 2003). The entire transmission line corridor falls within the Kalahari Xeric Savanna Ecoregion.

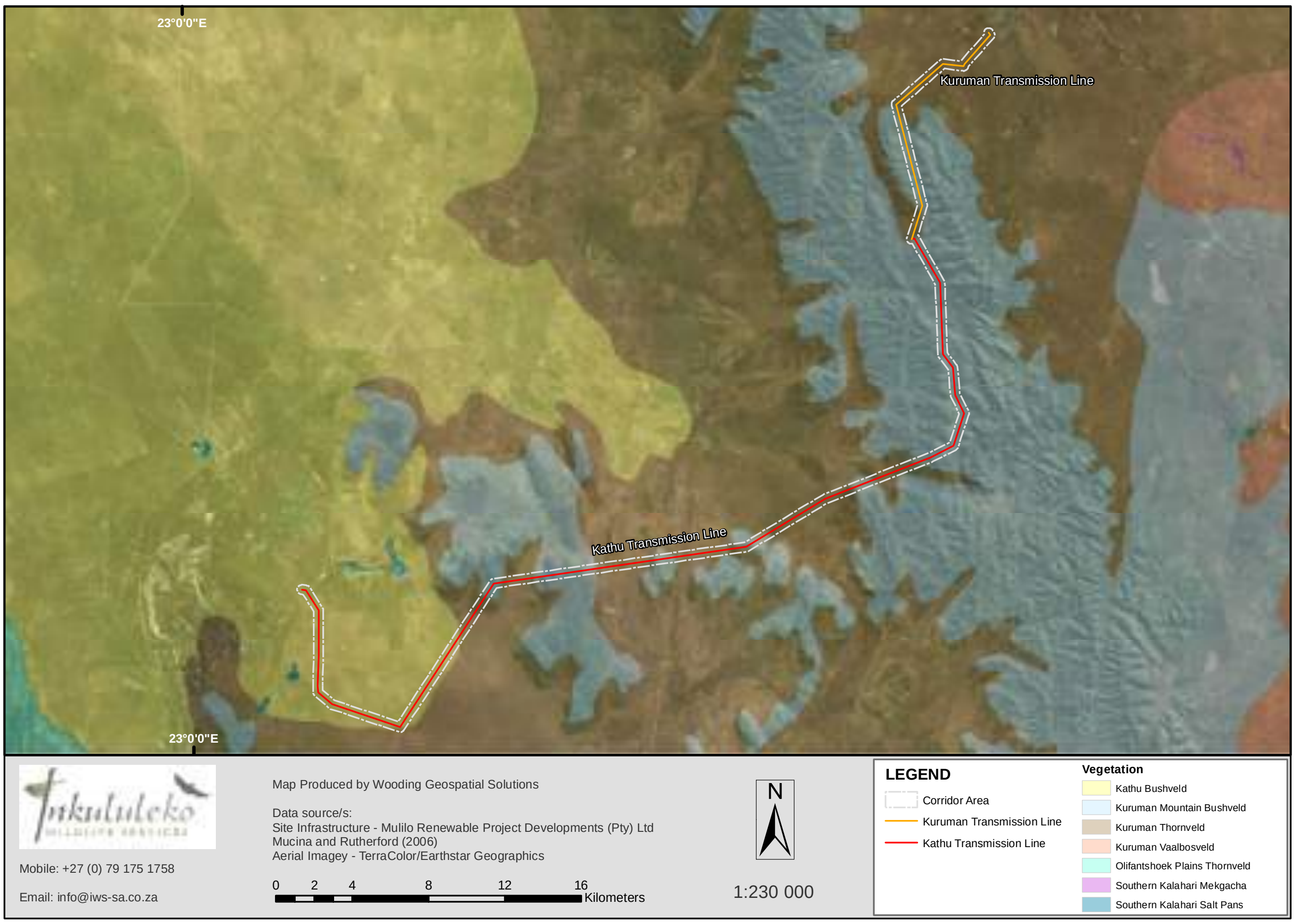

Figure 3. Vegetation units along the transmission line corridor

1.4. APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

1.4.1. International

There are various international conventions, unions and treaties in place for the protection of biodiversity, including bats. Below are just a few:

- Convention on Biological Diversity
- The Bonn Convention (on the Conservation of Migratory Species of Wild Animals)
- CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora)
- Agenda 21 and Rio Declaration
- The IUCN (World Conservation Union)

1.4.2. Regional Agreements

Certain agreements are relevant biodiversity on the continent of Africa of which the Environmental Initiative of the New Partnership for Africa's Development (NEPAD) Action Plan was established during the 2003 African Convention on Conservation of Nature and Natural Resources held in Maputo.

1.4.3. National Legislation and Guidelines

Unlike in the UK and the USA, bats are not directly legally protected in South Africa. However, there are various Acts and Regulations relevant to the protection of fauna, including bats:

- National Environmental Management Act, 1998 (Act 107 of 1998)

- NEM: Biodiversity Act, 2004 (Act 10 of 2004) (NEM:BA)
- NEM: Biodiversity Act, 2004: Threatened and Protected Species (TOPS) Regulations

1.4.4. Provincial Legislation and Guidelines

Each province of SA has its own conservation legislation, guidelines or policies. Most provinces list all or some bats as Protected Species (PS). Such legislation, guidance or policy should be seriously taken into consideration in site specific EIAs. In addition, most provinces require that permits are required for work that involves catching and handling of wild animals and hunting of wild animals, including bats. The Northern Cape Nature Conservation Act, Act No 9 of 2009 recognizes 58 bat species as protected.

1.4.5. Bat Monitoring Guidelines

Whilst not directly relevant to transmission line development, the following national monitoring guidelines for bats and wind energy facilities (WEFs) have been released and have been adopted as the best-practise guidelines by DEA, Environmental Assessment Practitioners (EAPs) and specialists. Some aspects of these guidelines can be adopted to transmission line assessments. The guidelines are as follows:

- South African Good Practice Guidelines for Operational Monitoring for Bats at Wind Energy Facilities. 1st Edition (Aronson et al 2014).
- South African Good Practise Guidelines for Surveying Bats in Wind Energy Facility Development – Pre-construction. Edition 4.1 (Sowler et al 2017)
- The South African Bat Fatality Threshold Guidelines Edition 2 (MacEwan et al 2018) (under revision).
- Mitigation Guidance for Bats at Wind Energy Facilities in South Africa. 2nd Edition (Aronson et al 2018).

1.4.6. Buffer Zones

SABAA recommends a minimum 200 m buffer around all potentially important bat features including e.g., rocky ridges and outcrops, delineated watercourses, woody vegetation (aloes and trees including alien bush clumps), protected areas (as defined by NEM:PA (Act 57 of 2003) and built structures (e.g., mine adits, farm buildings, bridges and water towers) for any development.

For transmission lines: No transmission line infrastructure should be constructed within 2 km of any large known confirmed roosts and 500 m from smaller confirmed roosts. However, transmission lines can cross bat important foraging areas such as freshwater features, as long as all the other water use license mitigation measures are in place in the case of wetlands and rivers.

Appropriate site-specific buffers need to be selected by a qualified specialist for bat conservation important habitat (whether it is for foraging or roosting) that will meet the requirements of the particular species or populations occurring in the area.

1.5. RESULTS OF THE DESKTOP REVIEW AND FIELD ASSESSMENT

1.5.1. Potential Bat Species

Based on historical records and modelled distributions (Monadjem et al 2010) and IWS's knowledge, 13 bats, presented in Table 1 have the potential to occur along the alternative transmission line routes, but vary in their likelihoods of occurrence.

Table 1. Potential Bat Species for the Kuruman Phase 1 and Phase 2 Transmission Lines

Scientific name	Common name	Regional Red List Status 2016*	Likelihood of Occurrence	Confirmed at / near certain cave roosts**
Cistugo seabrae	Angolan Hairy Bat	Near Threatened	Low	-
Eidolon helvum	African Straw-colored Fruit Bat	Least Concern	Medium	-
Eptesicus hottentotus	Long-tailed Serotine Bat	Least Concern	Medium	-
Hipposideros caffer	Sundevall's Leaf-nosed Bat	Least Concern	Low	Soetfonetin
Miniopterus natalensis	Natal Long-fingered Bat	Least Concern	High	Soetfontein, Blinkklip, Wonderwerk, Boesmansgat
Myotis tricolor	Temminck's Hairy Bat	Least Concern	Low	-
Neoromicia capensis	Cape Serotine Bat	Least Concern	High	Boesmansgat
Nycteris thebaica	Egyptian Slit-faced Bat	Least Concern	High	-
Rhinolophus clivosus	Geoffroy's Horseshoe Bat	Least Concern	High	Soetfontein, Blinkklip, Eye of Kuruman
Rhinolophus damarensis	Damara Horseshoe Bat	Least Concern	High	Wonderwerk
Rhinolophus denti	Dent's Horseshoe Bat	Near Threatened	High	Soetfontein, Blinkklip, Wonderwerk,
Sauromys petrophilus	Flat-headed Free-tail Bat	Least Concern	Low	-
Tadarida aegyptiaca	Egyptian Free-tailed Bat	Least Concern	High	Wonderwerk, Boesmansgat

* Child et al 2016
** This does not exclude them from occurring in other suspected roosts or foraging all along the corridor. Bats forage over long distances nightly and migrate over substantial distances seasonally. Non-cave dwellers are likely to occupy a variety of the identified potential roosts.

Whilst the two Near Threatened species listed in above will be of concern, particularly the confirmed Dent's Horseshoe Bat, it is not only conservation important or rare bats for which buffer zones, impact avoidance and mitigation measures should be implemented. All bats are particularly susceptible to anthropogenic changes because of their low reproductive rate, longevity, and high metabolic rates (Voigt and Kingston 2016), limiting their ability to recover from declines and to maintain sustainable populations (Barclay and Harder 2003). Therefore, all of the 13 above species will be considered in the impact assessment.

1.5.2. Roost and Bat Foraging Feature Inspection Results

The tracks driven and walked and the features identified or inspected on site are shown in Figure 4.

Figure 4. Field Assessment Tracks and Waypoints

IWS had inspected all of the caves in Table 2, except Boesmansgat, between 2011 and 2014 and now again for this assessment in August 2018, including Boesmansgat. In addition, Monadjem et al (2008) inspected all of the caves, excluding Wonderwerk and Boesmansgat in March and April 2008. The findings from each visit were as follows in Table 2.

Table 2. Summary of Cave Findings Over the Last 10 Years

	Soetfontein	**Wonderwerk**	**Blinkklip**	**Eye of Kuruman**	**Boesmansgat**
2008	20-50 *Rhinolophus clivosus* 1 *Rhinolophus denti* 1200 *Miniopterus natalensis*	-	15-20 *Rhinolophus clivosus*	1 *Rhinolophus clivosus*	-
2011-2014	12 *Rhinolophus clivosus* 100 *Rhinolophus denti,* , 100 *Miniopterus natalensis* and *Hipposideros caffer* recorded but numbers unclear	No confirmation of bats roosting in cave, but lots of evidence of night roosting. *Rhinolophus denti, Rhinolophus damarensis* and *Miniopterus natalensis* activity recorded outside cave mouth. Established owl roost within cave. *Tadarida aegyptiaca* and *Neoromicia capensis* roosting in	12 *Nycteris thebaica* recorded, 1 *Miniopterus natalensis* caught and released 12 *Rhinolophus denti* caught and released.	Gate locked	-

		rock crevices at cave entrance			
2018	50-100 *Rhinolophus clivosus* 200-500 *Rhinolophus denti* *10 Rhinolophus damarensis* 20-50 *Miniopterus natalensis* 4 *Nycteris thebaica* Screengrabs of one of each call is in Appendix 1.13	Serious archaeological digging in the cave, so bat presence not evident and unlikely	Could not get hold of the landowners	Gate locked	No evidence of bats roosting in the lower chamber. Upper chamber not accessible, but the following bat passes were recorded on the night of 8 August 2018 captured Bat passes recorded from sunset to sunrise included: 291 *Tadarida aegyptiaca* 16 *Neoromicia capensis* 1 *Miniopterus. Natalensis* Screengrabs of one of each call is in Appendix 1.13

1.5.3. Route Investigation Results

Ground-truthed points and associated photographs can be found in Appendix 1.13. This information, together with the features marked in Figure 4 and desktop level information were used to compile the sensitivity map in Section 1.6.

1.6. SENSITIVITY MAP

Using data gathered from the desktop review and from on the ground field assessment, a sensitivity map was constructed for the transmission line corridor using the features and buffers specified in Table 3. The resulting sensitivity map is shown in Figure 6 and Figure 6.

Table 3. Bat Sensitivity Map Features for the Kuruman Phase 1 and Phase 2 Transmission Lines

Feature	Feature Sensitivity	Feature Buffer 1	Buffer 1 Sensitivity	Feature Buffer 2	Buffer 2 Sensitivity
All Old Mines	Medium-High	500 m	Medium-High	2000 m	Medium
All Dams, Wetlands, Rivers (perennial and non-perennial), Waterpoints and Reservoirs (please use the attached site-specific wetlands and rivers rather than the generic ones. However, please keep all dams, water points and resevoirs).	High for the feature and 32m buffer	200 m on top of the 32m buffer	Medium-High	2000 m	Medium
Rocky Areas/ Rocky Outcrops	Medium-High	500 m	Medium-High	2000 m	Medium
Homesteads/ Town Edges/ Sub-stations/ Stone Ruins/ Farm Buildings	Medium-High	500 m	Medium-High	2000 m	Medium
Eye of Kuruman	Medium-High	200 m	Medium-High	2000 m	Medium
Wonderwerk Cave	Medium-High	200 m	Medium-High	2000 m	Medium
Boesmansgat Cave	Medium-High	500 m	Medium-High	2000 m	Medium
Blinkklip Cave	Medium-High	500 m	Medium-High	2000 m	Medium
Soetfontein Cave	High	2000 m	High	10000 m	Medium
Dolomite Geology	Medium-High	500 m	Medium-High	10000 m	Medium

1.6.1. Protocol for Areas of Bat Sensitivity

Table 4. Protocol for varying levels of Bat Sensitivity

Sensitivity	Description and Protocol
High	High sensitivity areas were considered to have high roosting and/ or foraging potential. These areas are potentially unsuited to development owing to the High bat importance. Overhead transmission lines may cross overhead of linear wetlands and rivers, as long as no ground infrastructure such as pylons, lay-down areas, sub-stations or construction camps occur within these areas. All other areas of High bat sensitivity, especially roosts and their associated High sensitivity buffers should be avoided.
Medium-High	Medium-High sensitivity areas have potential for medium-high significance impacts and should be avoided, where possible. Overhead transmission lines may cross overhead of these areas. Where possible, ground infrastructure such as pylons, sub-stations or construction camps should avoid these areas. The exception would be for safety reasons in terms of pylon spacing.
Medium	Medium sensitivity areas were considered to have medium roosting and/ or foraging potential. These areas are potentially suitable for development, but low significance impacts may occur.
Low	Low sensitivity areas were all remaining areas and were considered to have low roosting and/ or foraging potential and no known occurrence of conservation important species. Impacts on bats in these areas are unlikely. These areas are the most suitable for development

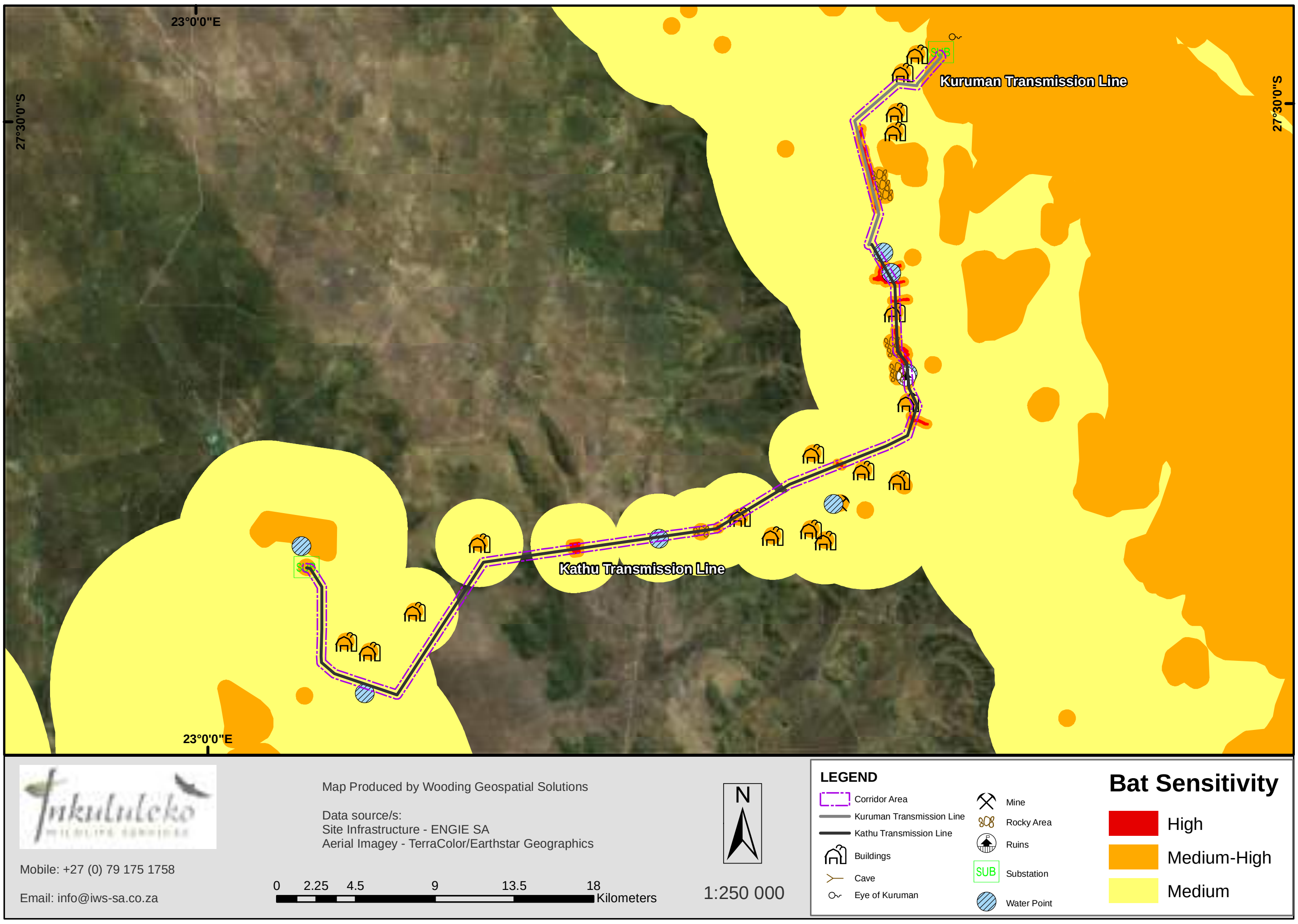

Figure 5. Sensitivity Map for the Phase 1 and Phase 2 WEF Transmission Lines showing Features

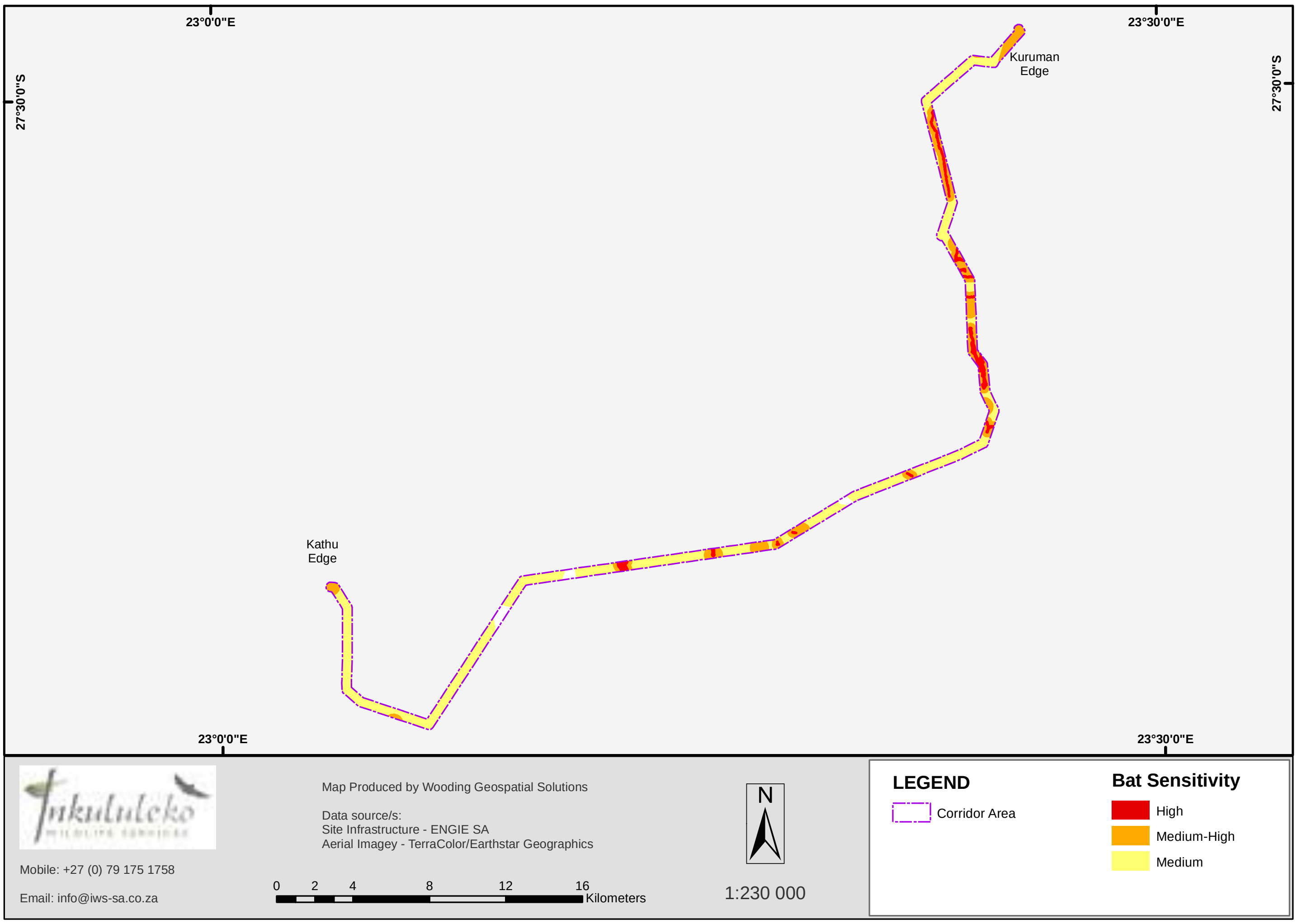

Figure 6. Clipped Sensitivity Map for the Phase 1 and Phase 2 WEF Transmission Lines

1.7. IDENTIFICATION OF KEY ISSUES

1.7.1. Key Issues Identified

Potential bat related issues identified include:

- Construction Phase:
    - The removal of natural and exotic vegetation for the lay down of pylons, construction camps and under the transmission lines.
    - Increased noise and vibrations due to construction activities and vehicles.
    - Increased dust deposition during construction.
    - Hazardous chemicals including spilled coolants, engine oil, herbicides for vegetation clearance were also identified as potential environmental pollutants and source of poisons to species feeding and watering in the area.
    - Bats forage over very large distances and migrate over even further distances, therefore, it is not only direct roost disturbance we are concerned about but foraging area and migration route disturbance. For example, the Natal Long-fingered Bat has been cited to travel up 22 km during a night's foraging and is known to migrate up to 260 km (Van der Merwe, 1975) between summer maternity caves and winter hibernation caves in South Africa. In Europe, bats have been reported to migrate from tens of km to up to 4000 km (Jones et al 2009).
- Operational Phase:
    - Electromagnetic radiation from the transmission lines. No studies on the health effects of electromagnetic radiation on bats are available. Studies on humans to short-term exposure yield no clear health exposure-response (ICNIRP, 1998). Exposure to electromagnetic radiation has shown behavioural effects on bats and rats (Nicholls & Racey, 2007; Nicholls & Racey, 2009).
    - According to the IFC (2007), the combination of the height of transmission towers and distribution poles and the electricity carried by transmission and distribution lines can pose potentially fatal risk to birds and bats through collisions and electrocutions. Whilst electrocution from the actual transmission lines may only affect fruit bats in SA (no evidence from SA, only from Malawi, Zambia and possibly Windhoek) where parallel power lines are closely spaced or sagging of lines has occurred, it is unlikely to affect insectivorous bats due to their small size. However, electrocution at the sub-stations is possible for bats seeking roosts. Bats colliding with lines or pylon infrastructure is possible where high densities of bats occur, especially at roost exists, but information on this in SA is lacking.

1.7.2. Identification of Potential Impacts

The potential impacts identified (and further assessed in Section 1.8 below) are:

<u>Construction Phase</u>

- Habitat loss, disturbance and alteration.
    - Construction activity footprint disturbance to and destruction of bat foraging or migration habitat, such as natural bushveld, thornveld, rocky ridges, open water and wetlands. South Africa and African species may do similar but the research is not available.
    - Disturbance to and destruction of bat roosts. No large bat roosts occur along the transmission line corridor, however, if trees are removed or buildings disturbed, this could impact on smaller roosts. Dust and construction noise vibrations also can disturb or scare bats.

<u>Operational Phase</u>

- Health or navigation impacts related to electromagnetic radiation from the transmission lines.
- Collision with transmission lines or pylons.
- Electrocution at sub-stations.

<u>Decommissioning Phase</u>

- Same as for construction phase.

1.7.3. *Cumulative impacts*

- Additive disturbance impact to foraging areas and potentially to roosts, in addition to existing transmission lines in the area, the proposed wind turbines and operational buildings.

  This project may cause some impacts to bats which are already at risk due to other activities in the area. Such other impacts, which are considered of a higher significance for bats, include roost disturbance (clearing of trees for mining, closing of defunct mine shafts, human activities in caves and old mines), habitat decline (mining, wind energy, housing, litter all contribute to habitat decline in the greater area) and wind energy (bats are directly killed by wind turbines (Arnett and Baerwald, 2013; MacEwan, 2016) and the adjacent Kuruman WEFs will be no exception)).

1.8. IMPACT ASSESSMENT SUMMARY

Table 5. Impact assessment summary table for the Construction Phase

Impact pathway	Nature of potential impact/risk	Status[1]	Extent[2]	Duration[3]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
BATS															
CONSTRUCTION PHASE															
Direct Impacts															
Clearing of vegetation, vibrations, noise and dust production	Disturbance to and destruction of bat foraging habitat.	Negative	Site	Long-term	Substantial	Likely	Moderate	Moderate	Moderate	No	Yes	High sensitivity areas were considered to have high roosting and/ or foraging potential. These areas are potentially unsuited to development owing to the High bat importance. Where possible, transmission lines to avoid areas of high bat sensitivity. Overhead transmission lines may cross overhead of linear wetlands and rivers, as long as no ground infrastructure such as pylons, lay-down areas, sub-stations or construction camps are in these areas. All other areas of High bat sensitivity, especially trees and old and new buildings and their associated buffers should be avoided, where possible. Medium-High sensitivity areas have potential for medium-high significance impacts and should be avoided, where possible. Overhead transmission lines may cross overhead of these areas. Where possible, ground infrastructure such as pylons, lay-down areas, sub-stations or construction camps should avoid these areas. The exception would be for safety reasons in terms of pylon spacing.	Low	4	High
Clearing of vegetation, vibrations, noise and dust production	Disturbance to and destruction of bat roosts	Negative	Local	Short-term	Moderate	Unlikely	High	Low	Low	Yes	Yes	Where possible, avoidance of high and medium-high bat sensitivity areas. High sensitivity areas were considered to have high roosting and/ or foraging potential. These areas are potentially unsuited to development owing to the High bat importance. Overhead transmission lines may cross overhead of linear wetlands and rivers, as long as no ground infrastructure such as pylons, lay-down areas, sub-stations or construction camps are in these areas. All other areas of High bat sensitivity, especially trees and old and new buildings and their associated buffers should be avoided, where possible. The exception would be for safety reasons in terms of pylon spacing.	Very Low	5	High

[1] Status: Positive (+) ; Negative (-)
[2] Site; Local (<10 km); Regional (<100); National; International
[3] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Impact pathway	Nature of potential impact/risk	Status[1]	Extent[2]	Duration[3]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
												If any trees or buildings are demolished along the route, these should be thoroughly inspected for bat presence. If bats are present, they should be chased away before demolition. Each tree and/or building should be replaced with a bat box in an area near water and not intended for future development (contact: http://ecosolutions.co.za/products-services/bat-boxes) The current route does not encroach on High sensitive cave-type roosts or their buffers.			
Indirect Impacts															
Disturbance to foraging areas and small roosts will scare bats away from the area.	Loss of ecosystem services offered by the bats and other possible unknown indirect impacts.	Negative	Local	Long-term	Moderate	Likely	High	Low	Low	No	Yes	Same as for direct impacts..	Very Low	5	High

Table 6. Impact assessment summary table for the Operational Phase

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
BATS															
OPERATIONAL PHASE															
Direct Impacts															
Electromagnetic radiation emissions from the transmission lines.	Health and behavioural impacts to bats	Negative	Local	Long-term	Moderate	Unlikely	High	Moderate	Low	No	Yes	Where possible, avoidance of high and medium-high bat sensitivity areas.	Very Low	3	Low
Collision with transmission lines and associated infrastructure	Bat fatalities	Negative	Site	Long-term	Moderate	Very Unlikely	High	Low	Low	No	Yes	Where possible, avoidance of high and medium-high bat sensitivity areas.	Very Low	3	Medium
Electrocution of bats at sub-stations	Bat fatalities	Negative	Site	Long-term	Moderate	Likely	High	Low	Low	No	Yes	Make sure that sub-stations are bat-friendly. i.e. there should be no opportunity for roosting – no small gaps between electrical infrastructure and in roofs and buildings. No hanging spaces. High fencing to	Very Low	3	Medium

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
												avoid fly throughs. Consult with a bat specialist during the design and construction phases.			
Indirect Impacts															
Disturbance to foraging areas and small roosts, causing loss in bats from the area.	Loss of ecosystem services offered by the bats and other possible unknown indirect impacts.	Negative	Local	Long-term	Moderate	Likely	High	Low	Low	No	Yes	Same as for direct impacts..	Very Low	5	Medium

Table 7. Cumulative impact assessment summary table

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
BATS															
CUMULATIVE IMPACTS															
Adding transmission lines to an area that already has several transmission lines and proposed wind turbines will create cumulative impacts	Bat disturbances and fatalities	Negative	Regional	Long-term	Substantial	Likely	Moderate	Low	Moderate	No	Yes	High sensitivity areas were considered to have high roosting and/ or foraging potential. These areas are potentially unsuited to development owing to the High bat importance. Where possible, transmission lines to avoid areas of high bat sensitivity. Overhead transmission lines may cross overhead of linear wetlands and rivers, as long as no ground infrastructure such as pylons, lay-down areas, sub-stations or construction camps are in these areas. All other areas of High bat sensitivity, especially trees and old and new buildings and their associated buffers should be avoided, where possible. Medium-High sensitivity areas have potential for medium-high significance impacts and should be avoided,	Low	4-3	Medium

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
												where possible. Overhead transmission lines may cross overhead of these areas. Where possible, ground infrastructure such as pylons, lay-down areas, sub-stations or construction camps should avoid these areas. The exception would be for safety reasons in terms of pylon spacing. Operational mitigation to be applied to wind turbines. All other mitigation measures recommended above in this report to be implemented.			
Indirect Impacts															
Bat disturbances and fatalities	Bat population declines and loss of ecosystem services offered by the bats and other possible unknown indirect impacts.	Negative	Regional	Long-term	Moderate	Likely	High	Low	Low	No	Yes	Same as for direct impacts..	Very Low	5	Medium

1.9. INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAM

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
A. Construction / Operational Phase					
A.1. BAT IMPACTS					
Disturbance to and/or loss of bats	Least disturbance to bats and their foraging and roosting habitats and no bat fatalities.	High sensitivity areas were considered to have high roosting and/ or foraging potential. These areas are potentially unsuited to development owing to the High bat importance. Where possible, transmission lines to avoid areas of high and medium-high bat sensitivity. Overhead transmission lines may cross overhead of linear wetlands and rivers, as long as no ground infrastructure such as pylons, lay-down areas, sub-stations or construction camps are in these areas. All other areas of High bat sensitivity, especially trees and old and new buildings and their associated buffers should be avoided, where possible.	If any High or Medium-High sensitive areas are to be crossed or developed in, a bat specialist should be consulted in the design and construction phases.	Once in the design and once in the construction phase.	Developer to appoint a bat specialist if needed.
Disturbance to and/or loss of bats	Least disturbance to bats and their foraging and roosting habitats and no bat fatalities.	If any trees or buildings are demolished along the route, these should be thoroughly inspected for bat presence. If bats are present, they should be chased away before demolition. Each tree and/or building should be replaced with a bat box in an area near water and not intended for future	All trees and buildings that will be demolished to be inspected before demolition and new bat boxes to be erected in an area near water and not intended for future development (contact:	During construction	Environmental Control Officer (ECO) or Bat Specialist

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		development (contact: http://ecosolutions.co.za/products-services/bat-boxes)	http://ecosolutions.co.za/products -services/bat-boxes)		
Disturbance to and/or loss of bats	Least disturbance to bats and their foraging and roosting habitats and no bat fatalities.	Make sure that new sub-stations are bat-friendly. i.e. there should be no opportunity for roosting – no small gaps between electrical infrastructure and buildings and into roofs. No hanging spaces. High fencing to avoid fly throughs. Consult with a bat specialist during the design and construction phases.	Sub-stations to be inspected for bat presence and/or fatalities	Once per season – winter, spring, summer and autumn.	Environmental Control Officer (ECO) or Bat Specialist if there is no ECO.
Disturbance to and/or loss of bats	Least disturbance to bats and their foraging and roosting habitats and no bat fatalities.	Awareness and education of contractors.	Contractors to be made aware of all potential impacts on bats and the mitigation and management measures.	Before construction starts..	Environmental Control Officer (ECO) and/ or Developer
Disturbance to and/or loss of bats	Least disturbance to bats and their foraging and roosting habitats and no bat fatalities.	Any routine inspections of the route or bird monitoring programmes to also look out for dead bats and to report these.	Any routine inspections of the route or bird monitoring programmes to also look out for dead bats and to report these. .	Throughout the life of the project.	ECO, contractors, operators or bird specialists

1.10. CONCLUSION AND RECOMMENDATIONS

Bats, the second most diverse mammal group on the planet, warrant consideration and protection at the very least due to their economic value and the ecosystem services they provide, although tourism and biodiversity heritage value is also very important.

The potential impacts to bats by the transmission lines during the construction phase could include roost disturbance and foraging habitat loss, alteration or disturbance associated with clearing the right of way (which is expected to continue into the operational phase) and sensory disturbance due to increased levels of noise and dust associated with heavy vehicles and other machinery. During the operational phase, bats could potentially be negatively impacted by collision with and electrocution by (fruit bats only) the transmission lines (but the likelihood is low) and electrocution at the sub-stations. Other potential impacts associated with the operational phase include health and behavioural impacts due to electromagnetic radiation emitted by the transmission lines, however, due to a lack of research in this area, there is a low confidence in this impact.

If all the mitigation and management measures described in Sections 1.8 and 1.9 are implemented, the residual impacts will likely be low and IWS does not object to the project. There are greater cumulative threats to bats in the area due to proposed wind energy developments, large scale mining operations and general habitat degradation.

1.11. REFERENCES

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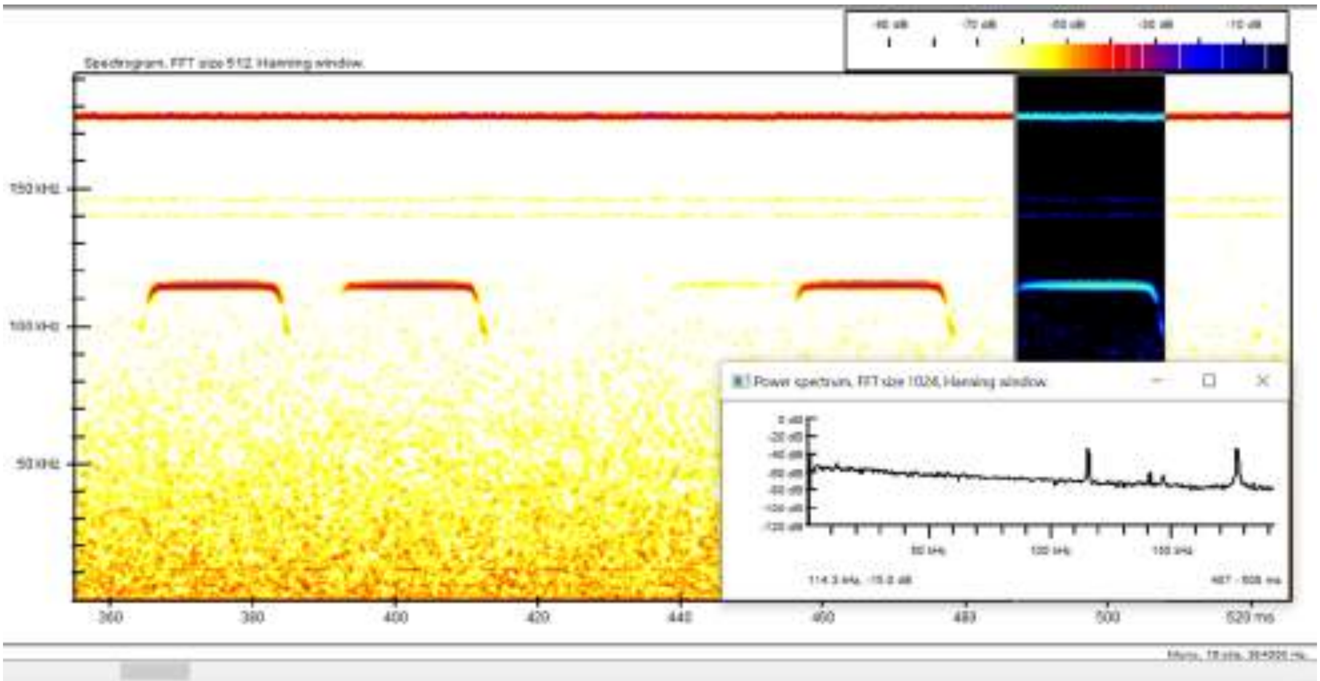
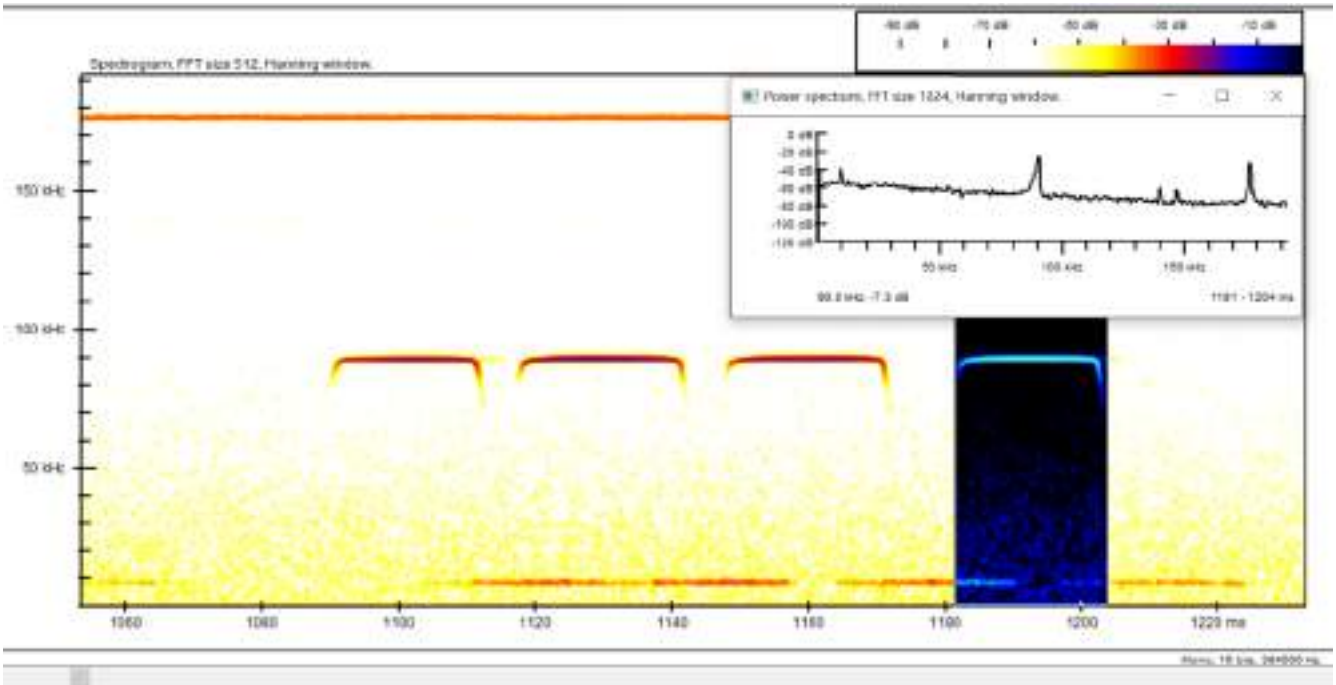
1.12. APPENDICES

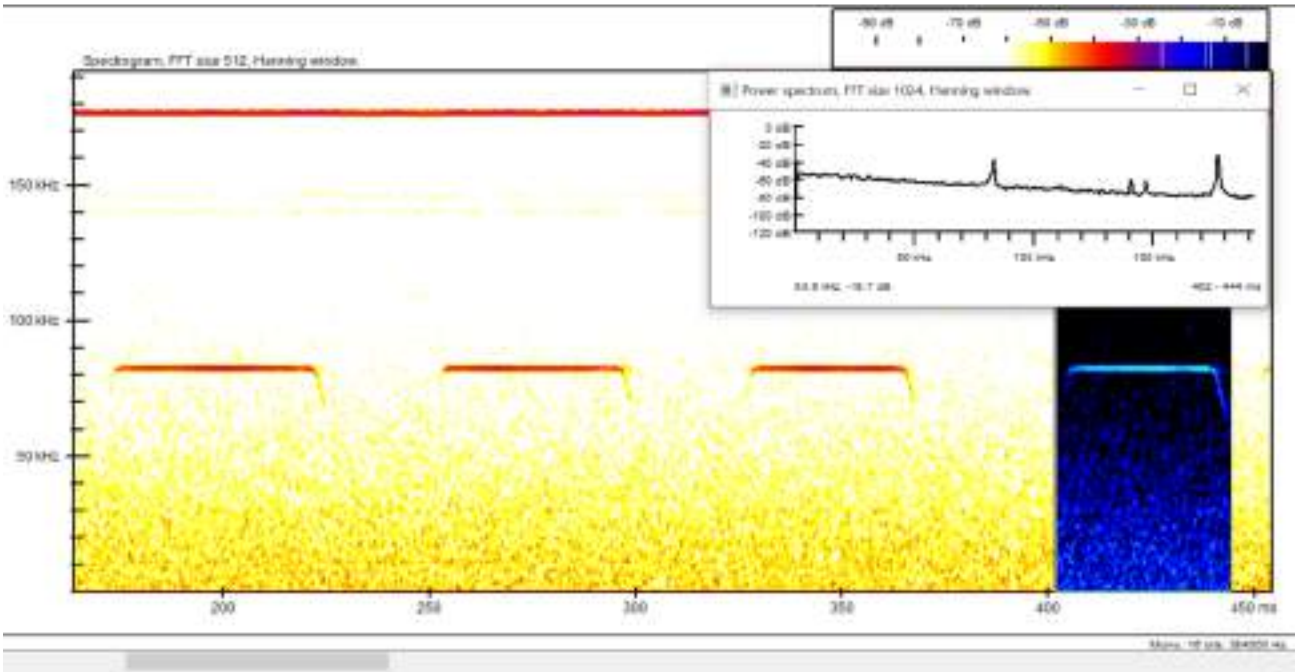
1.12.1. Appendix 1 – Soetfontein Cave Bat Calls



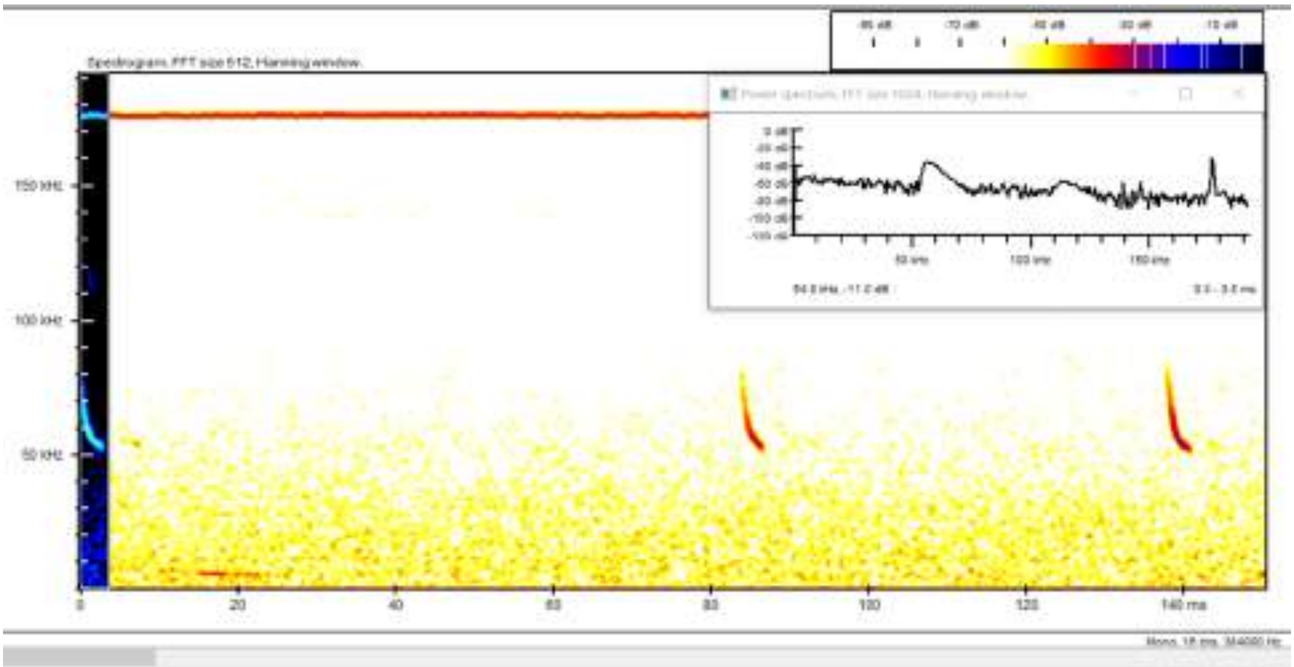
Rhinolophus denti



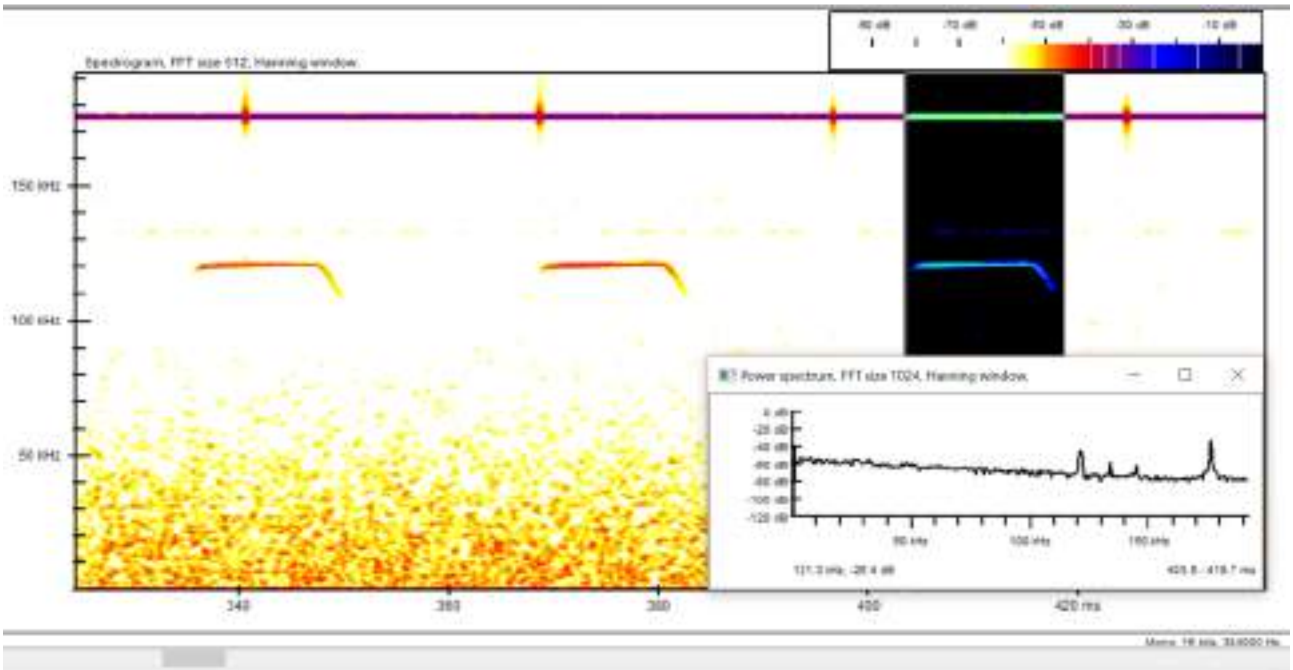
Rhinolophus clivosus



Rhinolophus damarensis (darlingi)



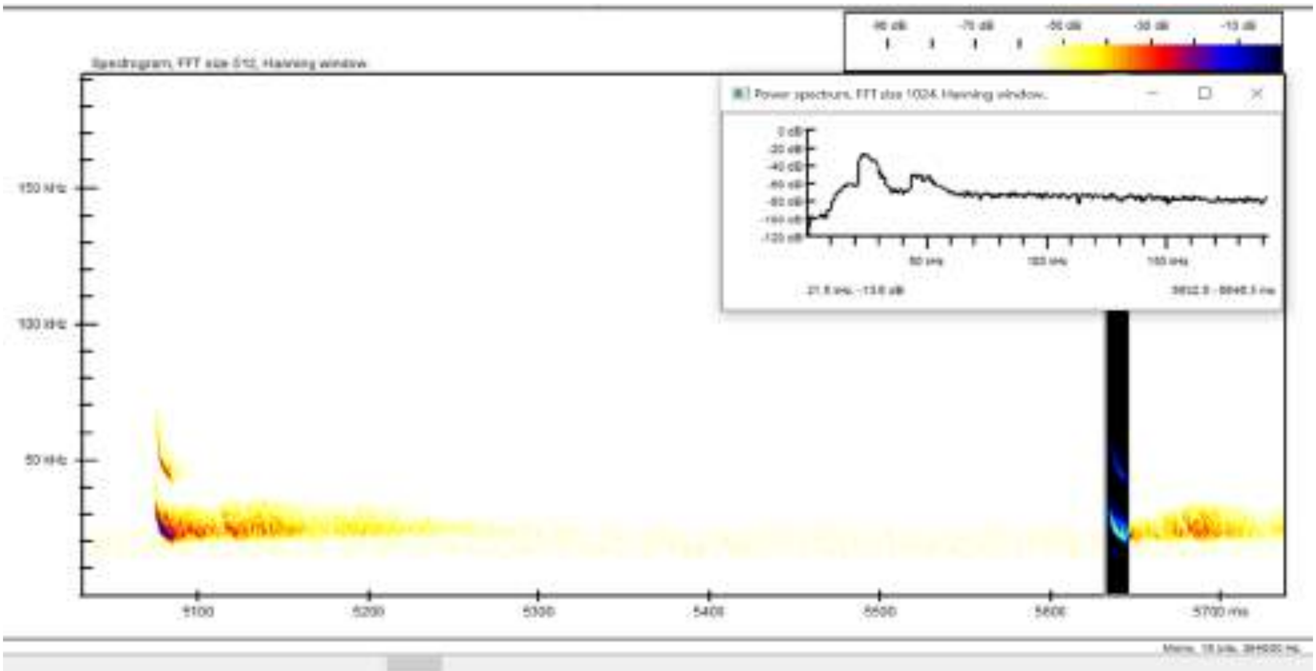
Miniopterus natalensis



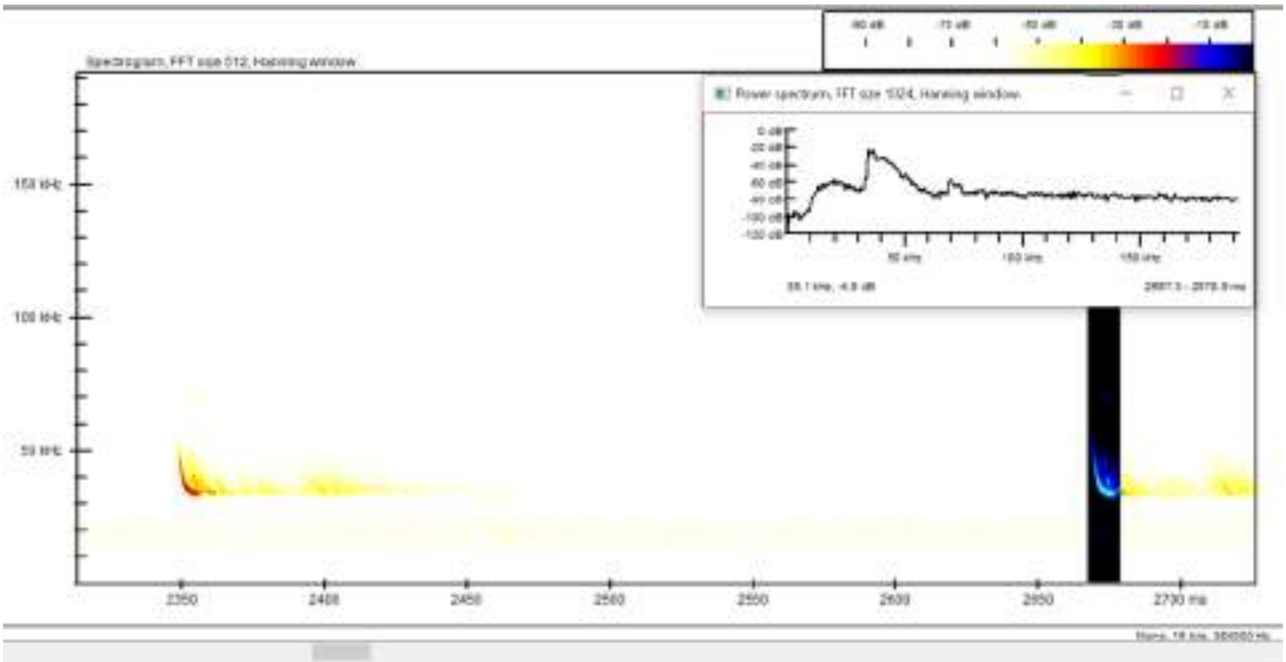
Unidentified Rhinolophus sp. (Could possibly be *R. denti* calling at a higher frequency?)

Nycteris thebaica observed in cave but not recorded or photographed.

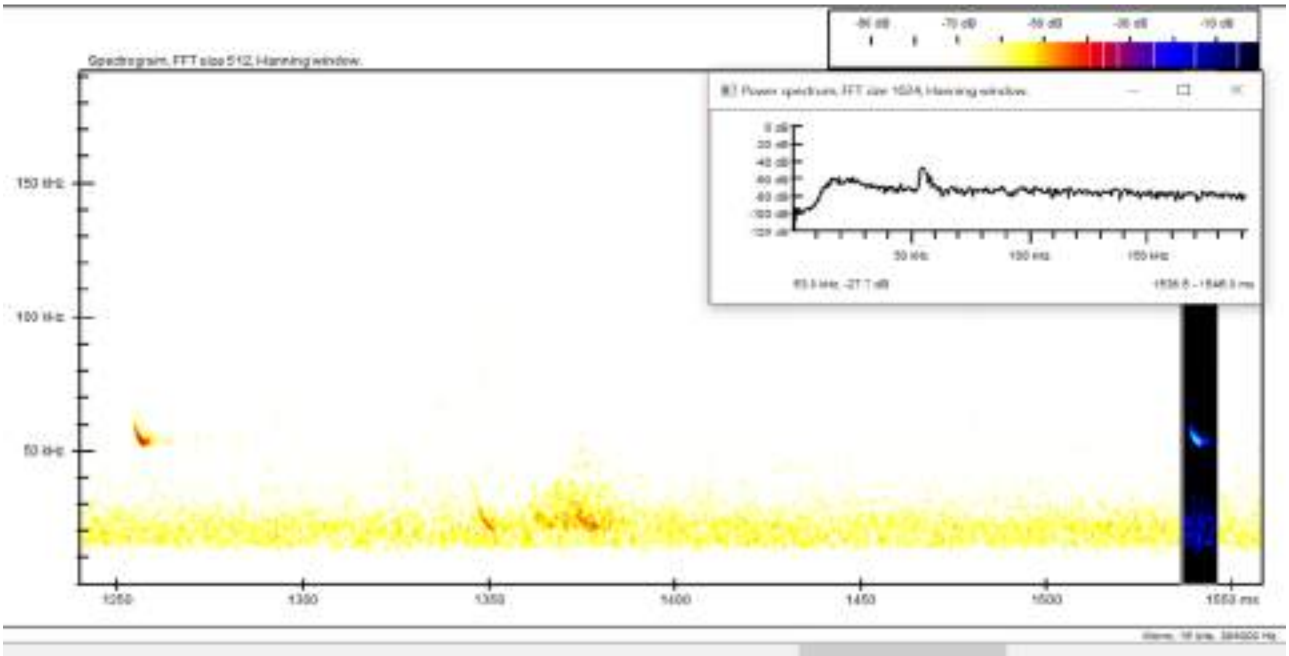
1.12.2. Appendix 2 – Boesmansgat Cave Bat Calls



Tadarida aegyptiaca



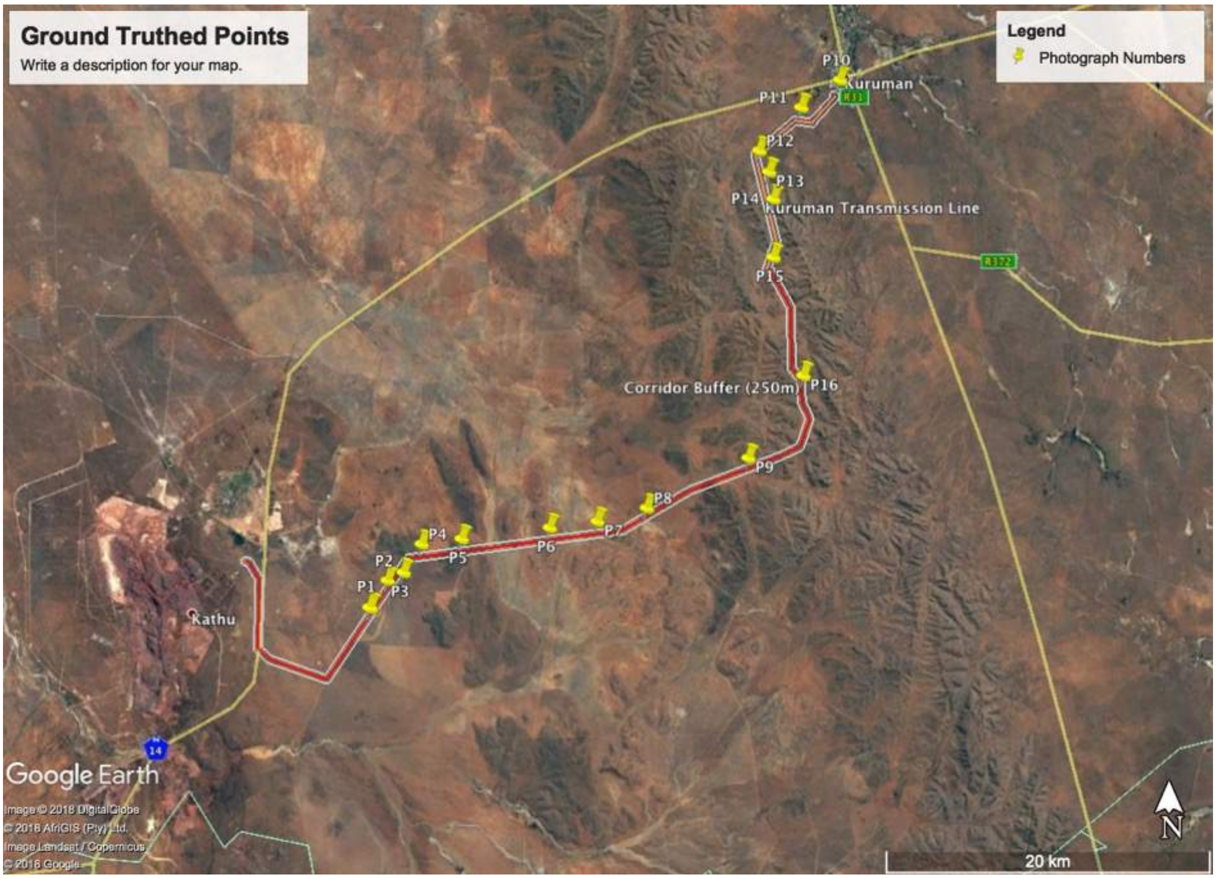
Neoromicia capensis



Miniopterus. Natalensis

Bat passes recorded from sunset to sunrise:
Tadarida aegyptiaca - 291
Neoromicia capensis - 16
Miniopterus. Natalensis - 1

1.12.3. Appendix 3 Ground Truthed Points and Photos



P1 Looking ESE

P2 looking WNW

P3 looking S

P4 looking SSW

P5 looking S

P6 looking E

P7 looking E

P8 Water tower

P9 looking N

P10 looking W

`P11 looking E

P12 looking S

P13 looking N

P14 looking SE

P15 looking WNW

P16 looking W

SPECIALIST FRESHWATER ASSESSMENT REPORT:

Basic Assessment for the proposed development of supporting electrical infrastructure to the proposed Kuruman Phase 1 and Phase 2 Wind Energy Facilities near Kuruman in the Northern Cape: BA REPORT

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services	EnviroSwift (Pty) Ltd.
P O Box 17001	22 Leiden Cresent
Congella, Durban, 4013	Cape Town, 7550
South Africa	South Africa

July 2018

SPECIALIST EXPERTISE

Natasha van de Haar

SACNASP Professional Natural Scientist (Registration number: 400229/11)
Natasha is a registered Professional Natural Scientist (Pr.Sci.Nat) with the South African Council for Natural Scientific Professions (SACNASP). She also holds a Masters Degree in Science (M.Sc.) in the field of Botany. Over the course of Natasha's career, she completed a number of floral identification short courses and also obtained a certificate of competence for wetland assessments from Rhodes University. She is also a member of the South African Wetland Society, Botanical Society of SA as well as the Western Cape Wetlands Forum.

Her career kicked off as a field ecologist in 2009, focusing on floral biodiversity and ecological functioning, with special mention of wetland ecology and functioning within South Africa (all provinces). She further worked as a specialist project member in Mauritius, Lesotho and Ghana. During the course of her career she obtained extensive experience in conducting terrestrial as well as wetland related surveys in the mining, residential and infrastructure development industries as well as development of several Alternative energy facilities. Natasha also gained experience in Biodiversity Offset Initiatives as well as RDL/protected plant permit applications. Presently her main focus is wetland assessments including delineation as well as present ecological state and function assessments

Louise Zdanow

SACNASP Professional Natural Scientist (Registration number:114072)
Louise is the Managing Director of EnviroSwift KZN (Pty) Ltd. She has a BSc Honours degree in Botany from the University of Cape Town. She began working as an environmental specialist in 2012 and has since gained extensive experience in conducting freshwater as well as botanical assessments in the residential, mining and infrastructure development industries. Louise is a registered Professional Natural Scientist (Pr. Sci. Nat.) with the South African Council for Natural Scientific Professions (SACNASP, Reg. no. 114072), and is an accredited SASS5 practitioner. She is a member of the South African Wetland Society and the International Association of Impact Assessments South Africa. She has received a certificate of competence for the Tools for Wetland Assessments course attended at Rhodes University, and has attended a soil classification course presented by Jon Atkinson of the KZN Department of Agriculture and Rural Development.

SPECIALIST DECLARATION

I, Louise Zdanow, as the appointed independent specialist, in terms of the 2014 EIA Regulations (as amended in 2017), hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist: lzdanow

Name of Specialist: Louise Zdanow

Date: 03/07/2018

EXECUTIVE SUMMARY

Mulilo Renewable Project Developments (Pty) Ltd (hereafter, “Mulilo”) has appointed EnviroSwift (PTY) Ltd (hereafter, “EnviroSwift”) to undertake a specialist assessment of the impact that the development of supporting electrical infrastructure to the proposed Kuruman Phase 1 and Phase 2 Wind Energy Facilities (WEFs) could have on freshwater features. The project footprint is situated in the north-eastern parts of the Northern Cape Province, between the towns of Kuruman and Kathu within the Ga-Segonyana Local Municipality. Kuruman is located approximately 236km (by road) to the north-west of the provincial capital, Kimberley.

Three alternatives have been proposed for the supporting electrical infrastructure hereafter referred to as Alternative 1, Alternative 2 and Alternative 3.

Alternative 1 runs from the Kuruman Phase 1 substation to the Ferrum substation. From a technical perspective, this is the preferred 132kV overhead line should both Phase 1 and 2 WEFs be authorised. However, in the event that the Phase 2 WEF is not constructed, this line would not be considered.

Alternative 2 runs from Kuruman Phase 1 substation to Segame substation. In the event that only Phase 1 WEF is constructed, Alternative 1 would be too expensive and therefore Alternative 2 would be the preferred route.

Alternative 3 runs from Kuruman Phase 1 substation to Kuruman Phase 2 substation. Alternative 3 would be required if only Phase 2 WEF is constructed. The complete 132kV line would require authorisation of Alternative 2 and Alternative 3.

Service roads will be required beneath each of the alternatives. Where existing access roads are present below or adjacent to the proposed transmission line, these will be utilised. Where access roads are not present jeep tracks <5m wide will be established.

Jointly, all three alternatives as well as immediately adjacent areas will be referred to as the ‘project footprint’ within this report.

<u>Summary of Background Information</u>

The quaternary catchments indicated for the project footprint are D41J, D41L and D41K and the project footprint falls within the Southern Kalahari Ecoregion, within the Lower Vaal Water Management Area (WMA) and within the Molopo sub-Water Management Area (sub-WMA) as defined by the National Freshwater Ecosystem Priority Areas project (NFEPA, 2011).

The nearest river system is a tributary of the Kuruman River located approximately 1.4km to the north east of the north eastern portion of the project footprint, with the Kuruman River itself located approximately 3.7km from the project footprint. The Kuruman River as well as the tributary are ephemeral watercourses indicated to be within a Class B (largely natural) Present Ecological State (PES) (NFEPA, 2011). The Ga-Mogara River with its associated tributaries is located approximately 4km to the south of the south western portion of the project footprint.

The sub-quaternary catchment in which the project footprint is located was selected as an Upstream Management Area. Upstream Management Areas, are sub -quaternary catchments in which human activities need to be managed to prevent degradation of downstream river Freshwater Ecosystem Priority Areas (FEPAs) and Fish Support Areas (FSAs).

According to NFEPA (2011) Alternative 1 will traverse a single natural seep wetland indicated to fall within an AB wetland condition (natural or good) as well as a smaller artificial feature; Alternative 3 will also traverse this artificial feature; and Alternative 2 will not traverse any wetland features. An additional artificial wetland has also been indicated in close proximity to Alternative 1 and 3, however, this feature will not be traversed by either Alternative. The topography has also resulted in the formation of numerous small ephemeral drainage lines, several of which will be traversed by all three alternatives (Chief Directorate Surveys and Mapping attained August 2015).

Summary of Freshwater Specialist Assessment Results

The primary land use surrounding the project footprint is stock farming (cattle and sheep) and the north eastern portion of the project footprint extends through an area which is currently utilised as a game farm. The low regional rainfall in combination with the absence of perennial rivers near the project footprint is not favorable for extensive crop cultivation. As a result, natural vegetation has largely remained in a good condition. However, valleys associated with the south-eastern portion of the project footprint are overgrazed. Furthermore, natural vegetation cover was found to decrease, and erosion was noted in isolated areas near watering points, roads and fences. In addition, natural vegetation has been removed from a firebreak associated with the boundary fence of the adjacent military base.

The north eastern and south eastern extent of the project footprint is located within a landscape dominated by a series of ridges running in a north to south direction. Multiple ephemeral drainage lines originate at the crests along the length of the ridges.

The central and south western extent of the project footprint is characterised by flat, open bushveld with isolated hills and koppies. The flatter topography of these areas is less susceptible to the formation of ephemeral drainage lines and only five ephemeral drainage lines were encountered which will be traversed by Alternative 1.

Ephemeral drainage lines occurring on steep hillslopes associated with the ridges along the north eastern and south eastern portion of the project footprint can be defined as A Section channels. “A sections are those headward channels that are situated well above the zone of saturation at its highest level and because the channel bed is never in contact with the zone of saturation, these channels do not carry baseflow. They do however carry storm runoff during fairly high rainfall events but the flow is of short duration because there is no baseflow component.” (Department of Water Affairs and Forestry; DWAF, 2005). The lack of baseflow and short duration of stormwater runoff within the channels are not conducive for the formation of riparian zones.

Additional ephemeral drainage lines extend through the flat valleys at the bases of hillslopes associated with the project footprint and are often augmented by the A section channels. These ephemeral drainage lines can be defined as ‘arid drainage lines’ or ‘washes’ and are often characterised by poorly defined or discontinuous channels due to lower annual rainfall, longer rainfall intervals, high evapotranspiration and high infiltration in areas with sandy soils (Lichvar *et al*., 2004 and Grobler, 2016). Washes differ from arid drainage lines in that they are often larger and wider in extent. Poorly defined riparian zones are only associated with isolated areas along some of the larger arid drainage lines. All three alternatives will traverse arid drainage lines and alternatives 1 and 3 will traverse a wash.

According to the NFEPA project (2011) an artificial seep wetland will be traversed by Alternative 1 and 3. However, upon investigation it was found that this feature is in fact an artificial impoundment within an ephemeral drainage line. The natural seep wetland, indicated in close proximity to Alternative 1 and 3 was also investigated during the field survey. However, it was found to be an area cleared of vegetation in the vicinity of a primary residence. No wetland indicators as defined by DWAF (2008) were identified within the area indicated as wetland or immediate surroundings.

At the time of the field investigation the route of the western portion of Alternative 1 had not yet been finalised and the natural seep wetland indicated by NFEPA was therefore not investigated on site. However, after careful examination of Google Earth Pro Imagery (2017) it was concluded that the feature is in fact an area cleared of vegetation in the vicinity of a primary residence. No additional wetland characteristics were identified within this area.

The River Index of Habitat Integrity Assessment (IHIA) was used to assess the PES of the ephemeral drainage lines. Ephemeral drainage lines were divided into groups according to perceived degree of disturbance and each group was assessed accordingly:

- Group 1: A Section channels on hillslopes which have remained largely undisturbed due to their inaccessible nature;
- Group 2: A Section channels on hillslopes which have been disturbed as a result of the development of informal access roads or fences through the features or as a result of trampling by livestock. An increased level of erosion of the bed and banks of these features was noted;
- Group 3: Arid drainage lines and washes within valleys at the bases of hillslopes which are associated with a greater level of disturbance due to informal access road development and

increased grazing pressure. This disturbance has resulted in an increased level of erosion of the bed and banks of the features; and

- Group 4: Arid drainage lines and washes within valleys which have been significantly disturbed as a result of overgrazing, gravel road development, the clearing of vegetation for the establishment of a firebreak and the development of impoundments. Overgrazing has resulted in the trampling of vegetation and in the formation of erosion gullies within the features.

The instream scores calculated for the ephemeral drainage lines within Group 1 fall within IHIA Category A (unmodified, natural); and the instream scores calculated for the ephemeral drainage lines within Group 2, Group 3 and Group 4 fall within IHIA Category C (Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged).

The ephemeral drainage lines calculated an overall low Ecological Importance and sensitivity (EIS) score and are considered to be of low sensitivity in terms of water yield and quality (Macfarlane *et al.*, 2014). However, these features still provide valuable functions such as attenuation of floodwaters and retention of excess sediments.

The establishment of service roads traversing ephemeral drainage lines will result in the disturbance of vegetation and soils. The PES of the portions of the ephemeral drainage lines in the vicinity of the crossing areas is therefore likely to decrease. However, it is considered possible to maintain the PES of the features as a whole with the implementation of the recommendations as listed in within Section 1.6 of this report.

The most recent guideline for buffer allocation in South Africa (Macfarlane and Bredin, 2017) does not apply to channels which lack active channel characteristics i.e. channels which are not in contact with the zone of saturation and which do not have base flow (Macfarlane *et al.*, 2014). The minimum buffer zone requirements for electricity generation works is 20m (Macfarlane and Bredin, 2017). It is however the opinion of the specialist that, as far as possible, a buffer of at least 32m be provided for all drainage lines[1] in order to reduce the risk of erosion.

<u>**Impact Assessment**</u>

<u>Impacts considered to be likely during the construction, operational and decommissioning phase of all three alternatives include:</u>

Construction Phase
- Potential **direct** impact 1 – Disturbance of drainage lines;
- Potential **direct** impact 2 – Alteration of flow patterns; and
- Potential **direct** impact 3 – Impairment of water quality.

Operational Phase
- Potential **direct** impact 1 – Degradation of drainage lines; and
- Potential **direct** impact 2 – Alteration of the natural hydrological regime.

Decommissioning Phase
- Potential **direct** impact 1 – Degradation of drainage lines; and
- Potential **direct** impact 2 – Impairment of water quality.

<u>Cumulative impacts considered to be likely following authorisation of Phase 1 of the WEF include:</u>

Cumulative impacts
- Cumulative impact 1 – Proliferation of alien and invasive species; and
- Cumulative impact 2 – Erosion of drainage lines.

Table A: Impact table

Impact	Alternative	Before mitigation	After mitigation
Construction Phase			
Disturbance of drainage lines	Alternative 1	Moderate	Low
	Alternative 2	Low	Very Low
	Alternative 3	Moderate	Low

[1] In line with EIA Regulations.

Alteration of flow patterns	Alternative 1	Moderate	Low
	Alternative 2	Low	Very Low
	Alternative 3	Moderate	Low
Impairment of water quality	Alternative 1	Moderate	Very Low
	Alternative 2	Low	Very Low
	Alternative 3	Moderate	Very Low
Operational Phase			
Degradation of drainage lines	Alternative 1	Moderate	Low
	Alternative 2	Low	Very Low
	Alternative 3	Moderate	Low
Alteration of natural hydrological regime	Alternative 1	Moderate	Low
	Alternative 2	Low	Very Low
	Alternative 3	Moderate	Low
Decommissioning Phase			
Degradation of drainage lines	Alternative 1	Moderate	Low
	Alternative 2	Low	Very Low
	Alternative 3	Moderate	Low
Impairment of water quality	Alternative 1	Low	Very Low
	Alternative 2	Low	Very Low
	Alternative 3	Low	Very Low
Cumulative impact			
Proliferation of alien and invasive species	Alternative 1	Low	N/A
	Alternative 2	Very Low	N/A
	Alternative 3	Low	N/A
Erosion of drainage lines	Alternative 1	Low	N/A
	Alternative 2	Very Low	N/A
	Alternative 3	Low	N/A

Conclusion

Multiple ephemeral drainage lines will be traversed by the proposed supporting electrical infrastructure alternatives. The current impact to these features is largely limited to erosion as a result of increased grazing pressure and the development of access roads, firebreaks, fence lines and impoundments within the features. The drainage lines were therefore calculated to fall within PES Categories A (unmodified, natural) and C (moderately modified). Although the ephemeral drainage lines calculated an overall low EIS score and are considered to be of low sensitivity in terms of water yield and quality (Macfarlane *et al.*, 2014), these features do still provide valuable functions such as attenuation of floodwaters and retention of excess sediments. The unnecessary disturbance of drainage lines must therefore be avoided, and a buffer zone of at least 32m is therefore considered important wherein only essential activities should be allowed during the establishment of service roads.

Should both Phase 1 and Phase 2 of the proposed WEF be authorised, transmission line Alternative 1 will be the preferred route from a technical perspective. This Alternative will traverse approximately 3.76km[2] of ephemeral drainage line habitat in total, however, transmission lines will be above ground and associated service roads will follow existing gravel roads where possible. Therefore, only approximately 2.1km of Alternative 1 will require the establishment of new jeep tracks through ephemeral drainage lines. Prior to the implementation of mitigation measures, impacts associated with the proposed development of Alternative 1 were calculated to be of a low to moderate (negative) significance. However, with the effective implementation of the mitigation measures as provided within Section 1.6 of this report, it is the opinion of the freshwater specialist that all impacts may be reduced to very low and low (negative) significances.

Should only Phase 1 of the proposed WEF be authorised, transmission line Alternative 2 will be the preferred route from a technical perspective. This Alternative extends a much shorter total distance than Alternative 1 and 3 and will result in the disturbance of the smallest area of ephemeral drainage line habitat. Only approximately 0.13km of Alternative 2 will require the establishment of new jeep tracks through ephemeral drainage lines. Prior to the implementation of mitigation measures, impacts associated with the proposed development of Alternative 2 were calculated to be of a very low and low (negative) significance. However,

[2] Refers to the total length of the transmission line and jeep track which will directly traverse drainage lines.

with the effective implementation of the mitigation measures as provided within Section 1.6 of this report, it is the opinion of the freshwater specialist that all impacts may be reduced to very low (negative) significances.

Should only Phase 2 of the proposed WEF be authorised, transmission line Alternative 3 will be the preferred route from a technical perspective, however, this will also necessitate the development of transmission line Alternative 2. Alternative 3 will therefore extend over approximately 2.8km of ephemeral drainage line habitat in total. However, only approximately 1.5km of Alternative 3 will require the establishment of new jeep tracks through ephemeral drainage lines. Prior to the implementation of mitigation measures, impacts associated with the proposed development of Alternative 3 were calculated to be of a low to moderate (negative) significance. However, with the effective implementation of the mitigation measures as provided within Section 1.6 of this report, it is the opinion of the freshwater specialist that all impacts may be reduced to very low and low (negative) significances.

It is therefore the opinion of the freshwater specialist that authorisation may be granted for either of the three proposed transmission line alternatives. It should however be noted that an application for an Environmental Authorisation in terms of the National Environmental Management Act (NEMA) Environmental Impact Assessment (EIA) Regulations (2014, amended in 2017) will be required as proposed development related activities will occur within 32m of a watercourse. Furthermore, the proposed development will require authorisation from the Department of Water and Sanitation (DWS) in terms of Section 21 (c) and (i) of the National Water Act (NWA).

LIST OF ABBREVIATIONS

Table 1: Abbreviations.

ASL	Above Sea Level
BGIS	Biodiversity Geographic Information System
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EI	Ecological Importance
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Programme
EMPr	Environmental Management Programme (EMPr)
EO	Environmental Officer
ES	Ecological Sensitivity
FEPA	Freshwater Ecosystem Priority Area
GPS	Global Positioning System
HGM	Hydrogeomorphic
LUDS	Land Use Decision Support Tool
MAP	Mean Annual Precipitation
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act
NFA	National Forest Act
NFEPA	National Freshwater Ecosystem Priority Areas
NPAES	National Protected Areas Expansion Strategy
NWA	National Water Act
PES	Present Ecological State
PSDF	Provincial Spatial Development Framework
WEF	Wind Energy Facility
WMA	Water Management Area
WMS	Water Management Systems
WUL	Water Use License

GLOSSARY

Table 2: Glossary.

Active channel bank	The bank of the channel(s) that has been inundated at sufficiently regular intervals to maintain channel form and to keep the channel free of established terrestrial vegetation.
Alluvial Fan	An alluvial deposit that is typically fan-shaped that is formed by a stream or watercourse where its velocity is abruptly decreased, as at the mouth of a ravine or at the foot of a slope.
Alluvial Material / Deposits	Deposit of sand, mud, etc. formed by flowing water, or the sedimentary matter deposited thus within recent times, especially in the valleys of large rivers.
Baseflow	Long-term flow in a river that continues after storm flow has passed.
Biodiversity	The number and variety of living organisms on earth, the millions of plants, animals, and micro-organisms, the genes they contain, the evolutionary history and potential they encompass, and the ecosystems, ecological processes, and landscapes of which they are integral parts.
Buffer	Strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area.

Catchment	The area contributing to runoff at a particular point in a river system.
Chroma	The relative purity of the spectral colour, which decreases with increasing greyness.
Cumulative impact	The impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.
Delineation	(of a wetland or riparian zone): to determine the boundary of a water resource (wetland or riparian area) based on soil and vegetation (wetland) or geomorphological and vegetation (riparian zone) indicators.
Environmental Impact Assessment (EIA)	In relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application as defined in National Environmental Management Act.
Ephemeral	A river or watercourse that only flows at the surface periodically, especially those drainage systems that are only fed by overland flow (runoff).
Episodic	Relating to rivers and watercourses typically located within arid or semi-arid environments that only carry flow in response to isolated rainfall events.
Fluvial	Pertaining to rivers and river flow and associated erosive activity.
Gleying	A soil process resulting from prolonged soil saturation, which is manifested by the presence of neutral grey, bluish or greenish colours in the soil matrix.
Hydric Soils	(= Hydromorphic soils) Soils formed under conditions of saturation, flooding or ponding for sufficient periods of time for the development of anaerobic conditions and thus favouring the growth of hydrophytic vegetation.
Hydrology	The study of the occurrence, distribution and movement of water over, on and under the land surface.
Hydromorhpy	A process of gleying and mottling resulting from the intermittent or permanent presence of excess water in the soil profile.
Intermittent flow	Flows only for short periods.
Phreatophyte	A plant with a deep root system that draws its water supply from near the water table.
Reach	A portion of a river.
Riparian Area	(as defined by the National Water Act): includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterised by alluvial soils (deposited by the current river system), and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas.
Stream Order	A morphometric classification of a drainage system according to a hierarchy or orders of the channel segments. Within a drainage network the un-branched channel segments which terminate at the stream head are termed as “first order streams”
Understorey	The part of the forest / woodland which grows at the lowest height level below the canopy

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R326 EIA Regulations 7 April 2017	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- **a) details of-** **i. the specialist who prepared the report; and** **ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;**	Page 1
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 2
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1.1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.1.5
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 1.3 and Section 1.6.4
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.1.4
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.1.3
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1.3.6
g) an identification of any areas to be avoided, including buffers;	Section 1.3.8
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 1.3.8
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.1.4
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 1.6 and Section 1.7
k) any mitigation measures for inclusion in the EMPr;	Section 1.8
l) any conditions for inclusion in the environmental authorisation;	Section 1.6
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 1.8
n) a reasoned opinion- **i. whether the proposed activity, activities or portions thereof should be authorised;** **(iA) regarding the acceptability of the proposed activity or activities and** **ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;**	Section 1.6, Section 1.8 and Section 1.9
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q) any other information requested by the competent authority.	N/A
2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

TABLE OF CONTENTS

TABLES AND FIGURES

LIST OF TABLES

LIST OF FIGURES

SUPPORTING ELECTRICAL INFRASTRUCTURE TO THE PROPOSED KURUMAN PHASE 1 AND PHASE 2 WIND ENERGY FACILITIES

1.1. INTRODUCTION AND METHODOLOGY

1.1.1. Scope and Objectives

Mulilo Renewable Project Developments (Pty) Ltd (hereafter, "Mulilo") has appointed EnviroSwift (PTY) Ltd (hereafter, "EnviroSwift") to undertake a specialist assessment of the impact that the development of supporting electrical infrastructure to the proposed Kuruman Phase 1 and Phase 2 Wind Energy Facilities (WEFs) could have on freshwater features. The project footprint is situated in the north-eastern parts of the Northern Cape Province, between the towns of Kuruman and Kathu within the Ga-Segonyana Local Municipality. Kuruman is located approximately 236km (by road) to the north-west of the provincial capital, Kimberley (Figure 1 and 2).

Three alternatives have been proposed for the supporting electrical infrastructure hereafter referred to as Alternative 1, Alternative 2 and Alternative 3.

Alternative 1 runs from the Kuruman Phase 1 substation (C) to the Ferrum substation (A) (C-B-A in Figure 2 below). From a technical perspective, this is the preferred 132kV overhead line should both Phase 1 and 2 WEFs be constructed. However, in the event that the Phase 2 WEF is not constructed, this line would not be considered. Alternative.

Alternative 2 runs from Kuruman Phase 1 substation (C) to Moffat substation (D) (C-D in Figure 2 below). In the event that only Phase 1 WEF is constructed, Alternative 1 would be too expensive and therefore Alternative 2 (C – D) would be the preferred route.

Alternative 3 runs from Kuruman Phase 1 substation (C) to Kuruman Phase 2 substation (B) (C-B in Figure 2 below). Alternative 3 would be required if only Phase 2 WEF is constructed. The complete 132kV line would require authorisation of Alternative 2 (C – D) and Alternative 3 (C – B).

Service roads will be required beneath each of the alternatives. Where existing access roads are present below or adjacent to the proposed transmission line these will be utilized. Where access roads are not present jeep tracks <5m wide will be established.

The farms through which the transmission line alternatives will extend include:

- ERF 1 of the farm Kuruman;
- Portion 1 and 2 of the Farm Hartland 381;
- The remainder of the Farm Rossdale 382;
- The remainder of the Farm Woodstock 441;
- Portion 1 of the Farm Bramcote 446;
- The remainder of the Farm Mansfield 445;
- Portion 1 and 3 of the Farm Newstead 449;
- Portion 3 and 4 of the Farm Thoresby 450;
- The remainder of the Farm Hartnolls 548;
- The remainder of the Farm Demaneng 546;
- The remainder of the Farm Lylyveld 545; and
- Portion 10 and the remainder of the Farm Sekgame 461.

Jointly, all three alternatives as well as immediately adjacent areas will be referred to as the 'project footprint' in this report.

Figure 1: Location of the project footprint in relation to surrounding areas.

Figure 2: Locality of the project footprint in relation to the towns of Kuruman and Kathu (A = Ferrum substation, B = Kuruman Phase 2 substation, C = Kuruman Phase 1 substation, and D = Segame substation) (Google Earth Pro, 2017).

1.1.2. Terms of Reference

The terms of reference as part of the Basic Assessment included the following:

- Desktop delineation of wetland features with the use of digital satellite imagery (Google Earth Pro, 2017) and available contour maps.
- A physical site survey during which areas of interest was investigated and delineated according to the method supplied by the Department of Water Affairs and Forestry (DWAF,2005 updated in 2008) in order to groundtruth the accuracy of the desktop delineations, as well as to verify the perceived level of sensitivity.
- Presentation of final delineated features on maps in order to inform the authorisation process of the various alternatives.
- Assessment of freshwater features associated with the various alternatives according to applicable/site specific methodology:
  a) Classification of freshwater systems according to Ollis *et al*., 2013;
  b) Application of the river Index of Habitat Integrity Assessment (IHIA, Kemper, 1999); and
  c) Determination of the Ecological Importance and Sensitivity (EIS) based on the approach adopted by the Department of Water Affairs and Forestry (DWAF) as detailed in the document "Resource Directed Measures for Protection of Water Resources" (1999).
- Impact assessment of all potential freshwater impacts (construction, operation and decommissioning phases) associated with each of the proposed alternatives. The cumulative impact were also assessed.
- Providing mitigation measures and recommendations in line with the National Water Act (NWA) as well as National Environmental Management Act (NEMA).

1.1.3. Approach and Methodology

1.1.3.1 Desktop Assessment

Available national and provincial databases were utilised in order to determine the high level conservation significance of wetlands and rivers associated with the project footprint. Primary resources which were utilised are listed within Section 1.1.5.

Ephemeral drainage lines associated with the project footprint were desktop delineated with the use of background information and digital satellite imagery (Google Earth Pro). Vector data obtained from the Chief Directorate Surveys and Mapping (August 2015) was overlain on Google Earth Pro imagery (2017) in order to determine the potential locality of watercourses. Changes in topography and evidence of water moving through the landscape, such as channels, changes in soil colour and changes in vegetation structure, were utilised in order to desktop delineate the boundaries of the ephemeral drainage lines.

1.1.3.2 Watercourse Delineation

The desktop assessment was followed by a physical site survey undertaken in mid-January 2018. At this time the route of the western portion of Alternative 1 had not yet been finalised, however, pre-selected areas of interest associated with Alternative 2, Alternative 3 and within the eastern portion of Alternative 1, were investigated in order to groundtruth the accuracy of the desktop delineations as well as to verify the perceived level of sensitivity of watercourses.

For the purpose of the identification of water resources, the definition as provided by the NWA (Act no. 36, 1998) was used to guide the site survey. The NWA defines a water resource as a watercourse, surface water, estuary or aquifer, of which the latter two are not applicable to this assessment due to an estuary being associated with the sea and, in line with best practice guidelines, wetland and riparian assessments only include the assessment of the first 50 cm from the soil surface, therefore aquifers are excluded. In addition, reference to a watercourse as provided above includes, where relevant, its bed and banks.

In order to establish if the watercourses in question can be classified as 'wetland habitat' or 'river habitat', the definitions as drafted by the NWA (Act no. 36, 1998)[3] were taken into consideration:

- A 'wetland' is land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil; and
- 'Riparian' habitat includes the physical structure and associated vegetation of the areas associated with a watercourse which are commonly characterized by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent areas'.

Watercourses were identified with the use of the definitions provided above and the delineation took place according to the method supplied by DWAF (2005, updated 2008). No wetland areas as defined by the NWA were encountered within the project footprint or within 500m of the project footprint boundary. However, numerous ephemeral drainage lines were encountered.

Several indicators are prescribed in the watercourse delineation guideline to facilitate the delineation of the riparian zone of watercourses.

Indicators used to determine the boundary of the riparian zone include:

1) Landscape position;
2) Alluvial soils and recently deposited material;
3) Topography associated with riparian areas; and
4) Vegetation associated with riparian areas.

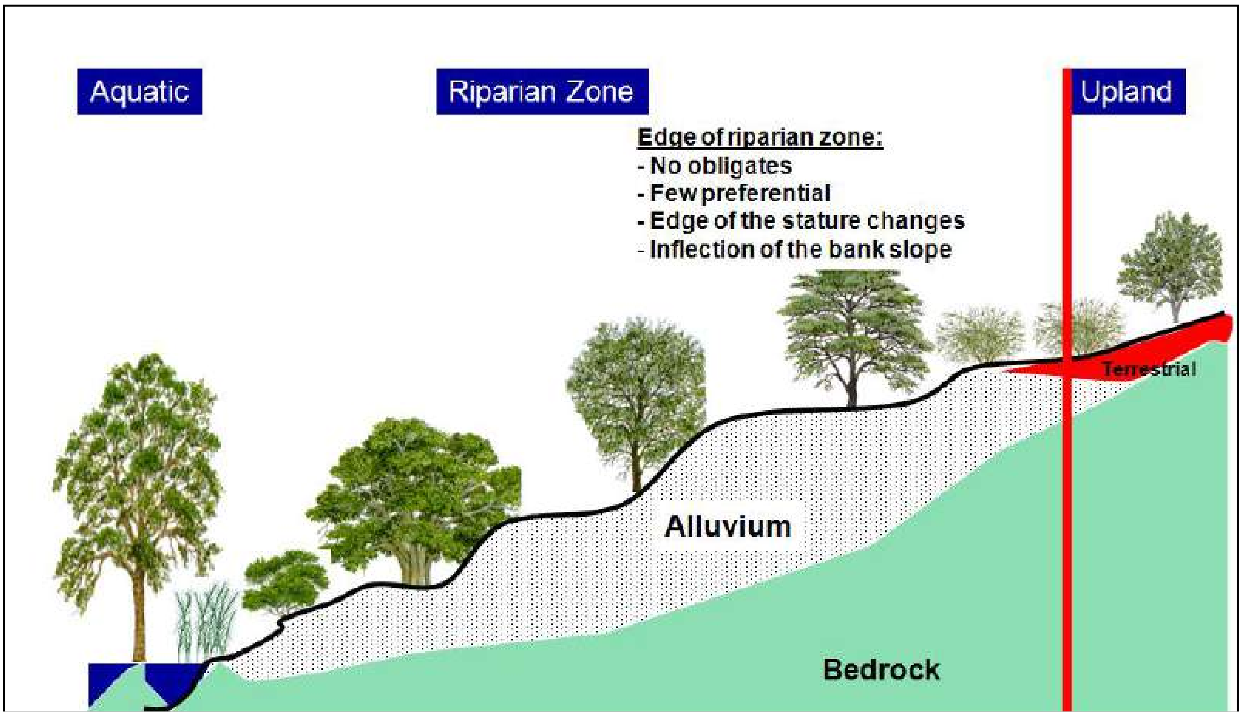


Figure 3: A schematic diagram illustrating the edge of the riparian zone on one bank of a large river (DWAF, 2008).

[3] The definitions as provided by the NWA (Act No. 36 of 1998) are the only legislated definitions of wetlands in South Africa.

1.1.3.3 Watercourse Classification

The ‘Classification System for Wetlands and other Aquatic Ecosystems in South Africa’ developed by Ollis *et al*., (2013) encompasses all aquatic ecosystems, including wetlands, except for deep marine systems. Ollis *et al.* defines aquatic ecosystems as ecosystems that are permanently or periodically inundated by flowing or standing water, or which have soils that are permanently or periodically saturated within 0.5 m of the soil surface.

The inland component of the Classification System has a six-tiered structure presented in the figure below.

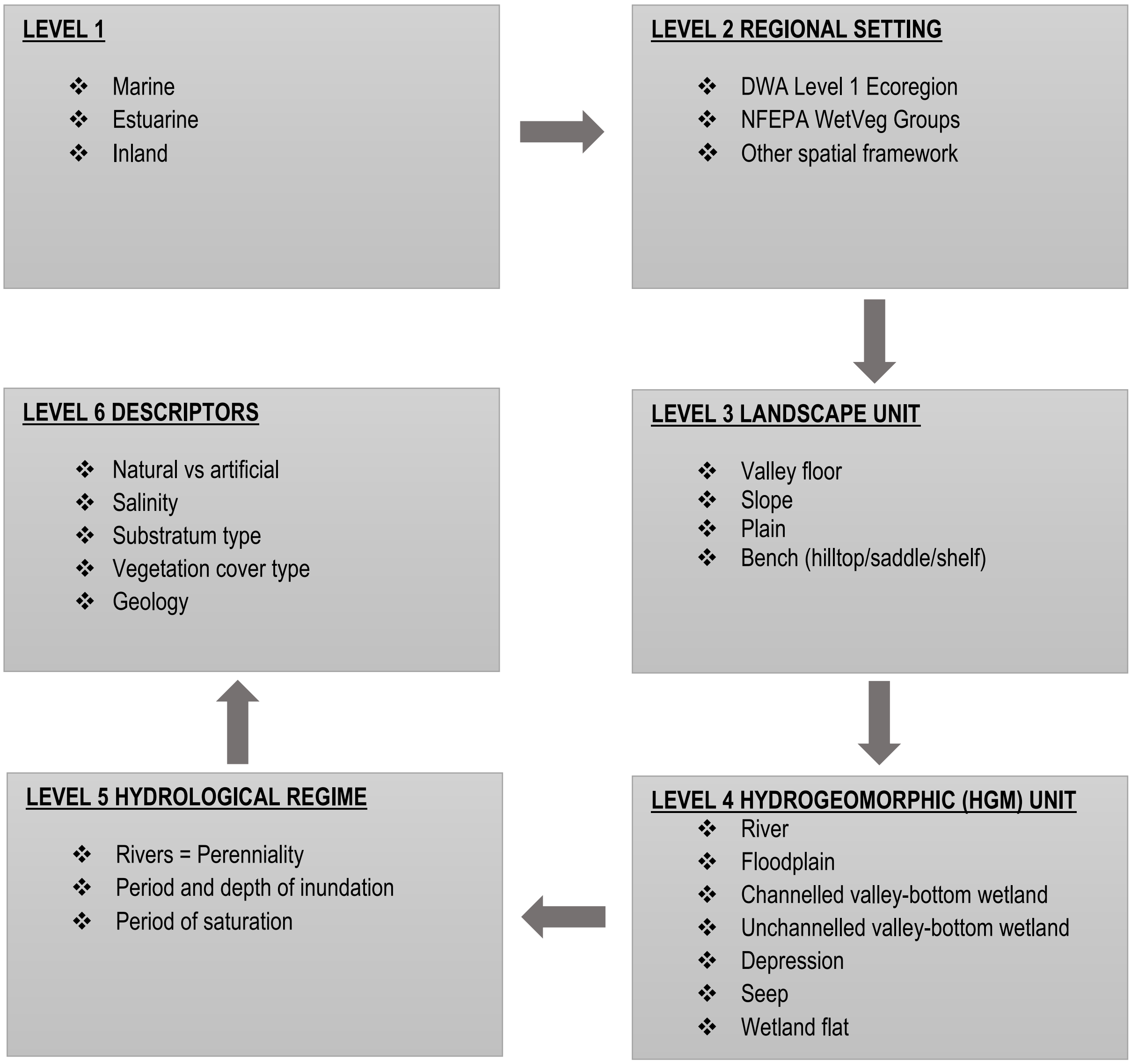


Figure 4: Classification System for wetlands and other aquatic ecosystems in South Africa.

1.1.3.4 River Index of Habitat Integrity

The River IHIA is utilised in order to determine the Present Ecological State (PES) of rivers. The River IHIA is based on two components of the watercourse, the riparian zone and the instream channel. Assessments are made separately for both aspects, but data for the riparian zone is primarily interpreted in terms of the potential impact on the instream component.

1.1.3.5 Ecological Importance and Sensitivity

The Ecological Importance and Sensitivity (EIS) method applied to rivers is based on the approach adopted by the DWAF as detailed in the document "Resource Directed Measures for Protection of Water Resources" (1999). In the method a series of determinants are assessed on a scale of 0 to 4, where "0" indicates no importance and "4" indicates very high importance.

It should be noted that the EIS assessment was done solely based on the attributes found at the project footprint and immediate surroundings. Furthermore, the precautionary principle was applied during the EIS assessment, due to only one field survey being undertaken and the consequent probability of overlooking faunal and floral species. However, the field survey results were supplemented by background information and therefore the conclusions are considered representative of the features that were assessed.

1.1.3.6 Recommended Ecological Category (REC)

The REC is determined by the PES score as well as importance and/or sensitivity. Water resources which have a PES falling within an E or F ecological category are deemed unsustainable. In such cases the REC must automatically be increased to a D. Where the PES is determined to be within an A, B, C or D ecological category, the EIS components must be evaluated to determine if any of the aspects of importance and sensitivity are high or very high. If this is the case, the feasibility of increasing the PES (particularly if the PES is in a low C or D category) should be evaluated and either set at the same ecological category or higher depending on feasibility. This is recommended to enable important and/or sensitive water resources to maintain their functionality and continue to provide the goods and services for the environment and society.

1.1.3.7 Buffer Determination

The recently published Buffer Zone Guidelines for Rivers, Wetlands and Estuaries (Macfarlane and Bredin, 2016), allows the user to rate key elements such as threats posed by land use / activities on the water resource, climatic factors, the sensitivity of the water resource (i.e. river, wetland or estuary), and buffer zone attributes in order to determine the size a buffer would need to be in order to sufficiently protect a river, wetland or estuary. However, it should be noted that the buffer tool cannot be applied to ephemeral systems which lack active channel characteristics i.e. channels which are not in contact with the zone of saturation and which do not have base flow (Macfarlane *et al*., 2014).

1.1.4. Assumptions and Limitations

Desktop delineations were undertaken with the use of background information and digital satellite imagery (Google Earth Pro, 2017). As a result, some discrepancies relating to the extent of the watercourse boundaries may be possible. However, pre-selected areas of interest were groundtruthed in order to determine the accuracy of the desktop delineations, and the findings as presented within this report were considered sufficient in order to inform the outcomes of the study and the impact assessment.

Only digital satellite imagery (Google Earth Pro, 2017) was utilised in inaccessible areas where distribution lines have been proposed. However, only a small selection of areas was entirely inaccessible, and the digital satellite imagery was considered sufficient to surmise the impact potential on the ephemeral drainage lines.

The accuracy of the Global Positioning System (GPS) utilised at pre-selected areas of interest will affect the accuracy of the delineation. A Garmin GPSMap 64 was used which has an estimated accuracy rating of 3-5 meters. EnviroSwift is of the opinion however that this limitation is of no material significance and that the freshwater-related constraints have been adequately identified.

The assessment was confined to the top 50 cm of soil, in line with the delineation guideline provided by DWAF (updated 2008). Therefore, groundwater was not considered as part of this assessment.

A single field survey was undertaken in January 2018[4]. Therefore, the field survey was undertaken within the optimum season for Freshwater Assessments as prescribed by DWAF (updated 2008). However, seasonal variation in watercourses and vegetation characteristics was not considered as part of this assessment. There is therefore the possibility that some aspects and species may have been missed, however general findings and results were considered sufficient to inform the PES and EIS assessment of the freshwater features.

All watercourses associated with the project footprint are intermittent systems, therefore no instream ecological assessment (South African River Health Programme protocols) and on-site collection and testing of water samples was undertaken.

In assessing the identified potential construction phase impacts, it has been assumed that good housekeeping measures (listed below) will be implemented through adherence to the Environmental Management Programme (EMPr):

- Clean up any spillages (e.g. concrete, oil, fuel), immediately. Remove contaminated soil and dispose of it appropriately;
- Service vehicles and machinery within demarcated areas, preferably off-site;
- Use bunded surfaces within designated areas for re-fuelling vehicles. Direct runoff from these areas towards a collection area and dispose contaminated water and soil at an appropriate registered facility. Vehicles should preferably be refueled off site within an area authorised by the Environmental Control Officer (ECO);
- Provide adequate temporary toilets for the duration of the construction phase, these should be located at least 30 m from all delineated watercourse boundaries;
- Prohibit the washing of vehicles, tools or machinery in watercourses or associated buffer areas;
- Store fuel, chemicals and other hazardous substances in suitable, secure, weather-proof containers and within an area with impermeable and bunded floors, preferably within areas earmarked for construction at least 30 m from the delineated edge of any watercourse and within an already disturbed area, as far as practically possible.
- Inspect all storage facilities and vehicles on a regular basis for the early detection of deterioration or leaks;
- Locate fuel and chemical storage facilities outside areas prone to flooding;
- Protect stockpiles, if required, from erosion using tarp or erosion blankets;
- Ensure that no standing water gathers at stockpile sites, to reduce erosion as well as the contamination of the water by nutrients/ toxics;
- Cover storage piles to limit dust generation;
- Restrict the dumping or storage of construction material to the footprint of construction areas. These areas should be located at least 30 m from all delineated watercourse boundaries;
- Dispose of used oils, wash water from cement and other pollutants at an appropriately licensed landfill site;
- Remove all construction material and waste upon completion of the project; and
- Remove all contaminated soil from storage and maintenance areas, thereafter rip, profile and monitor until indigenous vegetation has established.

[4] The region receives most of it's rainfall during summer and autumn. However, rainfall prior to the field survey was low.

1.1.5. Source of Information

Primary information sources used to inform the desktop assessment included:

- Northern Cape Provincial Spatial Development Framework; PSDF (2012);
- The South African National Biodiversity Institute - Biodiversity GIS (BGIS) [online]. URL: http://bgis.sanbi.org;
- The National Freshwater Ecosystem Priority Areas project (NFEPA, 2011);
- Google Earth Pro (2017) and Vector data received from the Chief Directorate Surveys and Mapping (2015); and
- The vegetation of South Africa, Lesotho and Swaziland as compiled by Mucina and Rutherford (2006).

1.2. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO FRESHWATER IMPACTS

Construction related aspects (activities) associated with supporting electrical infrastructure that could result in the identified direct and cumulative impacts discussed in Section 1.6.1 include:

1) Clearance of vegetation within drainage lines and the recommended buffer zones during the placement of support structures for distribution lines and during the development of laydown areas.

2) Disturbance of vegetation and soils during the establishment of jeep track service roads (<5m wide) through ephemeral drainage lines.

2) Disturbance of vegetation e.g. edge effects as well as indiscriminate movement of construction vehicles and personnel.

3) Site preparation following the removal of vegetation such as levelling and compacting of soil for service roads, stripping and excavation of soil for foundations of transmission line support structures and stockpiling.

5) Use of concrete during construction of transmission line support structures as well as accidental spillage of hazardous chemicals.

Operation related aspects (activities) associated with supporting electrical infrastructure that could result in the identified direct and cumulative impacts discussed in section 1.6.2. include:

1) Inadequate maintenance of service roads at ephemeral drainage line crossings.

2) Lack of ongoing eradication of alien and invasive vegetation.

Decommissioning related aspects (activities) associated with supporting electrical infrastructure that could result in the identified direct and cumulative impacts discussed in section 1.6.3. and section 1.6.4, respectively, include:

1) Earth moving activities in the vicinity of drainage lines or associated buffer zones including:

- Ripping and reprofiling of service roads through ephemeral drainage lines; and
- Removal of transmission line support structures.

2) Lack of follow-up monitoring and erosion control where needed.

2) Lack of follow-up management of alien and invasive vegetation within disturbed areas.

No aspect that could potentially result in a fatal flaw or indirect impact were identified as part of the Freshwater Impact Assessment.

1.3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

1.3.1. Baseline Description of the Receiving Environment

The project footprint is situated in the north-eastern parts of the Northern Cape Province, between the towns of Kuruman and Kathu within the Ga-Segonyana Local Municipality. Kuruman is located approximately 236km (by road) to the north-west of the provincial capital, Kimberley. The Northern Cape Province can be described as being semi-arid in the east, to arid in the central region, to hyper-arid in the far western parts of Namaqualand (PSDF, 2012).

Approximately 97,69% of the Ga-Segonyana Local Municipality has been classified as 'remaining natural habitat' and the applicable terrestrial ecosystems have been listed as Least Threatened (information retrieved from The Land Use Decision Support Tool (LUDS, 2014) available on www.bgis.co.za).

The project footprint extends across the Kuruman Thornveld, Kuruman Mountain Bushveld and the Kathu Bushveld vegetation types (Figure 5) at a varying altitude of between 1 200 to 1 600m above sea level (ASL). These vegetation types are known for summer and autumn rainfall with very dry winters. The Mean Annual Precipitation (MAP) documented for the Kuruman Mountain Bushveld is between 250 to 500mm, for the Kuruman Thornveld 300 to 450mm and for the Kathu Bushveld 220 to 380mm (Mucina and Rutherford, 2006, updated 2012).

Kuruman Mountain Bushveld is associated with the Kuruman and Asbestos Hills which consist of banded iron formations with jaspilite, chert and riebeckite asbestos of the Asbestos Hills Subgroup of the Griqualand West Supergroup. Soils are shallow, sandy soils of the Hutton form. The geology of the Kuruman Thornveld is associated with Campbell Group dolomite and chert and mostly younger, superficial, Kalahari Group sediments, with red, wind-blown sand of the Hutton form. Locally rock pavements are formed in places. Kathu Bushveld is associated with aeolean red sand and surface calcrete with deep sandy soils of the Hutton and Clovelly soil forms. Additional attributes of the region are provided in Table 3.

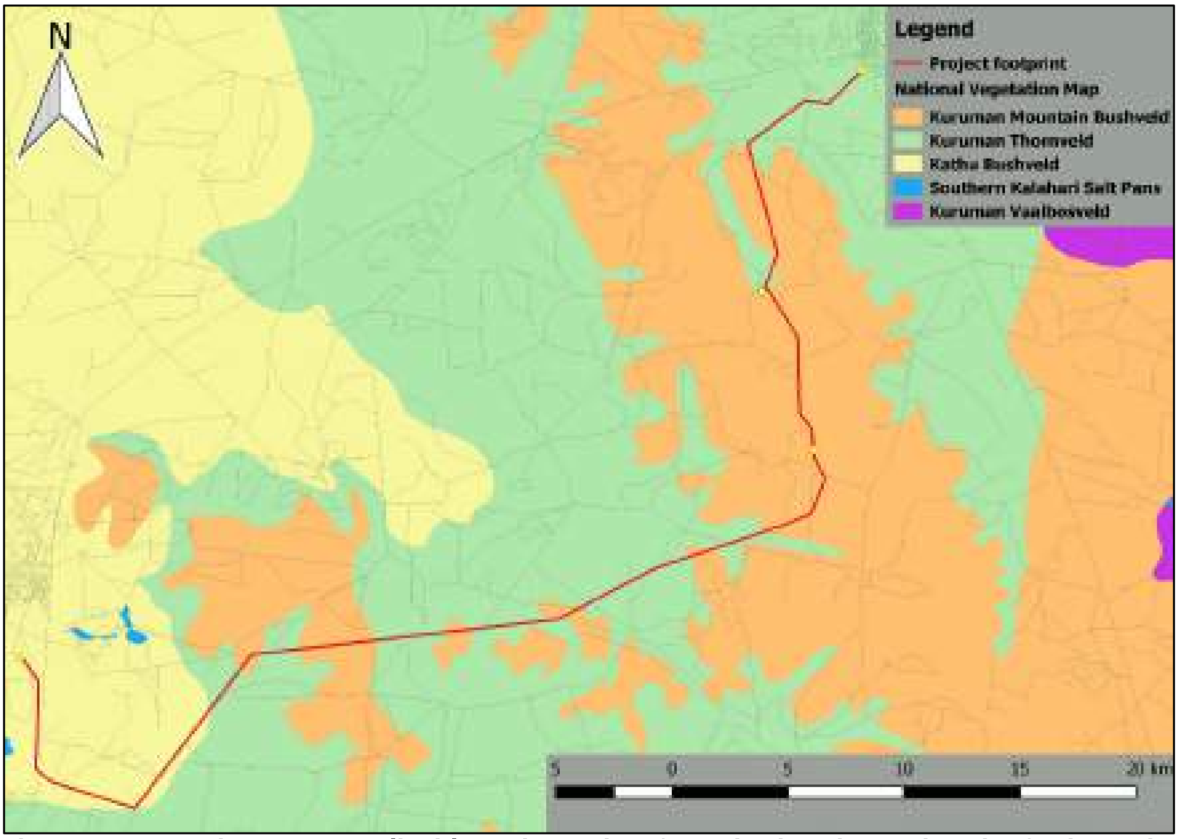


Figure 5: Vegetation types applicable to the project footprint (Mucina and Rutherford, 2006).

Undisturbed Kuruman Mountain Bushveld is characterised by rolling hills with gently to moderately steep slopes, and hill pediment areas with a well-developed grass layer and patches of open shrubveld dominated by *Lebeckia macrantha.* In contrast, undisturbed Kuruman Thornveld is characterised by flat rocky plains and some sloping hills with a very well developed closed shrub layer and well developed open tree stratum consisting of *Acacia erioloba;* while undisturbed Kathu Bushveld is characterised by a medium tall tree layer with *Acacia erioloba* in places, but mostly open bushveld including *Boscia albitrunca* as the dominant trees (Mucina and Rutherford, 2006).

The quaternary catchments indicated for the project footprint are D41J, D41L and D41K and the project footprint falls within the Southern Kalahari Ecoregion (Figure 6) and within the Lower Vaal Water Management Area (WMA) (Figure 7) and the Molopo sub-Water Management Area (sub-WMA) as defined by NFEPA (2011).

Table 3: Attributes of the region (Macfarlane and Bredin, 2016 and Mucina and Rutherford, 2006).

Attributes	
Inherent erosion potential (K factor) of catchment soils	0.39 – 0.63 (moderate to moderately high)
Rainfall seasonality	Summer to autumn
Mean annual precipitation (mm)	400 - 600 mm
Mean annual temp. (°C)	16 - 19 °C
Rain intensity	High

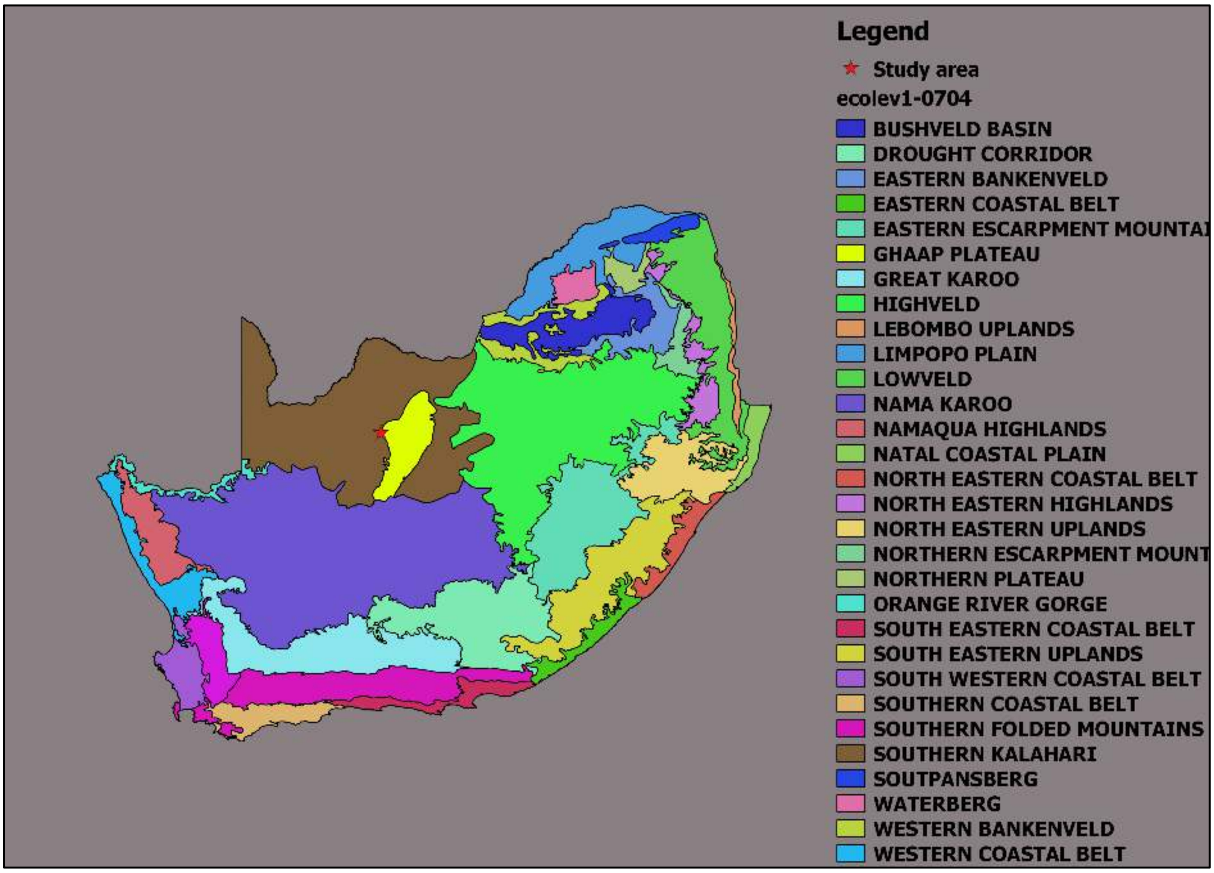


Figure 6: South African Ecoregions in relation to the project footprint.

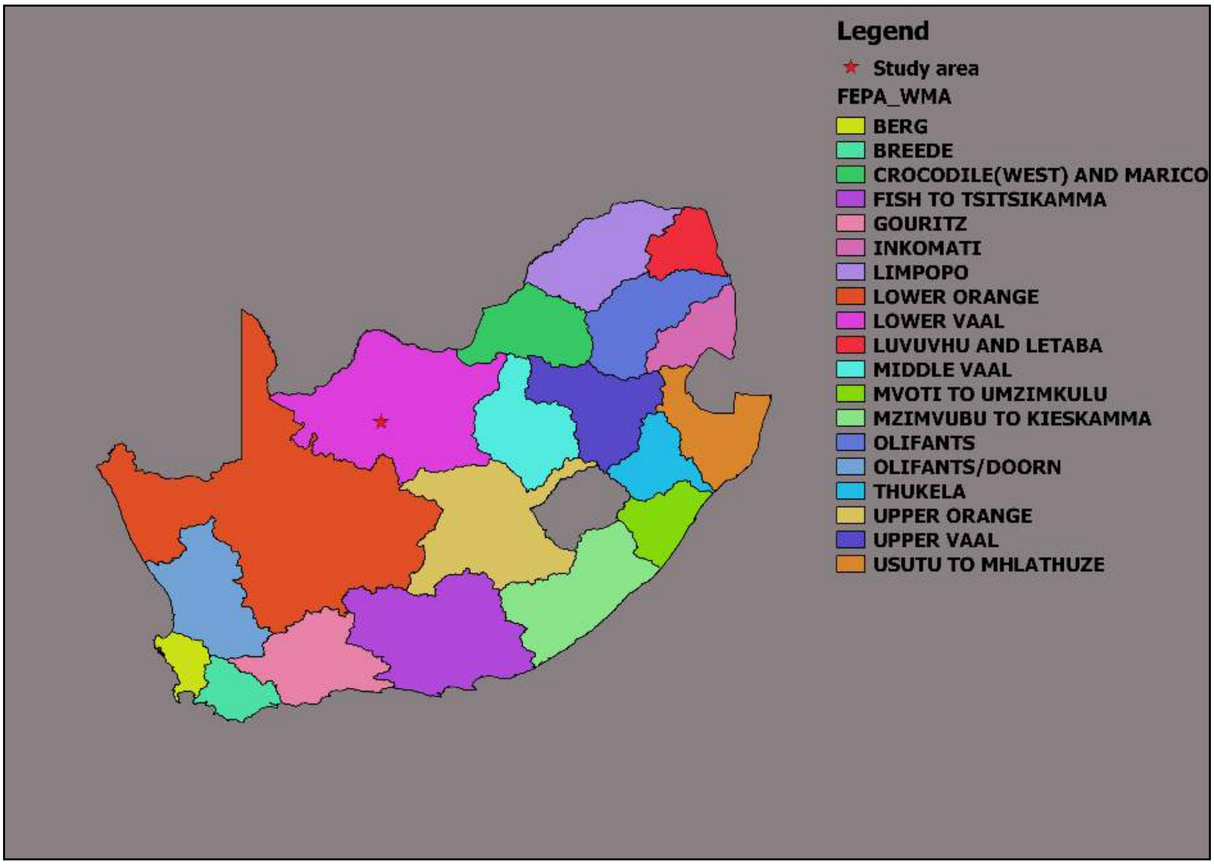


Figure 7: NFEPA WMA in relation to the project footprint.

Only the Kuruman River and one of its larger tributaries, the Ga-Mogara River, traverse the Ga-Segonyana Local Municipality. The Kuruman River originates east of Kuruman where it receives water from several springs of which the Great Koning Eye, Little Koning Eye and the Kuruman Eye are the largest (Zitholile, 2015). The confluence of the Kuruman River with the Molopo River is situated approximately 280km upstream of the project footprint. Both the Kuruman River and the Ga-Mogara River are usually dry, flowing only for short periods following sufficient rainfall.

The nearest river system is a tributary of the Kuruman River located approximately 1.4km to the north east of the north eastern portion of the project footprint, with the Kuruman River itself located approximately 3,7km from the project footprint. The Kuruman River as well as the tributary are ephemeral watercourses indicated to be within a Class B (largely natural) PES (NFEPA, 2011). The Ga-Mogara River with its associated tributaries is located approximately 4km to the south of the south western portion of the project footprint (Figure 8).

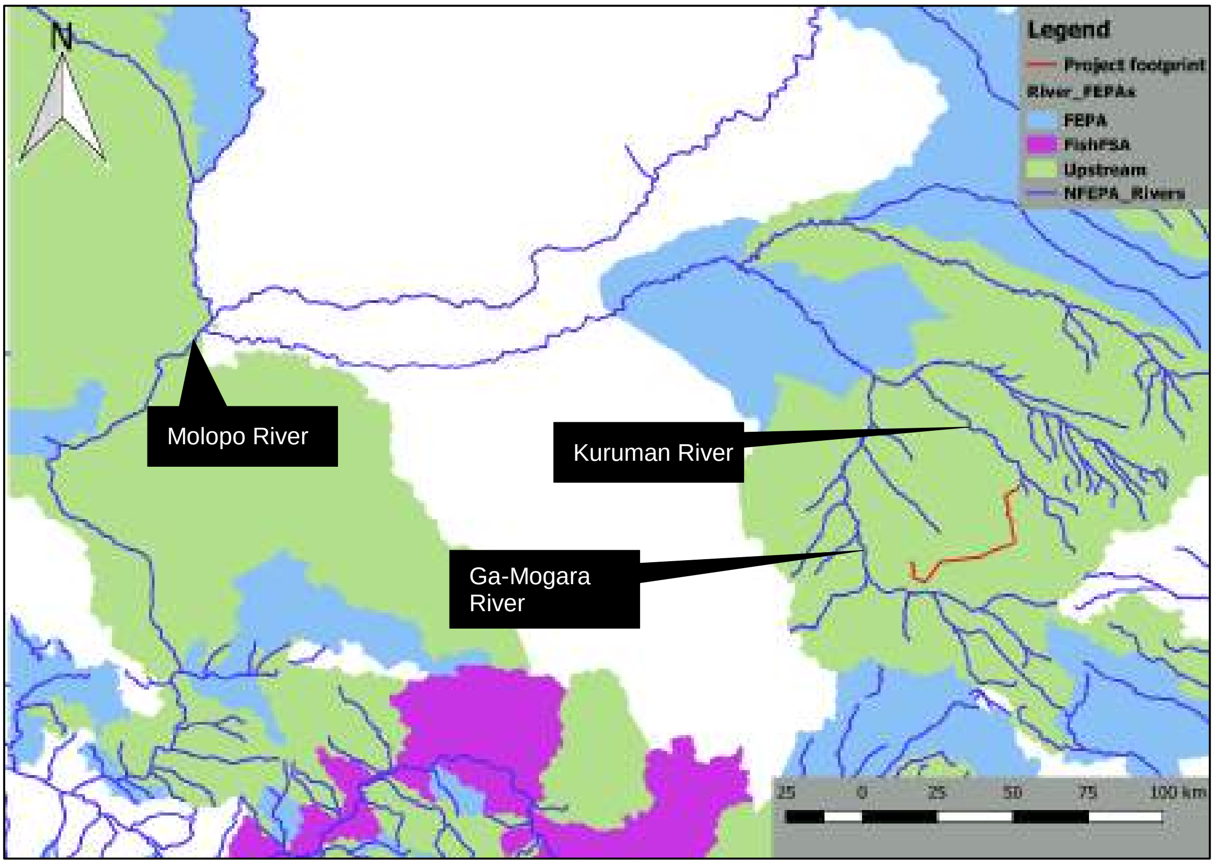


Figure 8: Freshwater Ecosystem Priority Areas and major rivers.

The sub-quaternary catchment in which the project footprint is located was selected as an Upstream Management Area (Figure 8). Upstream Management Areas, are sub -quaternary catchments in which human activities need to be managed to prevent degradation of downstream river Freshwater Ecosystem Priority Areas (FEPAs) and Fish Support Areas (FSAs). The sub-quaternary catchment located downstream of the confluence of the Ga-Mogara River with the Kuruman River was selected as a river FEPA and therefore requires adequate protection. River FEPAs achieve biodiversity targets for river ecosystems and fish species, and are identified in rivers that are currently in a good condition (A or B ecological category).

According to NFEPA (2011) Alternative 1 will traverse a single natural seep wetland (natural wetland a in Figure 9) indicated to fall within an AB wetland condition (natural or good) as well as a smaller artificial feature (artificial wetland a in Figure 9); Alternative 3 will also traverse this artificial feature; and Alternative 2 will not traverse any wetland features (Figure 9). An additional artificial wetland (artificial wetland b in Figure 9) and an additional natural wetland (natural wetland b in Figure 9) have also been indicated in close proximity to Alternative 1 and 3, however, these features will not be traversed by either Alternative (Figure 9). The topography has also resulted in the formation of numerous small ephemeral drainage lines, several of which will be traversed by all three alternatives (Chief Directorate Surveys and Mapping attained August 2015). The applicable wetland vegetation unit for the seep wetlands is the Eastern Kalahari Bushveld Group 3 and 4 (Figure 9) which is listed as 'Least Threatened' (NFEPA, 2011).

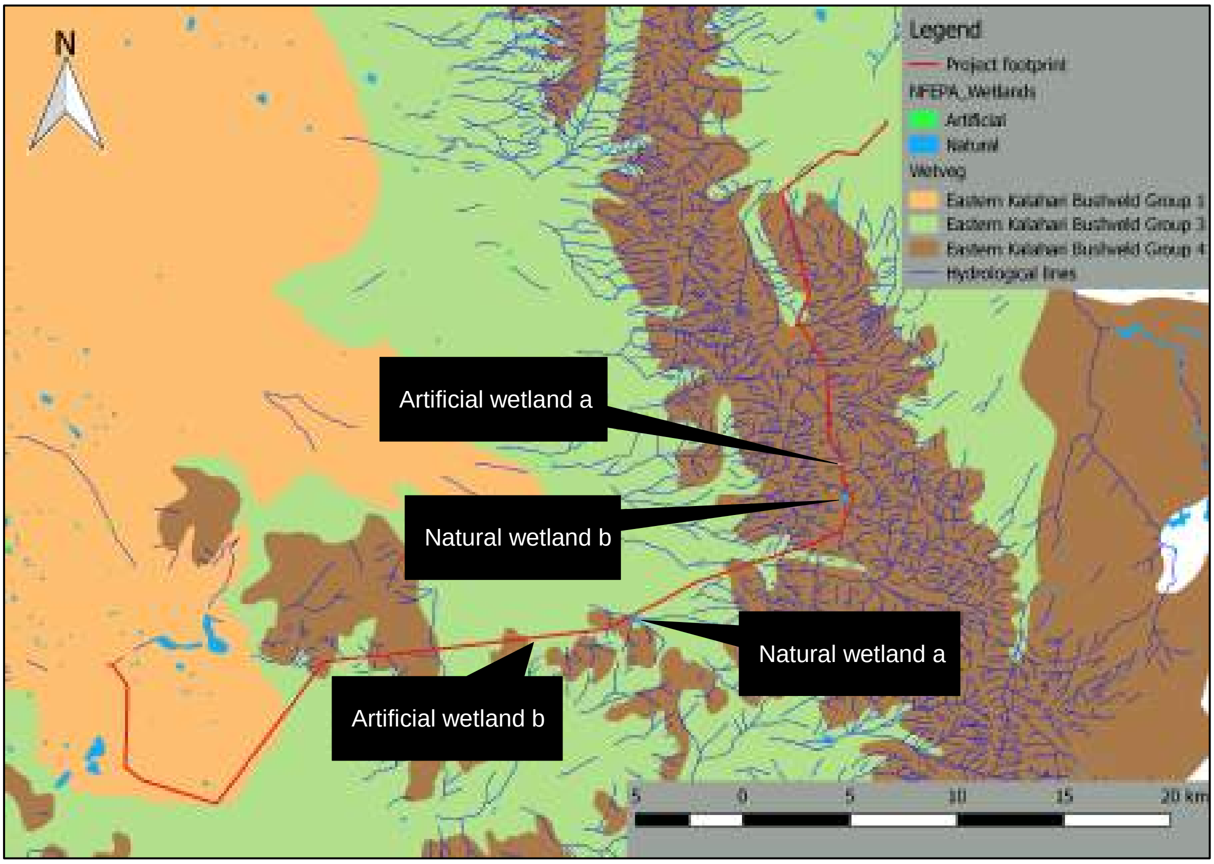


Figure 9: Wetland vegetation units and wetland habitat (NFEPA, 2011) as well as hydrological lines[5].

1.3.2. Results of the Field Study

The north eastern and south eastern extent of the project footprint is located within a landscape dominated by a series of ridges running in a north to south direction. Multiple ephemeral drainage lines originate at the crests along the length of the ridges. Some of these drainage lines steadily increase in size as they confluence with each other. However, drainage lines were also encountered which do not accumulate sufficient water volumes and which dissipate at the base of the ridge.

The central and south western extent of the project footprint is characterised by flat, open bushveld with isolated hills and koppies. The flatter topography of these areas is less susceptible to the formation of ephemeral drainage lines and only five ephemeral drainage lines were encountered which will be traversed by the project footprint (Alternative 1).

Ephemeral drainage lines occurring on steep hillslopes associated with the ridges along the north eastern and south eastern portion of the project footprints can be defined as A Section channels (Figures 10, 13 and 14). "A sections are those headward channels that are situated well above the zone of saturation at its highest level and because the channel bed is never in contact with the zone of saturation, these channels do not carry baseflow. They do however carry storm runoff during fairly high rainfall events but the flow is of short duration because there is no baseflow component." (DWAF, 2005). Many of these channels are located at gradients too steep to allow deposition of alluvial soil or overtopping of banks which in turn would be conducive of the formation of riparian zones.

[5] Vector data received from the Chief Directorate Surveys and Mapping August 2015.

Figure 10: Representative photos of A Section channels (indicated by white arrows).

Additional ephemeral drainage lines extend through the flat valleys at the bases of hillslopes associated with the project footprint and are often augmented by the A section channels. These ephemeral drainage lines can be defined as ‘arid drainage lines’ or ‘washes’ and are often characterised by poorly defined or discontinuous channels due to lower annual rainfall, longer rainfall intervals, high evapotranspiration and high infiltration in areas with sandy soils (Lichvar *et al*., 2004 and Grobler, 2016) (Figures 11, 13, 14 and 15). Washes differ from arid drainage lines in that they are often larger and wider in extent. The lack of sufficient surface water flow within the majority of the arid drainage lines and washes in combination with the absence of shallow groundwater resources (pers. communication with Mr. du Plessis) is not conducive to the formation of riparian zones. All three alternatives will traverse arid drainage lines and Alternatives 1 and 3 will traverse a wash.

Poorly defined riparian zones are only associated with isolated areas along some of the larger arid drainage lines. Although the tree community is sparse within these isolated areas, trees such as *Vachellia erioloba* (Camel thorn) and *Ziziphus mucronata* (Buffalo thorn) provide shelter for avifauna as well as nutrient concentrations that enable the persistence of understory’s which in turn provide foraging and breeding habitat for ground dwelling faunal species (van Rooyen, 2001).

Figure 11: Representative photos of arid drainage lines (top) and washes (bottom).

According to the NFEPA project (2011) an artificial seep wetland will be traversed by Alternative 1 and 3 (Figure 9). However, upon investigation, it was found that this feature is in fact an artificial impoundment within an ephemeral drainage line (Figure 12a). The natural seep wetland, indicated in close proximity to Alternative 1 and 3 (NFEPA, 2011, Figure 9) was also investigated during the field survey. However, it was found to be an area cleared of vegetation in the vicinity of a primary residence. No wetland indicators as defined by DWAF (2008) were identified within the area indicated as wetland or immediate surroundings (Figure 12b).

At the time of the field investigation the route of the western portion of Alternative 1 had not yet been finalised and the natural seep wetland indicated to be traversed by the route (natural wetland a in Figure 9) as well as the artificial wetland in close proximity to the route (artificial wetland b in Figure 9) were therefore not investigate on site. However, after careful examination of Google Earth Pro Imagery (2017) it was concluded that the area indicated as a natural seep wetland is in fact an area cleared of vegetation in the vicinity of a primary residence (Figure 12c). In addition, the area indicated as an artificial wetland is an impoundment within a drainage line within which artificial wetland habitat has developed.

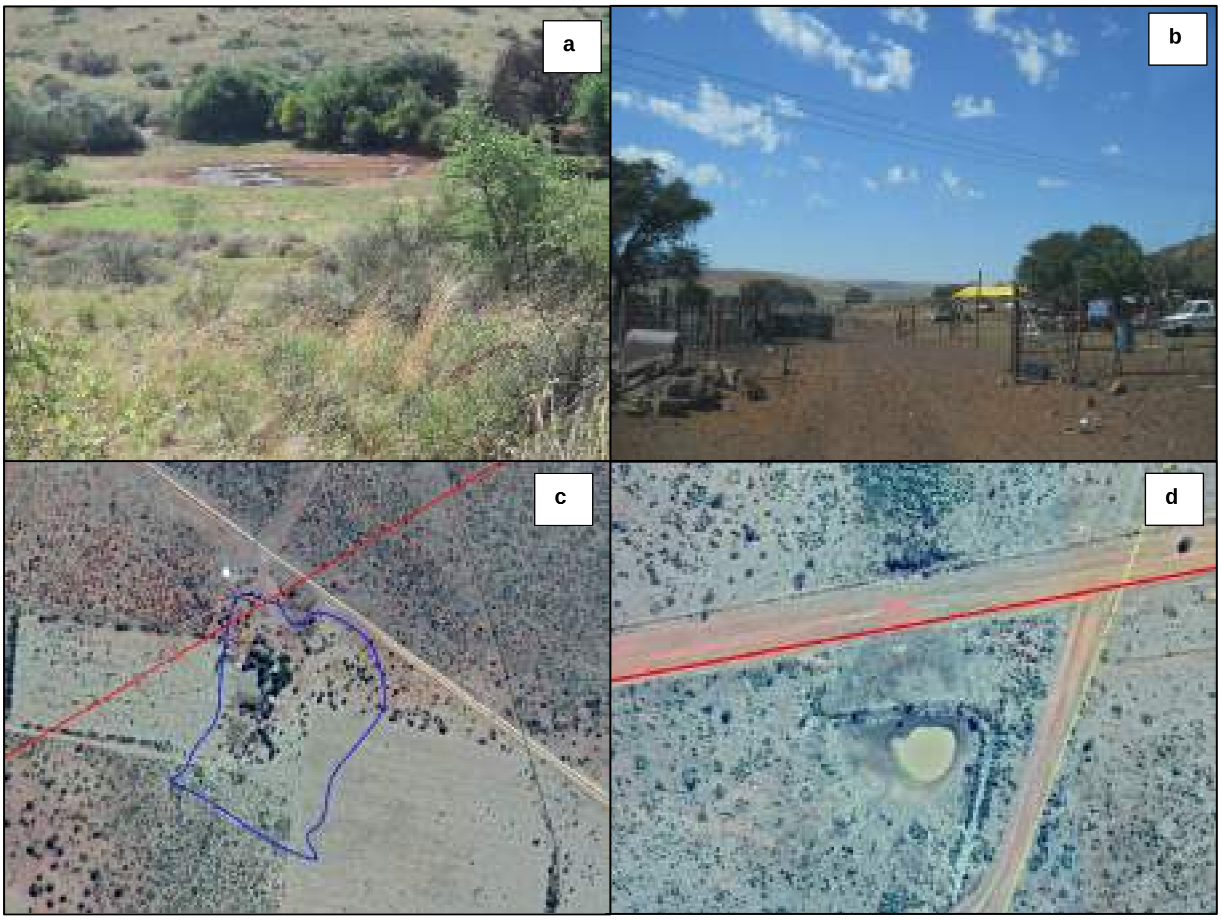


Figure 12: Representative photos of the artificial impoundment (a), the area indicated as a seep wetland in close proximity to Alternative 1 and 3 by NFEPA (b); and Google Earth Pro (2017) imagery of the area indicated as a seep by NFEPA which will be traversed by Alternative 1 (boundary of wetland indicated in blue) (c) as well as the impoundment within close proximity to Alternative 1.

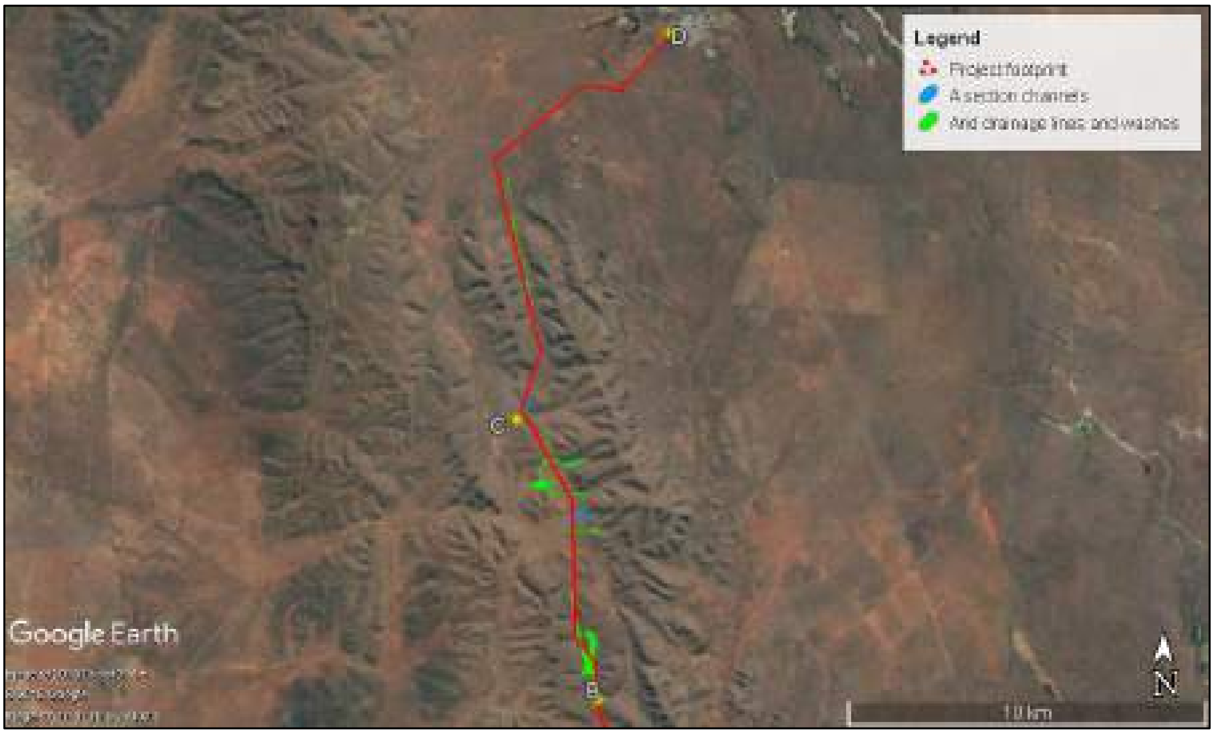


Figure 13: Ephemeral drainage lines (including A section channels, arid drainage lines and washes) associated with the project footprint (northern portion) (please refer to shape files provided)[6].

Figure 14: Ephemeral drainage lines (including A section channels, arid drainage lines and washes) associated with the project footprint (central portion) (please refer to shape files provided) [7].

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[6] Please note, the delineations depicted in the figure above present those portions of ephemeral drainage lines in the vicinity of the project footprint, however, all the ephemeral drainage lines are longitudinal in nature and extend beyond the presented delineations.
[7] Please note, the delineations depicted in the figure above present those portions of ephemeral drainage lines in the vicinity of the project footprint, however, all the ephemeral drainage lines are longitudinal in nature and extend beyond the presented delineations.

Figure 15: Ephemeral drainage lines (including arid drainage lines and washes) associated with the project footprint (southern portion) (please refer to shape files provided) [8].

1.3.3. Aquatic Ecosystem Classification

All ephemeral drainage lines are located within a valley floor landscape which occurs at the base of a valley, situated between two distinct valley side-slopes, where alluvial or fluvial processes typically dominate (Ollis *et al*. 2013). The table below summarise the results from **Level 4** through to **Level 6**.

Table 4: Aquatic ecosystem classification (Ollis *et al*., 2013)

	Ephemeral drainage lines
Level 4	**River**: a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water. A river is taken to include both the active channel and the riparian zone as a unit[9].
Level 5	**Intermittent:** water flows for a relatively short time of less than one season's duration.
Level 6	**Natural**: existing in, or produced by nature; not made or caused by humankind.

1.3.4. Watercourse Delineation

Ephemeral drainage lines were desktop delineated with the use of background information and digital satellite imagery (Google Earth Pro). Vector data obtained from the Chief Directorate Surveys and Mapping (August 2015) was overlain on Google Earth Pro imagery in order to determine the potential locality of watercourses. Changes in topography and evidence of water moving through the landscape, such as channels, changes in soil colour and changes in vegetation structure, were utilised in order to desktop delineate the boundaries of the ephemeral drainage lines.

[8] Please note, the delineations depicted in the figure above present those portions of ephemeral drainage lines in the vicinity of the project footprint, however, all the ephemeral drainage lines are longitudinal in nature and extend beyond the presented delineations.

[9] The ephemeral drainage lines encountered are not considered to be representative of typical rivers with riparian zones, however, of the definitions provided by the classification system, the 'river' definition best describes these features.

The desktop assessment was followed by a physical site survey undertaken in mid-January 2018. At this time the route of the western portion of Alternative 1 had not yet been finalised, however, pre-selected areas of interest associated with Alternative 2, Alternative 3, and the eastern portion of Alternative 1 were investigated in order to groundtruth the accuracy of the desktop delineations as well as to verify the perceived level of sensitivity of watercourses.

According to DWAF (2008), indicators used to determine the boundary of the riparian zone of watercourses include: landscape position; alluvial soils and recently deposited material; topography associated with riparian areas; and vegetation associated with riparian areas. However, due to a lack of a distinctive riparian zone, indicators such as landscape position and topography were utilised as the primary indicators when delineating the boundary of ephemeral drainage lines during the site survey. The majority of the ephemeral drainage lines were characterised by the presence of poorly defined or discontinuous channels and, where present, the banks of these channels were utilised to define the extent of the watercourses.

Figure 16: Representative images of ephemeral drainage lines associated with the project footprint. Note poorly defined channels utilized when determining the extent of the watercourses.

1.3.5. Present Ecological State (PES)

In order to determine the PES of the ephemeral drainage lines, the River IHIA was applied (refer to methodology in section 1.1.3.4). The IHIA is founded on the assessment of two separate modules of a watercourse namely riparian habitat and instream habitat. However, due to a lack of riparian habitat within the ephemeral drainage lines, the riparian habitat module of the IHIA could not be applied and to some degree aspects assessed as part of the instream assessment would not be entirely applicable either. However, to obtain an estimated PES category for these drainage lines, the IHIA instream module was applied.

The primary surrounding land use is stock farming (cattle and sheep) and the north eastern portion of the project footprint extends through an area which is currently utilised as a game farm. The low regional rainfall in combination with the absence of perennial rivers near the project footprint is not favorable for extensive crop cultivation. As a result, natural vegetation has largely remained in a good condition. However, valleys associated with the south-eastern portion of the project footprint are overgrazed. Furthermore, natural vegetation cover was found to decrease, and erosion was noted in isolated areas near watering points, roads and fences. In addition, natural vegetation has been removed from a firebreak associated with the boundary fence of the adjacent military base.

Ephemeral drainage lines were divided into groups according to perceived degree of disturbance and each group was assessed accordingly:

- Group 1: A Section channels on hillslopes which have remained largely undisturbed due to their inaccessible nature;
- Group 2: A Section channels on hillslopes which have been disturbed as a result of the development of informal access roads or fences through the features or as a result of trampling by livestock. An increased level of erosion of the bed and banks of these features was noted;
- Group 3: Arid drainage lines and washes within valleys at the bases of hillslopes which are associated with a greater level of disturbance due to informal access road development and increased grazing pressure. This disturbance has resulted in an increased level of erosion of the bed and banks of the features; and
- Group 4: Arid drainage lines and washes within valleys which have been significantly disturbed as a result of overgrazing, gravel road development, the clearing of vegetation for the establishment of a firebreak and the development of impoundments. Overgrazing has resulted in the trampling of vegetation and in the formation of erosion gullies within the features.

The instream scores calculated for the ephemeral drainage lines within Group 1 fall within IHIA Category A (unmodified, natural); and the instream scores calculated for the ephemeral drainage lines within Group 2, Group 3 and Group 4 fall within IHIA Category C (Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged) (Refer to Tables 6, 7, 8 and 9 and to Figures 18, 19 and 20).

Table 5: Descriptive classes for the assessment of modifications to habitat integrity (after IHIA, 1999).

IMPACT CATEGORY	DESCRIPTION	SCORE
None	No discernible impact, or the modification is located in such a way that it has no impact on habitat quality, diversity, size and variability.	0
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size and variability is also very small.	1 - 5
Moderate	The modifications are present at a small number of localities and the impact on habitat quality, diversity, size and variability is also limited.	6 - 10
Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size and variability. Large areas are, however, not influenced.	11 - 15
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area is affected. Only small areas are not influenced.	16 - 20
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section is influenced detrimentally.	21 - 25

Table 6: IHIA results for ephemeral drainage lines falling within Group 1.

GROUP 1	Impact score	Weight	IHI Score	Impact Category	Confidence
Instream criteria					
Water abstraction	0	14	0	None	M
Flow modification	0	13	0	None	M
Bed modification	2	13	1.04	Small	H
Channel modification	2	13	1.04	Small	H
Water quality	0	14	0	None	L
Inundation	0	10	0	None	M
Exotic macrophytes	0	9	0	None	H
Exotic fauna	0	8	0	None	L
Solid waste disposal	0	6	0	None	H
Provisional Instream Habitat Integrity		100	97.92		
IHIA Category			**A**		

Table 7: IHIA results for ephemeral drainage lines falling within Group 2.

GROUP 2	Impact score	Weight	IHI Score	Impact Category	Confidence
Instream criteria					
Water abstraction	0	14	0	None	M
Flow modification	14	13	7.28	Moderate	M
Bed modification	14	13	7.28	Moderate	H
Channel modification	14	13	7.28	Moderate	H
Water quality	0	14	0	None	L
Inundation	0	10	0	None	M
Exotic macrophytes	0	9	0	None	H
Exotic fauna	0	8	0	None	L
Solid waste disposal	0	6	0	None	H
Provisional Instream Habitat Integrity		100	78.16		
IHIA Category			**C**		

Table 8: IHIA results for ephemeral drainage lines falling within Group 3.

GROUP 3	Impact score	Weight	IHI Score	Impact Category	Confidence
Instream criteria					
Water abstraction	0	14	0	None	M
Flow modification	16	13	8.32	Moderate	M
Bed modification	15	13	7.8	Moderate	H
Channel modification	15	13	7.8	Moderate	H
Water quality	0	14	0	None	L
Inundation	0	10	0	None	M
Exotic macrophytes	0	9	0	None	H
Exotic fauna	0	8	0	None	L
Solid waste disposal	0	6	0	None	H
Provisional Instream Habitat Integrity		100	76.08		
IHIA Category			**C**		

Table 9: IHIA results for ephemeral drainage lines falling within Group 4.

GROUP 4	Impact score	Weight	IHI Score	Impact Category	Confidence
Instream criteria					
Water abstraction	0	14	0	None	M
Flow modification	15	13	7.8	Moderate	M
Bed modification	20	13	10.4	Moderate	H
Channel modification	20	13	10.4	Moderate	H
Water quality	0	14	0	None	L
Inundation	0	10	0	None	M
Exotic macrophytes	0	9	0	None	H
Exotic fauna	0	8	0	None	L
Solid waste disposal	0	6	0	None	H
Provisional Instream Habitat Integrity		100	71.4		
IHIA Category			**C**		

Figure 17: Evidence of erosion and livestock grazing encountered within ephemeral drainage lines.

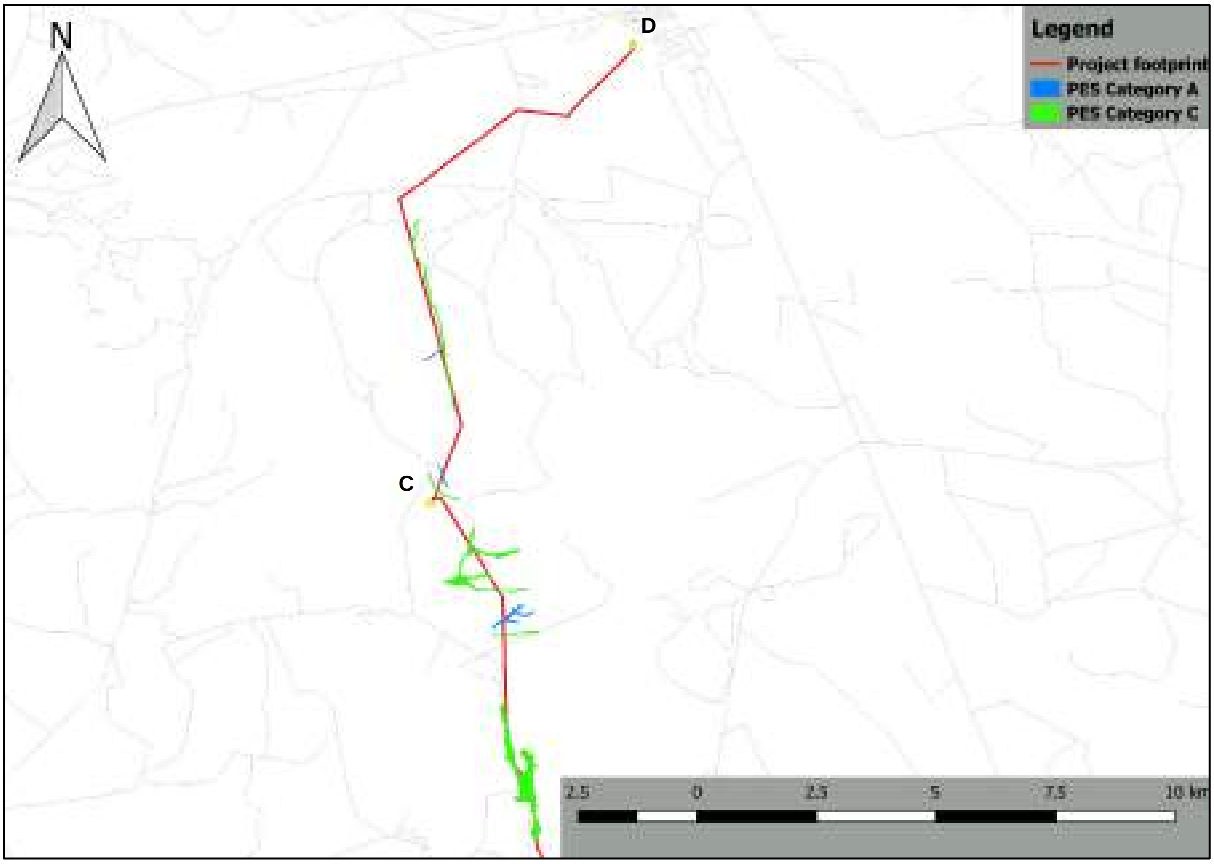

Figure 18: PES of ephemeral drainage lines associated with the northern portion of the project footprint (Alternative 1, 2 and 3).

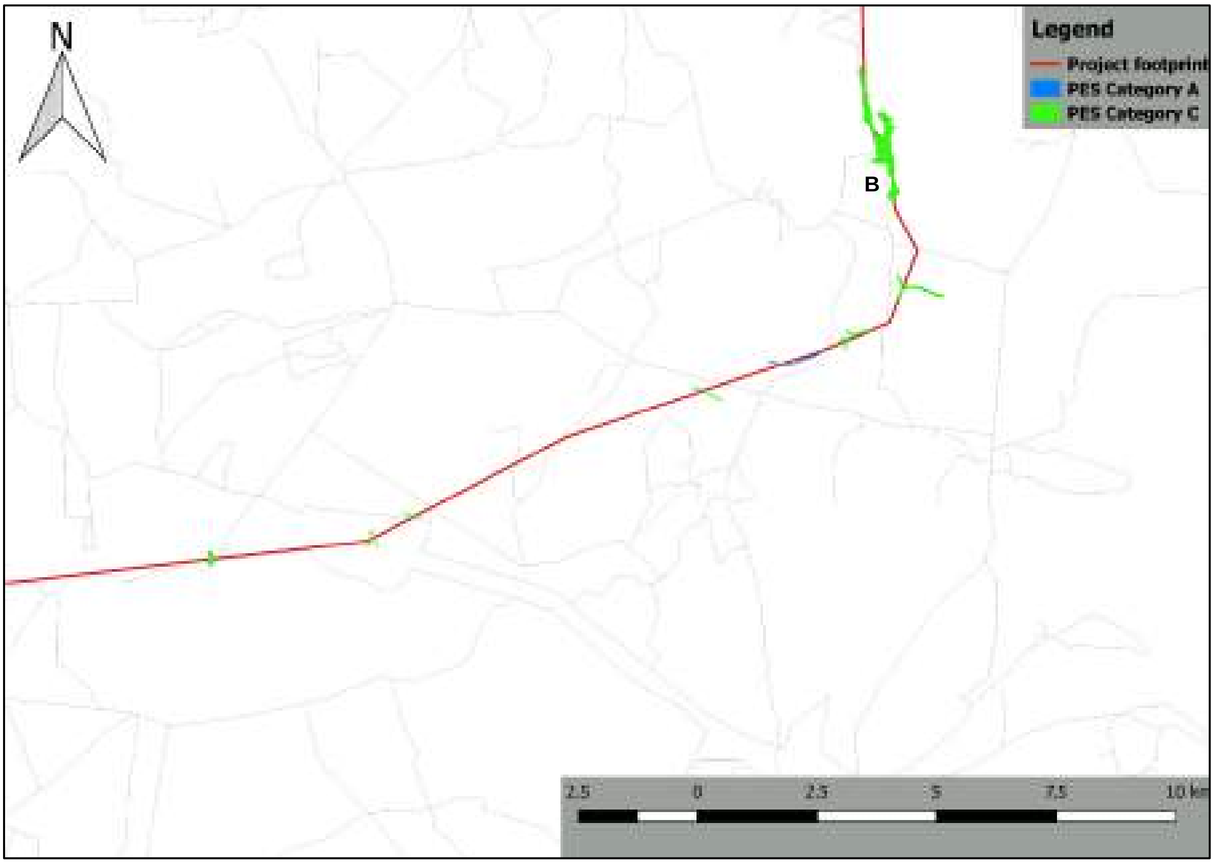

Figure 19: PES of ephemeral drainage lines associated with the central portion of the project footprint (Alternative 1 and 3).

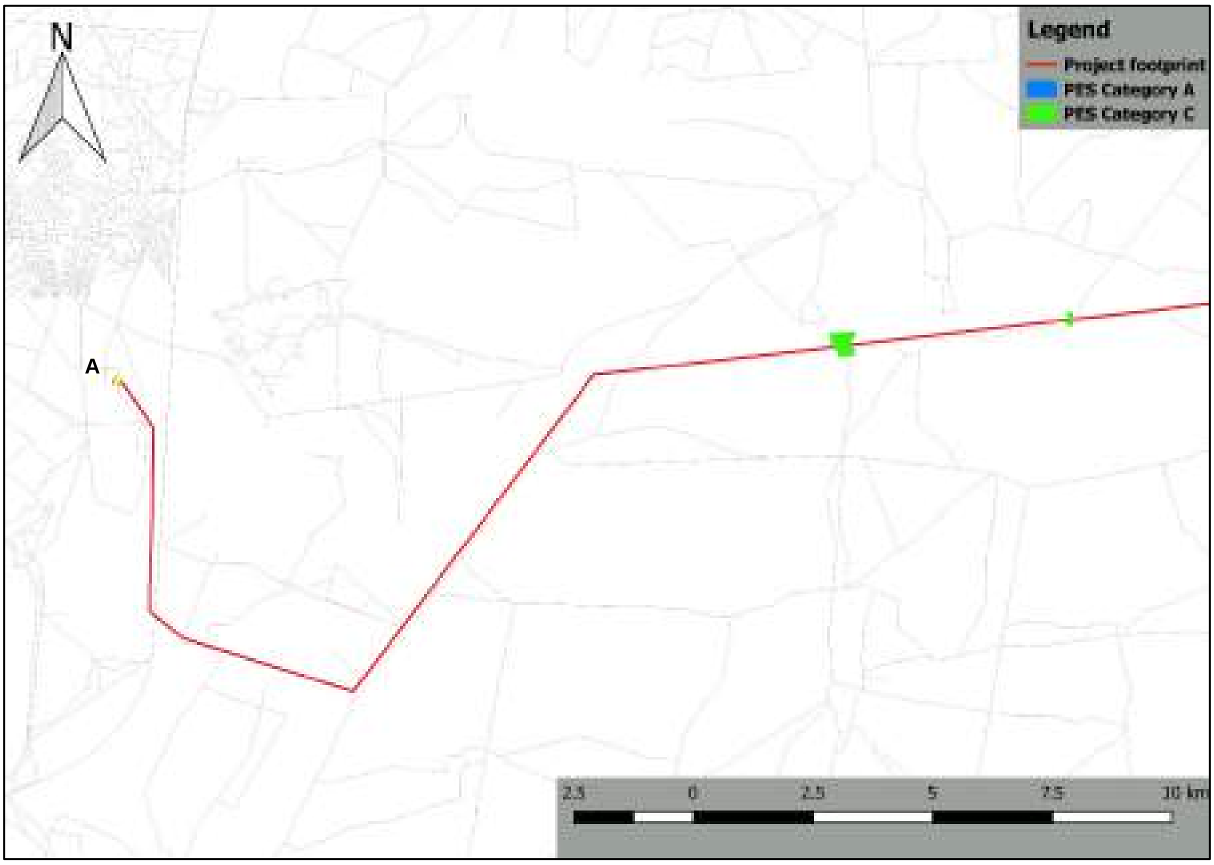

Figure 20: PES of ephemeral drainage lines associated with the southern portion of the project footprint (Alternative 1).

1.3.6. Ecological Importance and Sensitivity (EIS)

The EIS method of assessment for rivers is based on the approach adopted by the DWA as detailed in the document "Resource Directed Measures for Protection of Water Resources" (1999). Due to their similar characteristics and nature, all ephemeral drainage lines were considered in a single assessment. Although the PES of the various features differed slightly, this does not have a significant impact on the overall EIS of the features.

Ephemeral drainage lines associated with the project footprint are situated above the zone of saturation and therefore do not carry baseflow. Due to the absence of baseflow these drainage lines only flow for short intervals after sufficient rainfall and are not associated with a diversity of habitat units such as riffles, runs or rapids. Furthermore, the lack of sufficient surface water flow in combination with the absence of shallow groundwater resources (pers. communication with Mr. du Plessis) is not conducive to the formation of riparian zones. The poor diversity of instream habitat units and the lack of riparian areas decreases the ability of the drainage lines to support a high diversity of species or to provide refugia to aquatic biota. The poor diversity of habitat units also decreases the sensitivity of the features to flow changes and flow related water quality changes. Furthermore, the lack of flowing water within the features for the majority of the year decreases the importance of the drainage lines in terms of the provision of migration corridors for aquatic biota. However, it should be noted that an impoundment within one of the drainage lines (indicated as artificial wetland b in Figure 9) was found to contain artificial wetland habitat which may provide suitable breeding habitat for Giant Bullfrogs as well as additional toad species (Todd, 2018). All mitigation measures for this habitat as recommended by the faunal specialist must therefore be strictly adhered to in order to prevent the disturbance of potential habitat.

The ephemeral drainage lines were not found to support rare and endangered species or unique populations of species. It is also considered highly unlikely that the drainage lines will support biota which are intolerant to changes in flow due to the highly ephemeral nature of the features. However, the drainage lines are located within a natural area and provide the habitat to support individuals of protected species such as *Acacia erioloba* (Camel Thorn) and *Nerine* sp. which increases the importance of the features slightly.

Although the ephemeral drainage lines calculated an overall low EIS score (Table 10) and are considered to be of low sensitivity in terms of water yield and quality (Macfarlane *et al.*, 2014), these features do still provide valuable functions such as attenuation of floodwaters and retention of excess sediments. Furthermore, the drainage lines provide the habitat to support protected floral species. The unnecessary disturbance of these features must therefore be avoided.

Table 10: EIS results for the ephemeral drainage lines

	Ephemeral drainage lines	Confidence
Rare and endangered biota	1	3
Populations of unique biota	0	3
Intolerant biota	0	3
Species/taxon richness	1	3
Diversity of habitat types or features*	1	4
Refuge value of habitat types	1	4
Sensitivity of habitat to flow changes	1	4
Sensitivity to flow related water quality changes	1	4
Migration route/corridor for instream and riparian biota	0	3
National parks, Wilderness areas, Nature reserves, Natural Heritage sites, and Natural areas	1	4
TOTAL	**6**	
MEDIAN	**1**	
OVERALL EIS	**Low/Marginal**	

Score guideline Very high = 4; High = 3, Moderate = 2; Marginal/Low = 1; None = 0
Confidence rating Very high confidence = 4; High confidence = 3; Moderate confidence = 2; Marginal/low confidence = 1
* a rating of zero is not appropriate in this context.

1.3.7. Recommended Ecological Category (REC)

The establishment of service roads traversing ephemeral drainage lines will result in the disturbance of vegetation and soils. The PES of the portions of the ephemeral drainage lines in the vicinity of the service road crossing areas is therefore likely to decrease. However, it is considered possible to maintain the PES of the features as a whole[10] with the implementation of the recommendations as listed in Section 1.6 below. These recommendations include amongst others; the location of laydown areas outside of watercourses and their buffer areas, limiting the extent of the construction footprint area to avoid unnecessary disturbance; making use of existing access roads where possible, alien and invasive species control; monitoring of service roads traversing ephemeral drainage lines during the operational phase in order to avoid erosion of the features or alteration of the natural flow patterns through the features; and rehabilitation of all service road crossing areas during the decommissioning phase of the development.

1.3.8. Buffer Requirements

The most recent guideline for buffer allocation in South Africa does not apply to channels which lack active channel characteristics i.e. channels which are not in contact with the zone of saturation and which do not have base flow (Macfarlane *et al*., 2014). The minimum buffer zone requirements for electricity generation works is 20m (Macfarlane and Bredin, 2017). It is however the opinion of the specialist that a buffer of at least 32m[11] be provided for all drainage lines in order to reduce the risk of erosion (Figure 21, 22 and 23). No laydown areas should be sited within any of the 32m buffer areas. Where possible, transmission line support structures must also be placed outside of the 32m buffer areas. However, it is noted that this will not be possible in areas where ephemeral drainage lines traverse extended distances across the landscape. In these situations it is recommended that mitigation measures as listed within Section 1.6 are implemeted. In addition, the advocated buffers should be designated ‘’No Go’’ zones within the project footprint wherein only essential activities should be allowed during the establishment of service roads and the placement of transmission line support structures and distribution lines.

[10] The PES of the remainder of the longitudinal systems can be maintained.
[11] In line with EIA Regulations.

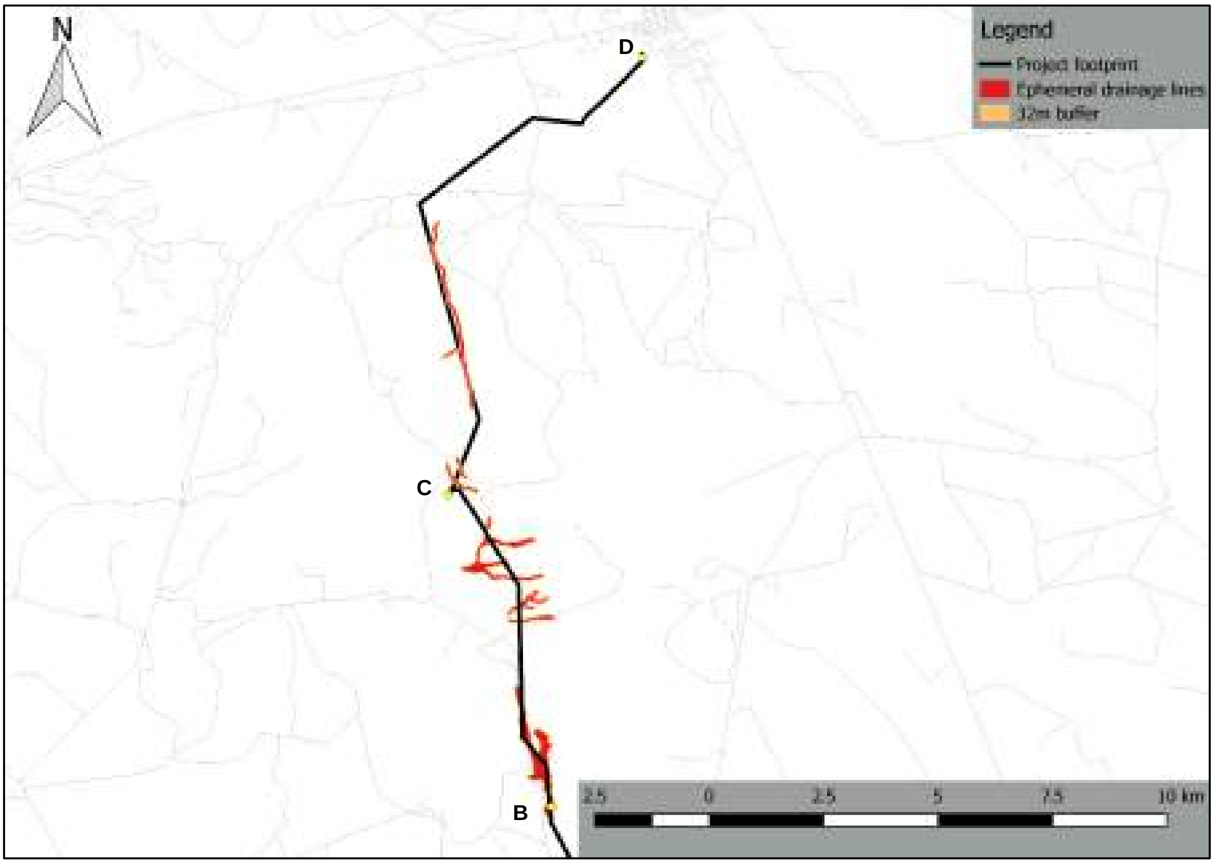

Figure 21: Ephemeral drainage lines and 32m buffer areas associated with the northern portion of the project footprint (Alternative 1, 2 and 3).

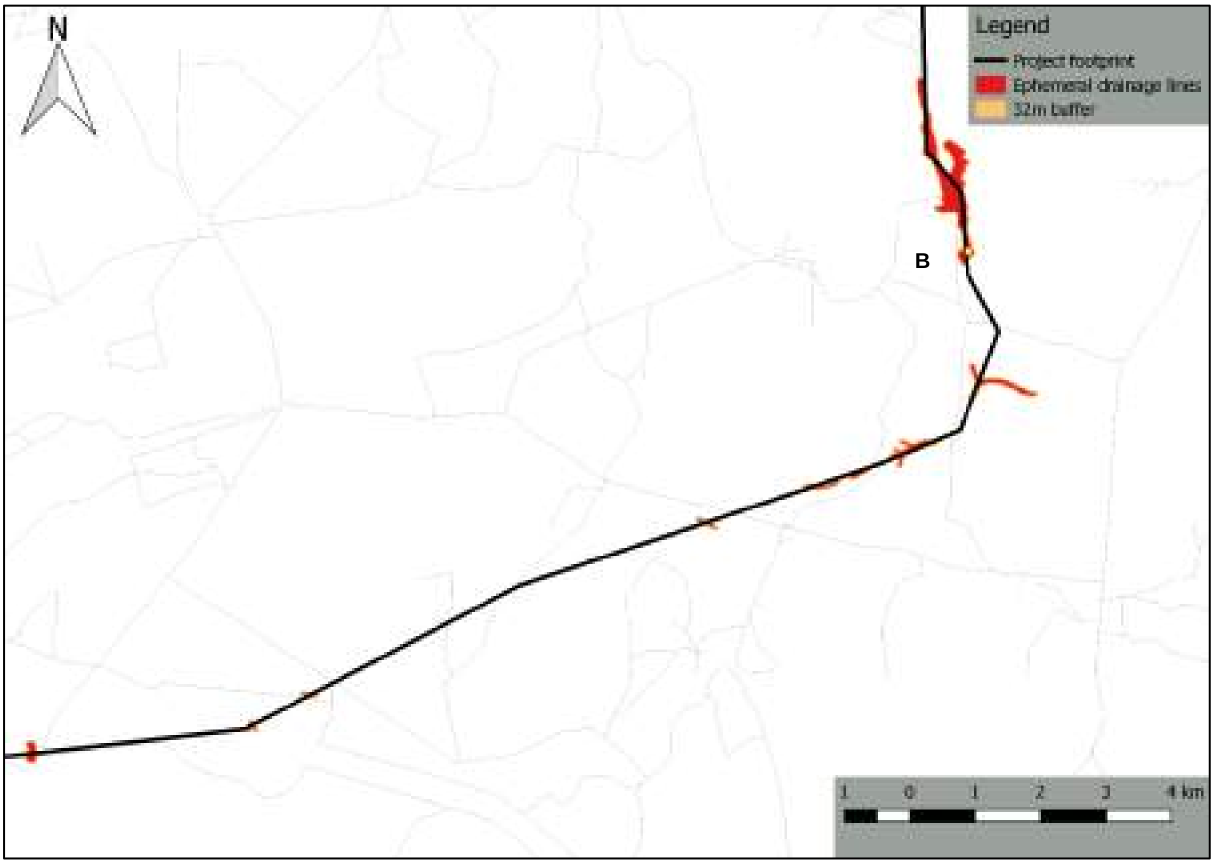

Figure 22: Ephemeral drainage lines and 32m buffer areas associated with the central portion of the project footprint (Alternative 1 and 3).

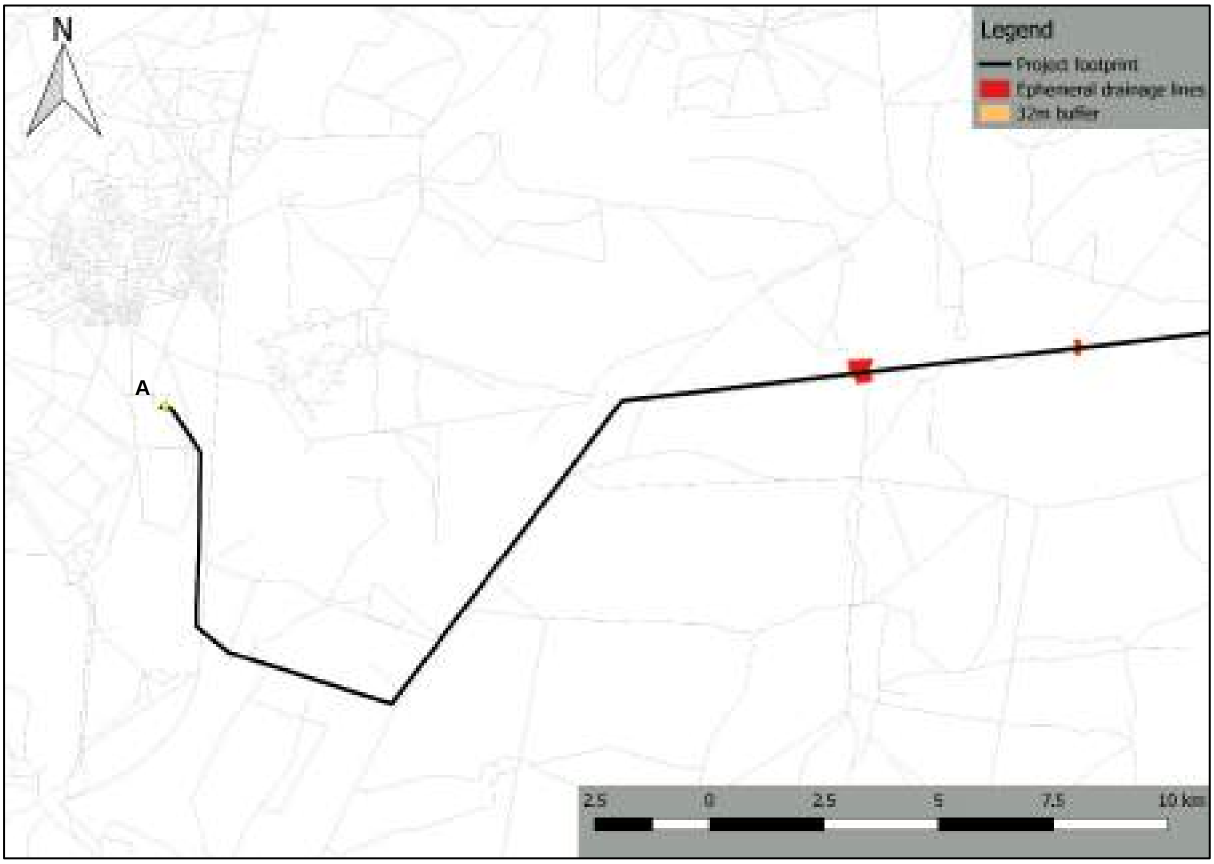

Figure 23: Ephemeral drainage lines and 32m buffer areas associated with the southern portion of the project footprint (Alternative 1).

1.4. APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

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

Any development within 32 meters a watercourse may require Environmental Authorisation in terms of the NEMA 107 of 1998 and subsequent amendments to the Act.

A watercourse is defined in the Act as:
(a) River or spring;
(b) A natural channel in which water flows regularly or intermittently;
(c) A wetland, pan, 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 as defined in the National Water Act (NWA, 1998) (Act No. 36 of 1998).

Note that a reference to a watercourse includes, where relevant, its bed and banks; and

“wetland” means land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

“dam” when used in these Regulations means any barrier dam and any other form of impoundment used for the storage of water, excluding reservoirs.

1.4.2. National Water Act (Act No 36 of 1998)

The crossing of watercourses e.g. with service roads is considered to be a water use as defined within the NWA and would require the authorisation from the Department of Water and Sanitation (DWS). In terms of the proposed project, water uses listed within Section 21 that will most likely require authorisation include -
(c) impeding or diverting the flow of water in a watercourse; and
(i) altering the bed, banks, course or characteristics of a watercourse.

It is important to note that "Altering the beds, banks, course or characteristics of a watercourse" means any change affecting the resource quality within the riparian habitat or 1:100 year flood line, whichever is the greater distance.

1.4.3. National Forest Act (Act No 84 of 1998)

The removal of *Acacia erioloba* or any other tree listed within the National Forest Act (NFA) 84 of 1998 at watercourse crossing points will require a tree removal permit which can be obtained from the Department of Agriculture, Forestry and Fisheries (DAFF).

1.4.4. National Environmental Management Biodiversity Act (Act No. 10 of 2004) Alien and Invasive Species Regulations (GN R598 of 2014)

According to the National Environmental Management Biodiversity Act (NEMBA, Act No. 10 of 2004) Alien and Invasive Species Regulations (GN R598 of 2014) alien and invasive species must be eradicated and managed according to the category and criteria specified.

1.4.5. Northern Cape Nature Conservation Act (Act 9 of 2009)

Restricted activities involving protected plants such as individuals of *Nerine* sp.

Subject to the provisions of Section 52, no person may, without a permit –

a) Pick;
b) Import;
c) Export;
d) Transport;
e) Cultivate; or
f) Trade in

A specimen of a protected plant.

1.5. IDENTIFICATION OF KEY ISSUES

1.5.1. Identification of Potential Impacts

Sections 21 (c) and (i) of the NWA, refer to the physical changes that are made to a watercourse. Watercourses in context to this project include all delineated ephemeral drainage lines presented in Figures 13, 14 and 15. It is a requirement of the WUL application process that potential impact on the following characteristics be determined:

- Impact on the flow regime;
- Impact on the water quality;
- Impact on biota - the animal and plant life of a particular region or habitat; and
- Impact on riparian habitat.

These four direct impacts therefore formed the foundation of the freshwater impact assessment however, any additional potential impacts were also identified and assessed.

Three alternatives were provided by the proponent for assessment. These include (with reference to Figure 2):

- Alternative 1: runs from the Kuruman Phase 1 substation (C) to the Ferrum substation (A) (C-B-A). This is the preferred 132kV overhead line should both Phase 1 and 2 WEFs be constructed. However, in the event that the Phase 2 WEF is not constructed, this line will only be considered if Alternative 2 is not recommended/authorised.
- Alternative 2: runs from Kuruman Phase 1 substation (C) to Segame substation (D) (C-). In the event that only Phase 1 WEF is constructed, Alternative 1 would be too expensive and therefore Alternative 2 (C – D) would be the preferred route.
- Alternative 3: runs from Kuruman Phase 1 substation (C) to Kuruman Phase 2 substation (B) (C-B). Alternative 3 would be required if only Phase 2 WEF is constructed. The complete 132kV line would require authorisation of Alternative 2 (C – D) and Alternative 3 (C – B).

<u>Impacts considered to be likely during the construction, operational and decommissioning phase of all three alternatives include:</u>

1.5.1.1. Construction Phase

- Potential **direct** impact 1 – Disturbance of drainage lines;
- Potential **direct** impact 2 – Alteration of flow patterns; and
- Potential **direct** impact 3 – Impairment of water quality.

1.5.1.2. Operational Phase

- Potential **direct** impact 1 – Degradation of drainage lines; and
- Potential **direct** impact 2 – Alteration of the natural hydrological regime.

1.5.1.3. Decommissioning Phase

- Potential **direct** impact 1 – Degradation of drainage lines; and
- Potential **direct** impact 2 – Impairment of water quality.

<u>Cumulative impacts considered to be likely following authorisation of any of the three proposed alternatives include:</u>

1.5.1.4. Cumulative impacts

- Cumulative impact 1 – Proliferation of alien and invasive species; and
- Cumulative impact 2 – Erosion of drainage lines.

It is the opinion of the specialist that any potential indirect impact can be avoided with strict adherence to mitigation measures provided for direct impacts. No indirect impacts were identified as part of this assessment.

1.6. ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

In assessing the identified potential construction phase impacts, it has been assumed that good housekeeping measures (listed in Section 1.1.4.) will be implemented through adherence to the EMPr.

1.6.1. Construction Phase Impact

1.6.1.1. Potential Impact 1 - Disturbance of drainage lines

a) Nature of the impact:

Development of electrical and support infrastructure and laydown areas within ephemeral drainage lines, and the establishment of service roads traversing ephemeral drainage lines will result in disturbance of the bed and banks and the lowering of the PES of ephemeral drainage lines.

Movement of construction vehicles through ephemeral drainage lines will result in the compaction of soils which may impact on vegetation and result in erosion.

Edge effects and indiscriminate driving, fires and dumping of construction material and spoil will also result in disturbance, it is therefore important that access into areas bordering the designated crossings is strictly prohibited.

Proliferation of alien vegetation as well as bush encroachment are also considered highly likely if not adequately managed.

b) Significance of impact without mitigation measures:

The significance of the impact associated with each Alternative was based on the total area of ephemeral drainage line habitat that will be disturbed as a result of the development of the proposed transmission lines and associated support structures, laydown areas and service roads. According to the layout plan provided, Alternative 1 will traverse approximately 3.76km[12] of ephemeral drainage line habitat, Alternative 2 will traverse approximately 0.18km of ephemeral drainage line habitat and Alternative 3 will traverse approximately 2.8km of ephemeral drainage line habitat.

However, transmission lines will be above ground and associated service roads will follow existing gravel roads where possible. It has also been assumed that transmission line support structures will be located outside of ephemeral drainage lines as far as possible. Therefore, only approximately 2.1km of Alternative 1; 0.13km of Alternative 2; and 1.5km of Alternative 3 will require the establishment of new jeep tracks through ephemeral drainage lines.

The significant distance of ephemeral drainage line habitat which will be traversed by alternatives 1 and 3 is largely attributed to a significant portion of each Alternative which will traverse an extended area through an ephemeral drainage line (wash) where no existing gravel access roads are present (Figure 24). A new jeep service track will therefore need to be established through this area. An existing gravel access road is however located to the west of the ephemeral drainage line and it is therefore highly recommended that the

[12] Refers to the total length of the transmission line and jeep track which will directly traverse drainage lines.

transmission line and service roads follow this existing access road in order to reduce the impact to surrounding ephemeral drainage line habitat.

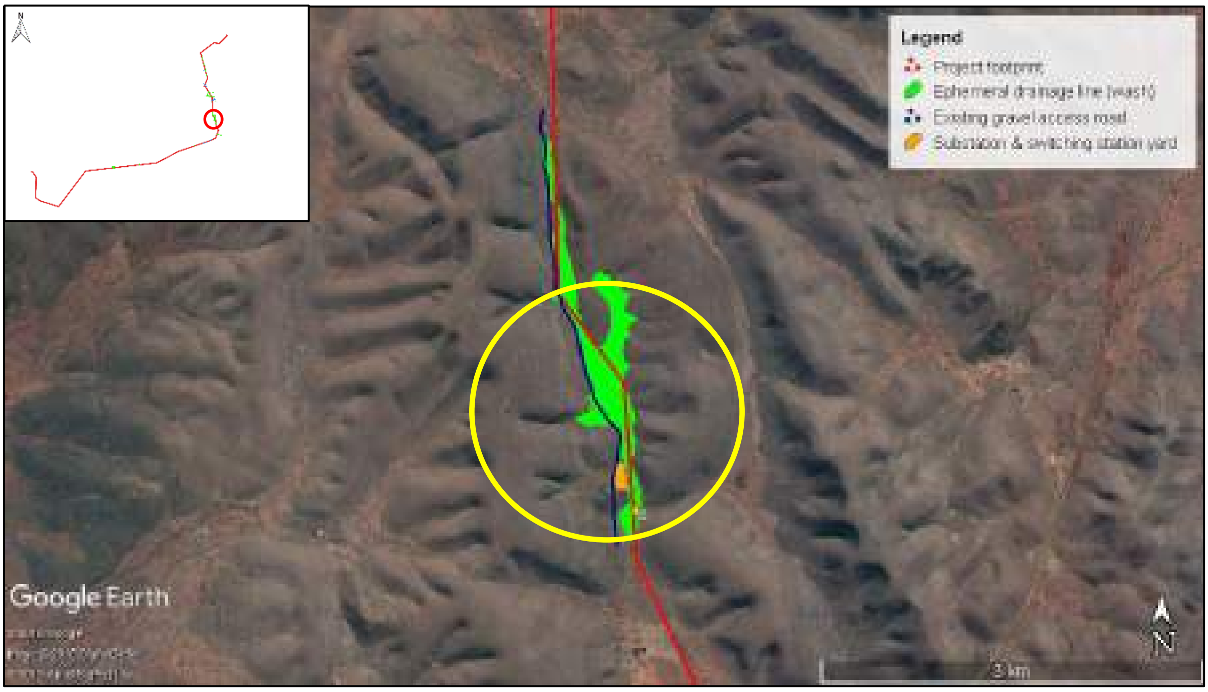

Figure 24: Significant distance of an ephemeral drainage line (wash) traversed by alternatives 1 and 3 where no existing gravel access roads are present (indicated by yellow circle); and an existing gravel access road indicated in dark blue.

The impact associated with Alternative 1 and 3 is therefore considered to be of a Moderate (negative) significance and the impact associated with Alternative 2 is considered to be of a Low (negative) significance prior to the implementation of mitigation measures.

c) <u>Proposed mitigation measures:</u>

- The following recommendations regarding service road crossing areas are made for all alternatives:
  - Make use of existing access roads/service roads where possible and any turning areas required must be located outside of the buffer zones of ephemeral drainage lines;
  - Where the project footprint (including the transmission line and associated support structures as well as service road) will traverse the ephemeral drainage line as indicated in figure 24 above, it should do so following the existing gravel access road which is located to the west of the ephemeral drainage line. The establishment of new jeep tracks should not be required within this feature;
  - Where the crossing of ephemeral drainage lines is unavoidable, designate a single jeep track crossing area for new service roads. The following recommendations for new service road crossings apply:
    - No hard engineering should be utilized when establishing crossing areas;
    - If possible, new service road crossing areas should be developed at 90 degree angles to ephemeral drainage lines in order to limit the area of disturbance;
    - Vegetation at crossing areas should be cut rather than uprooted in order to avoid further disturbance of soils;
    - Excavation and cutting of channel banks and beds must be avoided;
    - Strictly prohibit any activity outside of the designated crossing area;

  - Appoint an Environmental Control Officer (ECO) to inspect ephemeral drainage line crossings on a weekly basis (at least) and take measures to address unforeseen disturbances to the ephemeral drainage lines.
- The following recommendations regarding the transmission line support structures are made for all alternatives:
  - Laydown areas must be place outside of ephemeral drainage lines and outside of 32m buffer areas;
  - Where possible, transmission line support structures must be placed outside of ephemeral drainage lines and outside of 32m buffer areas;
  - Mitigation measures for bullfrogs and toads (Todd, 2018) as specified for the artificial wetland habitat associated with an impoundment in an ephemeral drainage line (indicated as artificial wetland b in Figure 9) must be adhered to;
  - Where avoidance of ephemeral drainage lines is not possible due to the extended distances that they traverse through the landscape (e.g. Figure 24 above), the following measures are recommended:
    - Make use of existing access roads to support structure localities where possible. The indiscriminate movement of vehicles through ephemeral drainage lines in order to reach support structures must be strictly prohibited;
    - Support structures must be placed at least 300m apart and should preferably be placed within the buffer areas of the ephemeral drainage lines or within previously disturbed areas;
    - Support structures should only be placed within areas with a low risk of erosion;
    - Site specific erosion measures must be implemented where support structures will be placed within the ephemeral drainage lines or within 10m of the delineated boundaries of ephemeral drainage lines;
    - Engineer disturbed areas associated with transmission line support structures to coincide as closely as possible to original contours. Ensure that excavated vegetation and soil mounds are not left unattended (recreate original contours);
    - The appointed ECO must monitor each of the support structures located within ephemeral drainage lines or their buffer areas on a weekly basis for signs of erosion. Should erosion or sedimentation be noted immediate corrective measures must be undertaken. Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. Care must be taken to prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures. Additional erosion control measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern and, where possible, only soft engineering techniques should be implemented.
  - Keep the disturbance footprint at transmission line support structures to a minimum. Where possible, vegetation should be cut rather than uprooted in order to make way for support structures and laydown areas. This will prevent further disturbance of soils;
  - Store topsoil removed from the construction footprint of transmission line support structures at designated stockpile areas for use in rehabilitation activities. Designated stockpile areas must be located outside of the buffer areas of ephemeral drainage lines, preferably within already disturbed areas;
  - Stockpile topsoil and subsoil removed during construction separately for future rehabilitation;
  - Prohibit the dumping of excavated material within ephemeral drainage lines. Spoil material must be appropriately disposed of at a registered waste disposal facility;
  - Rehabilitate any areas surrounding transmission line support structures which have been disturbed as a result of construction related activities in order to prevent alien vegetation proliferation. A rehabilitation plan must be developed including rehabilitation measures such as:

- Rip and loosen compacted soils to a depth of 300mm in order to aid in the establishment of vegetation;
- Redistribute stockpiled topsoil across the area;
- Revegetate disturbed areas with vegetation assemblages reflecting the general species composition of the area as soon as possible after the application of topsoil and stabilising of soils. A botanical specialist should advise on appropriate species to be utilised during revegetation; and
- Strictly prohibit the use of alien vegetation during rehabilitation activities.

▪ Alien and Invasive species control:
  - o Appoint an ECO to check the construction footprint of transmission line support structures, service road crossing areas as well as immediately adjacent areas for alien and invasive species weekly and alien species noted must be removed;
  - o Remove alien species manually, by hand as far as possible. The use of herbicides should be avoided. Should the use of herbicides be required, only herbicides which have been certified safe for use in aquatic environments by an independent testing authority may be considered;
  - o Dispose of removed alien plant material at a registered waste disposal site or burn on a bunded surface where no stormwater runoff is expected;
  - o Remove vegetation before seed is set and released;
  - o Cover removed alien plant material properly when transported, to prevent it from being blown from vehicles; and

▪ Prohibit fires.

d) Significance of impact with mitigation measures:

The impact associated with Alternative 1 and 3 was assessed to be of a Low (negative) significance and the impact associated with Alternative 2 was assessed to be of a Very Low (negative) significance after the implementation of mitigation measures.

1.6.1.2. Potential Impact 2 - Alteration of flow patterns

a) Nature of the impact:

Reduction of infiltration capacity and increase in runoff volume and intensity from areas cleared for service roads, transmission line support structures and for laydown areas will result in an increase in the volume of water reaching the ephemeral drainage lines and will ultimately result in an increase in the erosion of drainage lines.

b) Significance of impact without mitigation measures:

The impact associated with Alternative 1 and 3 was assessed to be of a Moderate (negative) significance and the impact associated with Alternative 2 was assessed to be of a Low (negative) significance.

c) Proposed mitigation measures:

▪ The following recommendations regarding service road crossing areas are made for all alternatives:
  - o Make use of existing access roads/service roads where possible and any turning areas required must be located outside of the buffer zones of ephemeral drainage lines;
  - o Where the crossing of ephemeral drainage lines is unavoidable, designate a single jeep track crossing area for new service roads. The following recommendations for new service road crossings apply:
    - No hard engineering should be utilized while establishing crossing areas;

    - If possible, new service road crossing areas should be developed at 90 degree angles to ephemeral drainage lines in order to limit the area of disturbance;
    - Vegetation at crossing areas should be cut rather than uprooted in order to avoid further disturbance of soils;
    - Excavation and cutting of channel banks and beds must be avoided;
    - Strictly prohibit any activity outside of the designated crossing area;
- The following recommendations are made regarding the transmission line support structures for all alternatives:
  - Laydown areas must be place outside of ephemeral drainage lines and outside of 32m buffer areas;
  - Where possible, transmission line support structures must be placed outside of ephemeral drainage lines and outside of 32m buffer areas;
  - Where avoidance of ephemeral drainage lines is not possible due to the extended distances that they traverse through the landscape (e.g. Figure 24 above), the following measures are recommended:
    - Make use of existing access roads to support structure localities where possible. The indiscriminate movement of vehicles through ephemeral drainage lines in order to reach support structures must be strictly prohibited;
    - Support structures must be placed at least 300m apart and should preferably be placed within the buffer areas of the ephemeral drainage lines or within previously disturbed areas;
    - Support structures should only be placed within areas with a low risk of erosion;
    - Site specific erosion measures must be implemented where support structures will be placed within the ephemeral drainage lines or within 10m of the delineated boundaries of ephemeral drainage lines;
    - Engineer disturbed areas associated with transmission line support structures to coincide as closely as possible to original contours. Ensure that excavated vegetation and soil mounds are not left unattended (recreate original contours);
    - The appointed ECO must monitor each of the support structures located within ephemeral drainage lines or their buffer areas on a weekly basis for signs of erosion. Should erosion or sedimentation be noted immediate corrective measures must be undertaken. Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. Care must be taken to prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures. Additional erosion control measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern and, where possible, only soft engineering techniques should be implemented.
  - Strategically divert stormwater away from the construction footprint area of transmission line support structures and laydown areas. Stormwater must not be discharged into ephemeral drainage lines and their associated buffer areas. Stormwater should rather be discharged as diffuse flow at multiple discharge points into well vegetated areas outside of the buffer, and energy dissipaters (such as areas of rock riprap grassed with indigenous vegetation or similar structures) must be constructed where stormwater is released in order to reduce the runoff velocity and therefore erosion;
  - Implement erosion control measures where required (e.g. covering steep/unstable/erosion prone areas with geotextiles; stabilising areas susceptible to erosion with sandbags; covering areas prone to erosion with brush packing, straw bales, mulch; diverting stormwater away from areas susceptible to erosion *etc*). This is of particular importance where the transmission line is located on steep hillsides which are prone to erosion; and
  - Rehabilitate any areas surrounding transmission line support structures which have been disturbed as a result of construction related activities in order to reduce an

increase in stormwater runoff from bare areas e.g. laydown areas. A rehabilitation plan must be developed including rehabilitation measures such as:

- Rip and loosen compacted soils to a depth of 300mm in order to aid in the establishment of vegetation;
- Redistribute stockpiled topsoil across the area;
- Revegetate disturbed areas with vegetation assemblages reflecting the general species composition of the area as soon as possible after the application of topsoil and stabilising of soils. A botanical specialist should advise on appropriate species to be utilised during revegetation; and
- Strictly prohibit the use of alien vegetation during rehabilitation activities.

▪ The ECO must check ephemeral drainage lines and laydown areas associated with transmission line support structures for erosion damage after every heavy rainfall event. Should erosion or sedimentation be noted immediate corrective measures must be undertaken. Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. Care must be taken to prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures. Additional erosion control measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern.

d) Significance of impact with mitigation measures:

The impact associated with Alternative 1 and 3 was assessed to be of a Low (negative) significance and the impact associated with Alternative 2 was assessed to be of a Very Low (negative) significance after the implementation of mitigation measures.

1.6.1.3. Potential Impact 3 - Impairment of water quality

a) Nature of the impact:

The term water quality is used to describe the concentration of dissolved salts (solutes) and of particulate (clastic) sediment (Macfarlane *et al.*, 2007). Therefore, accidental spillage of hazardous material including chemicals and hydrocarbons such as fuel, and oil, the use of cement within watercourses as well as sediment originating from disturbed areas, were all considered contributors to this impact. Construction areas located outside of the delineated drainage lines may also be a source of sedimentation, if the buffer zones[13] are not kept intact.

It has been assumed that all housekeeping measures listed for the construction phase will be implemented through adherence to the EMPr, by so doing impact resulting from solutes will largely be addressed. However, the runoff of solutes from areas in which support structures will be developed as well as sediment laden runoff will still need to be adequately managed.

Due to the presence of permeable substratum along ephemeral drainage lines, impairment of the quality of surface water may also pose a risk to groundwater resources.

b) Significance of impact without mitigation measures:

The impact associated with Alternative 1 and 3 was assessed to be of a Moderate (negative) significance and the impact associated with Alternative 2 was assessed to be of a Low (negative) significance.

[13] Buffer zones will intercept sediment laden stormwater and decrease runoff velocities.

c) Proposed mitigation measures:

Solutes:

- The following recommendations are made regarding the transmission line support structures for all alternatives:
    - Laydown areas must be place outside of ephemeral drainage lines and outside of 32m buffer areas;
    - Where possible, transmission line support structures must be placed outside of ephemeral drainage lines and outside of 32m buffer areas;
    - Where avoidance of ephemeral drainage lines is not possible due to the extended distances that they traverse through the landscape (e.g. Figure 24 above), support structures must be placed at least 300m apart and should preferably be placed within the buffer areas of the ephemeral drainage lines or within previously disturbed areas;
- If required, dispose of concrete and cement-related mortars utilised during the construction of support structure foundations in an environmental sensitive manner (can be toxic to aquatic life). Washout should not be discharged into drainage lines; and
- Prohibit the mixing of concrete on exposed soils. Concrete must be mixed on an impermeable surface in an area of low environmental sensitivity identified by the ECO outside of the buffer area.

Sediment:

- Laydown areas must be place outside of ephemeral drainage lines and outside of 32m buffer areas;
- Where possible, transmission line support structures must be placed outside of ephemeral drainage lines and outside of 32m buffer areas;
- Where avoidance of ephemeral drainage lines is not possible due to the extended distances that they traverse through the landscape (e.g. Figure 24 above), the following measures are recommended:
    - Make use of existing access roads to support structure localities where possible. The indiscriminate movement of vehicles through ephemeral drainage lines in order to reach support structures must be strictly prohibited;
    - Support structures must be placed at least 300m apart and should preferably be placed within the buffer areas of the ephemeral drainage lines or within previously disturbed areas;
    - Support structures should only be placed within areas with a low risk of erosion;
    - Site specific erosion measures must be implemented where support structures will be placed within the ephemeral drainage lines or within 10m of the delineated boundaries of ephemeral drainage lines;
    - Engineer disturbed areas associated with transmission line support structures to coincide as closely as possible to original contours. Ensure that excavated vegetation and soil mounds are not left unattended (recreate original contours).
    - The appointed ECO must monitor each of the support structures located within ephemeral drainage lines or their buffer areas on a weekly basis for signs of erosion for the duration of the construction phase. Should erosion or sedimentation be noted immediate corrective measures must be undertaken. Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. Care must be taken to prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures. Additional erosion control measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern and, where possible, only soft engineering techniques should be implemented.
- Minimise the area of disturbance and the amount of earthworks;

- Place silt fences / traps strategically on the periphery of the construction footprint area including soil stockpile areas and laydown areas. Ensure runoff is not channeled directly into the drainage lines;
- Appoint an ECO to check all sediment trapping devices weekly and to ensure devices are cleared and repaired when needed;
- The contractor / ECO must check each service road crossing and all laydown areas for erosion damage and sedimentation after every heavy rainfall event for the duration of the construction phase. Should erosion or sedimentation be noted immediate corrective measures must be undertaken. Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. Care must be taken to prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures. Additional erosion control measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern.

d) Significance of impact with mitigation measures:

The impact associated with all alternatives is considered to be of a Very Low (negative) significance after the implementation of mitigation measures.

1.6.2. Operational Phase Impact

1.6.2.1. Potential Impact 1 - Degradation of drainage lines

a) Nature of the impact:

A lack of effective management of service road crossing areas and areas disturbed during the construction of transmission line support structures e.g. laydown areas, will result in the ongoing degradation of natural vegetation due to alien vegetation encroachment as well as the erosion of ephemeral drainage lines at service road crossing areas. This will likely result in a decrease in the PES of drainage lines.

b) Significance of impact without mitigation measures:

The impact associated with Alternative 1 and 3 was assessed to be of a Moderate (negative) significance and the impact associated with Alternative 2 was assessed to be of a Low (negative) significance.

c) Proposed mitigation measures:

- Eradicate alien and weed vegetation at each service road crossing area as well as at areas disturbed as a result of the construction of transmission line support structures:
  - Appoint an ECO to check the construction footprint of transmission line support structures, service road crossing areas as well as immediately adjacent areas for alien and invasive species bi-monthly, and alien species noted must be removed;
  - Remove alien species manually, by hand as far as possible. The use of herbicides should be avoided. Should the use of herbicides be required, only herbicides which have been certified safe for use in aquatic environments by an independent testing authority may be considered;
  - Dispose of removed alien plant material at a registered waste disposal site or burn on a bunded surface where no stormwater runoff is expected;
  - Remove vegetation before seed is set and released; and
  - Cover removed alien plant material properly when transported, to prevent it from being blown from vehicles.

- Appoint an ECO to inspect the service road crossings twice a year as well as after heavy rainfall events for the duration of the operational phase in order to determine whether any additional erosion control measures are required. Should erosion or sedimentation be noted immediate corrective measures must be undertaken. Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. Care must be taken to prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures. Additional erosion control measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern and, where possible, only soft engineering techniques should be implemented.

d) Significance of impact with mitigation measures:

The impact associated with Alternative 1 and 3 was assessed to be of a Low (negative) significance and the impact associated with Alternative 2 was assessed to be of a Very Low (negative) significance after the implementation of mitigation measures.

1.6.2.2. Potential Impact 2 - Alteration of the natural hydrological regime

a) Nature of the impact:

Compaction of soils at service road crossing areas may result in an increase in runoff into, and the associated erosion of ephemeral drainage lines at crossing points. The erosion of the channels of ephemeral drainage lines will result in the concentration of flows through the features. Furthermore, inadequate rehabilitation of laydown areas/bare areas associated with transmission line support structures during the construction phase may result in an increase of bare areas and an increase of runoff into drainage lines

b) Significance of impact without mitigation measures:

The impact associated with Alternative 1 and 3 was assessed to be of a Moderate (negative) significance and the impact associated with Alternative 2 was assessed to be of a Low (negative) significance.

c) Proposed mitigation measures:

- Implement all construction phase hydrological/flow related mitigation measures in order to prevent operational phase impacts;
- Appoint an ECO to inspect the service road crossings and rehabilitated laydown areas twice a year as well as after heavy rainfall events for the duration of the operational phase in order to determine whether any additional erosion control measures are required. Should erosion or sedimentation be noted immediate corrective measures must be undertaken. Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. Care must be taken to prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures. Additional erosion control measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern and, where possible, only soft engineering techniques should be implemented.

d) Significance of impact with mitigation measures:

The impact associated with Alternative 1 and 3 was assessed to be of a Low (negative) significance and the impact associated with Alternative 2 was assessed to be of a Very Low (negative) significance after the implementation of mitigation measures.

1.6.3. Decommissioning Phase Impact

1.6.3.1. Potential Impact 1 - Degradation of drainage lines

a) Nature of the impact:

Any area disturbed during decommissioning activities, not adequately rehabilitated, will result in proliferation of alien and weed vegetation and erosion.

b) Significance of impact without mitigation measures:

The impact associated with Alternative 1 and 3 was assessed to be of a Moderate (negative) significance and the impact associated with Alternative 2 was assessed to be of a Low (negative) significance.

c) Proposed mitigation measures:

- Undertake rehabilitation concurrently with decommissioning activities, as far as practically possible;
- Rehabilitate all areas disturbed during decommissioning activities. A rehabilitation plan must be developed including rehabilitation measures such as:
  - Rip and loosen compacted soils associated with service road crossing areas and with areas from which transmission line support structures have been removed to a depth of 300mm in order to aid in the establishment of vegetation;
  - If required, reshape and reprofile the crossing areas so that they tie in with the surrounding channel and banks both longitudinally and perpendicularly (height, slope and structure);
  - If required, reshape and reprofile areas from which transmission line support structures have been removed so that they coincide as closely as possible to original contours;
  - Revegetate disturbed areas with vegetation assemblages reflecting the general species composition of the area as soon as possible; and
  - Strictly prohibit the use of alien vegetation during rehabilitation activities.
- Eradicate alien and weed vegetation within the drainage lines as well as within any additionally disturbed areas:
  - Remove alien species manually, by hand as far as possible. The use of herbicides should be avoided. Should the use of herbicides be required, only herbicides which have been certified safe for use in aquatic environments by an independent testing authority may be considered;
  - Dispose of removed alien plant material at a registered waste disposal site or burn on a bunded surface where no stormwater runoff is expected;
  - Remove vegetation before seed is set and released; and
  - Cover removed alien plant material properly when transported, to prevent it from being blown from vehicles.
- The contractor/EO must check each area where decommissioning has taken place within an ephemeral drainage line or associated buffer zone for alien vegetation proliferation and erosion damage once a year and after every heavy rainfall event, until an indigenous vegetation cover of at least 50% has been reached within disturbed areas. Any alien species noted must be removed immediately by hand. Should erosion or sedimentation be noted immediate corrective measures must be undertaken. Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. Care must be taken to prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures. Additional erosion control measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted

according to each concern and, where possible, only soft engineering techniques should be implemented.

d) Significance of impact with mitigation measures:

The impact associated with Alternative 1 and 3 was assessed to be of a Low (negative) significance and the impact associated with Alternative 2 was assessed to be of a Very Low (negative) significance after the implementation of mitigation measures.

1.6.3.2. Potential Impact 2 – Impairment of water quality

a) Nature of the impact:

It has been assumed that all good housekeeping measures listed for the construction phase will be implemented in the decommissioning phase as well. Therefore, sediment originating from areas where service roads through ephemeral drainage lines have been decommissioned or from where infrastructure is removed is the main concern associated with impairment of water quality during the decommissioning phase.

b) Significance of impact without mitigation measures:

The impact associated with all alternatives was assessed to be of a Low (negative) significance.

c) Proposed mitigation measures:

- Minimise the area of disturbance and the amount of earthworks during decommissioning activities;
- Decommissioning of service roads traversing ephemeral drainage lines must be undertaken during the dry season.
- Decommissioning of transmission line support structures should also be undertaken during the dry season, However, if this is not possible the following mitigation measures are recommended:
  - o Divert stormwater runoff from disturbed areas into sediment trapping devices. Ensure stormwater is not channeled directly into a drainage line;
  - o Construct silt fences and earthen dikes / diversions at areas where sheet flow is expected, to retain and divert sediment-laden runoff;
  - o Construct silt fences / traps in areas prone to erosion, to retain sediment-laden runoff;
  - o Appoint an ECO to check all sediment trapping devices weekly to ensure devices are cleared and repaired when needed;
- Rehabilitate all areas disturbed during decommissioning activities. A rehabilitation plan must be developed including rehabilitation measures such as:
  - o Rip and loosen compacted soils associated with service road crossing areas and with areas from which transmission line support structures have been removed to a depth of 300mm in order to aid in the establishment of vegetation;
  - o If required, reshape and reprofile the crossing areas so that they tie in with the surrounding channel and banks both longitudinally and perpendicularly (height, slope and structure);
  - o If required, reshape and reprofile areas from which transmission line support structures have been removed so that they coincide as closely as possible to original contours;
  - o Revegetate disturbed areas with vegetation assemblages reflecting the general species composition of the area as soon as possible; and
  - o Strictly prohibit the use of alien vegetation during rehabilitation activities.

- The contractor/ECO must check each area where decommissioning has taken place within an ephemeral drainage line or associated buffer zone for erosion damage and sedimentation once a year or after every heavy rainfall event, until an indigenous vegetation cover of at least 50% has been reached within disturbed areas. Should erosion or sedimentation be noted immediate corrective measures must be undertaken. Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. Care must be taken to prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures. Additional erosion control measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern and, where possible, only soft engineering techniques should be implemented.

d) Significance of impact with mitigation measures:

The impact associated with all alternatives is considered to be of a Very Low (negative) significance after the implementation of mitigation measures.

1.6.4. Cumulative Impact

1.6.4.1. Impact 1 - Proliferation of alien and invasive species

a) Nature of the impact:

The abundance and diversity of alien and weed species within the project footprint is currently not considered to be high. However, with increased vehicle access and disturbance it is considered highly likely that it will worsen over time.

The significance of the encroachment of *Prosopis* spp. into watercourses was already documented by Henderson in 1991, at the time both the Molopo and Kuruman Rivers were invaded almost exclusively by *Prosopis* spp., which have formed extensive stands in places. Areas identified to be of increased risk to invasion included road transects and ephemeral drainage lines. The risk posed due to water abstraction by extensive stands is considered significant and could result in destruction of riparian ecosystems if not successfully managed (Van den Berg, 2010).

Mitigation measures have been provided in an attempt to limit alien vegetation proliferation within disturbed areas. It is however considered unlikely to be entirely successful, this project would therefore contribute to the cumulative impact posed by alien and invasive species along drainage lines.

b) Significance of impact without mitigation measures:

The impact associated with Alternative 1 and 3 was assessed to be of a Low (negative) significance and the impact associated with Alternative 2 was assessed to be of a Very Low (negative) significance.

c) Proposed mitigation measures:

- No mitigation measures in addition to those advocated for the construction, operational and decommissioning phase are available.

d) Significance of impact with mitigation measures:

The impact associated with Alternative 1 and 3 will remain a Low (negative) significance and the impact associated with Alternative 2 will remain a Very Low (negative) significance.

1.6.4.2. Impact 2 – Erosion of drainage lines

a) Nature of the impact:

Inherent erosion potential (K factor) of catchment soils were documented as moderate to moderately high (refer to Section 1.3.1.) and erosion within disturbed areas along drainage lines was considered significant at the time of the field survey. Exacerbation of erosion in already eroded areas as well as additional erosion of disturbed drainage lines would most likely add to the cumulative impact within the erosion prone region.

b) Significance of impact without mitigation measures:

The impact associated with Alternative 1 and 3 was assessed to be of a Low (negative) significance and the impact associated with Alternative 2 was assessed to be of a Very Low (negative) significance.

c) Proposed mitigation measures:

- No mitigation measures in addition to those advocated for the construction, operational and decommissioning phases are available.

d) Significance of impact with mitigation measures:

The impact associated with Alternative 1 and 3 will remain a Low (negative) significance and the impact associated with Alternative 2 will remain a Very Low (negative) significance.

1.7. IMPACT ASSESSMENT SUMMARY

The assessment of impacts and recommendation of mitigation measures as discussed above are collated in Table 11 to 14 below. It should be noted that significance ratings were assessed based on the information available at the time of the assessment.

Table 11: Impact assessment summary table for the Construction Phase.

Impact pathway	Nature of potential impact/risk	Status[14]	Extent[15]	Duration[16]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
FRESHWATER															
CONSTRUCTION PHASE															
Direct Impacts															
Construction of support structures, general edge effects as well as indiscriminate driving and removal of vegetation	Disturbance of drainage lines associated with Alternative 1	Negative	Local	Long-term	Substantial	Very Likely	Moderate	Low	Moderate	No	Yes	Refer to Section 1.6.1.1	Low	4	Medium
	Disturbance of drainage lines associated with Alternative 2	Negative	Local	Long-term	Moderate	Very Likely	Moderate	Low	Low	No	Yes	Refer to Section 1.6.1.1	Very Low	5	Medium
	Disturbance of drainage lines associated with Alternative 3	Negative	Local	Long-term	Substantial	Very Likely	Moderate	Low	Moderate	No	Yes	Refer to Section 1.6.1.1	Low	4	Medium
Establishment of service roads crossing ephemeral drainage lines as well as compacting soil within other construction footprints	Alteration of flow patterns within ephemeral drainage lines associated with Alternative 1	Negative	Local	Long-term	Substantial	Very Likely	Moderate	Low	Moderate	No	Yes	Refer to Section 1.6.1.2	Low	4	Medium
	Alteration of flow patterns within ephemeral drainage lines associated with Alternative 2	Negative	Local	Long-term	Moderate	Very Likely	Moderate	Low	Low	No	Yes	Refer to Section 1.6.1.2	Very Low	5	Medium
	Alteration of flow patterns within ephemeral drainage lines associated with Alternative 3	Negative	Local	Long-term	Substantial	Very Likely	Moderate	Low	Moderate	No	Yes	Refer to Section 1.6.1.2	Low	4	Medium
Use of concrete and accidental spillage of hazardous chemicals, generation of	Impairment of water quality within ephemeral drainage	Negative	Local	Long-term	Substantial	Likely	High	Low	Moderate	No	Yes	Refer to Section 1.6.1.3	Very Low	4	Medium

[14] Status: Positive (+) ; Negative (-)
[15] Site; Local (<10 km); Regional (<100); National; International
[16] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Impact pathway	Nature of potential impact/risk	Status[14]	Extent[15]	Duration[16]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
sediment	lines associated with Alternative 1														
	Impairment of water quality within ephemeral drainage lines associated with Alternative 2	Negative	Local	Long-term	Moderate	Likely	High	Low	Low	No	Yes	Refer to Section 1.6.1.3	Very Low	5	Medium
	Impairment of water quality within ephemeral drainage lines associated with Alternative 3	Negative	Local	Long-term	Substantial	Likely	High	Low	Moderate	No	Yes	Refer to Section 1.6.1.3	Very Low	4	Medium
Indirect Impacts															
N/A															

Table 12: Impact assessment summary table for the Operational Phase.

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
FRESHWATER															
OPERATIONAL PHASE															
Direct Impacts															
Inadequate maintenance and monitoring	Degradation of drainage lines associated with Alternative 1	Negative	Local	Long-term	Substantial	Very likely	High	Low	Moderate	No	Yes	Refer to Section 1.6.2.1	Low	4	Medium
	Degradation of drainage lines associated with Alternative 2	Negative	Local	Long-term	Moderate	Very likely	High	Low	Low	No	Yes	Refer to Section 1.6.2.2	Very Low	5	Medium
	Degradation of drainage lines associated with Alternative 3	Negative	Local	Long-term	Substantial	Very likely	High	Low	Moderate	No	Yes	Refer to Section 1.6.2.3	Low	4	Medium
Inadequate maintenance and monitoring	Alteration of the natural hydrological regime of ephemeral drainage lines associated with Alternative 1	Negative	Local	Long-term	Substantial	Very likely	High	Low	Moderate	No	Yes	Refer to Section 1.6.2.1	Low	4	Medium
	Alteration of the natural hydrological regime of ephemeral drainage lines associated with Alternative 2	Negative	Local	Long-term	Moderate	Very likely	High	Low	Low	No	Yes	Refer to Section 1.6.2.2	Very Low	5	Medium
	Alteration of the natural hydrological regime of ephemeral drainage lines associated with Alternative 3	Negative	Local	Long-term	Substantial	Very likely	High	Low	Moderate	No	Yes	Refer to Section 1.6.2.3	Low	4	Medium
Indirect Impacts															
N/A															

Table 13: Impact assessment summary table for the Decommissioning Phase.

Impact pathway	Nature of potential impact/risk	Status[17]	Extent[18]	Duration[19]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
FRESHWATER															
DECOMMISSIONING PHASE															
Direct Impacts															
Inadequate rehabilitation	Degradation of drainage lines associated with Alternative 1	Negative	Local	Long Term	Substantial	Very likely	Moderate	Low	Moderate	No	Yes	Refer to Section 1.6.3.1	Low	4	Medium
	Degradation of drainage lines associated with Alternative 2	Negative	Local	Long Term	Moderate	Very likely	Moderate	Low	Low	No	Yes	Refer to Section 1.6.3.2	Very Low	5	Medium
	Degradation of drainage lines associated with Alternative 3	Negative	Local	Long Term	Substantial	Very likely	Moderate	Low	Moderate	No	Yes	Refer to Section 1.6.3.3	Low	4	Medium
Removal of infrastructure	Impairment of water quality within ephemeral drainage lines associated with Alternative 1	Negative	Local	Long Term	Moderate	Very likely	Moderate	Low	Low	No	Yes	Refer to Section 1.6.3.1	Very Low	5	Medium
	Impairment of water quality within ephemeral drainage lines associated with Alternative 2	Negative	Local	Long Term	Moderate	Very likely	Moderate	Low	Low	No	Yes	Refer to Section 1.6.3.2	Very Low	5	Medium
	Impairment of water quality within ephemeral drainage lines associated with Alternative 3	Negative	Local	Long Term	Moderate	Very likely	Moderate	Low	Low	No	Yes	Refer to Section 1.6.3.3	Very Low	5	Medium
Indirect Impacts															
N/A															

[17] Status: Positive (+) ; Negative (-)
[18] Site; Local (<10 km); Regional (<100); National; International
[19] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Table 14: Cumulative Impact assessment summary table.

Impact pathway	Nature of potential impact/risk	Status[20]	Extent[21]	Duration[22]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
FRESHWATER															
CUMULATIVE IMPACTS															
Authorisation of Alternative 1	Proliferation of alien and invasive species	Negative	Local	Long Term	Moderate	Likely	Moderate	Low	Low	No	No	N/A	Low	4	Medium
Authorisation of Alternative 2	Proliferation of alien and invasive species	Negative	Local	Long Term	Slight	Likely	Moderate	Low	Very Low	No	No	N/A	Very Low	5	Medium
Authorisation of Alternative 3	Proliferation of alien and invasive species	Negative	Local	Long Term	Moderate	Likely	Moderate	Low	Low	No	No	N/A	Low	4	Medium
Authorisation of Alternative 1	Erosion of drainage lines	Negative	Local	Long Term	Moderate	Likely	Moderate	Low	Low	No	No	N/A	Low	4	Medium
Authorisation of Alternative 2	Erosion of drainage lines	Negative	Local	Long Term	Slight	Likely	Moderate	Low	Very Low	No	No	N/A	Very Low	5	Medium
Authorisation of Alternative 3	Erosion of drainage lines	Negative	Local	Long Term	Moderate	Likely	Moderate	Low	Low	No	No	N/A	Low	4	Medium

[20] Status: Positive (+) ; Negative (-)
[21] Site; Local (<10 km); Regional (<100); National; International
[22] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

1.8. INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAM

A description of the key monitoring recommendations for each applicable mitigation measure identified for all phases of the project is provided below and should be included in the EMPr or environmental authorisation;

Table 15: Key monitoring recommendations for the design phase.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
A. DESIGN PHASE					
A.1. FRESHWATER ECOLOGY IMPACTS					
Potential impact on ephemeral drainage lines as a result of the proposed transmission line and associated infrastructure.	Avoid or minimize impacts on ephemeral drainage lines.	▪ Ensure that the design of the proposed transmission line takes the sensitivity mapping of the freshwater specialist into account to avoid and reduce impacts on ephemeral drainage lines. ▪ Laydown areas must be place outside of ephemeral drainage lines and outside of 32m buffer areas. ▪ Where possible, transmission line support structures must be placed outside of ephemeral drainage lines and outside of 32m buffer areas. ▪ Where avoidance of ephemeral drainage lines is not possible due to the extended distances they traverse through the landscape (e.g. Figure 24), the following measures are recommended: o Make use of existing access roads to support structure localities where possible. The indiscriminate movement of vehicles through ephemeral drainage lines in order	▪ Ensure that specified mitigation actions are taken into consideration during the planning and design phase.	▪ During design cycle and before construction commences.	▪ Project developer and appointed freshwater specialist.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		to reach support structures must be strictly prohibited; o Support structures must be placed at least 300m apart and should preferably be placed within the buffer areas of the ephemeral drainage lines or within previously disturbed areas; o Support structures should only be placed within areas with a low risk of erosion; o Site specific erosion measures must be implemented where support structures will be placed within the ephemeral drainage lines or within 10m of the delineated boundaries of ephemeral drainage lines; o Engineer disturbed areas associated with transmission line support structures to coincide as closely as possible to original contours. Ensure that excavated vegetation and soil mounds are not left unattended (recreate original contours); o The appointed ECO must monitor each of the support structures located within ephemeral drainage lines or their buffer areas on a weekly basis for signs of erosion. Should erosion or sedimentation be noted immediate corrective measures must be undertaken. Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. Care must be taken to prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures.			

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
		Additional erosion control measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern and, where possible, only soft engineering techniques should be implemented. ▪ Make use of existing access roads/service roads where possible. ▪ Where the crossing of ephemeral drainage lines is unavoidable, designate a single crossing area for new service roads. Strictly prohibit any activity outside of the designated crossing area. ▪ If possible, new service road crossing areas should be developed at 90 degree angles to ephemeral drainage lines in order to limit the area of disturbance.			

Table 16: Key monitoring recommendations for the construction phase.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
B. CONSTRUCTION PHASE					
A.1. FRESHWATER ECOLOGY IMPACTS					
Disturbance of drainage lines	Avoid or minimize disturbance of ephemeral drainage lines.	▪ Refer to Section 1.6.1.1	▪ Inspect the ephemeral drainage line crossings and take measures to address unforeseen disturbances to the ephemeral drainage lines. ▪ Check the construction footprint of transmission line support structures, service road crossing areas as well as immediately adjacent areas for alien and invasive species and alien species noted must be removed.	▪ On a weekly basis (at least) during the construction phase.	▪ ECO
Alteration of flow patterns	Prevent the alteration of flow patterns through ephemeral drainage lines.	▪ Refer to Section 1.6.1.2	▪ Check ephemeral drainage lines for erosion damage. ▪ Should erosion of channels be noted, immediate corrective measures must be undertaken. ▪ Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. ▪ Care must be taken to	▪ After every heavy rainfall event during the construction phase.	▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures. ▪ Additional erosion control measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern.		
Impairment of water quality	Prevent the impairment of water quality within ephemeral drainage lines.	▪ Refer to Section 1.6.1.3	▪ Check all sediment trapping devices and ensure devices are cleared and repaired when needed. ▪ Check each service road crossing and all laydown areas for erosion damage and sedimentation. ▪ Should erosion or sedimentation be noted immediate corrective measures must be undertaken. ▪ Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. ▪ Care must be taken to prevent additional disturbance	▪ On a weekly basis (at least) during the construction phase. ▪ After every heavy rainfall event during the construction phase.	▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			to the ephemeral drainage lines during the implementation of these measures. ▪ Additional erosion control measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern. ▪ Check construction footprint areas in order to ensure that concrete for support structure foundations is being mixed on an impermeable surface and that washout is not being discharged into drainage lines.		

Table 17: Key monitoring recommendations for the operational phase.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
C. OPERATIONAL PHASE					
A.1. FRESHWATER ECOLOGY IMPACTS					
Degradation of drainage lines	Avoid or minimize degradation of ephemeral drainage lines.	▪ Refer to Section 1.6.2.1	▪ Monitor the site, including all ephemeral drainage line crossing areas, in order to determine whether any additional alien vegetation control measures will be required. ▪ Check each service road crossing and rehabilitated laydown area for erosion damage and sedimentation. ▪ Should erosion or sedimentation be noted immediate corrective measures must be undertaken. ▪ Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. ▪ Care must be taken to prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures.	▪ Bi-monthly during the operational phase (for alien vegetation). ▪ Twice a year as well as after heavy rainfall events during the operational phase (for erosion and sedimentation).	▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			▪ Additional erosion control measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern.		
Alteration of the natural hydrological regime	Prevent the alteration of the natural hydrological regime of ephemeral drainage lines.	▪ Refer to Section 1.6.2.2	▪ Inspect the service road crossings and rehabilitated laydown areas in order to determine whether any additional erosion control measures are required. ▪ Should erosion or sedimentation be noted immediate corrective measures must be undertaken. ▪ Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. ▪ Care must be taken to prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures. ▪ Additional erosion control measures must then be	▪ Twice a year as well as after heavy rainfall events during the operational phase.	▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern.		

Table 18: Key monitoring recommendations for the decommissioning phase.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
D. DECOMMISSIONING PHASE					
A.1. FRESHWATER ECOLOGY IMPACTS					
Degradation of drainage lines	Avoid or minimize degradation of ephemeral drainage lines.	▪ Refer to Section 1.6.3.1	▪ Check each area where decommissioning has taken place within an ephemeral drainage line or associated buffer zone for alien vegetation proliferation and erosion damage. ▪ Any alien species noted must be removed immediately by hand. ▪ Should erosion or sedimentation be noted immediate corrective measures must be undertaken. ▪ Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. ▪ Care must be taken to prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures. ▪ Additional erosion control	▪ Once a year and after every heavy rainfall event, until an indigenous vegetation cover of at least 50% has been reached within disturbed areas.	▪ Contractor/ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern.		
Impairment of water quality	Prevent the impairment of water quality within ephemeral drainage lines.	▪ Refer to Section 1.6.3.2	▪ Check all sediment trapping devices to ensure devices are cleared and repaired when needed. ▪ Check each area where decommissioning has taken place within an ephemeral drainage line or associated buffer zone for erosion damage and sedimentation. ▪ Should erosion or sedimentation be noted immediate corrective measures must be undertaken. ▪ Rehabilitation measures may include filling of erosion gullies and rills and the stabilization of gullies with silt fences. ▪ Care must be taken to prevent additional disturbance to the ephemeral drainage lines during the implementation of these measures.	▪ Weekly during the decommissioning phase. ▪ Once a year and after every heavy rainfall events, until an indigenous vegetation cover of at least 50% has been reached within disturbed areas.	▪ Contractor/EO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
			▪ Additional erosion control measures must then be applied in order to avoid any further disturbance. Erosion measures will need to be adapted according to each concern.		

1.9. CONCLUSION AND RECOMMENDATIONS

Multiple ephemeral drainage lines will be traversed by the proposed supporting electrical infrastructure alternatives. The current impact to these features is largely limited to erosion as a result of increased grazing pressure and the development of access roads, firebreaks, fence lines and impoundments within the features. The drainage lines were therefore calculated to fall within PES Categories A (unmodified, natural) and C (moderately modified). Although the ephemeral drainage lines calculated an overall low EIS score and are considered to be of low sensitivity in terms of water yield and quality (Macfarlane *et al.*, 2014), these features do still provide valuable functions such as attenuation of floodwaters and retention of excess sediments. The unnecessary disturbance of drainage lines must therefore be avoided, and a buffer zone of at least 32m is therefore considered important wherein only essential activities should be allowed during the establishment of service roads.

Should both Phase 1 and Phase 2 of the proposed WEF be authorised, transmission line Alternative 1 will be the preferred route from a technical perspective. This Alternative will traverse approximately 3.76km of ephemeral drainage line habitat in total, however, transmission lines will be above ground and associated service roads will follow existing gravel roads where possible. Therefore, only approximately 2.1km of Alternative 1 will require the establishment of new jeep tracks through ephemeral drainage lines. Prior to the implementation of mitigation measures, impacts associated with the proposed development of Alternative 1 were calculated to be of a low to moderate (negative) significance. However, with the effective implementation of the mitigation measures as provided within Section 1.6 of this report, it is the opinion of the freshwater specialist that all impacts may be reduced to very low and low (negative) significances.

Should only Phase 1 of the proposed WEF be authorised, transmission line Alternative 2 will be the preferred route from a technical perspective. This Alternative extends a much shorter total distance than Alternative 1 and 3 and will result in the disturbance of the smallest area of ephemeral drainage line habitat. Only approximately 0.13km of Alternative 2 will require the establishment of new jeep tracks through ephemeral drainage lines. Prior to the implementation of mitigation measures, impacts associated with the proposed development of Alternative 2 were calculated to be of a very low and low (negative) significance. However, with the effective implementation of the mitigation measures as provided within Section 1.6 of this report, it is the opinion of the freshwater specialist that all impacts may be reduced to very low (negative) significances.

Should only Phase 2 of the proposed WEF be authorised, transmission line Alternative 3 will be the preferred route from a technical perspective, however, this will also necessitate the development of transmission line Alternative 2. Alternative 3 will therefore extend over approximately 2.8km of ephemeral drainage line habitat in total. However, only approximately 1.5km of Alternative 3 will require the establishment of new jeep tracks through ephemeral drainage lines. Prior to the implementation of mitigation measures, impacts associated with the proposed development of Alternative 3 were calculated to be of a low to moderate (negative) significance. However, with the effective implementation of the mitigation measures as provided within Section 1.6 of this report, it is the opinion of the freshwater specialist that all impacts may be reduced to very low and low (negative) significances.

It is therefore the opinion of the freshwater specialist that authorisation may be granted for either of the three proposed transmission line alternatives. It should however be noted that an application for an Environmental Authorisation in terms of the NEMA EIA Regulations (2014, amended in 2017) will be required as proposed development related activities will occur within 32m of a watercourse.

Furthermore, the proposed development will require authorisation from the DWS in terms of Section 21 (c) and (i) of the NWA.

Table 19: Impact assessment summary table.

Impact	Alternative	Before mitigation	After mitigation
Construction Phase			
Disturbance of drainage lines	Alternative 1	Moderate	Low
	Alternative 2	Low	Very Low
	Alternative 3	Moderate	Low
Alteration of flow patterns	Alternative 1	Moderate	Low
	Alternative 2	Low	Very Low
	Alternative 3	Moderate	Low
Impairment of water quality	Alternative 1	Moderate	Very Low
	Alternative 2	Low	Very Low
	Alternative 3	Moderate	Very Low
Operational Phase			
Degradation of drainage lines	Alternative 1	Moderate	Low
	Alternative 2	Low	Very Low
	Alternative 3	Moderate	Low
Alteration of natural hydrological regime	Alternative 1	Moderate	Low
	Alternative 2	Low	Very Low
	Alternative 3	Moderate	Low
Decommissioning Phase			
Degradation of drainage lines	Alternative 1	Moderate	Low
	Alternative 2	Low	Very Low
	Alternative 3	Moderate	Low
Impairment of water quality	Alternative 1	Low	Very Low
	Alternative 2	Low	Very Low
	Alternative 3	Low	Very Low
Cumulative impact			
Proliferation of alien and invasive species	Alternative 1	Low	N/A
	Alternative 2	Very Low	N/A
	Alternative 3	Low	N/A
Erosion of drainage lines	Alternative 1	Low	N/A
	Alternative 2	Very Low	N/A
	Alternative 3	Low	N/A

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GEOHYDROLOGICAL ASSESSMENT:

Basic Assessment for the Proposed Development of the 132 kV Power Line (Phase 1 and Phase 2) near Kuruman - Northern Cape

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services	Daniel Mulder, Julian Conrad and Neville Paxton
	GEOSS – Geohydrological and Spatial Solutions International (Pty) Ltd
P O Box 17001	P.O. Box 12412
	Die Boord, Stellenbosch 7613
	South Africa
Congella, Durban, 4013	Mill Street, Cape Town, 8010
South Africa	South Africa

26/09/2018

SPECIALIST EXPERTISE

CURRICULUM VITAE – Daniel Mulder

GENERAL

Nationality:	South African
Profession:	Geohydrologist
Specialization:	Groundwater exploration, regional development, monitoring and management, geohydrological impact assessment including GIS and Remote Sensing expertise.
Position in firm:	Geohydrologist at GEOSS - Geohydrological and Spatial Solutions International (Pty) Ltd
Date commenced:	1st September 2018
Language skills:	English (good – speaking, reading and writing) Afrikaans (good - speaking, reading and writing).

KEY SKILLS

- Groundwater exploration, development, monitoring and management.
- Arc GIS software (ESRI products)
- Proficient in working with regional groundwater development and management.

RELEVANT EXPERIENCE

- Numerous groundwater exploration, development, monitoring and management projects.
- Groundwater impact assessments

EDUCATIONAL AND PROFESSIONAL STATUS

Qualifications

2016	BSc Hon –Hydrogeology; North West University, Potchefstroom Campus, South Africa
2015	BSc – Geology & Geography; North West University, Potchefstroom Campus, South Africa

Memberships

- Ground Geological Society of South Africa (GSSA) / Groundwater Division of the Geological Society of South Africa

EMPLOYMENT RECORD

September 2017 – present:	GEOSS (Geohydrological and Spatial Solutions International (Pty) Ltd
January 2017 – August 2017:	AGES (Africa Geo-Environmental Engineering and Science) (Pty) Ltd, Potchefstroom

CURRICULUM VITAE - Julian Edward Conrad

GENERAL

Nationality:	South African
Profession:	Geohydrologist
Specialization:	Groundwater exploration, development, management and monitoring and the application of spatial technologies for geohydrological assessment and management purposes
Position in firm:	Director & geohydrologist: GEOSS - Geohydrological and Spatial Solutions International (Pty) Ltd
Language skills:	English (mother tongue), Afrikaans (average).

Key skills

- Project leadership and management for the delivery of contract projects on brief, budget and time.
- Groundwater Resource Directed Measures (RDM) projects, including Reserve determinations; Classification; and Resource Quality Objectives. Groundwater Catchment Management Strategies as well as groundwater Validation and Verification. Legal compliance of groundwater use.
- Groundwater management and monitoring – database design, development and analysis of groundwater level and quality data.
- Groundwater development - borehole drilling and test pumping supervision and analysis.
- Groundwater exploration - (aerial photo interpretation, resistivity, magnetic and EM34 geophysical surveys for borehole siting purposes)
- Specialization in Geographical Information Systems (GIS) for geohydrological application.

Educational and professional status
Qualifications

1995: M.Sc. (Hydrogeology and GIS), University of Rhode Island, United States of America
1985: B.Sc. (Hon) (Engineering geology), University of Natal, Durban, South Africa
1984: B.Sc. (Geology), University of Natal, Durban, South Africa.

Courses

2010	Introduction to QGIS (GISSA) / Skills Presentation (Elsabé Daneel Productions cc)
2006	South African Groundwater Decision Tool (SAGDT)
2004	Fractured Rock Aquifer Assessment / 2001 Isotope Techniques in Catchment Management
2000	Groundwater Recharge
1999	Remote Sensing and Geohydrology / Applied 3D Groundwater Modelling (MODFLOW)
1997	Avenue Programming / 1995 ArcView (GIMS)
1991	Advanced training on Arc/Info (DWA&F) / 1990 Pump test analysis (IGS-UOFS).

Memberships

- International Association of Hydrogeologists (IAH)
- Geological Society of South Africa (GSSA) / Groundwater Division of the Geological Society of South Africa
- Water Institute of South Africa (WISA)
- Geo-Information Society of South Africa (GISSA)
- South African Council for Natural Scientific Professions (SACNASP)

EMPLOYMENT ECORD

- 1 March 2001 – present: Founded GEOSS – a company specializing in geohydrology.
- 1 May 1990 – 28 Feb. 2001 Hydrogeologist with Environmentek, Groundwater Group, CSIR.
- Jan. 1986 – Dec. 1988 Geotechnical geologist with Rőssing Uranium Limited, Namibia.

RELEVANT EXPERIENCE

- 28 years' experience in geohydrology, including the development of the GRDM and Water Resources Classification methodologies. This includes work in Validation and Verification projects and the development of the groundwater component of Catchment Management Strategies.
- Numerous groundwater exploration; development; monitoring and management projects have been completed.
- Numerous Environmental Impact Assessment (EIA) projects have been completed, that have triggered groundwater studies, both at the Scoping and EIA phases.
- Project management of numerous groundwater projects and large projects that have included many sub-consultants and specialists, especially RDM studies.

PUBLICATIONS (DETAILS ON REQUEST).

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CURRICULUM VITAE - Neville Paxton

GENERAL

Nationality:	South African
Profession:	Geohydrologist
Specialization:	Groundwater exploration, development, sampling and monitoring.
Position in firm:	Geohydrologist
Year of birth & ID #:	1986 - 861228 5151 084
Language skills:	Afrikaans (very good), English (mother tongue)

KEY SKILLS

- Groundwater sampling, soil sampling, field measurements, borehole logging, data logging for groundwater monitoring, borehole depth and water level measurements, augering for piezometer installation, groundwater geophysics, yield test management and conducting hydrocensus studies.

EDUCATIONAL AND PROFESSIONAL STATUS

Qualifications

2014 BSc (Hons) (Environmental & Engineering Geology- specialization: Hydrogeology) University of Pretoria
2013 BSc Bridging Course (Geology) University of Pretoria
2009 BSc (Geography) University of Pretoria

Memberships

- Groundwater Division of the Geological Society of South Africa
- NICOLA - Network for Industrially Contaminated Land in Africa

EMPLOYMENT RECORD

- 5 January 2015 to present GEOSS, field assistance on Groundwater sampling and monitoring
- Mar 2014 – Dec 2014 Student geohydrologist at GCS (Groundwater Consulting Services)
- 2012 - 2014 University of Pretoria, GIS Assistant.

SPECIALIST DECLARATION

I, **Julian E Conrad,** as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist

Name of company: GEOSS - Geohydrological & Spatial Solutions International (Pty) Ltd.

Professional Registration (including number): SACNASP - 400159/05
Date: 26 September 2018

EXECUTIVE SUMMARY

Mulilo Renewable Project Developments (Pty) Ltd is proposing to develop the Kuruman Wind Energy Facility (WEF) consisting of a Phase 1 and Phase 2 along with associated electrical infrastructure (including a transmission line (Alternative 1: 132 kV, 50 km overhead line to the Ferrum Substations). Several issues were encountered with the finalization of this route, and an alternative route was proposed. The new proposed 132 kV Lohathla route is approximately 2 km shorter, has significantly less negative environmental impacts and now only involves 5 landowners. This report focuses on the potential impact of the 132 kV line as part of a basic assessment.

The area of interest receives most of its rainfall during the summer months with an average of 266 mm per year with increased evaporation rates during the summer months. The regional geological setting consists of sedimentary deposits underlain by five distinct geological formations which directly correlate with the regional geohydrological characterization. According to the regional scale groundwater map the greater portion of the study area hosts a "fractured" aquifer (i.e. fractures within the bedrock constitute an aquifer) with borehole yields being in the range of 0.1 – 0.5 L/s. The regional groundwater quality using Electrical Conductivity as an indicator shows that in general the quality is "good" (EC of 0 – 70 mS/m). This correlates with data obtained in the field where the EC varied from 16.2 mS/m to a maximum of 90.6 mS/m. The DRASTIC groundwater vulnerability rating methodology (Department of Water Affairs and Forestry, 2005) indicates that the larger study area can be classified as having a "low" groundwater vulnerability rating.

The potential impacts on the groundwater can be from:

- Over-abstraction of groundwater,
- Accidental oil spillages or fuel leakages.

These issues can be easily managed and potential groundwater impacts completely minimized.

The authors consider groundwater to be a viable source for use during the construction phase (if required for the foundations of the pylons and anchor stays). All boreholes being used should be yield tested; sampled (including analysis for asbestos); authorized and equipped with water level and water quality monitoring infrastructure; as well as a flow meter, prior to use. The planned groundwater use is within the General Authorization so the groundwater use need only be registered.

In terms of the geohydrological assessment, the proposed activity will essentially have no impact on the groundwater of the area and from a groundwater perspective can be authorized.

LIST OF ABBREVIATIONS

bh	Borehole
ch	collar height
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
GEOSS	Geohydrological & Spatial Solutions International (Pty) Ltd.
GIS	Geographic Information System
ha	Hectare
L/s	liters per second
m	Meters
MAP	Mean Annual Precipitation
mbch	metres below collar height
mbgl	metres below ground level
mg/L	milligrams per litre
mm/a	millimetres per annum
mS/m	milliSiemens per meter
mV	milliVolts
NGA	National Groundwater Archive
ORP	Oxygen Reduction Potential
TDS	Total Dissolved Solids
temp	Temperature
WEF	Wind Energy Facility
WL	water level
WP	wind pump
WULA	Water Use License Application

GLOSSARY

Definitions	
Aquifer	A geological formation that has structures or textures that hold water or permit appreciable water movement through them.
Borehole	includes a well, excavation, or any other artificially constructed or improved groundwater cavity which can be used for the purpose of intercepting, collecting or storing water from an aquifer; observing or collecting data and information on water in an aquifer; or recharging an aquifer [from National Water Act (Act No. 36 of 1998)].
DRASTIC	An acronym for a groundwater vulnerability assessment methodology: D = depth to groundwater / R = recharge/ A = aquifer media type / S = soil type / T = topography / I = impact of the unsaturated zone / C = hydraulic conductivity. The methodology uses a rating and weighting approach and was developed by the Environmental Protection Agency (USA)
Fractured aquifer	Fissured and fractured bedrock resulting from decompression and/or tectonic action. Groundwater occurs predominantly within fissures and fractures.
Groundwater	Water found in the subsurface in the saturated zone below the water table or piezometric surface i.e. the water table marks the upper surface of groundwater systems.
Intergranular aquifer	Generally unconsolidated but occasionally semi-consolidated aquifers. Groundwater occurs within intergranular interstices in porous medium. Typically occur as alluvial deposits along river terraces.
Intergranular and fractured aquifers	Largely medium to coarse grained granite, weathered to varying thicknesses, with groundwater contained in intergranular interstices in the saturated zone, and in jointed and occasionally fractured bedrock.
Karst aquifer	Generally known as a bedrock having water bearing properties due to the formation of dissolution cavities. Usually highly soluble rock, in which the landforms are formed primarily by dissolution/precipitation of the rock.
Vulnerability	The tendency or likelihood for contaminants to reach a specified position in the ground-water system after introduction at some location above the uppermost aquifer (National Research Council, 1993).

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page 1, 2, 3, 4
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 5
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1.1.1.
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.1.1.5.
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 1.2
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.3.3.
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.1.1.1. Section 1.1.1.2. Section 1.1.1.3.
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1.6.1.1. Section 1.6.1.2. Section 1.6.1.3. Section 1.6.1.4.
g) an identification of any areas to be avoided, including buffers;	Section 1.3.4.
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Appendix A: Map 6
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.1.1.4.
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Section 1.6.1.1. Section 1.6.1.2. Section 1.6.1.3. Section 1.6.1.4. Section 1.7
k) any mitigation measures for inclusion in the EMPr;	Section 1.7
l) any conditions for inclusion in the environmental authorisation;	Section 1.2
m) any monitoring requirements for inclusion in the EMPr n) or environmental authorisation;	Section 1.9
o) a reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 1.9
p) a description of any consultation process that was undertaken during the course of preparing the specialist report;	-
q) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	-
r) any other information requested by the competent authority.	-
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	-

TABLE OF CONTENTS

TABLES AND FIGURES

GEOHYDROLOGICAL ASSESSMENT

This chapter presents the findings of the Geohydrological Assessment that was prepared by Mr. Daniel Mulder, Mr. Julian Conrad and Mr. Neville Paxton (Geohydrological and Spatial Solutions International (PTY) Ltd (GEOSS)) as part of the Basic Assessment (BA) for the proposed 132kV line connecting the Kuruman Wind Energy Facility (WEF) project within the national grid Northern Cape Province, South Africa.

1.1. INTRODUCTION AND METHODOLOGY

1.1.1.1. ***Scope and Objectives***

The project Applicant intends to make use of boreholes to source groundwater (if available and if suitable) for the Construction phase of the project. During the construction phase (anticipated to be 18 months, with the highest use during the first 6 months) an average of 409,640 liters will be used per week (i.e. 0.7 L/s continuous use) for the entire WEF construction. The water for this aspect of the project is planned to be used for the construction of power line foundations (both for the footings and anchor lines). Groundwater will be stored in a suitable container or reservoir tanks (or similar) during the construction phase.

The overall scope of this Geohydrological Assessment is to determine the impact of the proposed project, with specific empathize on the 132 kV Power Line, on the surrounding geohydrology and any geohydrological features, as well as to recommend mitigation measures to reduce the significance of potential negative impacts.

One of the objectives of this Geohydrological Assessment is to confirm whether the groundwater is in fact sufficient and suitable for use (i.e. in terms of quantity (i.e. borehole yields) and quality). This study is therefore aimed at providing a clear indication of groundwater availability and suitability from existing boreholes.

For this specialist study, a desktop study was conducted based on existing maps and reports of the geology and geohydrology of the study area. Groundwater data, including groundwater levels and groundwater quality data, was obtained from the National Groundwater Archive (NGA) for the area surrounding the proposed study site. This was followed by a detailed field work component for completion of the Geohydrological Assessment.

1.1.1.2. ***Terms of Reference***

The Scope of Work is based on the following broad Terms of Reference, which have been specified for this specialist study on groundwater (i.e. this Geohydrological Assessment):

- Identify significant features or disturbances within the proposed project area and define any environmental risks in terms of geohydrology and the proposed project infrastructure;
- Conduct a desktop study and describe the existing environment in terms of geohydrology (including hydrogeological characterization of aquifers types, sensitivity and vulnerability), and groundwater (quality, quantity, use, potential for industrial or domestic use) in the area surrounding the proposed development;
- Conduct a on site assessment to determine the location of any boreholes and to collect groundwater samples (where possible) to ascertain the water quality;
- Develop a sensitivity map indicating the presence of sensitive areas, "no-go" areas, setbacks/buffers, as well as the identification of red flags or risks associated with geohydrological impacts;
- Highlight any gaps in baseline data and provide a description of confidence levels;
- Assess potential direct, indirect and cumulative impacts resulting from the construction, operational and decommissioning phases of the proposed project on the surrounding geohydrology;
- Identify any relevant legal and permit requirements that may be required in terms of groundwater/geohydrological impacts likely to be generated as a result of the proposed project;
- Provide mitigation, monitoring and management measures in order to minimize any negative geohydrological impacts and enhance the positive impacts;
- Assess the consequences and significance of potential groundwater contamination; and
- If necessary, recommend groundwater management and monitoring for the proposed site.

1.1.1.3. ***Approach and Methodology***

The specialist study was completed as follows:

<u>Task 1</u>: A desktop study and relevant literature review pertaining to the site was completed. Borehole data was obtained from the NGA and a project GIS was established.

<u>Task 2</u>: A site visit was completed on 23, 24 and 25 January 2018. The field work included a hydrocensus, which extended to 1 km from the outline of the property boundaries. The objective of this task was three-fold:

- To locate the NGA boreholes and complete a borehole assessment.
- To locate boreholes not yet recorded on the NGA and complete assessments.
- To collect anecdotal information from the land owners in the area as well as from discussions with other experienced geohydrologists. It was essential to collect as much information as possible relating to groundwater quality, groundwater levels and borehole yields.

<u>Task 3</u>: All the data obtained from the desktop review and fieldwork was assessed and the impacts relating to the site evaluated.

<u>Task 4</u>: The findings of the investigation, potential risks, any potential mitigation measures, monitoring requirements as well as relevant recommendations have been included in a report.

1.1.1.4. ***Assumptions and Limitations***

The following assumptions and limitations apply:

- The geohydrological assessment is based on previous studies and available literature for the study area. Regional scale Geographic Information System (GIS) datasets based on 1: 500 000 and previous hydrogeological work completed has been assumed to be correct.
- The main limitation is that no drill records or yield test data exists for production or wind pump boreholes to clarify yields and geological logs.
- The acquisition of accurate groundwater levels proved to be difficult, therefore data was limited to information obtained from local parties. Nonetheless these limitations have not negatively impacted the conclusions of the project.

The information obtained was sufficient to provide comprehensive geohydrological characterization of the regional setting.

1.1.1.5. ***Source of Information***

The geological information has been obtained from geological maps produced by the Council for Geoscience and Slabbert et al, (1999).

The groundwater related data and maps were obtained from the 1: 500 000 Hydrogeological map series of the Republic of South Africa (Department of Water Affairs and Forestry (DWAF), 2002).

The report compiled by GEOSS (2016) as part of a contamination risk assessment for a proposed tailings dam south-west of the study area within a similar geological setting was also reviewed and relevant information was used in this report, where applicable.

From the field visit (completed on the 23, 24 and 25 January 2018) the existing data sets were assessed and new data sourced. Data was collected on borehole/wind pump positions; depth to groundwater levels; and field chemistry (i.e. pH; temperature; electrical conductivity (EC); total dissolved solids (TDS); salinity and oxygen reduction potential (ORP)). The field data obtained from the site visit was useful as it enabled the assessment of the more regional existing data sets and provides valuable insights into the geohydrology of the area. Where possible groundwater was sampled and submitted for inorganic chemical analysis to a SANAS accredited laboratory (Bemlab) in the Western Cape. The chemistry analysis has been classified according to the SANS241-1: Standards for Drinking Water (2015).

1.2. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO THE GEOHYDROLOGICAL ASSESSMENT

As mentioned above, the Project Applicant intends to make use of existing boreholes to source groundwater (if available and if suitable) for the construction phase. As a result, water pipelines may need to be constructed in order to transfer groundwater from existing boreholes. Groundwater will need to be stored on site in suitable containers or reservoir tanks during the construction phases.

Generally, groundwater can be impacted negatively in two manners, namely:

- Over-abstraction (where groundwater abstraction exceeds recharge rates) which can result in the alteration of groundwater flow directions and gradients. Dropping water levels within a Karst aquifer may result in dolines or sinkholes.
- Quality deterioration (i.e. from anthropogenic activities negatively impacting groundwater quality).

There is currently limited groundwater abstraction taking place in relation to the size of the study area and the average expected (based on regional datasets). Groundwater is mostly used for drinking purposes and for livestock. The low rainfall and high evapotranspiration rates within the study area are a limiting factor for the recharge of the aquifer underlying the study area.

The groundwater requirement for the project can be met by using the existing boreholes. However, agreements will have to be put in place with the current land owners for the use of groundwater. These agreements will have to be legally valid documents and the necessary endorsements will be required from the Department of Water and Sanitation (DWS). If no such agreements can be put in place, then additional boreholes will need to be drilled on the WEF property, followed by yield and water quality testing, and then authorization from DWS to use the groundwater will be required. The groundwater will need to be stored in water tanks on site. The groundwater required for this phase will be very low.

1.3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

1.3.1.1. *Introduction*

The nearest town to the centroid of the study area is Kuruman, approximately 10 km to the north-east **Map 1 – APPENDIX A**. The Kuruman landscape is arid with red wind-transported sands occurring widely along plains with ironstone mountains stretching from north to south.

1.3.1.2. *Rainfall and temperature*

Kuruman is located in a summer rainfall district. The town receives approximately 266 mm of rain per year. It typically receives the lowest rainfall (0 mm) in June (winter months) and the highest (52 mm) in February (summer months). During summer months the regional setting has high evaporation rates which decreases during the winter months. There is a clear correlation between the rainfall and the evaporation of the area **(Figure 1)**. This is true as precipitation occurs as late afternoon thunder showers (sometimes hail storms), due to evaporation during long hot summer days.

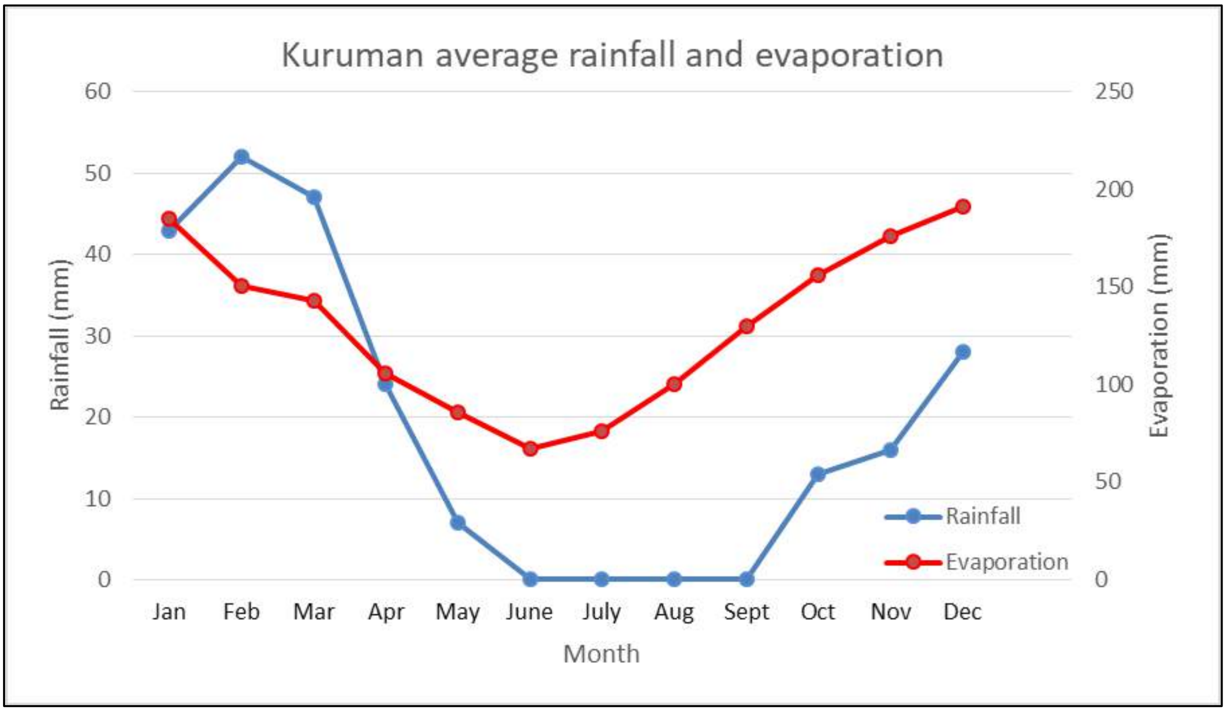

Figure 1: Long Term Rainfall for Kuruman (1950 -2000). (Source: Cape Farm Mapper; https://gis.elsenburg.com/apps/cfm/)

The monthly distribution of average monthly minimum and maximum temperatures (**Figure 2**) shows that the temperatures range from the lowest 1.3 ^{o}C in July to 31.1 ^{o}C in January. The region is the coldest during the July where previously temperatures reaching sub-zero have been recorded.

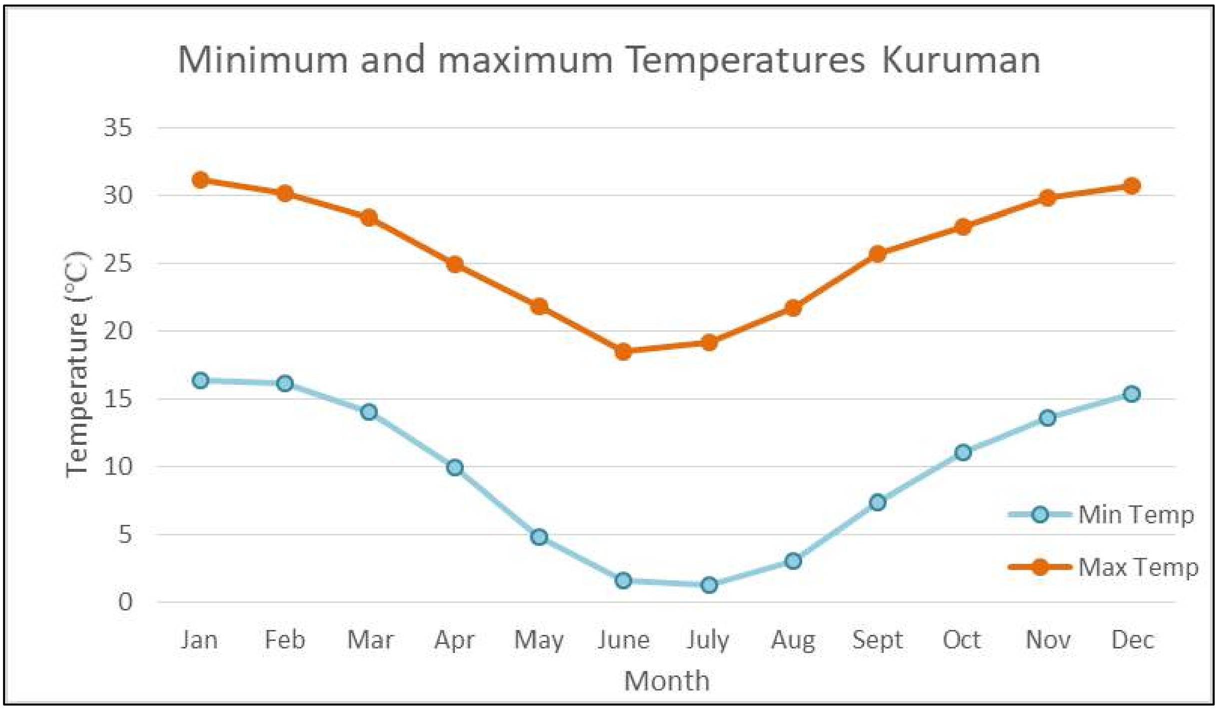

Figure 2: Long term rainfall for Kuruman (1950 – 2000). (Source: Cape Farm Mapper; https://gis.elsenburg.com/apps/cfm/)

1.3.1.3. *Regional Geology*

The Geological Survey of South Africa (now the Council for Geoscience) has mapped the area at 1:250 000 scale (2722 - Kuruman). The geological setting is shown in **Map 2 (Appendix A).** The main geology of the area is listed in **Table 1**.

Table 1: Geological formation within the study area

Symbol	Lithology	Group	Formation
Qs	Red to flesh coloured windblown sand	N/A Quaternary deposits	
▽△▵	Alluvium	N/A Quaternary deposits	
Vo	Amygloidal andesitic lava with interbeds of tuff, agglomerate, chert and red jasper	Olifantshoek	Ongeluk
Vm	Diamicite banded jasper, siltstone, mudstone, sandstone, grit and dolomite with chert	-	Gamagara
Vad	Yellow-brown banded or massive jaspilite with crocidolite; flat-pebble conglomerate	Griquatown	Danielskuil
Vak	Banded ironstone with subordinate amphibolite; crocidolite; ferruginised brecciated banded ironstone (blink-klip breccia. At base in places; brown jaspilite and chert.		Kuruman
Vgd	Fine and coarse- grained dolomite, chert and dolomitic limestone with prominent inter-bedded chert, limestone and banded ironstone; chert breccia at top (siliceous breccia or manganese marker)	Campbell	Ghaap Plateau

The geological formations are overlain by Quaternary Age deposits which comprises of younger red to buff coloured wind-blown sands and older alluvial material. This is underlain by (in order of youngest to oldest):

- volcanic rocks consisting of amygdaloidal andesitic lavas (the Ongeluk Formation)
- diamictite banded jasper that outcrops towards the west of the study area (the Gamagara Formation)
- the yellow brown banded or massive jaspilite (the Danielskuil Formation)
- banded ironstone (with subordinate amphibolite; crocidolite; and ferruginised brecciated banded ironstone) of the Kuruman Formation.
- The fine to coarse - grained dolomite with interbedded chert of the Ghaap Plateau Formation (which is part of the Campbell Group).

The Danielskuil and Kuruman Formations are part of the Griquatown Group and form the distinctive north-south trending ironstone rich mountain ranges of the larger Kuruman area.

The proposed 132 kV Power Line is located in an area where there are two faults trending from north-west towards the south-east. These faults are prominent in the Danielskuil and Kuruman Formations resulting in fracturing of the bedrock (**Map 2, Appendix A**). These faults are good target zones if further groundwater development is going to take place. They are not likely to result in instability of the area for the proposed 132 kV Power Lines. Historically, the larger Kuruman area has been mined for iron ore and asbestos.

1.3.1.4. ***Regional Hydrogeology***

According to the 1:500 000 scale groundwater map of Kuruman (2723) the northern portion of the study area hosts a fractured aquifer with an average borehole yield of 0.1 – 0.5 L/s and 2 – 5 L/s for the most southern portion **(Map 3 Appendix A).**

Groundwater quality is good with greatest recharge occurring in the mountainous areas. The regional 1:500 000 groundwater quality maps **(Map 4, Appendix A)** indicate that the study area's groundwater quality is classified as "good" with an associated electrical conductivity (EC) of < 70 mS/m.

Both these classifications are based on regional datasets, and therefore only provide an indication of conditions to be expected.

1.3.1.5. ***Results of the Field Study***

An initial desktop study was completed using the National Groundwater Archive (NGA) and a 1 km search radius. No boreholes were located on the NGA for the study area, including the additional 1 km search radius.

From the field hydrocensus conducted on 23, 24 and 25 January 2018, fourteen boreholes were located within the broader study area. The broader study area comprises the Phase 1 and Phase 2 sites – as well as an additional 1 km search radius. Details of the hydrocensus boreholes (HBH) are summarized in **Table 2** and shown on **Map 5 (Appendix. A**).

It was requested that the site visit is only to be carried out on the farms affected by the proposed Mulilo wind farms (i.e. Kuruman Phase 1 and Phase 2). However some of the surrounding farms were visited and boreholes located on these non-Mulilo properties. They have been included in this study as they provide useful additional data. Sufficient information with regards to the regional geohydrological setting was obtained from the site visit. Communication with the landowners of the farms proved to be valuable to understanding more about the regional geohydrology. Consultation with land owners is always important for site specific data and anecdotal information.

The following information was collected in the field (for both Phase 1 and Phase 2 areas):

- Fourteen boreholes were located.
- Seven of the fourteen boreholes were equipped with submersible pumps, with groundwater being abstracted either by means of solar power or electricity. The boreholes were being used daily (for different lengths of time depending on the water requirements).
- Three sites were equipped with mono pumps and are in regular use, mostly for livestock watering.
- Four sites were equipped with wind pumps however are actually not in use. They are either damaged or blocked.
- Groundwater levels and field chemistry was measured where possible.
    - It was difficult to measure water levels as most boreholes were equipped with pumps.
    - Samples of the groundwater were collected where possible and submitted for testing to determine the chemical groundwater characteristics of the area. All samples measured in the field had an EC of approximately 70 mS/m. Borehole HBH10 had the highest EC (field measurement EC = 91 mS/m).

Two hydrocensus boreholes are located in close proximity to the proposed 132 kV Power Line (i.e. HBH11and HBH12). Unfortunately no groundwater levels or borehole yields could be measured at these two sites. Photos of all he hydrocensus sites are included in **Appendix B.**

Table 2: Hydrocensus boreholes (24 – 26 January 2018)

BH_ID	Latitude (DD, WGS84)	Longitude (DD, WGS84)	WL (mbgl)	pH	EC (mS/m)	TDS (mg/L)	Temp (°C)	Yield (L/s)	Status	Comments
HBH1	-27,53495°	23,33459°	-	-	-	-	-	-	Not in Use	Wind pump. No access point for WL
HBH2	-27,53500°	23,33444°	-	-	-	-	-	-	Not in Use	Wind pump. No access point for WL
HBH3	-27,53503°	23,33483°	87,1	-	-	-	-	-	Not in Use	Wind pump.
HBH4	-27,50562°	23,40556°	-	8,38	31,6	202	21	-	In Use	Submersible pump equipped.
HBH5	-27,50587°	23,40571°	14,37	-	-	-	-	-	In Use	Submersible pump equipped.
HBH6	-27,50251°	23,40132°	31	7,61	42,1	282	23,4	-	In Use	Submersible pump equipped.
HBH7	-27,49538°	23,39873°	31,2	8,03	21,9	140	25,6	~30	In Use	Submersible pump equipped.
HBH8	-27,52362°	23,35946°	-	7,42	16,9	112	23,8	4,5	In Use	Submersible pump equipped, solar power.
HBH9	-27,54420°	23,37337°	-	7,43	9	48,2	22,3	0,8	In Use	Submersible pump equipped, solar power.
HBH10	-27,57643°	23,37623°	-	7,92	90,6	50,1	23,7	0,2	In Use	Submersible, pump equipped, solar power. BH depth ~ 240 m
HBH11	**-27,65011°**	**23,40659°**	**-**	**8,36**	**20,7**	**157**	**22,2**	**-**	**In Use**	**Old Mono. BH depth ~120 m**
HBH12	**-27,60462°**	**23,39927°**	**-**	**7,41**	**18,13**	**124**	**22,3**	**-**	**In Use**	**Old Mono. BH depth ~180 m**
HBH13	-27,62941°	23,43610°	-	-	-	-	-	-	Not in Use	Unequipped and blocked
HBH14	-27,62883°	23,44548°	-	7,5	16,2	111,1	22,3	-	In Use	Equipped, Old mono.

HBH = hydrocensus borehole
WL = water level
m = metres
Temp = temperature
EC = electrical conductivity

TDS = total dissolved solids
mbgl = metres below ground level
mg/L = milligrams per litre
mS/m = milliSiemens per metre
shaded cells are boreholes in close proximity to the proposed 132 kV Power Line

1.3.1.6. *Geochemical analysis*

Four samples were taken from four boreholes within the area of the proposed 132 kV Power Line of the Kuruman WEF and submitted for inorganic chemical analysis to SANAS accredited laboratory (Bemlab) in the Western Cape. The certificate of analysis for all the samples is presented in Appendix B.

The chemistry results obtained have been classified according to the SANS241-1: 2015 standards for domestic water. **Table 3** enables an evaluation of the water quality with regards to the various limits. **Table 4** presents the water chemistry analysis results, colour coded according to the SANS241-1: 2015 drinking water assessment standards.

Table 3: Classification table for specific limits

Acute Health
Aesthetic
Chronic health
Operational
Acceptable

Table 4: Localised groundwater results classified according the SANS241-1:2015

Analyses	HBH6	HBH10	HBH11	HBH14	SANS 241-1:2015
pH (at 25 ºC)	6.9	8.1	7.9	7.3	≥5 - ≤9.7 Operational
Conductivity (mS/m) (at 25 ºC)	42.0	68.0	20.0	15.0	≤170 Aesthetic
Total Dissolved Solids (mg/l)	252.0	409.0	118.4	88.6	≤1200 Aesthetic
Sodium (mg/l as Na)	9.7	12.0	3.0	3.1	≤200 Aesthetic
Potassium (mg/l as K)	2.7	8.3	1.5	1.1	N/A
Magnesium (mg/l as Mg)	10.1	47.6	9.2	5.1	N/A
Calcium (mg/l as Ca)	60.7	62.7	19.5	18.9	N/A
Chloride (mg/l as Cl)	22.7	14.0	8.6	9.0	≤300 Aesthetic
Sulphate (mg/l as SO4)	7.0	30.0	1.4	1.4	≤250 Aesthetic ≤500 Acute Health
Nitrate & Nitrite Nitrogen (mg/l as N)	4.5	0.5	0.8	0.8	≤12 Acute Health
Fluoride (mg/l as F)	0.1	0.2	0.1	0.1	≤1.5 Chronic Health
Iron (mg/l as Fe)	0.1	0.1	0.1	0.1	≤0.3 Aesthetic ≤2 Chronic Health
Zinc (mg/l as Zn)	0.0	0.0	0.0	0.7	≤5 Aesthetic

The chemistry results obtained have been classified according to the DWAF (1998) standards for domestic water. **Table 5** enables an evaluation of the water quality with regards to the various parameters measured (DWAF, 1998). **Table 6** presents the water chemistry analysis results colour coded according to the DWAF drinking water assessment standards.

Table 5 Classification table for the localised groundwater results (DWAF, 1998)

Blue	**(Class 0)**	**Ideal water quality** - suitable for lifetime use.
Green	**(Class I)**	**Good water quality** - suitable for use, rare instances of negative effects.
Yellow	**(Class II)**	**Marginal water quality** - conditionally acceptable. Negative effects may occur.
Red	**(Class III)**	**Poor water quality** - unsuitable for use without treatment. Chronic effects may occur.
Purple	**(Class IV)**	**Dangerous water quality** - totally unsuitable for use. Acute effects may occur.

Table 6: Classified local groundwater results

Sample Marked :	**HBH6**	**HBH10**	**HBH11**	**HBH14**	**DWA (1998) Drinking Water Assessment Guide**				
					Class 0	**Class I**	**Class II**	**Class III**	**Class IV**
pH	6.9	8.1	7.9	7.3	5-9.5	4.5-5 & 9.5-10	4-4.5 & 10-10.5	3-4 & 10.5-11	< 3 & >11
Conductivity (mS/m)	42	68	20	15	<70	70-150	150-370	370-520	>520
	mg/L								
Total Dissolved Solids	252	409	118.4	88.6	<450	450-1000	1000-2400	2400-3400	>3400
Sodium (as Na)	9.7	12	3	3.1	<100	100-200	200-400	400-1000	>1000
Potassium (as K)	2.7	8.3	1.5	1.1	<25	25-50	50-100	100-500	>500
Magnesium (as Mg)	10.1	47.6	9.2	5.1	<70	70-100	100-200	200-400	>400
Calcium (as Ca)	60.7	62.7	19.5	18.9	<80	80-150	150-300	>300	
Chloride (as Cl)	22.7	14	8.6	9	<100	100-200	200-600	600-1200	>1200
Sulphate (as SO4)	7	30	1.43	1.43	<200	200-400	400-600	600-1000	>1000
Nitrate& Nitrite (as N)	4.53	0.45	0.78	0.84	<6	6.0-10	10.0-20	20-40	>40
Iron (as Fe)	0.1	0.1	0.1	0.1	<0.5	0.5-1.0	1.0-5.0	5.0-10.0	>10
Zinc (as Zn)	0.03	0.03	0.03	0.72	<20	>20			

From the results presented in **Table 4** and **Table 6** it is clear that the groundwater qualities of the respective boreholes good, in terms of dissolved mineral concentrations. None of the water samples analysed have dissolved mineral concentrations that should have a negative effect and impact on human or animal health once consumed (microbiological analysis was not conducted).

A number of chemical diagrams have been plotted for the water sample and these are useful for chemical characterisation of the water. The chemistry of the sample has been plotted on a tri-linear diagram known as a Piper diagram (**Figure 3**). This diagram indicates the distribution of cations and anions in separate triangles and then a combination of the chemistry in the central diamond.

From **Figure 3** (central diamond) the sample is classified as having mainly a mixed calcium-chloride/sulphate hydrofacies.

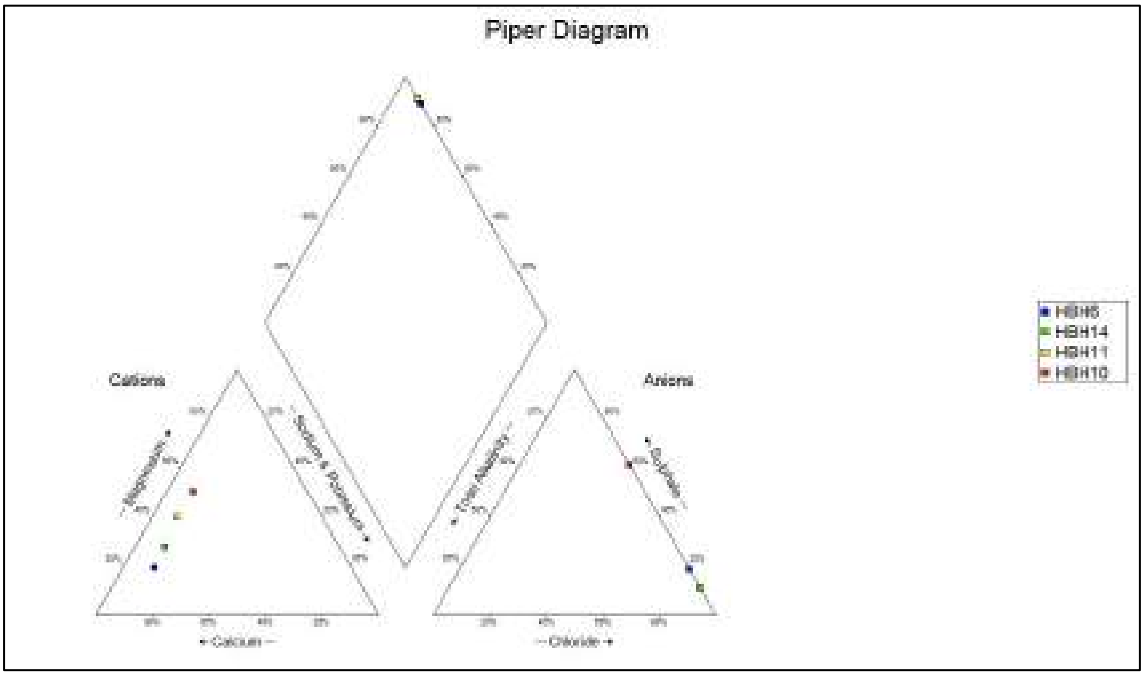

Figure 3: ***Piper diagram of the groundwater samples***

The following Stiff diagrams are graphical representations of the relative concentrations of the cations (positive ions) and anions (negative ions). This diagram shows concentrations of cations and anions relative to each other (not as a percentage as with Piper) and direct reference can be made to specific salts in the water. The Stiff diagram for the HBH6, HBH10, HBH11 and HBH14 are shown in **Figure 4.**

From the shape of the Stiff diagram the major ions present in the water can be compared. Studying the "shape" of the Stiff diagrams it is clear that HBH11 and HBH14's water source is from similar geological environments, as it has similar cation and anion concentrations; with high calcium and low bicarbonate (alkalinity) with secondary magnesium, sodium and potassium. HBH10 shows that the water has high concentration of calcium and low bicarbonate (alkalinity) with high magnesium concentration in comparison to the other samples. HBH6 shows that the water has high concentration of calcium with very little bicarbonate (alkalinity) with secondary magnesium, sodium and potassium.

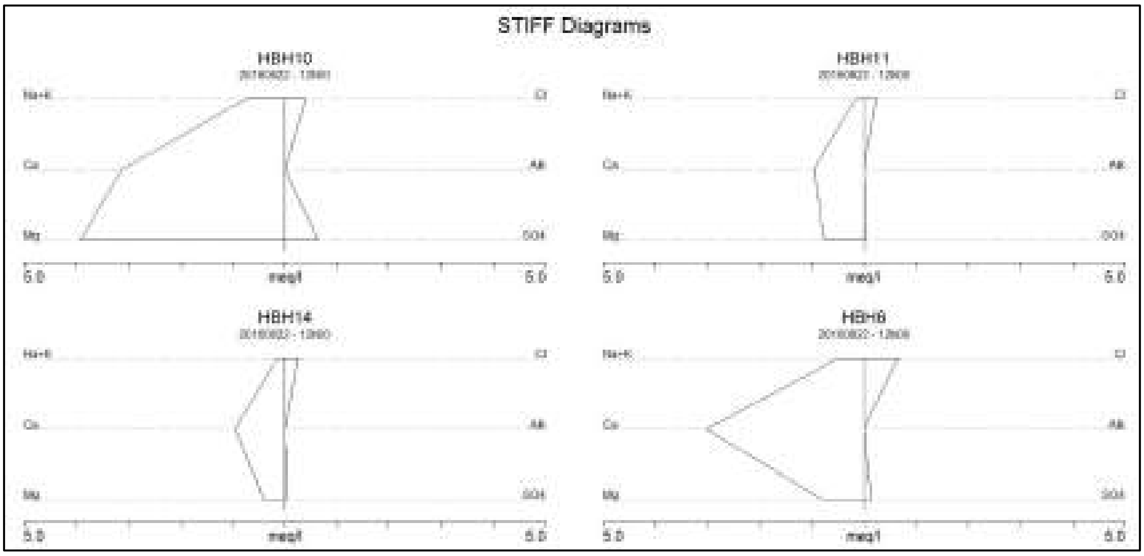

Figure 4: Stiff diagrams of borehole samples from hydrocensus

1.3.1.7. ***Geohydrological Characterisation (Aquifer Vulnerability)***

The new proposed site for the 132 kV Power Line overlies a fractured aquifer that possesses water bearing properties due to fracturing. Several methods have been developed to classify an aquifer's vulnerability. The DRASTIC method has been applied to this study.

1.3.1.8. ***Aquifer Vulnerability (DRASTIC)***

Groundwater vulnerability can be defined as the "tendency for contaminants to reach a specified position in the groundwater system after introduction at some location" (Vrba and Zaporozec, 1994). Key physical parameters which determine groundwater vulnerability include lithology, thickness, effective porosity, groundwater flow direction, age and residence time of water. Generally, the residence time of a contaminant in groundwater and the distance that it travels in the aquifer are considered important measures of vulnerability.

There are two main groups of methods for assessing groundwater vulnerability, namely:

- Index or subjective rating methods,
- Statistical or process-based methods.

The "index or subjective rating method" is relatively easily addressed within a GIS framework. The cell-based layer approach facilitates the assignment of ratings and weights and rapid achievement of a final result of relative groundwater vulnerability. This approach also means that the algorithm can easily be repeated as new or more detailed data sets are obtained or if ratings and weightings need to be adjusted as a result of a sensitivity analysis for example. The most well-known "index or subjective rating method" is the "DRASTIC" method (Aller et al., 1987). The DRASTIC method of Aller et al. (1987) uses the typical overlay technique often applied in subjective rating methods. The DRASTIC approach is based on four major assumptions:

- The contaminant is introduced at ground surface
- The contaminant is flushed into the groundwater by precipitation
- The contaminant has the mobility of water
- The area evaluated using DRASTIC is 40.5 ha or larger.

The implication of these assumptions is that DRASTIC should not be used for contaminants that do not have the mobility of water or for point assessment (such as storage tanks). In addition, groundwater conditions in South Africa are dominated by secondary/fracture-controlled flow conditions. The DRASTIC method does not consider local preferential flow paths of fractured aquifer systems particularly well. The DRASTIC method takes into account the following factors:

D	=	depth to groundwater	(5)
R	=	recharge	(4)
A	=	aquifer media	(3)
S	=	soil type	(2)
T	=	topography	(1)
I	=	impact of the vadose zone	(5)
C	=	conductivity (hydraulic)	(3)

The number indicated in parenthesis at the end of each factor description is the weighting or relative importance at that factor.

Groundwater vulnerability maps developed using the DRASTIC method have been produced in many parts of the world. In spite of the widespread use of DRASTIC, the effectiveness of the method has been met with mixed success due to hydrogeological heterogeneity and the many assumptions that need to be made in determining groundwater vulnerability. In addition, the use of a generic vulnerability map only gives a broad indication of relative vulnerability and in many instances detailed scale, contaminant specific vulnerability assessments are required. From the assumptions outlined by Aller et al. (1987), DRASTIC can only be applied to non-point source pollution, as DRASTIC is inaccurate in point source assessments.

As part of the Groundwater Resources Assessment Project (DWAF, 2005), numerous data sets were produced and this enabled the mapping of groundwater vulnerability at the national scale on a 1 km by 1 km cell (pixel) size basis (Conrad and Munch, 2007). This national scale map indicates the relative vulnerability of groundwater resources throughout the country and provides project planners a clear idea of what level of groundwater protection is required.

A national scale map of groundwater vulnerability has been completed for South Africa (DWAF, 2005). The groundwater vulnerability for the study area is shown in **Map 6 -Appendix A**. The study area has a **<u>low</u>** groundwater vulnerability.

1.4. APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

1.4.1. The National Water Act (NWA)

The National Water Act (1998) is administered by the Department of Water and Sanitation (DWS) and is the main legislation for managing water resources in South Africa. The purpose of the NWA is to provide a framework for the equitable allocation and sustainable management of water resources. Both surface and groundwater sources are redefined by the Act as national resources which cannot be owned by any individual, and rights to which are not automatically coupled to land rights, but for which prospective users must apply for authorization and register as users. The National Water Act also provides for measures to prevent, control and remedy the pollution of surface and groundwater sources.

The Phase 2 area is within quaternary catchment D41L. The groundwater General Authorisation (GA) for this catchment is 45 m^3/ha/a. The Phase 2 area is 4 433 hectares, thus 199 485 m^3/a of groundwater can be abstracted under the GA. This equates to approximately 6.3 L/s (continuous abstraction) for the entire Phase 2 area. The proposed groundwater use is less than this (peak usage is 0.7 L/s for only 6 months) and will thus fall within the GA. Only a registration process will have to be followed for the groundwater use; i.e. Section 39 of the National Water Act, 1998 (Act No. 36 of 1998) is applicable. Although the development footprint is 400 ha, the total farm land is 4 433 ha and it's the total farm area that is used for the GA calculation.

1.5. IDENTIFICATION OF KEY ISSUES

1.5.1.1. *Identification of Potential Impacts*

The following potential impacts on groundwater of the proposed project activities are as follows:

- Lowering of the groundwater level due to abstraction (during the first 6 months of the construction phase)
- Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages during the construction, operational and decommissioning phases.

Any construction activities such as the excavation and installation of foundations and piling (narrow diameter holes for foundation purposes) will have minimal to no impact on the groundwater of the site or region, as the groundwater level is approximately 15 – 30 mbgl.

The potential impacts identified during the Basic Assessment are:

1.5.1.2. *Construction Phase*

- Potential lowering of the groundwater level;
- Potential impact on groundwater quality as a result of accidental oil spillages or fuel leakages.

1.5.1.3. *Operational Phase*

- None

1.5.1.4. *Decommissioning Phase*

- None

1.5.1.5. *Cumulative impacts*

- None

1.6. ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

1.6.1.1. *Groundwater impact as a result of groundwater abstraction. (Construction, Phase)*

This impact is only applicable during the construction phase Even at the peak requirement the proposed groundwater abstraction is very low relative to the aquifer storage and transmissivity.

The status of this impact is rated as negative with a site specific spatial extent and a long-term duration (i.e. for the life of the project). The consequence and probability of the impact is respectively rated as slight and extremely unlikely. The reversibility of the impact is rated as high and the irreplaceability is rated low. The significance of the impact without the implementation of mitigation measures is rated as low. With effective implementation of prevention / mitigation actions (i.e. to adhere to the borehole's safe yield and to monitor water levels and flow), the impact of the proposed abstraction on groundwater is predicted to be of very low significance.

1.6.1.2. *Potential Impact on Groundwater Quality as a result of Accidental Oil Spillages or Fuel Leakages (Construction Phase)*

If there is an accidental oil spill or fuel leakage during the construction phase, then the low permeability of the unsaturated zone will provide significant attenuation capacity. The status of this impact (for the construction phase) is rated as negative with a site specific spatial extent and long-term duration (i.e. for the life of the facility). The consequence and probability of the impact is respectively rated as slight and extremely unlikely. The reversibility of the impact is rated as high and the irreplaceability is rated as low. The significance of the impact without the implementation of mitigation measures is rated as low.

A precautionary approach must be implemented and reasonable measures must be undertaken to prevent oil spillages and fuel leakages from occurring. During the construction phase, vehicles must be regularly serviced and maintained to check and ensure there are no leakages. Any engines that stand in one place for an excessive length of time must have drip trays. Diesel fuel storage tanks should be above ground on an impermeable concrete surface in a bunded area. Construction vehicles and equipment should also be refueled on an impermeable surface. A designated area should be established at the construction site camp for this purpose, if off-site refueling is not possible. If spillages occur, they should be contained and removed as rapidly as possible, with correct disposal procedures of the spilled material, and reported. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes.

With effective implementation of these prevention / mitigation actions, the impact of the project on groundwater as a consequence of accidental oil spillages and fuel leakages is predicted to be of very low significance.

1.6.1.3. *Cumulative Impacts*

The 132 kV Power Line at the Kuruman WEF is being built on the high lying areas (which are geologically very stable). The planned groundwater usage is very low. There is no need to implement a groundwater level or groundwater quality monitoring network.

1.7. IMPACT ASSESSMENT SUMMARY

The following tables provide a summary of the impact the proposed wind farm will play on groundwater within the study area

Table 7: Impact assessment summary table for the Construction Phase

Construction Phase													
Direct and Indirect Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Conse-quence**	**Probability**	**Reversibility of Impact**	**Irreplace ability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Construc-tion of storage yards and pylons	Ground-water contamination	Neutral	Site	Short-term	Slight	Very Unlikely	High	Low	All reasonable measures must be taken to prevent soil and groundwater contamination. Vehicles to be correctly serviced	Low	Very low	5	High

Construction Phase													
Direct and Indirect Impacts													
Aspect/ Impact	**Nature of Potential**	**Status**	**Spatial Extent**	**Duration**	**Conse-quence**	**Probability**	**Reversibility of Impact**	**Irreplace ability**	**Potential Mitigation**	**Significance of Impact and Risk**		**Ranking of**	**Confidence Level**
Accidental oil spillage / fuel leakage	Groundwater contamination	Neutral	Site	Short-term	Slight	Extremely unlikely	High	Low	Vehicles must be regularly serviced and maintained to check and ensure there are no leakages. Any engines that stand in one place for an excessive length of time must have drip trays. Diesel fuel storage tanks should be above ground on an impermeable surface in a bunded area. Vehicles and equipment should also be refuelled on an impermeable surface. If spillages occur, they should be contained and removed as rapidly as possible, with correct disposal procedures of the spilled material. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes	Low	Very low	5	High

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1.8. INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAM

Certain measures need to be put in place to ensure that the local and regional aquifers' groundwater does not get impacted. The following aspects are considered to be applicable to the 132 kV Power Line at the Kuruman WEF:

1.8.1.1. *Groundwater abstraction (if groundwater is to be used in the Construction Phase)*

- The production boreholes that are put into use should be yield tested prior to use (according to SANS10299) so that the correct pump sizes and installation depths can be determined.
- The planned production boreholes should also be sampled and chemically and microbiologically analysed by a SANAS accredited laboratory. Samples should also be analysed for asbestos content.
- Once the boreholes are in use they should be equipped with:
  - observation pipes - so that the water levels can be measured (either manually or by data loggers)
  - Flow meters – to assess how much water is used and thereby all authorisations in place for use of the water are adhered to.
  - Sampling tap – to enable annual sampling to ensure the groundwater is safe for continued use – especially if it to be used as drinking water at the security buildings.

1.8.1.2. *Accidental oil spillage / fuel leakages*

- All vehicles and other equipment (generators etc.) must be regularly serviced to ensure they do not spill oil. Vehicles should be refuelled on paved (impervious) areas, optimally off-site. If liquid product is being transported it must be ensured this does not spill during transit.
- Emergency measures and plans must be put in place and rehearsed in order to prepare for accidental spillage.
- Diesel fuel storage tanks must be above ground on a concrete surface in a bunded area.
- Engines that stand in one place for an excessive length of time must have drip trays.
- Vehicle and washing areas must also be on paved surfaces and the by-products removed to an evaporative storage area or a hazardous waste disposal site (if the material is hazardous).

1.9. CONCLUSION AND RECOMMENDATIONS

The area experiences summer thunderstorms and experiences a wide range in temperatures. The nature of the rainfall means that surface run-off will be high during rain events. During the winter no rainfall occurs. Geologically the site is interesting with alluvial material overlying a sequence of lavas, jasper and banded ironstones forming the mountainous area.

Groundwater does occur on site, to a limited extent within the mountainous area (within a fractured aquifer setting), however it is quite deep (based on the depth of the boreholes). Across the site the groundwater quality is good is suitable for human consumption and general use in terms of quality according to the SANS241-1: 2015 drinking water assessment standards Groundwater use is currently minimal within the study area and the primary use is small scale stock watering and domestic use.

The water requirements for the Kuruman WEF can be met by using groundwater. However, agreements will have to be put in place with the current land owners for the use of groundwater. These agreements will have to be legally valid documents and the necessary endorsements will be required from the Department of Water and Sanitation (DWS). If no such agreements can be put in place, then additional boreholes will need to be drilled on the WEF property, followed by yield and water quality testing, and then authorization from DWS to use the groundwater will be required. The groundwater should also be tested to determine whether it is safe for consumption and for use when mixing cement. The samples should be analysed for the chemical and microbiological content and the presence of asbestos should also be screened for.

The groundwater vulnerability rating is low for the main portion of the study area.

With regard to the potential impacts – it must be ensured the groundwater use is sustainable and authorised. Any fuels / oils etc must be carefully handled on site and all measures to put in place to prevent spillages and possibly hydrocarbon s entering the ground. If this happens the spill must be cleaned up immediately and reported.

It is highly unlikely the proposed 132 kV Power Line construction for the Kuruman WEF will impact on the groundwater resources of the site, especially if all safety and preventative measures are put in place. From a groundwater perspective the 132 kV Power Line construction the Kuruman WEF can certainly proceed.

1.10. REFERENCES

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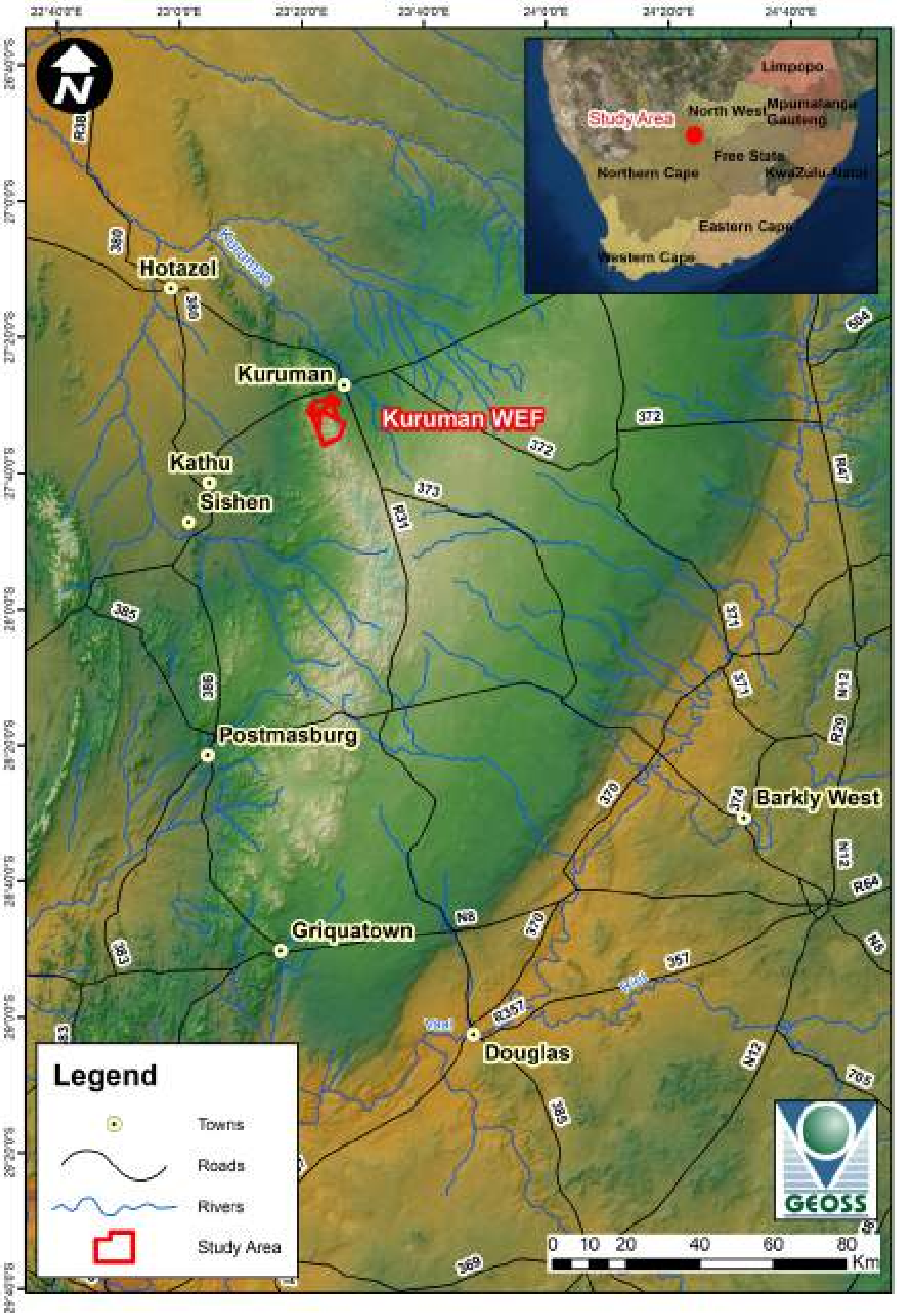
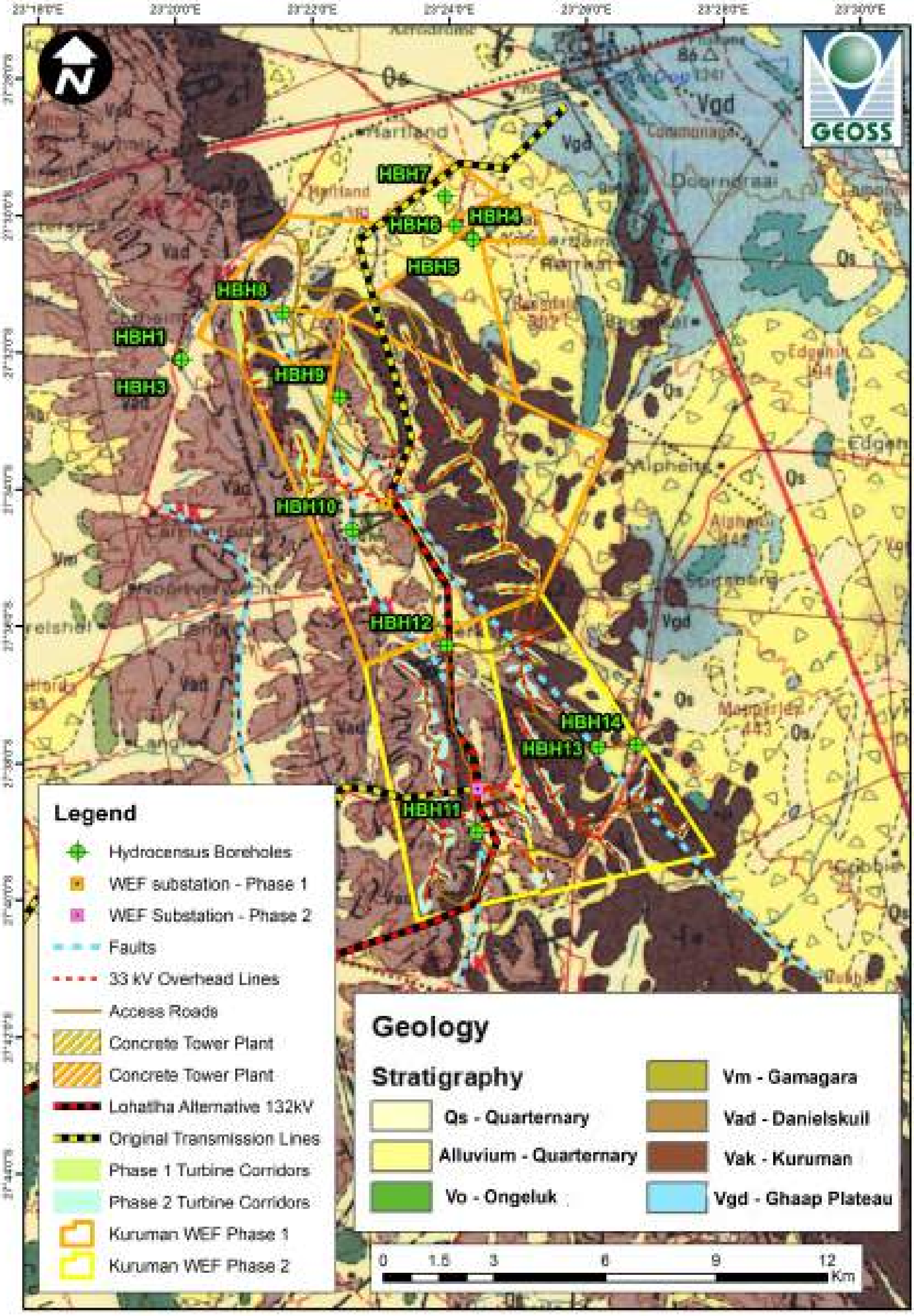
1.11. APPENDICES

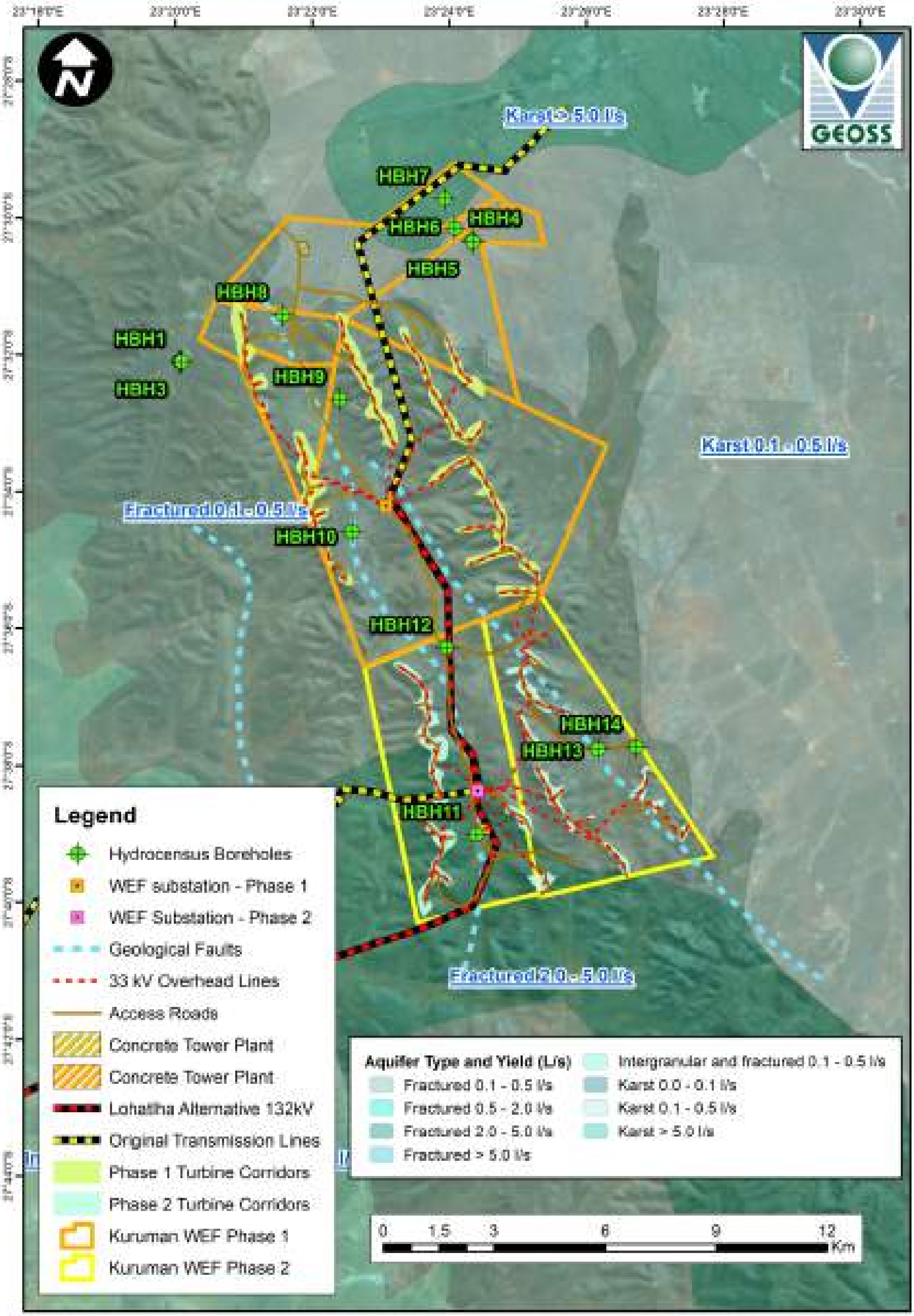
- ***APPENDIX A: Maps***



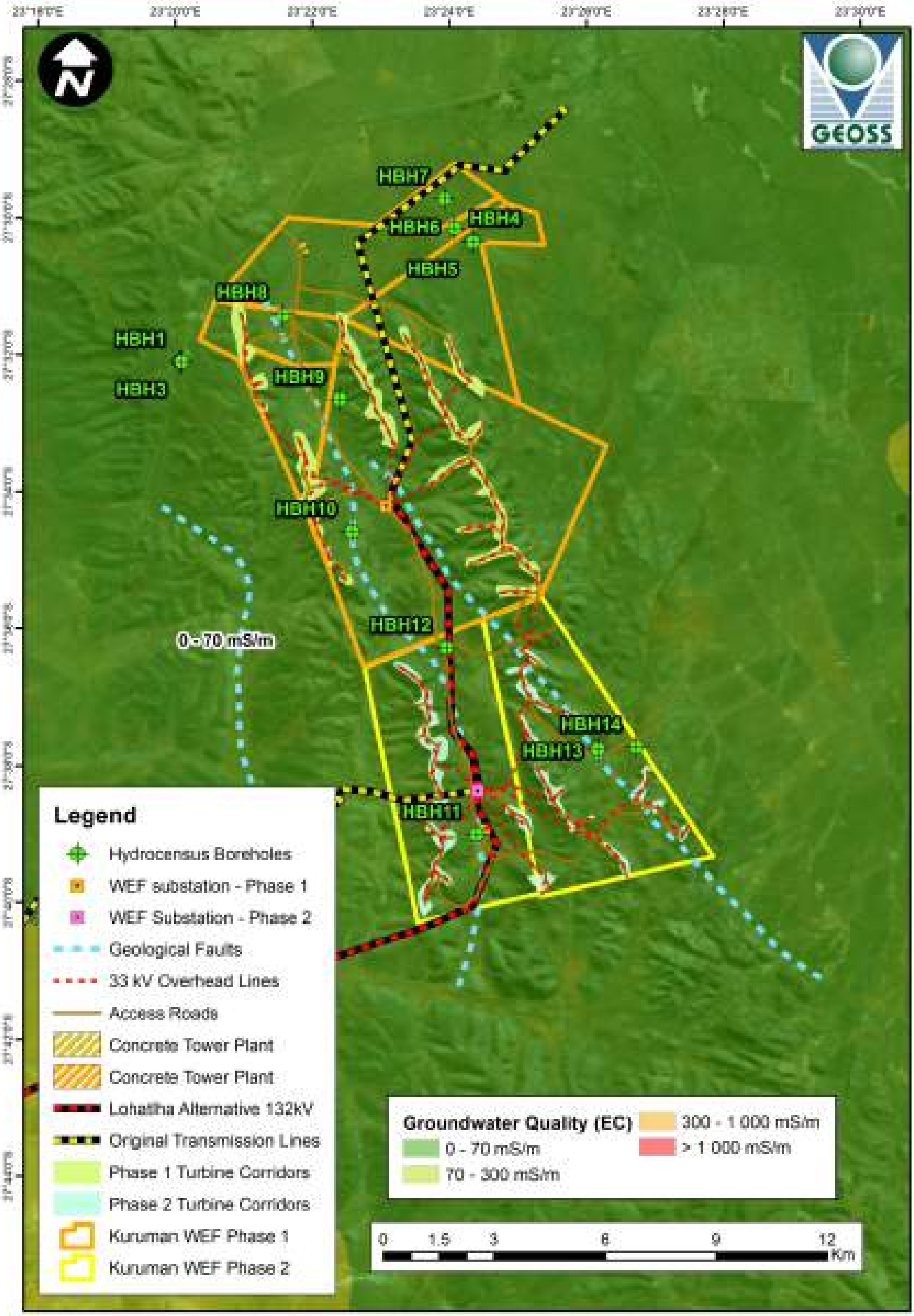
Map 1: Locality map of the study area within a regional setting



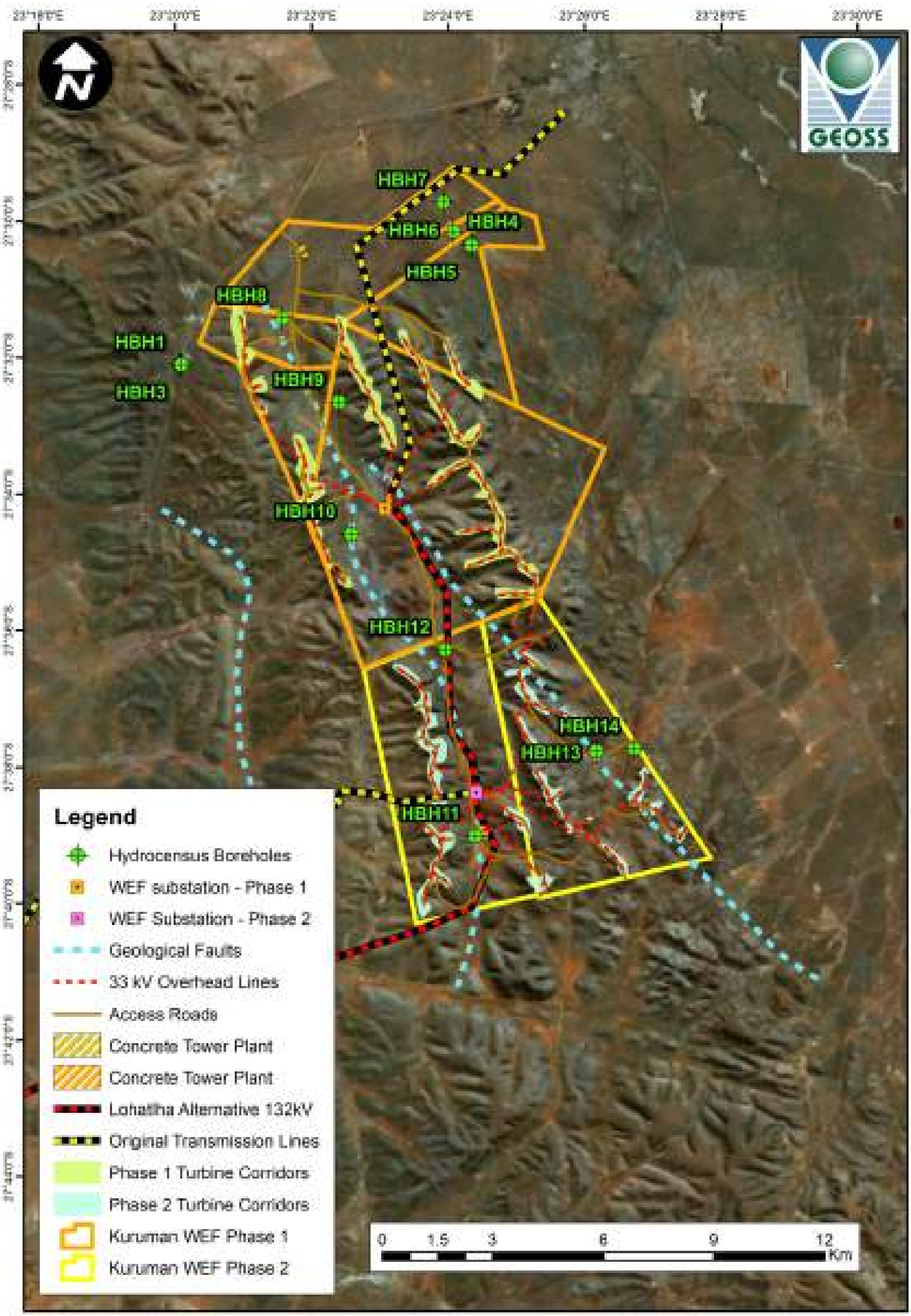
Map 2: Geological setting of the study area (CGS map: 1:250 000 scale 2922– Prieska).



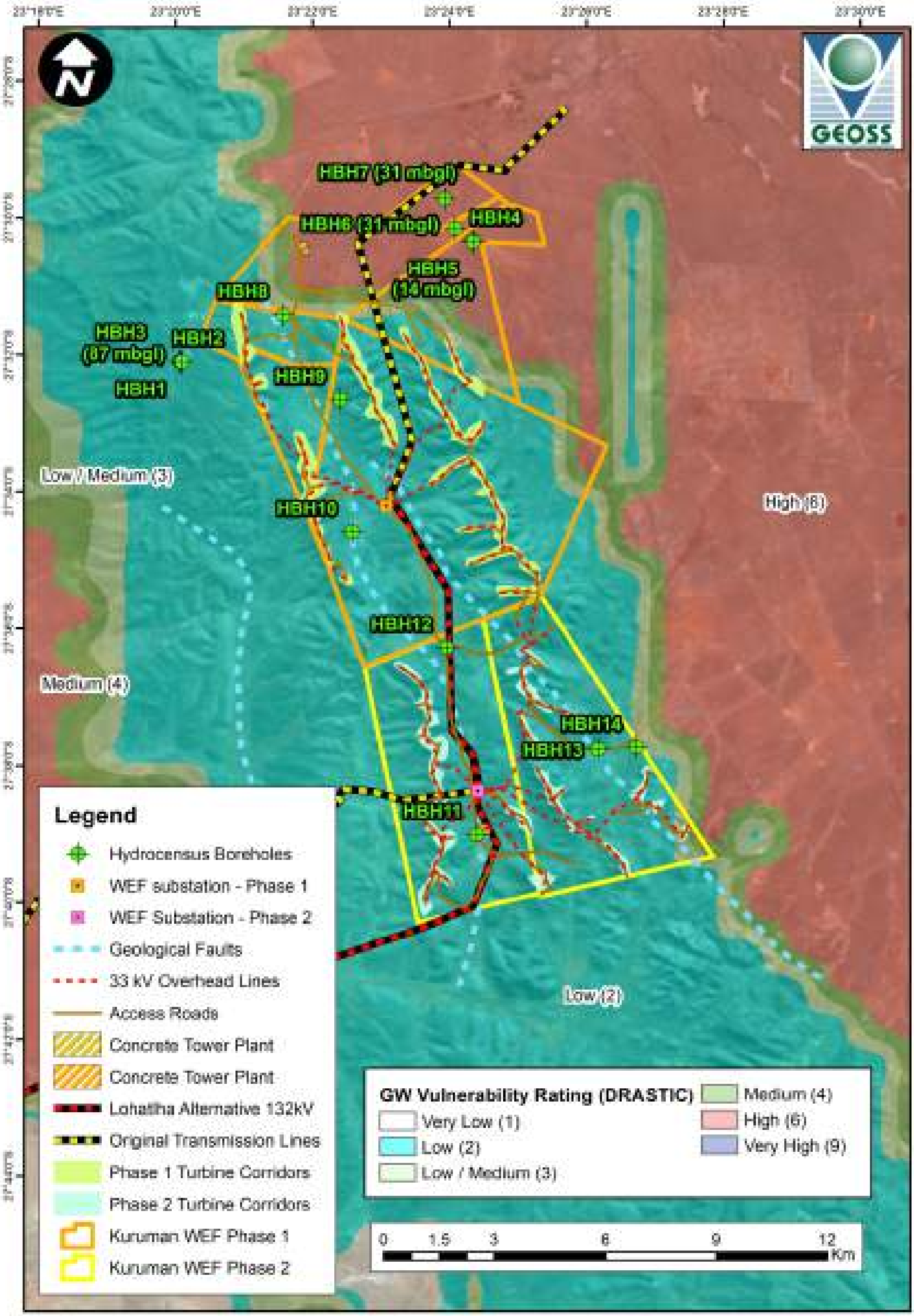
Map 3: Hydrogeological setting of the study area: Aquifer type and yield (DWAF, 2722 Kuruman)



Map 4: Regional groundwater quality (Department of Water Affairs groundwater map: 1:500 000 scale 2722 - Kuruman)



Map 5: Setting of the study area superimposed on an aerial photograph (source ESRI, 2018), showing hydrocensus boreholes.



Map 6: National groundwater vulnerability (calculated according to the DRASTIC methodology) and boreholes (DWAF, 2005).

- ***APPENDIX B: site photos***

Table 7: Photos of hydrocensus boreholes identified during site visit.

BH_ID	Photo
HBH1	
HBH2	
HBH3	
HBH4	No Photo Available

HBH5	No Photo Available
HBH6	
HBH7	
HBH8	

HBH9	
HBH10	
HBH11	
HBH12	

HBH13	
HBH14	

VISUAL IMPACT ASSESSMENT:

Basic Assessment for the proposed development of supporting electrical infrastructure for the proposed Kuruman Phase 1 and Phase 2 Wind Energy Facilities near Kuruman in the Northern Cape: BA REPORT

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services	SiVEST
P O Box 320	51 Wessels Road
Stellenbosch, 7600	Rivonia, 2128
South Africa	South Africa

11 September 2018

SPECIALIST EXPERTISE

Curriculum Vitae of Visual Specialist – Andrea Gibb

Name	Andrea Gibb
Profession	Environmental Practitioner / Visual Specialist
Name of Firm	SiVEST SA (Pty) Ltd
Present Appointment	Senior Manager Environmental Division
Years with Firm	7 Years
Date of Birth	29 January 1985
Place of Birth	South Africa
ID Number	8501290020089
Nationality	South African

Education

Matriculated 2003, Full Academic Colours, Northcliff High School, Johannesburg, South Africa

Professional Qualifications

BSc (Hons) Environmental Management (University of South Africa 2008-2010)
Coursework**:** Project Management, Environmental Risk Assessment and Management, Ecological and Social Impact Assessment, Fundamentals of Environmental Science, Impact Mitigation and Management, Integrated Environmental Management Systems & Auditing, Integrated Environmental Management, Research Methodology.
Research Proposal**:** Golf Courses and the Environment

BSc Landscape Architecture (with distinction) (University of Pretoria 2004-2007)
Coursework: Core modules focused on; design, construction, environmental science, applied sustainability, shifts in world paradigms and ideologies, soil and plant science, environmental history, business law and project management.
Awards: Cave Klapwijk prize for highest average in all modules in the Landscape Architecture programme, ILASA book prize for the best Landscape Architecture student in third year design, Johan Barnard planting design prize for the highest distinction average in any module of plant science.

Employment Record

Aug 2010 – to date	SiVEST SA (Pty) Ltd: Environmental Practitioner
Jan 2008 – July 2010	Cave Klapwijk and Associates: Environmental Assistant and Landscape Architectural Technologist
Feb 2006 – Dec 2006	Cave Klapwijk and Associates: Part time student

Key Experience

Specialising in the field of Environmental Management and Visual Assessment.

Andrea has 10 years' work experience and is employed by SiVEST Environmental as the Senior Manager heading up the Johannesburg office. She is primarily involved with managing large scale multifaceted Environmental Impact Assessments (EIAs) and Basic Assessments (BAs) (incl. Amendment Applications), undertaken according to International Finance Corporation (IFC) standards and Equator Principles, within the renewable energy generation and electrical distribution sectors. Andrea has extensive experience in overseeing public participation and stakeholder engagement processes and has also been involved in environmental feasibility and sensitivity analyses. She further specialises in undertaking and overseeing visual impact and landscape character assessments.

Key Visual Impact Assessment Experience

<u>Aug 2010 – to date</u>

- VIAs for the proposed construction of the Grasskoppies, Hartebeest Leegte, Ithemba and !Xha Boom Wind Farms near Loeriesfontein, Northern Cape Province.
- VIAs for the proposed Phezukomoya and San Kraal Wind Energy Facilities near Noupoort, Northern Cape Province.
- VIAs for the proposed Assagay Valley and Kassier Road North Mixed Use Developments, KwaZulu-Natal Province.
- VIA for the proposed construction of the Aletta 140MW Wind Energy Facility near Copperton, Northern Cape Province.
- VIAs (Scoping and Impact Phase) for the proposed construction of the Sendawo 1, 2 and 3 solar PV energy facilities near Vryburg, North West Province.
- VIA (Scoping and Impact Phase) for the proposed construction of the Sendawo substation and associated power line near Vryburg, North West Province.
- VIAs (Scoping and Impact Phase) for the proposed construction of the Tlisitseng 1 and 2 solar PV energy facilities near Lichtenburg, North West Province.
- VIA for the proposed construction of the Tlisitseng substation and associated 132kV power line near Lichtenburg, North West Province.
- VIA for the proposed Tinley Manor South Banks Development, KwaZulu-Natal Province.
- VIAs (Scoping and Impact Phase) for the proposed construction of the Helena 1, 2 and 3 75MW Solar PV Energy Facilities near Copperton, Northern Cape Province.
- Visual Status Quo and Due Diligence Report for the possible rapid rail extensions to the Gauteng network, Gauteng Province.
- VIA for the proposed Tweespruit to Welroux power lines and substation, Free State Province.
- VIA for the proposed construction of the Nokukhanya 75MW Solar PV Power Plant near Dennilton, Limpopo Province.
- VIA (Scoping and Impact Phase) for the proposed development of the Dwarsrug Wind Farm near Loeriesfontein, Northern Cape Province.
- VIA for the proposed construction of two 132kV power lines and associated infrastructure from the Redstone Solar Thermal Power Project site to the Olien MTS near Lime Acres, Northern Cape Province.
- VIAs for the Spoornet Coallink Powerline Projects in KZN and Mpumalanga.
- VIA for the (Scoping and Impact Phase) proposed Construction of the Renosterberg Wind Farm near De Aar, Northern Cape Province.
- VIA for the (Scoping and Impact Phase) proposed Construction of the Renosterberg Solar PV Power Plant near De Aar, Northern Cape Province.
- VIA for the proposed Mookodi Integration phase 2 132kV power lines and Ganyesa substation near Vryburg, North West Province.
- VIA for the proposed construction of a substation and 88kV power line between Heilbron (via Frankfort) and Villiers, Free State Province.
- Visual Status Quo Assessment for the Moloto Development Corridor Feasibility Study in the Gauteng Province, Limpopo Province and Mpumalanga Province.

SPECIALIST DECLARATION

I, **Andrea Gibb**, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Name of Specialist: Andrea Gibb

Date: 20 June 2018

EXECUTIVE SUMMARY

Although the majority of the study area has a largely natural, untransformed visual character, it is characterised by the presence of typical rural / pastoral infrastructure and is not typically valued or utilised for its tourism significance. In addition, the northern and south-western sections of the study area are characterised by the presence of high levels of human transformation / disturbance in the vicinity of the town of Kuruman, the suburb of Wrenchville and the town of Kathu. These areas will thus not be significantly impacted by the visual impacts associated with the proposed development. The rest of the study area / visual assessment zone has however seen limited transformation / disturbance and is considered to be largely natural / scenic. These undisturbed / natural areas will therefore be impacted significantly from a visual perspective as a result of the development of the proposed supporting electrical infrastructure.

Due to the presence of urban built-up areas and low levels of leisure-based or nature based tourism activities in the assessment area, no visually sensitive receptors with tourism significance were identified in the study area. Potentially sensitive receptor roads include the N14 national route. A total number of thirty-one (31) potentially sensitive visual receptors were also identified. Overall it can be concluded that the visual impact of the proposed development would be reduced due to the lack of sensitive visual receptors present. The proposed development is however expected to alter the largely natural / scenic character of the majority of the study area and contrast highly with the typical land use and/or pattern and form of human elements present in the undisturbed / natural areas of the study area.

The visual impact of the proposed development on most of the potentially sensitive visual receptors identified within the study area, including the N14 National Route receptor road, was rated as being medium (20 in total). In addition, the proposed development would result in a low visual impact on the remaining twelve (12) potentially sensitive receptor locations. It should be noted that the proposed development would not result in a high visual impact on any of the potentially sensitive receptor locations identified within the study area.

The impact rating revealed that overall the proposed development is expected to have a low negative visual impact rating during all phases of development, with relatively few mitigation measures available. Cumulative impacts associated with the proposed development would have a moderate negative visual impact rating during both construction and operation, with relatively few mitigation measures available. These impacts would however remain moderate after the implementation of the relevant mitigation measures, due to the nature of the impacts.

Several renewable energy developments (both wind and solar) are being proposed within a 50km radius of the proposed development. These renewable energy developments and their associated infrastructure would reduce the overall natural / scenic character of the study area, although they would increase the cumulative visual impacts if some or all of these developments are constructed. The relatively large number of renewable energy facilities within the surrounding area and their potential for large scale visual impacts could thus significantly alter the sense of place and visual character in the study area, as well as exacerbate the visual impacts on surrounding visual receptors.

LIST OF ABBREVIATIONS

BA	Basic Assessment
DBAR	Draft Basic Assessment Report
DEA	Department of Environmental Affairs
DEM	Digital Elevation Model
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
FBAR	Final Basic Assessment Report
GIS	Geographic Information System
I&AP	Interested and/or Affected Party
kV	Kilo Volt
MW	Megawatt
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NFEPA	National Freshwater Ecosystem Priority Areas
NGI	National Geospatial Information
OHL	Overhead Line
PPP	Public Participation Process
PV	Photovoltaic
SANBI	South African National Biodiversity Institute
VIA	Visual Impact Assessment
VR	Visual Receptor
WEF	Wind Energy Facility

GLOSSARY

Definitions	
Anthropogenic Feature	An unnatural feature as a result of human activity.
Aspect	Direction in which a hill or mountain slope faces.
Cultural Landscape	A representation of the combined worlds of nature and of man illustrative of the evolution of human society and settlement over time, under the influence of the physical constraints and/or opportunities presented by their natural environment and of successive social, economic and cultural forces, both external and internal (World Heritage Committee, 1992).
Power Line Route	The alignment followed by the proposed power line or power line alternatives.
Sense of Place	The unique quality or character of a place, whether natural, rural or urban. It relates to uniqueness, distinctiveness or strong identity.
Scenic Route	A linear movement route, usually in the form of a scenic drive, but which could also be a railway, hiking trail, horse-riding trail or 4x4 trail.
Sensitive Visual Receptors	An individual, group or community that is subject to the visual influence of the proposed development and is adversely impacted by it. They will typically include locations of human habitation and tourism activities.
Study Area	The study area / visual assessment zone is assumed to encompass a zone of 8km from the outer boundary of the proposed wind farm application site.
Vantage Point	A point in the landscape from where a particular project or feature can be viewed.
Viewpoint	A point in the landscape from where a particular project or feature can be viewed.
Viewshed	The outer boundary defining a visual envelope, usually along crests and ridgelines.

Visual Assessment Zone	The visual assessment zone / study area is assumed to encompass a zone of 8km from the outer boundary of the proposed wind farm application site.
Visual Character	The physical elements and forms and land use related characteristics that make up a landscape and elicit a specific visual quality or nature. Visual character can be defined based on the level of change or transformation from a completely natural setting.
Visual Contrast	The degree to which the development would be congruent with the surrounding environment. It is based on whether or not the development would conform with the land use, settlement density, forms and patterns of elements that define the structure of the surrounding landscape.
Visual Envelope	A geographic area, usually defined by topography, within which a particular project or other feature would generally be visible.
Visual Exposure	The relative visibility of a project or feature in the landscape.
Visual Impact	The effect of an aspect of the proposed development on a specified component of the visual, aesthetic or scenic environment within a defined time and space.
Visual Receptors	An individual, group or community that is subject to the visual influence of the proposed development but is not necessarily adversely impacted by it. They will typically include commercial activities and motorists travelling along routes that are not regarded as scenic.
Visual Sensitivity	The inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (visual character), spatial distribution of potential receptors, and the likely value judgements of these receptors towards the new development, which are usually based on the perceived aesthetic appeal of the area.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	**Page 1** and **Page 2**. A copy of the Specialists' curriculum vitae (CV) are included in **Appendix D**.
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	**Page 3**
c) an indication of the scope of, and the purpose for which, the report was prepared;	**Section 1.1.1**
(cA) an indication of the quality and age of base data used for the specialist report;	**Section 1.1.4** and **Section 1.1.5**
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	**Section 1.3**, **Section 1.5**, **Section 1.6** and **Section 1.7**.
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	**Section 1.1.3** and **Section 1.1.4**.
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	**Section 1.1.3**, **Section 1.1.4** and **Section 1.1.5**.
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	**Section 1.2, Section 1.3**, **Section 1.5**, **Section 1.6** and **Section 1.7**.
g) an identification of any areas to be avoided, including buffers;	**Section 1.3.6**, **Section 1.6.1** and **Section 1.6.2**.
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	The Visual Sensitivity Map has been provided in **Appendix C**.
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	**Section 1.1.4**
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	**Section 1.3**, **Section 1.5**, **Section 1.6** and **Section 1.7**.
k) any mitigation measures for inclusion in the EMPr;	**Section 1.6**, **Section 1.7** and **Section 1.8**
l) any conditions for inclusion in the environmental authorisation;	**N/A**. No specific conditions relating to the visual environment need to be included in the environmental authorisation
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	**Section 1.8**
n) a reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and	**Section 1.9**

ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	**Section 1.1.3**. Visual Impact Questionnaires have been included in **Appendix B**.
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	The only comments received during the consultation process included Visual Impact Questionnaires which were completed by the affected landowners. These questionnaires have been included in **Appendix B**.
q) any other information requested by the competent authority.	**N/A**. No information regarding the visual study has been requested from the competent authority to date.
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	**N/A**

TABLE OF CONTENTS

TABLES AND FIGURES

APPENDICES

VISUAL IMPACT ASSESSMENT: BA

1.1. INTRODUCTION AND METHODOLOGY

1.1.1. Scope and Objectives

Mulilo Renewable Project Developments (Pty) Ltd (hereafter referred to as 'Mulilo') is proposing to construct two (2) Collector Substations (as part of the Eskom Metering Station), a switching station (as part of the Eskom Substation) and a 132kV overhead power line near Kuruman in the Northern Cape Province (hereafter referred to as the 'proposed development'). The proposed development is aimed at feeding electricity generated by Mulilo's proposed Phase 1 and Phase 2 Kuruman Wind Energy Facilities (WEFs) into the national grid. The Phase 1 and Phase 2 Kuruman WEFs are however part of separate on-going Environmental Impact Assessment (EIA) processes.

This proposed development is currently the subject of an Environmental Authorisation (EA) application being submitted under the Environmental Impact Assessment (EIA) Regulations 2014 (as amended in 2017) and a Visual Impact Assessment (VIA) is required in order to inform the Basic Assessment Report (BAR) and Application for EA under NEMA.

The aim of the VIA is to identify potential visual issues associated with the development of the proposed electrical infrastructure, as well as to determine the potential extent of visual impacts. This is done by characterising the visual environment of the area and identifying areas of potential visual sensitivity that may be subject to visual impacts. This visual assessment focuses on the potential sensitive receptor locations, and provides an assessment of the magnitude and significance of the visual impacts associated with the proposed development.

1.1.2. Terms of Reference

The Terms of Reference for this VIA include the following:

- A description of the regional and local features;
- Identification of the visual character of the receiving environment;
- Desktop and field investigation to identify sensitive and potentially sensitive receptor locations;
- Mapping of the sensitive landscape features and/or receptor locations;
- Assessing (identifying and rating) the potential impacts on the environment,
- Description of the potential cumulative impacts;
- Identification of relevant legislation and legal requirements; and
- Providing recommendations on possible mitigation measures and rehabilitation procedures/ management guidelines.

1.1.3. Approach and Methodology

This BA level VIA is based on a combination of desktop-level assessment as well as field-based observation / verification.

- <u>Physical landscape characteristics</u>

Physical landscape characteristics such as topography, vegetation and land use are important factors influencing the visual character and visual sensitivity of the study area. Baseline information about the physical characteristics of the study area was initially sourced from spatial databases provided by National Geospatial Information (NGI), the South African National Biodiversity Institute (SANBI) and the South African National Land Cover Dataset (Geoterra Image – 2014). The characteristics identified via desktop means were later verified during the site visit.

- Identification of sensitive and potentially sensitive receptor locations

Receptor locations and routes that are sensitive and/or potentially sensitive to the visual intrusion of the proposed development were also identified and assessed in order to determine the impact of the proposed development on each of the identified receptor locations. Google Earth imagery was used in conjunction with field investigation to identify and assess visual receptor locations (both sensitive and potentially sensitive) within the study area, such as residences / dwellings and farmsteads / homesteads.

- Fieldwork and photographic review

A three (3) day site visit was undertaken between the 19th and the 21st of February 2018 (summer). The study area was visited in order to;

- verify the landscape characteristics identified via desktop means;
- classify the study area into zones of visual contrast;
- capture photos of the proposed study area;
- verify the sensitivity of visual receptor locations identified via desktop means;
- eliminate receptor locations that are unlikely to be influenced by the proposed development;
- identify any additional visually sensitive receptor locations within the study area; and
- inform the impact rating assessment from visually sensitive receptor locations.

- Impact Assessment

A rating matrix was used to objectively evaluate the significance of the visual impacts associated with the proposed development, both before and after implementing mitigation measures. Mitigation measures were identified (where possible) in an attempt to minimise the visual impact of the proposed development. The rating matrix made use of a number of different factors including geographical extent, probability, reversibility, irreplaceable loss of resources, duration and cumulative effect in order to assign a level of significance to the visual impact of the project.

A separate rating matrix was used to assess the visual impact of the proposed development on each visual receptor location (both sensitive and potentially sensitive), as identified. This matrix is based on three (3) parameters, namely the distance of an identified visual receptor from the proposed development, the presence of screening factors and the degree to which the proposed development would contrast with the surrounding environment from a particular location. Thereafter, the proposed power line route alternatives were comparatively assessed, in order to ascertain the preferred alternatives from a visual perspective.

- Consultation with I&APs

Continuous consultation with Interested and Affected Parties (I&APs) undertaken as part of the public participation process (PPP) for the BA will be used to help establish how the proposed development will be perceived by the various receptor locations and the degree to which the impact will be regarded as negative. Although I&APs have not as yet provided any feedback in this regard, the report will be updated to include relevant information as and when it becomes available.

1.1.4. Assumptions and Limitations

The following assumptions and limitations apply:

- This visual study has been undertaken based on the project description provided by Mulilo and the CSIR at the inception of the project, as well as the final layout information provided by Mulilo and the CSIR during the design phase of the project.

- Although photographs were taken during the site visit, these have been supplemented with Google Earth street view imagery as photographs could not be taken from certain locations in the study area (such as the Town of Kathu).

- Substations and power lines are very large structures by nature and could impact on receptors that are located relatively far away, particularly in areas with very flat terrain. Given the nature of the receiving environment and the height of the various components of the proposed development, the study area or visual assessment zone is assumed to encompass a zone of 5km from the proposed power line alternatives – i.e. all areas within a 5km radius of the power line and/or substation site alternatives. This 5km limit on the visual assessment zone relates to the importance of distance when assessing visual impacts. Although the proposed development may still be visible beyond 5km, the degree of visual impact would diminish considerably and as such the need to assess the impact on potential receptor locations beyond this distance would not be warranted.

- The identification of visual receptor locations has been based on a combination of desktop assessment as well as field-based observation. Initially Google Earth imagery was used to identify potential visual receptor locations within the study area. Thereafter a three (3) day site visit was undertaken between the 19th and 21st of February 2018 (summer) in order to verify the sensitive visual receptor locations within the study area and assess the visual impact of the development from these receptor locations where possible. Due to the extent of the study area, it was not possible to visit every potentially sensitive receptor location and as such a number of broad assumptions have been made in terms of the sensitivity of the receptors to the proposed development. It should be noted that not all receptor locations would necessarily perceive the proposed development in a negative way. This is usually dependent on the use of the facility and the economic dependency on the scenic quality of views from the facility. Sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include; tourism facilities and scenic locations within natural settings. The presence of a receptor location in an area potentially affected by the proposed development does not therefore necessarily mean that visual impact will be experienced.

- Due to access limitations during the field investigation and the nature of the study area, it was not possible to ground truth the identified potentially sensitive visual receptor locations (such as farmsteads and dwellings). As such, the nature and function of these receptor locations could not be fully confirmed during the field investigation, although they were still regarded as being potentially sensitive to the visual impacts associated with the proposed development and were included in the assessment.

- Potential visual impacts at each visual receptor location have been assessed and rated by way of a matrix which has been specifically developed for this purpose. The limitations of quantitatively assessing a largely subjective or qualitative type of impact should be noted. The matrix is relatively simplistic in considering three (3) main parameters relating to visual impact, but provides a reasonably accurate indicative assessment of the degree of visual impact likely to be exerted on each visual receptor location by the proposed development. The matrix should therefore be seen as a representation of the likely visual impact at a visual receptor location.

- The assessment of receptor-based impacts was based on the power line route alternatives and substation sites provided by the proponent. It is recognised however that the exact route of the proposed power line has not been determined, and as such the final routing of the proposed power line may result in greater or lesser visual impacts on receptor locations.

- No feedback regarding the visual environment has been received from the public participation process to date. Any feedback from the public during the review period of the Draft Basic Assessment Report (DBAR) will however be incorporated into further drafts of this report. Undertaking a perception survey falls outside of the scope of this VIA.

- Due to the varying scales and sources of information as well as the fact that the terrain data available for the study area (NGI 25m DEM) is fairly coarse and somewhat inconsistent; maps and terrain models may have minor inaccuracies. As such, only large scale topographical variations have been taken into account and minor topographical features or small undulations in the landscape may not be depicted on the DEM.

- Operational and security lighting will be required for the substations proposed within the development footprint. At the time of undertaking the visual study no information was available regarding the type and intensity of lighting required and therefore the potential impact of lighting at night has not been assessed at a detailed level. General measures to mitigate the impact of additional light sources on the ambiance of the nightscape have been provided.

- At the time of undertaking the visual study no detailed information was available regarding the design and layout of services and infrastructure associated with the proposed development. As such, the potential visual impact of the typical infrastructure associated with a power line development has been assessed.

- Visualisation modelling has not been undertaken for the proposed development as the final power line route alignment and tower locations have not been established.

- It should be noted that the fieldwork was undertaken in mid-February 2018, during late summer when most rainfall occurs in the area. As such, it is likely that the visual impact of the proposed development would be less significant at this time of year than it would be during the winter months when the surrounding vegetation is expected to provide less potential screening than in the late summer months.

- The overall weather conditions in the study area also have certain visual implications and are expected to affect the visual impact of the proposed development to some degree. As mentioned above, the fieldwork was undertaken during the late summer months which are characterised by clear weather conditions. In these conditions, the proposed development would present a greater contrast with the surrounding environment than it would on a cloudy overcast day. The weather conditions during the time of the study were therefore taken into consideration when undertaking this BA level VIA. In addition, the weather conditions during the time of the study were taken into consideration when undertaking the impact rating for each identified sensitive and potentially sensitive receptor locations.

1.1.5. Source of Information

Main sources of information for the VIA included:

- Project description for the proposed Kuruman Supporting Electrical Infrastructure provided by Mulilo;
- Elevation data from 25m DEM from the NGI;
- 1:50 000 topographical maps of South Africa from the NGI;
- Land cover and land use data extracted from the 2013-2014 South African National Land-Cover Dataset provided by GEOTERRA IMAGE;
- Vegetation classification data extracted from SANBI’s VEGMAP 2012 dataset; and
- Google Earth Satellite imagery 2016.

1.2. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO THE VISUAL IMPACT ASSESSMENT

In this section, the typical visual issues / impacts related to the establishment of substations and a 132kV power line as proposed are discussed.

At this stage, it is understood that the proposed development will include two (2) Collector Substations (as part of the Eskom Metering Station), a switching station (as part of the Eskom Substation) and a 132kV overhead power line. The aim of this development is to feed electricity generated by the proposed Phase 1 and Phase 2 Kuruman Wind Energy Facilities (WEFs) into the national grid.

Three (3) power line route alternatives have been identified for assessment during the BA process. These corridors are as follows:

- Route Alternative 1: Approximately 56.6kms in length linking the proposed Phase 1 Kuruman WEF substation to Ferrum substation.
- Route Alternative 2: Approximately 13.9kms in length linking the proposed Phase 2 Kuruman WEF substation to Segame substation.
- Route Alternative 3: Approximately 8.5.1kms in length linking the proposed Phase 1 Kuruman WEF substation to the proposed Phase 2 Kuruman WEF substation. This Option would only be required in the event that only Kuruman Phase 2 WEF is constructed.

Power line towers and substations are by their nature very large objects and thus highly visible. According to the project description provided by Mulilo, the tower height of the proposed 132kV power line is approximately 15m (equivalent in height to a 4-5 storey building). Although a pylon/tower structure would be less visible than a building, the height of the structure means that the pylon would still typically be visible from a considerable distance. A 132kV power line consists of a series of pylons/towers typically spaced approximately 170m to 250m apart in a linear alignment, thus increasing its visibility.

The degree of visibility of an object informs the level and intensity of the visual impact, but other factors also influence the nature of the visual impact. The landscape and aesthetic context of the environment in which the object is placed, as well as the perception of the viewer are also important factors. In the context of the 132kV power line, the type of tower used as well as the degree to which the towers would impinge upon or obscure a view is also a factor that will influence the experience of the visual impacts.

As described above, power lines and substations are not features of the natural environment, but are rather representative of human (anthropogenic) alteration of the natural environment. Thus when placed in a largely natural landscape, a substation and/or power line can be perceived to be highly incongruous in this context. The height and linear nature of the power line will exacerbate this incongruity within a natural landscape, as the towers may impinge on views within the landscape. In addition, the practice of clearing any taller vegetation from areas within the power line servitude can increase the visibility and incongruity of the power line. In a largely natural, bushier setting, vegetation clearance will cause fragmentation of the natural vegetation cover, thus making the power line more visible and drawing the viewer’s attention to the power line servitude, especially when it occurs within a context of natural thicket / bushveld vegetation where bushes or trees commonly occur.

As mentioned above, the viewer’s / receptor’s perception of the development is also very important, as certain receptors may not consider the development of a substation and/or power line to be a negative visual impact. The scenic / aesthetic value of an area and the prevalent land use practices also tend to affect people’s perception of whether a substation and/or power line is an unwelcome intrusion, and this in turn will determine the sensitivity of the identified receptors to the proposed development.

Power lines and substations are often perceived as visual impacts in areas where value is placed on the scenic or aesthetic character of the area, and where activities, which are based upon the enjoyment of, or exposure to, the scenic or aesthetic features of the area are practiced. Sensitivity to visual impacts is typically most pronounced in areas set aside for conservation of the natural environment (such as protected natural areas or conservancies), or in areas in which the natural character or scenic beauty of the area attracts visitors (tourists) to the area. Residents and visitors to these areas may perceive substations and/or power lines to be an unwelcome intrusion that would degrade the natural character and scenic beauty of the area, and which would potentially even compromise the practicing of tourism activities in the area.

Conversely, the presence / existence of other anthropogenic objects associated with the built environment may influence the perception of whether a substation and/or power line is a visual impact. Where industrial-type built-form exists, (such as renewable energy facilities, roads, railways and other power lines and substations), the visual environment could be considered to be "degraded" and thus the introduction of a new power line and substation into this setting may be considered to be less of a visual impact than if there was no existing built infrastructure visible. It is important to note that there are existing medium (Figure 14) and high (**Figure 24**) voltage power lines present in certain parts of the study area, while the newly constructed Ferrum-Mercury 400kV transmission power lines traverse the northern section of the study area in an east-west alignment and the south-western section of the study area in a north-south alignment (**Figure 23**). In addition, the Segame (**Figure 25**) and Ferrum (**Figure 26**) substations and are located in the northern section and south western sections of the study area respectively. The presence of these power lines and substations are therefore expected to lessen the visual contrast associated with the introduction of a new power line.

Other factors, as listed below, can also affect the nature and intensity of a potential visual impact associated with a substation and power line:

- The location of a substation and power line in the landform setting – i.e. in a valley bottom or on a ridge top. In the latter example the substation and/or power line would be much more visible and would "break" the horizon;
- The presence of macro- or micro-topographical features, such as buildings or vegetation that would screen views of the substation and power line from a receptor location;
- The presence of existing substations and power lines in the area and alignment in relation to these substations and power lines; and
- Temporary factors such as weather conditions (presence of haze, rainfall or heavy mist) which would affect visibility.

1.3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

1.3.1. Site Location

The proposed development is located between the towns of Kuruman and Kathu in the Northern Cape Province. (Refer to ***Regional Context Map*** which has been provided in **Appendix C**). In addition, the development lies within the boundaries of Ga-Segonyana Local Municipality, in the John Taolo Gaetsewe District Municipality. The proposed substations and 132kV power line route alternatives are shown in the ***Route Overview Map*** which has been provided in **Appendix C**.

1.3.2. Topography

The eastern section of the study area is largely dominated by the Kuruman Hills, a range of high hills and ridges running in a roughly north-south alignment, parallel to the R31 Main Road (**Figure 1**).

Figure 1: Typical view of the Kuruman Hills which dominate the eastern section of the study area

As such, the terrain within the hillier part of the study area is characterised by a mix of incised valleys and flatter, higher lying plateaux (**Figure 2**).

Figure 2: Typical view of the topography within the eastern section of the study area

The central and south-western sections of the study area and surrounding areas are however largely characterised by the relatively flat plains of the Ghaap Plateau with some relief in the form of isolated koppies and hills. As such, the terrain within these parts of the study area is characterised by flat to gently undulating landscape with gentle slopes. There are also areas of localised hilly topography characterised by the presence of relatively small hills / ridges / koppies (**Figure 3**). In addition, the Kuruman River traverses the north-eastern sector of the study area while the rest of the area is characterised by a network of low lying dry water courses.

Figure 3: Typical view of the topography within the central and south-western sections of the study area

The topography and slope of the study area is illustrated in the respective ***Topography Map*** and ***Slope Classification Map*** which have been provided in **Appendix C**.

<u>Visual Implications</u>

Areas of flat relief, such as the flat plains and the higher-lying grassy plateaux, are characterised by wide ranging vistas. Vistas in the hillier and higher-lying terrain can be more open or more enclosed, depending on the position of the viewer. Within some of the more incised valleys and hillier areas for example, the vista would be limited (**Figure 4**), whereas a much wider view or vista would be available from the higher-lying ridge tops or slopes (**Figure 5**). Importantly in the context of this study the same is true of objects placed at different elevations and within different landscape settings, with objects placed on high-elevation slopes or ridge tops being highly visible, while those placed within valleys or enclosed plateaux would be far less visible.


Figure 4: Typical limited vista experienced from an area of hillier terrain


Figure 5: Typical wide vista experienced from a high-lying area

1.3.3. Vegetation

According to Mucina and Rutherford (2006), the areas of the visual assessment zone which are characterised by flatter plains are largely covered by the Kuruman Thornveld vegetation type, which is generally characterized by a well-developed shrub layer and an open tree layer dominated by camel thorn trees (*Acacia erioloba*) (**Figure 6**).

Figure 6: Typical vegetation cover which can be found within the parts of the study area characterised by flatter plains

The hillier areas of the Kuruman Hills are classified as Kuruman Mountain Bushveld which is typically characterised by an open shrub layer and a well-developed grass layer (**Figure 7**).

Figure 7: Typical vegetation cover which can be found within the hillier parts of the study area such as the Kuruman Hills

It should also be noted that a large part of the south-western section of the study area, in close proximity to the town of Kathu, is covered by the Kathu Bushveld vegetation type, as well as small patches of Southern Kalahari Salt Pans. The Kathu Bushveld is characterised by a medium-tall tree layer with camel thorn trees (*Acacia erioloba*) in places, but mostly open and including shepherd trees (*Boscia albitrunca)* as the prominent trees. The shrub layer is characterized by Bluebush / Monkey Plum / Star-apple (*Diospyros lycioides)* and river honey-thorn (*Lycium hirsutum)*, while the grass layer is variable in cover (**Figure 8**). The Southern Kalahari Salt Pans are characterised by sparse, patchy grasslands, sedgelands and low herblands dominated by C_4 grasses (such as *Panicum, Eragrostis, Enneapogon, Tragus, Chloris* and *Cenchrus*) on the bottom of (mostly) dry riverbeds. Low shrublands in places with patches of taller shrubland (with *Schotia afra*) on the banks on the rivers. Relatively tall camel thorn trees (Acacia erioloba) can form a dominant belt along some of the rivers (e.g. the middle and lower reaches of the Kuruman River). In some other rivers the taller trees are scattered.

Figure 8: Typical vegetation cover which can be found within large parts of the south-western section of the study area

In certain areas, man has had an impact on the natural vegetation, especially around farmsteads, where over many years, tall exotic trees and other typical garden vegetation have been established (**Figure 9**). Much of the study area however is still characterised by natural low shrubland with transformation limited to a few isolated areas of cultivation.

Figure 9: Example of the typical tall exotic trees and other garden vegetation which have been established around farmsteads within the study area

A site locality map showing the vegetation cover which can be found within the study area is shown in the ***Vegetation Classification Map*** which has been provided in **Appendix C**.

<u>Visual Implications</u>

The predominant low shrub layer and open areas of grasslands across large parts of the eastern section of the study area, especially in the hillier areas, result in wide-open vistas (**Figure 7**). The well-developed shrub layer and open tree layer dominated by camel thorn trees in the flatter parts of the study area would however provide some form of screening and vistas are therefore expected to be limited to a degree in these areas (**Figure 6** and **Figure 8**). In addition, vegetation would also provide significant screening in areas where artificial wooded vegetation has been established around farmhouses (**Figure 9**). It should also be noted that the relatively low density of human habitation and natural vegetation cover across large portions of the study area would give the viewer the general impression of a largely natural rural setting (**Figure 10**), especially in the eastern and central parts of the study area.

Figure 10: Typical natural rural visual character of across much of the study area

1.3.4. Land Use

According to the South African National Land Cover dataset (2013-2014) from Geoterra Image (2014), much of the visual assessment area is characterised by natural unimproved vegetation which is dominated by low shrubland, grassland and woodland/open bush (Refer to ***Land Cover Classification Map*** which has been provided in **Appendix C**). The arid nature of the local climate has resulted in livestock rearing being the dominant activity within the area (**Figure 11**). Only very small, isolated areas have been cultivated and as such, the natural vegetation has been retained across much of the study area.

Figure 11: Evidence of livestock rearing taking place within the study area

The nature of the climate and corresponding land use has also resulted in low stocking densities and relatively large farm properties across the area. Thus the majority of the study area has a very low density of rural settlement, with relatively few scattered farmsteads occurring across the area. Built form in the rural parts of the study area is limited to isolated farmsteads (**Figure 10**), gravel access roads (**Figure 12**), ancillary farm buildings, telephone lines (**Figure 13**), fences and farm workers' dwellings.

Figure 12: Typical view of the gravel access roads which can be found within the study area

Figure 13: Typical view of the telephone lines which can be found within the study area

It should also be noted that existing medium voltage power lines are also present within the area and can thus also be found within parts of the rural sections of the study area (**Figure 14**).

Figure 14: Typical view of the existing medium voltage power lines which can be found within parts of the study area

One of the closest built-up areas is the town of Kuruman (**Figure 15**) which, along with the adjoining suburb of Wrenchville (**Figure 16**) is situated in the northern-eastern section of the study area. In addition, the town of Kathu is situated in the south-western section of study area (**Figure 17**).

Figure 15: Typical urban built-up character of the town of Kuruman

Figure 16: Typical urban built-up character of the Wrenchville suburb

Figure 17: Typical urban built-up character of the town of Kathu (Google Earth street view photograph)

It should be noted that the above-mentioned areas are characterised by significant amounts of urban transformation and/or disturbance and the impact of the proposed development would be considerably less in these areas. In addition, a part of the south-western section of the study area, in close proximity to the town of Kathu, is characterised by the presence of large scale mining activities associated with the Khumani Mine (**Figure 18**).


Figure 18: View of some of the large scale mining activities taking place within parts of the south-western section of the study area

Further human influence is visible in the area in the form of the N14 national route (**Figure 19**) which traverses the northern section of the study area in an east-west direction, as well as the south-western section of the study area in a north-south direction. The R31 main road (**Figure 20**) also traverses the north-eastern section of the study area and runs south through Kuruman, to Barkly West.


Figure 19: Typical view of the N14 national route


Figure 20: Typical view of the R31 main road

It should be noted that the Billy Duvenhage Nature Reserve is located in the northern section of the study area, adjacent to the town of Kuruman and the rural settlement of Budolong (**Figure 21**). This nature reserve was operated by the Kuruman Municipality, however, it is no longer operational, is severely degraded and has subsequently been closed down. This was confirmed during the site visit. Despite the fact that this reserve is no longer operational, severely degraded and is situated adjacent to Kuruman and Budolong, which are characterised by significant amounts of urban transformation and/or disturbance, the area set aside for this nature reserve is still regarded as being largely natural and/or scenic (**Figure 22**), In addition, the reserve is still listed in the South African Protected Areas Database (SAPAD 2017).

Figure 21: Entrance of the Billy Duvenhage Nature Reserve which is no longer operational

Figure 22: Typical natural / scenic view of the area set aside for the Billy Duvenhage Nature Reserve

Electricity infrastructure in the study area includes the newly constructed Ferrum-Mercury 400kV transmission power lines which traverse the northern and south western sections of the study area

(**Figure 23**). In addition, the visual assessment zone is characterised by the presence of other high voltage power lines which traverse the southern and south-western sections of the study area in an east-west alignment (**Figure 24**).

Figure 23: Typical view of the Ferrum-Mercury 400kV transmission power lines which traverse the study area

Figure 24: Typical view of the other high voltage transmission power lines which traverse the study area

Other electricity infrastructure in the area includes the Segame substation (**Figure 25**) situated on the southern boundary of Kuruman, in the northern section of the study area, as well as the Ferrum substation (**Figure 26**) in the south western section of the study area, in close proximity to the town of Kathu.

Figure 25: Typical view of the Segame Substation

Figure 26: Typical view of the Ferrum Substation

<u>Visual Implications</u>

As stated above, sparse human habitation and the predominance of natural vegetation cover across large portions of the study area would give the viewer the general impression of a largely natural rural setting (**Figure 10**).

High levels of human transformation and visual degradation only become evident in the northern and south-western sections of the study area with the urban / peri-urban development associated with the town of Kuruman, Wrenchville suburb and the town of Kathu (**Figure 15**, **Figure 16** and **Figure 17**), as well as the large scale mining activities associated with the Khumani mine (**Figure 18**). As such, the presence of high levels of human transformation and visual degradation in these areas are expected to reduce the visual impact associated with the proposed development. In addition, the presence of medium and high voltage power lines in parts of the study area, especially the undisturbed / natural areas, are expected to further reduce the visual impact associated with the proposed development.

The influence of the level of human transformation on the visual character of the area is described in more detail below.

1.3.5. Visual Character

The above physical and land use-related characteristics of the study area contribute to its overall visual character. Visual character can be defined based on the level of change or transformation from a completely natural setting, which would represent a natural baseline in which there is little evidence of human transformation of the landscape. Varying degrees of human transformation of a landscape would give rise to differing visual characteristics, with a highly modified urban or industrial landscape being at the opposite end of the scale to a largely natural undisturbed landscape. Visual character is also influenced by the presence of built infrastructure including buildings, roads and other features such as telephone or electrical infrastructure.

As mentioned above, much of the study area is characterised by rural areas with low densities of human settlement. Agriculture in the form of livestock grazing (**Figure 11**) is the dominant land use, which has transformed the natural vegetation in some areas.

However, much of the study area has retained a natural appearance due to the presence of low shrubs and taller trees dominated by camel thorn (*Acacia erioloba*). The most prominent anthropogenic elements in these areas include the N14 national route (**Figure 19**), the R31 main road (**Figure 20**), power lines (**Figure 14**, **Figure 23** and **Figure 24**) and other linear elements, such as telephone poles (**Figure 13**), communication poles and farm boundary fences. It should also be noted that the area surrounding the town of Kathu is characterised by large scale mining activities (**Figure 18**). The presence of this infrastructure is an important factor in this context, as the introduction of the proposed supporting electrical infrastructure would result in less visual contrast where other anthropogenic elements are already present.

In contrast to the overall rural character is the town of Kuruman (**Figure 15**), the suburb of Wrenchville (**Figure 16)** and the town of Kathu (**Figure 17**) which are distinctly urban and disturbed in character. In addition, as mentioned above, the area surrounding the town of Kathu is characterised by large scale mining activities which have further reduced the visual sensitivity of this part of the study area. Although Kuruman and Kathu are relatively small towns, they have a concentration of housing and other buildings such as schools, hospitals and churches, as well as relatively well established commercial centres to distinguish them from the surrounding rural landscape. It should be noted however that these areas have relatively small populations and occupy limited spatial extents, thus resulting in clearly defined urban edges which contain the urban visual character. The large scale mining activities taking place in the area surrounding the town of Kathu are also restricted to the south-western section of the study area only and thus they also occupy limited spatial extents.

As mentioned, the Billy Duvenhage Nature Reserve is located in the northern section of the study area, adjacent to the rural settlement of Budolong (**Figure 21**). This nature reserve is however no longer operational and has subsequently been closed down. Despite the fact that this reserve is no longer operational and is situated adjacent to an area characterised by significant amounts of urban transformation and/or disturbance (i.e. the rural settlement of Budolong), the area set aside for this nature reserve is still regarded as being largely natural and/or scenic (**Figure 22**).

The scenic quality of the landscape is also an important factor contributing to the visual character of an area or the inherent sense of place. Visual appeal is often associated with unique natural features or distinct variations in landform. As such, the hilly / mountainous terrain which occurs mainly in the eastern section of the study area and within other parts of the wider study area is considered to be an important feature that would potentially increase the scenic appeal and visual interest in the area.

It is important to note that several renewable energy developments (solar and wind) are being proposed in the surrounding area. These facilities and their associated infrastructure typically consist of very large structures which are highly visible. The presence of these renewable energy developments (if constructed) will thus further transform the current visual character and lessen the degree to which the proposed development would contrast with the elements and form in the surrounding environment.

The greater area surrounding the proposed development site is an important component when assessing visual character. The area can be considered to be typical of a Karoo or “platteland” landscape that would characteristically be encountered across the high-lying dry western and central interior of South Africa. Much of South Africa’s dry Karoo interior consists of wide open, uninhabited spaces sparsely punctuated by widely scattered farmsteads and small towns. Traditionally the Karoo has been seen by many as a dull, lifeless part of the country that was to be crossed as quickly as possible on route between the major inland centres and the Cape coast, or between the Cape and Namibia. However, in the last couple of decades this perception has been changing, with the launching of tourism routes within the Karoo. In a context of increasing urbanisation in South Africa’s major centres, the Karoo is being marketed as an undisturbed getaway, especially as a stop on a longer journey from the northern parts of South Africa to the Western and Eastern Cape coasts. Examples of this may be found in the relatively recently published “Getaway Guide to Karoo, Namaqualand and Kalahari” (Moseley and Naude-Moseley, 2008).

The typical Karoo landscape can also be considered a valuable ‘cultural landscape’ in the South African context. Although the cultural landscape concept is relatively new, it is becoming an increasingly important concept in terms of the preservation and management of rural and urban settings across the world (Breedlove, 2002).

Cultural Landscapes can fall into three categories (according to the Committee's Operational Guidelines):

i) "a landscape designed and created intentionally by man";
ii) an "organically evolved landscape" which may be a "relict (or fossil) landscape" or a "continuing landscape";
iii) an "associative cultural landscape" which may be valued because of the "religious, artistic or cultural associations of the natural element"

The typical Karoo landscape consisting of wide open plains, and isolated relief, interspersed with isolated farmsteads, windmills and stock holding pens, is an important part of the cultural matrix of the South African environment. The Karoo farmstead is also a representation of how the harsh arid nature of the environment in this part of the country has shaped the predominant land use and economic activity practiced in the area, as well as the patterns of human habitation and interaction. Small towns such as Kuruman, engulfed by an otherwise rural environment, form an integral part of the wider Karoo landscape. As such, the Karoo landscape as it exists today has value as a cultural landscape in the South African context. In the context of the types of cultural landscape listed above, the Karoo cultural landscape would fall into the second category, that of an organically evolved, “continuing” landscape.

Much of the study area, as visible to the viewer, represents a typical Karoo cultural landscape. This is important in the context of potential visual impacts associated with the development of supporting electrical infrastructure as introducing this type of development could be considered to be a degrading factor in the context of the natural Karoo character of the study area, as discussed further below.

1.3.6. Sensitive Visual Receptor Locations

A sensitive receptor location is defined as a location from where receptors would potentially be adversely impacted by a proposed development. This takes into account a subjective factor on behalf of the viewer – i.e. whether the viewer would consider the impact as a negative impact. As described above, the adverse impact is often associated with the alteration of the visual character of the area in terms of the intrusion of the proposed development into a ‘view’, which may affect the ‘sense of place’. The identification of sensitive receptor locations is typically undertaken based on a number of factors which include:

- the visual character of the area, especially taking into account visually scenic areas and areas of visual sensitivity;
- the presence of leisure-based (especially nature-based) tourism in an area;
- the presence of sites / routes that are valued for their scenic quality and sense of place;
- the presence of homesteads / farmsteads in a largely natural setting where the development may influence the typical character of their views; and
- feedback from interested and affected parties, as raised during the public participation process conducted as part of the BA study.

A distinction must be made between a potentially sensitive receptor location and a sensitive receptor location. A potentially sensitive receptor location is a site from where the proposed development may be visible, but the receptor may not necessarily be adversely affected by any visual intrusion associated with the development. Potentially sensitive receptor locations include locations such as residential dwellings, farmsteads / homesteads, as well as locations of commercial activities and certain movement corridors, such as roads that are not tourism routes. Sensitive receptor locations typically include sites that are likely to be adversely affected by the visual intrusion of the proposed development. They include tourism facilities, scenic sites and certain residential dwellings and/or farmsteads / homesteads in natural settings.

Generally, the visibility of the development would diminish exponentially over distance. As such, the proposed development would be more visible to receptors located within a short distance and these receptors would experience a higher adverse visual impact than those located at a moderate or long distance from the proposed development. The distance of a sensitive receptor location from the proposed development site was taken into account when rating the visual impact of the proposed development on these potential receptors.

In order to account for this, distance from the nearest proposed power line alternative was used to assign zones of visual impact. Based on the height and scale of the project, as well as the investigations undertaken during the fieldwork, the radii chosen to assign these zones of visual impact are as follows:

- 0 < 500m (high impact zone);
- 501m < 2km (moderate impact zone);
- 2.1 < 5km (low impact zone); and

- > 5km (negligible impact).

Preliminary desktop assessment of the study area identified several potentially sensitive visual receptor locations, including existing residential areas, farm houses, accommodation and sport/recreation facilities. However, relatively few leisure-based or nature based tourism activities were identified in the assessment area and as such only one (1) sensitive visual receptor location was originally identified, this being the Oryx Trail Game Lodge (**Figure 27**Figure 27).

Figure 27: View of the Oryx Trail Game Lodge

The Oryx Trail Game Lodge is located within the site proposed for the Phase 1 Kuruman WEF and was previously operated as a lodge for hunters. However, it is currently used as a wedding and conference venue and the owner (i.e. Clive Albutt) has plans to extend this lodge and keep it in operation notwithstanding the WEF development. It is now known that Mr Albutt owns a portion of the WEF application site land has a vested interest in the WEF and associated power line development. As such, the land owner would not perceive the proposed electrical infrastructure in a negative light and the lodge is no longer considered to be a sensitive or potentially sensitive receptor.

The only significant concentrations of human habitation in the study area occur in the northern and south-western sections of the assessment area respectively, where the towns of Kuruman, Kathu and the suburb of Wrenchville encroach into the study area. Although there is a high concentration of receptor locations in these areas, they are not regarded as sensitive to the visual impact of the proposed development due to the existing levels of visual degradation within these areas.

In many cases, roads, along which people travel, are regarded as sensitive receptor locations. The primary thoroughfares in the study area include the N14 national road (**Figure 19**) and the R31 main road (**Figure 20**). The N14 is the primary access road into Upington to the south-west and Vryburg to the north-east, and carries much of the local access traffic to and from these towns. In addition, the road connects Johannesburg/Gauteng with Springbok in the Northern Cape and forms part of a tourism route known as the Kokerboom Food & Wine Route. The Kokerboom Food & Wine Route takes tourists and travelers into one of the most interesting and beautiful areas of South Africa's Northern Cape Province and embraces the towns and settlements of Keimoes, Kanoneiland, Kenhardt, Augrabies, Upington and Marchand (http://www.openafrica.org/experiences/route/58-kokerboom-food-and-wine-route). This road is therefore valued or utilised for its scenic or tourism potential and as a result it is classed as a sensitive receptor road – i.e. a road along which motorists may object to the potential visual intrusion of the proposed supporting electrical infrastructure.

The R31 is a regional route in the Northern Cape Province that links Kuruman with Kimberley in the south east and carries much of the local access traffic to and from these towns. It is considered unlikely that this road would be widely used by tourists and as such it is not regarded as being visually sensitive.

Other thoroughfares in the study area are primarily used by local farmers travelling to and from Kuruman. They are therefore not regarded as visually sensitive as they do not form part of any scenic tourist routes, and are not specifically valued or utilised for their scenic or tourism potential.

Visual receptor locations are examined in more detail in **Section 1.6.1** and **Section 1.6.3**.

1.3.7. Existing and Proposed Renewable Energy Developments and Electrical Infrastructure

Several developments with similar impacts have been developed or are being proposed within a 50 km radius of the proposed development. These are relevant as they influence the cumulative visual impact of the proposed development and have been taken into consideration when identifying the cumulative impacts. The existing and proposed renewable energy developments within a 50 km radius of the proposed development are listed in **Table 1** below and are indicated in the ***Renewable Energy Developments within 50kms of the Development Map*** which has been provided in **Appendix C**. It is assumed that all of these renewable energy developments include grid connection electrical infrastructure, although details of this infrastructure were not available at the time of writing this report.

Unrelated to these renewable energy developments are two significant electrical infrastructure projects as listed below.

- The recently constructed 400kV Ferrum-Mercury transmission power lines which traverse the study area.
- The proposed upgrade of the existing 66kV network in the Hotazel – Kuruman – Sishen area. This project includes the upgrading of existing power lines (66kV to 132kV) over a distance of approximately 155km and the construction of two new substations. It should be noted that much of the southern alignment for this proposed power line follows the same route as that proposed for the Kuruman WEF 132kV grid connection.

Table 1: Existing and proposed renewable energy developments within 50kms of the proposed supporting electrical infrastructure

DEA_REF	PROJ_TITLE	APPLICANT	EAP	TECHNOLOGY	MEGAWATT
14/12/16/3/3/2/819	The 75 MW AEP Legoko Photovoltaic Solar Facility on Portion 2 of the Farm Legoko 460, Kuruman Rd within the Gamagara Local Municipality in the Northern Cape Province	AEP Lekogo Solar (Pty) Ltd	Cape Environmental Assessment Practitioners	Solar PV	75
14/12/16/3/3/2/820	The 75 MW AEP Mogobe Photovoltaic Solar Facility on portion 1 of the farm Legoko 460 and farm Sekgame 461, Kuruman Rd within the Gamagara Local Municipality in the Northern Cape Province	AEP Mogobe Solar (Pty) Ltd	Cape Environmental Assessment Practitioners	Solar PV	75
12/12/20/1858/1	Kathu Solar Energy Facility	Renewable Energy Investments South Africa Pty Ltd	Savannah Environmental Consultants (Pty) Ltd	Solar PV	75
12/12/20/1858/2	Kathu Solar Energy Facility 25MW 2	Lokian Trading and Investments	Savannah Environmental Consultants (Pty) Ltd	Solar PV	25
12/12/20/1860	Proposed establishment of the Sishen Solar Farm on Portion 6 of Wincanton 472, NC	VentuSA Energy Pty Ltd	Savannah Environmental Consultants (Pty) Ltd	Solar PV	74
12/12/20/1906	Proposed construction of solar farm for Bestwood, Kgalagadi District Municipality, NC	Katu Property Developers Pty Ltd	Rock Environmental Consulting (Pty) Ltd	Solar PV	0
14/12/16/3/3/2/274	Proposed establishment of the solar energy facility 1 on a site near Kathu in the Northern Cape	To review	Savannah Environmental Consultants (Pty) Ltd	Solar PV	Unkown
12/12/20/1994 12/12/20/1994/1 12/12/20/1994/2 12/12/20/1994/3	The Proposed Construction Of Kalahari Solar Power Project On The Farm Kathu 465, Northern Cape Province	Group Five Pty Ltd	WSP Environmental (Pty) Ltd	Solar PV	480
12/12/20/2566	A 19MW Photovoltaic Solar Power Generation Plant On The Farm Adams 328 Near Hotazel, Northern Cape Province	To review	To review	Solar PV	19
12/12/20/2567	The Proposed 150MW Adams Photo-Voltaic Solar Energy Facility On The Farm Adams 328 Near Hotazel Northern Cape Province	To review	To review	Solar PV	75
14/12/16/3/3/1/474	Construction of the Roma Energy Mount Roper Solar Plant on the Farm Moutn Roper 321, Kuruman, Ga-Segonyana Local Municipality	To review	EnviroAfrica Environmental Consultants (Pty) Ltd	Solar PV	10

14/12/16/3/3/1/468	The Proposed Roma Energy Solar Plant Middelplaats, Joe Morolong Local Municipality, Northern Cape	To review	EnviroAfrica Environmental Consultants (Pty) Ltd	Solar PV	Unknown
14/12/16/3/3/1/475	The Proposed Construction Of Keren Energy Whitebank Solar Plant On Farm Whitebank 379, Kuruman, Northern Cape Province	To review	EnviroAfrica Environmental Consultants (Pty) Ltd	Solar PV	10
14/12/16/3/3/2/273	The Proposed San Solar Energy Facility And Associated Infrastructure On A Site Near Kathu, Gamagara Local Municipality, Northern Cape Province	To review	Savannah Environmental Consultants (Pty) Ltd	Solar PV	75
14/12/16/3/3/2/616	Proposed renewable energy generation project on Portion 1 of the Farm Shirley No. 367, Kuruman RD, Gamagara Local Municipality, Shirley Solar Park	Danax Energy (Pty) Ltd	AGES Limpopo (Pty) Ltd	Solar PV	75
14/12/16/3/3/2/761	Proposed 75 MW Perth-Kuruman Solar Farm on the remainder of the farm Perth 276 within the Joe Morolong Local Municipality, Northern Cape Province	Agulhas-Hotazel Solar Power (Pty) Ltd	Strategic Environmental Focus (Pty) Ltd	Solar PV	75
14/12/16/3/3/2/762	The 75MW Perth-Hotazel Solar Farm and its associated infrastructure on the Remainder of the Farm Perth 276 within the Joe Morolong Local Municipality in Northern Cape Province	Agulhus-Hotazel Solar Power (Pty) Ltd	Strategic Environmental Focus	Solar PV	75
14/12/16/3/3/2/911	Proposed 75MW AEP Kathu Solar PV Energy Facility on the Remainder of the Farm 460 Legoko near Kathu within the Gamagara local Municipality in the Northern Cape Province	AEP Kathu Solar (Pty) Ltd	Cape Eprac	Solar PV	75
14/12/16/3/3/2/934	Kagiso Solar Power Plant near Hotazel, Northern Cape Province	Kagiso Solar Power Plant (RF) (Pty) Ltd	Environamics cc	Solar PV	115
14/12/16/3/3/2/935	Proposed 115 Megawatt (MW) Boitshoko Solar Power Plant on the Remaining Extent of Portion 1 of The Farm Lime Bank no. 471 Near Kathu in the Gamagara Local Municipality	Boitshoko Solar Power Plant (RF) (Pty) Ltd	Environamics cc	Solar PV	115
14/12/16/3/3/2/936	Tshepo Solar Power Plant near Hotazel, Northern Cape	Tshepo Solar Power Plant (RF) (Pty) Ltd	Environamics cc	Solar PV	115
14/12/16/3/3/2/679	Proposed 100 MW Postmansburg CSP development within Tsantsabane Local Municipality in Northern Cape Province	To review	Savannah Environmental Consultants (Pty) Ltd	CSP	100
14/12/16/3/3/2/698	Proposed RE Capital 10 (Pty) Ltd development near Postmasburg	RE Capital 10 (Pty) Ltd	Cape Environmental Assessment Practitioners (Pty) Ltd	Solar PV	75

12/12/20/2252/2/AM3	The 50 MW Ample Solar Groenwater (Concentrated Solar Power) Facility On Portion 4 And 5 Of Farm Groenwater 453 And Remainder Of Farm 455 In Postmasburg, Within Tsantsabane Local Municipality, Northern Cape Province	Ample Solar Holdings Pty Ltd	Enviroworks cc	CSP	50
14/12/16/3/3/2/1065	Kuruman Wind Energy Facility (WEF) Phase 1 near Kuruman, Northern Cape Province	Mulilo Renewable Project Developments (Pty) Ltd	Council of Scientific and Industrial Research (CSIR)	Wind	140
14/12/16/3/3/2/1066	Kuruman Wind Energy Facility (WEF) Phase 2 near Kuruman, Northern Cape Province	Mulilo Renewable Project Developments (Pty) Ltd	Council of Scientific and Industrial Research (CSIR)	Wind	140

Although it is important to assess the visual impacts of the proposed development itself, it is equally important to assess the cumulative visual impact that would materialise in the area as a result of the construction of the proposed electrical infrastructure in addition to the other renewable energy developments (both wind and solar) and electrical infrastructure in the surrounding area. Cumulative impacts are the combined impacts from different developments which, in combination, result in significant impacts that may be larger than the sum of all the impacts combined. The relatively large number of renewable energy facilities within the surrounding area and their potential for large scale visual impacts could significantly alter the sense of place and visual character in the study area, as well as exacerbate the visual impacts on surrounding visual receptors, once constructed.

As indicated in the ***Renewable Energy Developments within 50km Radius Map*** (**Appendix C**), there are several renewable energy facilities being proposed within the 5km visual assessment zone, namely the Solar Farm for Bestwood, the 75MW AEP Kathu Solar PV Energy Facility, the 75 MW AEP Legoko Photovoltaic Solar Facility, the 75 MW AEP Mogobe Photovoltaic Solar Facility and the Kuruman WEF Phase 1 and Phase 2 developments. In light of this, the visual receptors located within the visual assessment zone would experience exacerbated visual impacts should all of these renewable energy developments, and associated grid connection infrastructure be constructed. It should also be noted that, although most of the identified renewable energy facilities are located outside the 5km visual assessment zone, these renewable energy facilities are also expected to impact on the pastoral visual character of the larger area and increase the cumulative impact that would be experienced by visual receptors in the study area.

In addition to the other renewable energy developments, the proposed development of the supporting electrical infrastructure could exert a greater visual impact within the surrounding area by further altering the visual character and exposing a greater number of visual receptor locations to visual impacts. The development of the electrical infrastructure as proposed in conjunction with the other nearby renewable energy developments and electrical infrastructure may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings.

Large construction vehicles and equipment will contribute further to the alteration of the natural character of the study area during the construction phase and will also expose a greater number of visual receptors to visual impacts. The construction activities may thus also be perceived as a further unwelcome visual intrusion, particularly in more natural undisturbed settings.

Vehicles and trucks travelling to and from the proposed development site on gravel access roads are also expected to result in an increase in dust emissions in the greater area. The increased traffic on these roads and the dust plumes could create a greater visual impact within the greater area and may evoke more negative sentiments from surrounding viewers. It should however be noted that the majority of the existing roads in the vicinity of the proposed power line also appear to be gravel. As such, gravel access roads are not expected to contribute significantly to the overall cumulative visual impact.

Surface disturbance during construction would also result in a greater amount of bare soil being exposed which could result in a greater visual contrast with the surrounding environment. In addition, temporary stockpiling of soil during construction may alter the landscape further. Wind blowing over these disturbed areas could result in a greater amount of dust which would have a visual impact. It should however be noted that mitigation measures will be put in place during the construction and operation phases respectively in order to control dust and thus this is not expected to have a significant visual impact.

The significance of the above-mentioned visual impacts was however only found to range from medium to low and thus the impact of the proposed development, in addition to the other renewable energy developments in the surrounding area, is not significant enough to result in the cumulative visual impact being considered unacceptable. Additionally, mitigation measures will be put in place during the construction and operations phases respectively in order to ensure that the proposed development will not result in significant visual impacts.

As mentioned, several renewable energy facilities are located outside the 5km visual assessment. These facilities are however also expected to impact on the pastoral visual character of the larger area, in addition to the cumulative impact that would be experienced by visual receptors in the study area. Therefore, despite the fact that these facilities are located outside the 5km visual assessment zone, these facilities along with several others which are proposed or under construction, could still potentially impact cumulatively on some of the visual receptors. As such, it is envisaged that the most significant cumulative impact would be the change in the visual character within the larger study area due to the presence of these large scale industrial-type developments. These facilities will significantly alter the visual baseline within the study area, thereby reducing the visual impact of the proposed supporting electrical infrastructure on the surrounding potentially sensitive receptor locations. The impact of the proposed development would however be outweighed by the impact of the other renewable energy developments being proposed and/or constructed in the surrounding area.

Ultimately, the cumulative impact assessment found that the cumulative impact of the proposed development of the supporting electrical infrastructure would not significantly affect the surrounding area from a visual perspective. The anticipated cumulative impact could also be reduced to a medium significance after the implementation of appropriate mitigation measures. As such, the addition of the proposed development is not expected to contribute to a greater visual impact than all of the other renewable energy developments combined and thus the construction of the supporting electrical infrastructure is not expected to result in an unacceptable overall visual impact.

1.4. APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

Key legal requirements pertaining to the proposed development of the supporting electrical infrastructure are as follows:

In terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), (NEMA) and the EIA Regulations 2014 (as amended), the proposed development includes listed activities which require a Basic Assessment (BA) to be undertaken. As part of this BA process, the need for a VIA to be undertaken has been identified in order to assess the visual impact of the proposed supporting electrical infrastructure.

There is currently no legislation within South Africa that explicitly pertains to the assessment of visual impacts, however, in addition to NEMA the following legislation has relevance to the protection of scenic resources:

- National Environmental Management: Protected Areas Act, 2003 (Act No. 57 of 2003)
- National Heritage Resources Act, 1999 (Act No. 25 of 1999)

Based on these Acts, protected or conservation areas and sites or routes with cultural or symbolic value have been taken into consideration when identifying sensitive and/or potentially sensitive receptor locations and rating the sensitivity of the study area.

1.5. IDENTIFICATION OF KEY ISSUES

1.5.1. Key Issues Identified

The potential visual issues / impacts identified during the BA process for the proposed development include:

- Potential visual intrusion resulting from construction vehicles and equipment during construction;

- Potential impacts of increased dust emissions from construction activities and related traffic during construction;
- Potential visual scarring of the landscape as a result of site clearance and earthworks during construction;
- Potential visual intrusion on farmsteads / homesteads within the visual assessment zone.
- Potential alteration of the visual character of the area during operation;
- Potential visual intrusion resulting from infrastructure located on ridge lines and higher plateaus during operation;
- Potential visual intrusion resulting from vehicles and equipment involved in the decommissioning process;
- Potential impacts of increased dust emissions from decommissioning activity activities and related traffic;
- Combined visual impacts from several renewable energy facilities and their associated infrastructure in the broader area during the construction and operation phases could potentially alter the sense of place and visual character of the area; and
- Combined visual impacts from several renewable energy facilities and their associated infrastructure in the broader area during construction and operation phases could potentially exacerbate visual impacts on visual receptors.

As previously mentioned, no comments and/or feedback regarding the visual environment have been received from the public participation process to date. This report will however be updated to include relevant information as and when it becomes available.

1.5.2. Identification of Potential Impacts

Potential visual issues / impacts resulting from the proposed development of the supporting electrical infrastructure are outlined below.

1.5.3. Construction Phase

- Potential visual intrusion resulting from construction vehicles and equipment.
- Potential impacts of increased dust emissions from construction activities and related traffic.
- Potential visual scarring of the landscape as a result of site / vegetation clearance and earthworks.
- Potential visual intrusion on farmsteads / homesteads within the visual assessment zone.

1.5.4. Operational Phase

- Potential alteration of the visual character of the area.
- Potential visual intrusion resulting from infrastructure located on ridge lines and higher plateaus.
- Potential alteration of the night time visual environment as a result operational and security lighting at the substation.
- Potential visual intrusion on farmsteads / homesteads within the visual assessment zone.

1.5.5. Decommissioning Phase

- Potential visual intrusion resulting from vehicles and equipment involved in the decommissioning process;
- Potential impacts of increased dust emissions from decommissioning activities and related traffic;
- Potential visual intrusion on farmsteads / homesteads within the visual assessment zone as a result of decommissioning activities; and

1.5.6. *Cumulative impacts*

- Combined visual impacts from several renewable energy facilities and their associated infrastructure in the broader area during the construction and operation phases could potentially alter the sense of place and visual character of the area; and
- Combined visual impacts from several renewable energy facilities and their associated infrastructure in the broader area during construction and operations phases could potentially exacerbate visual impacts on visual receptors.

1.6. ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

1.6.1. *Results of the Field Study*

As previously stated, the field investigation and photographic review was conducted between the 19th and 21st of February 2018. A summary of the findings of this investigation is provided below.

<u>Visibility</u>

The field investigation confirmed that the Kuruman Hills are a significant feature of the local landscape and as such, infrastructure placed on the ridges and higher lying plateaus of these hills would be highly visible to several identified potentially sensitive receptor locations, sensitive receptor locations and receptor roads as described below.

<u>Sensitive Visual Receptors</u>

The field investigation revealed a total of one (1) sensitive receptor location and thirty-one (31) potentially sensitive receptor locations in the visual assessment zone. These receptor locations are shown in the ***Potentially Sensitive Visual Receptor Locations Map*** which has been provided in **Appendix C**.

As previously mentioned however, the sensitive receptor location identified as Oryx Trail Game Lodge was later removed from the list of sensitive and potentially sensitive receptors due to the fact that the owner has a vested interest in the WEF and associated infrastructure development and thus would not view the proposed power line in a negative light.

During the field investigation it was established that the Billy Duvenhage Nature Reserve (VR67), which is situated adjacent to the rural settlement of Budolong in the northern section of the study area, no longer functions as a nature reserve and is severely degraded. The reserve is however still listed in the South African Protected Areas Database (SAPAD 2017) and as such is regarded as a potentially sensitive receptor location.

The majority of the potentially sensitive receptor locations were identified as scattered farmsteads / homesteads which house the local farmers as well as their farm workers. These dwellings are regarded as potentially sensitive visual receptor locations as they are located within a mostly rural setting and the proposed development will likely alter natural vistas experienced from these dwellings, however their sentiments toward the development are unknown.

Details of the potentially sensitive receptor locations are provided in

Table 2 below.

Table 2: Potentially sensitive visual receptor locations in the study area

Name	Details	Approximate distance to nearest proposed power line alternative	Visual Impact Zone
VR2	Town of Kuruman (Smallholdings)	3.9km to Alt 2	Low
VR3	Town of Kuruman (Northern Section)	3.1km to Alt 2	Low
VR4	Town of Kuruman (Central Section)	1.4km to Alt 2	Moderate
VR5	Suburb of Wrenchville	3.9km to Alt 2	Low
VR6	Town of Kuruman (Southern Section)	0.9km to Alt 2	Moderate
VR7	Kuruman Country Club	3.3km to Alt 2	Low
VR8	Farmstead / Homestead	2.9km to Alt 2	Low
VR9	Farmstead / Homestead	3.6km to Alt 2	Low
VR10	Farmstead / Homestead	5.0km to Alt 2	Low
VR11	Farmstead / Homestead	0.7km to Alt 2	Moderate
VR14	Farmstead / Homestead	2.1km to Alt 2	Low
VR18	Farmstead / Homestead	2.1km to Alt 2	Low
VR19	Farmstead / Homestead	4.3km to Alt 2	Low
VR20	Farmstead / Homestead	4.2km to Alt 2	Low
VR35	Farmstead / Homestead	4.5km to Alt 1	Low
VR36	Farmstead / Homestead	3.4km to Alt 1	Low
VR37	Farmstead / Homestead	3.2km to Alt 1	Low
VR38	Farmstead / Homestead	1.1km to Alt 1	Moderate
VR39	Farmstead / Homestead	4.8km to Alt 1	Low
VR40	Farmstead / Homestead	4.14km to Alt 1	Low
VR41	Farmstead / Homestead	3.5km to Alt 1	Low
VR42	Farmstead / Homestead	1.7km to Alt 1	Moderate
VR43	Farmstead / Homestead	0.21km to Alt 1	High
VR44	Farmstead / Homestead	1.4km to Alt 1	Moderate
VR45	Farmstead / Homestead	1.9km to Alt 1	Moderate
VR46	Farmstead / Homestead	0.11km to Alt 1	High
VR47	Farmstead / Homestead	2.8km to Alt 1	Low
VR49	Farmstead / Homestead	1.2km to Alt 1	Moderate
VR57	Farmstead / Homestead	2.5km to Alt 1 and Alt 3	Low
VR64	Farmstead / Homestead	3.9km to Alt 2	Low
VR67	Billy Duvenhage Nature Reserve	4.1km to Alt 2 (nearest part of reserve)	Low

Field investigation also revealed that the sections of N14 that traverse parts of the study area are visually degraded in part due to urban development around Kuruman, Wrenchville and Kathu (**Figure 28**), as well as the presence of medium and high voltage power lines which are visible from various sections of the road (**Figure 29**). In addition, as previously mentioned, the south-western section of the visual assessment zone, near the town of Kathu, is characterised by the presence of large scale mining activities (**Figure 18**) and thus this part of the study area is significantly degraded from a visual perspective. Passing traffic on the N14 is therefore only expected to experience a low level of visual impact as a result of the proposed development. It should however be noted that there are some sections of this road which are relatively unaffected by visual transformation / degradation and thus views from these sections of the road would be regarded as largely natural in character.

Figure 28: Example of visual degradation which is visible from parts of the N14 national route

Figure 29: Typical view of a high voltage power line which is visible from sections of the N14 national route

Figure 30: Typical view of a part of the N14 national route which is largely natural / untransformed

Several places of interest identified in the towns of Kuruman and Kathu were assessed during the field investigation and subsequently excluded from the list of potentially sensitive receptor locations. These locations were not regarded as sensitive or potentially sensitive to the visual impact of the proposed development due to the existing visual degradation within these built-up areas, especially near the town of Kathu.

The degree of visual impact experienced will vary from one receptor location to another, as it is largely based on the viewer's perception. Factors influencing the degree of visual impact experienced by the viewer include the following:

- Value placed by the viewer on the natural scenic characteristics of the area;
- The viewer's sentiments toward the proposed structures. These may be positive (a symbol of progression toward a less polluted future) or negative (foreign objects degrading the natural landscape); and
- Degree to which the viewer will accept a change in the typical Karoo character of the surrounding area.

1.6.2. Visual Sensitivity

Visual Sensitivity can be defined as the inherent sensitivity of an area to potential visual impacts associated with a proposed development. It is based on the physical characteristics of the area (i.e. topography, landform and land cover), the spatial distribution of potential receptor locations, and the likely value judgements of these receptor locations towards a new development (Oberholzer: 2005). A viewer's perception is usually based on the perceived aesthetic appeal of an area and on the presence of economic activities (such as recreational tourism) which may be based on this aesthetic appeal.

In order to assess the visual sensitivity of the area, SiVEST has developed a matrix based on the characteristics of the receiving environment which, according to the Guidelines for Involving Visual and Aesthetic Specialists in the EIA Processes, indicate that visibility and aesthetics are likely to be 'key issues' (Oberholzer: 2005).

Based on the criteria in the matrix (**Table 3**), the visual sensitivity of the area is broken up into a number of categories, as described below:

- **High** - The introduction of a new development such as the erection of a substation or power line would be likely to be perceived negatively by receptor locations in this area; it would be considered to be a visual intrusion and may elicit opposition from these receptor locations
- **Moderate** - Presence of receptor locations, but due to the nature of the existing visual character of the area and likely value judgements of receptor locations, there would be limited negative perception towards the new development as a source of visual impact.
- **Low** - The introduction of a new development would not be perceived to be negative, there would be little opposition or negative perception towards it.

The table below outlines the factors used to rate the visual sensitivity of the study area. The ratings are specific to the visual context of the receiving environment within the study area.

Table 3: Environmental factors used to define visual sensitivity of the study area

FACTORS	**RATING**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pristine / natural character of the environment										
Presence of sensitive visual receptor locations										
Aesthetic sense of place / scenic visual character										
Value to individuals / society										
Irreplaceability / uniqueness / scarcity value										
Cultural or symbolic meaning										
Scenic resources present in the study area										
Protected / conservation areas in the study area										
Sites of special interest present in the study area										
Economic dependency on scenic quality										
Local jobs created by scenic quality of the area										
International status of the environment										
Provincial / regional status of the environment										
Local status of the environment										
**Scenic quality under threat / at risk of change										

**Any rating above '5' will trigger the need to undertake an assessment of cumulative visual impacts.

Low							**Moderate**							**High**
10	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**	**120**	**130**	**140**	**150**

Based on the above factors, the study area is rated as having a moderately-low visual sensitivity. This is mainly due to the largely rural character of the area interspersed with areas of visual disturbance / transformation. An important factor contributing to the visual sensitivity of an area is the presence, or absence of visual receptors that may value the aesthetic quality of the landscape and depend on it to produce revenue and create jobs. As described above, relatively few sensitive and potentially sensitive receptor locations are present in the study area. There are however formally protected areas and leisure / nature-based tourism activities in the study area, and the area would still be valued as a typical Karoo cultural landscape.

Although the area is associated with a moderately-low visual sensitivity, it should be stressed that the concept of visual sensitivity has been utilised indicatively to provide a broad-scale indication of whether the area is likely to be sensitive to visual impacts, and is based on the physical characteristics of the study area, economic activities and land use that predominates. This does not mean that high visual impacts could not potentially be experienced in areas of low visual sensitivity. The potential presence and perception of sensitive receptor locations as discussed above must also be taken into account.

1.6.3. Receptor Impact Rating

In order to assess the impact of the proposed development on the identified sensitive and potentially sensitive receptor locations listed in **Section 1.6.1**, a matrix that takes into account a number of factors has been developed (**Table 5**), and is applied to each identified visual receptor location.

The matrix has been based on a number of factors as listed below:

- Distance of a receptor location from the proposed development (zones of visual impact);
- Presence of screening factors (topography, vegetation etc.); and
- Visual contrast of the development with the landscape pattern and form.

These factors are considered to be the most important factors when assessing the visual impact of a proposed development on a sensitive and/or potentially sensitive receptor location in this context. It should be noted that this rating matrix is a relatively simplified way to assign a likely representative visual impact, which allows a number of factors to be considered. Experiencing of visual impacts is however a complex and qualitative phenomenon, and is thus difficult to accurately quantify. The matrix should therefore be seen as a representation of the likely visual impact at a visual receptor location. Part of its limitation lies in the quantitative assessment of what is largely a qualitative or subjective impact.

As described above, distance of the viewer / receptor location from the development is an important factor in the context of experiencing visual impacts which will have a strong bearing on mitigating the potential visual impact. A high impact rating has been assigned to receptor locations that are located within 500m of the proposed development. Beyond 5km, the visual impact would be virtually nil, as the development would appear to merge with the elements on the horizon. Any visual receptor locations beyond this distance have therefore not been assessed as they fall outside the study area and would not be visually influenced by the proposed development. Where a visual receptor is located within more than one (1) distance band, such as a receptor road, it is assigned a score according to the distance at its closest point to the proposed development (i.e. the highest visual impact experienced).

Based on the height and scale of the proposed development, as well as the investigations undertaken during the fieldwork, the distance categories chosen to assign levels of visual impact are as follows:

- 0 <= 500m (high impact);
- 501m < 2km (moderate impact);
- 2.1km < 5km (low impact); and
- > 5km (Negligibly low impact).

The presence of screening factors is equally important in this context as the distance away from the development. Screening factors can be vegetation, buildings, as well as topography. For example, a grove of trees located between a visual receptor location and an object could completely shield the object from the receptor. Topography (relative elevation and aspect) plays a similar role as a visual receptor location in a deep or incised valley will have a very limited viewshed and may not be able to view an object that is in close proximity, but not in its viewshed. As such, the complete screening of the development has been assigned an overriding negligible impact rating, as the development would not impose any impact on the visual receptor.

The visual contrast of a development refers to the degree to which the proposed development would be congruent with the surrounding environment. This is based on whether or not the development would conform to the land use, settlement density, structural scale, form and pattern of natural elements that define the structure of the surrounding landscape. The visual compatibility is an important factor to be considered when assessing the impact of the development on visual receptors within a specific context. A development that is incongruent with the surrounding area could have a significant visual impact on visual receptors as it may change the visual character of the landscape.

Land use and visual character in the surrounding landscape was assessed to determine the level of transformation and the degree to which the proposed development would appear to be visually compatible with the surrounding environment when viewed from a particular location. In the context of this proposed development, the presence or absence of existing electrical infrastructure, dense settlement or other urban built-up form were important factors influencing the level of visual contrast. For example, if the development was located adjacent to an existing substation or power line it would result in significantly less visual contrast. The development site was therefore classified into the following zones of visual contrast:

- **High –** undeveloped / natural / rural areas;
- **Moderate –** cultivated areas, urban sports grounds, golf courses, urban smallholdings, bare earth and areas within 500m of any existing power line in undeveloped / natural / rural area
- **Low –** areas within 250m of mines, quarries and diggings and areas within 1km from a visually transformed urban / built-up areas / plantations.

The outcome of the visual contrast classification in relation to the sensitive and potentially sensitive visual receptor locations is provided in the ***Zones of Visual Contrast Map*** in **Appendix C**.

Through the matrix a score for each receptor location (both sensitive and potentially sensitive) is calculated. The range in which the score falls, as listed in **Table 4** below, determines the visual impact rating for each visual receptor location.

Table 4: Ratings scores

Rating	Overall Score
High Visual Impact	8-9
Medium Visual Impact	5-7
Low Visual Impact	3-4
Negligible Visual Impact	(overriding factor)

An explanation of the matrix is provided in **Table 5** below.

Table 5: Visual assessment matrix used to rate the impact of the proposed development on sensitive and potentially sensitive receptors

	VISUAL IMPACT RATING			
VISUAL FACTOR	**HIGH**	**MEDIUM**	**LOW**	**OVERRIDING FACTOR: NEGLIGIBLE**
Distance of receptor away from proposed development	0 ≤= 500m **Score 3**	501m ≤ 2km **Score 2**	2.1km ≤ 5km **Score 1**	5km <
Presence of screening factors	No / almost no screening factors – development highly visible **Score 3**	Screening factors partially obscure the development **Score 2**	Screening factors obscure most of the development **Score 1**	Screening factors completely block any views towards the development, i.e. the development is not within the viewshed
Visual Contrast	**High contrast** with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or human elements (infrastructural form). Typically, a natural / pastoral environment with low-density rural infrastructure present (low voltage power lines and farm boundary fences). **Score 3**	**Moderate contrast** with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or human elements (infrastructural form) and existing level of visual transformation. Typically, areas within close proximity to other prominent infrastructure (high voltage power lines and railway lines) and within intensive agricultural lands / cultivated fields. **Score 2**	**Corresponds** with the pattern and form of the natural landscape elements (vegetation and land form), typical land use and/or human elements (infrastructural form) and existing level of visual transformation. Presence of urban form and industrial-type infrastructure. The area is not highly valued or sensitive to change (e.g. the outskirts of urban and built-up areas). **Score 1**	

Table 6 below presents a summary of the overall visual impact of the proposed development on each of the potentially sensitive visual receptor locations which were identified within the study area. As previously mentioned, due to access limitations during the field investigation and the nature of the study area, the identified receptor locations could not be fully investigated from a visual perspective. The receptors were still however regarded as being potentially sensitive to the visual impacts associated with the proposed development and were assessed as part of the VIA. In light of the above, the visual impact rating has is primarily a desktop assessment.

Table 6: Summary – Potentially Sensitive Visual Receptor Rating

Receptor Location	Distance	Screening	Contrast	OVERALL IMPACT RATING
VR2 - Town of Kuruman (Smallholdings)	Low (1)	Low (1)	Low (1)	**LOW (3)**
VR3 - Town of Kuruman (Northern Section)	Low (1)	Low (1)	Low (1)	**LOW (3)**
VR4 - Town of Kuruman (Central Section)	Medium (2)	Low (1)	Low (1)	**LOW (4)**
VR5 - Suburb of Wrenchville	Low (1)	Low (1)	Low (1)	**LOW (3)**
VR6 - Town of Kuruman (Southern Section)	Medium (2)	Low (1)	Low (1)	**LOW (4)**
VR7 - Kuruman Country Club	Low (1)	Low (1)	Medium (2)	**LOW (4)**
VR8 - Farmstead / Homestead	Low (1)	Medium (2)	High (3)	**MEDIUM (6)**
VR9 - Farmstead / Homestead	Low (1)	Low (1)	Medium (2)	**LOW (4)**
VR10 - Farmstead / Homestead	Low (1)	Low (1)	Medium (2)	**LOW (4)**
VR11 - Farmstead / Homestead	Medium (2)	Medium (2)	Medium (2)	**MEDIUM (6)**
VR14 - Farmstead / Homestead	Low (1)	Medium (2)	Medium (2)	**MEDIUM (5)**
VR18 - Farmstead / Homestead	Low (1)	Medium (2)	Medium (2)	**MEDIUM (5)**
VR19 - Farmstead / Homestead	Low (1)	Low (1)	Medium (2)	**LOW (4)**
VR20 - Farmstead / Homestead	Low (1)	Low (1)	Low (1)	**LOW (3)**
VR35 - Farmstead / Homestead	Low (1)	Medium (2)	Medium (2)	**MEDIUM (5)**

Receptor Location	Distance	Screening	Contrast	OVERALL IMPACT RATING
VR36 - Farmstead / Homestead	Low (1)	Medium (2)	Medium (2)	**MEDIUM (5)**
VR37 - Farmstead / Homestead	Low (1)	Medium (2)	Medium (2)	**MEDIUM (5)**
VR38 - Farmstead / Homestead	Medium (2)	Medium (2)	Medium (2)	**MEDIUM (6)**
VR39 - Farmstead / Homestead	Low (1)	Medium (2)	Medium (2)	**MEDIUM (5)**
VR40 - Farmstead / Homestead	Low (1)	Medium (2)	Medium (2)	**MEDIUM (5)**
VR41 - Farmstead / Homestead	Low (1)	Medium (2)	High (3)	**MEDIUM (6)**
VR42 - Farmstead / Homestead	Medium (2)	Medium (2)	High (3)	**MEDIUM (7)**
VR43 - Farmstead / Homestead	High (3)	Medium (2)	Medium (2)	**MEDIUM (7)**
VR44 - Farmstead / Homestead	Medium (2)	Medium (2)	High (3)	**MEDIUM (7)**
VR45 - Farmstead / Homestead	Medium (2)	Medium (2)	High (3)	**MEDIUM (7)**
VR46 - Farmstead / Homestead	High (3)	Medium (2)	Medium (2)	**MEDIUM (7)**
VR47 - Farmstead / Homestead	Low (1)	Medium (2)	Medium (2)	**MEDIUM (5)**
VR49 - Farmstead / Homestead	Medium (2)	Medium (2)	Medium (2)	**MEDIUM (6)**
VR57 - Farmstead / Homestead	Low (1)	Low (1)	Medium (2)	**LOW (4)**
VR64 - Farmstead / Homestead	Low (1)	Medium (2)	Medium (2)	**MEDIUM (5)**
VR67 - - Billy Duvenhage Nature Reserve	Low (1)	Medium (2)	Low (1)	**LOW (4)**
Receptor Road – N14 National Route	High (3)	Medium (2)	Medium (2)	**MEDIUM (7)**

As indicated above, the proposed development would result in a medium visual impact on the majority of the receptor locations, including the N14 National Route receptor road (20 receptors in total). In addition, it was found that the proposed development would result in a low visual impact on twelve (12) of the potentially sensitive receptor locations. It should be noted that the proposed development would not result in a high visual impact on any of the potentially sensitive receptor locations identified within the study area.

1.6.4. Night-time Impacts

Power lines and associated towers or pylons are not generally lit up at night and, thus light spill associated with the proposed electrical infrastructure project is only likely to emanate from the proposed substations.

These substations are located in areas which are largely rural in character with low densities of human settlement and as such there are few existing light sources present. As such, the existing nightscape is considered to be mostly 'unpolluted' and the introduction of new light sources could potentially impact upon the visual quality of the nightscape. The substation sites are not however expected to be associated with extensive lighting and as such the resulting light pollution will only be marginal.

It should also be noted that the substations and power lines will only be constructed if the proposed Kuruman Phase 1 and Phase 2 WEFs (part of separate on-going EIA processes) are also developed. Light sources for the WEFs will include operational and security lighting as well as permanent aviation lights or red aircraft warning lights on the top of each wind turbine. The lighting impacts from the proposed substations would therefore be subsumed by the glare and contrast of the lights associated with the WEFs. As such, the substations alone are not expected to result in significant lighting impacts.

1.6.5. Overall Visual Impact Rating

1.6.5.1. Potential Impact 1 (Construction Phase)

Nature of the impact

- Potential visual intrusion resulting from construction vehicles and equipment.
- Potential impacts of increased dust emissions from construction activities and related traffic.
- Potential visual scarring of the landscape as a result of site / vegetation clearance and earthworks.
- Potential visual intrusion on farmsteads / homesteads within the visual assessment zone.

Significance of impact without mitigation measures

During the construction phase, large construction vehicles and equipment will alter the natural character of the study area and expose visual receptor locations to visual impacts associated with construction activities. These activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. A network of gravel roads will be required in order to provide access to the proposed power line servitude and substation sites. It is likely that the visual impact associated with these roads would be limited to the impact resulting from the clearing of vegetation. However, if these roads are not maintained correctly during the construction phase, vehicles travelling along these roads could increase dust emissions and create dust plumes. The increased traffic on the gravel roads and the resultant dust plumes could therefore also create a visual impact and may evoke negative sentiments from surrounding viewers. It should however be noted that the majority of the existing roads in the vicinity of the proposed development are also gravel roads and as such, additional gravel access roads are not expected to contribute to the overall visual impact of the proposed development. The visual intrusion of the construction activities associated with the proposed substations and power line could adversely affect farmsteads / homesteads within the visual assessment zone. Surface disturbance during construction would also expose bare soil which could visually contrast with the surrounding environment. Additionally, the temporary stockpiling of soil during construction may alter the landscape and wind blowing over these disturbed areas could result in dust which would have a visual impact. Vegetation clearance required for the construction of the proposed substations is expected to increase dust emissions and alter the natural character of the surrounding area, thus creating a visual impact.

The significance of visual impacts without mitigation measures during construction are rated as low.

Proposed mitigation measures

- Carefully plan to reduce the construction period.
- Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
- Vegetation clearing should take place in a phased manner.
- Maintain a neat construction site by removing rubble and waste materials regularly.
- Make use of existing gravel access roads where possible.
- Limit the number of vehicles travelling to and from the proposed development, where possible.
- If dust plumes become an issue, dust suppression techniques must be implemented on gravel access roads utilised during construction, where possible (unless there are water shortages).
- If dust plumes become an issue, dust suppression must be implemented in all areas where vegetation clearing has taken place (unless there are water shortages).
- Ensure that all soil stockpiles are covered in order to reduce dust.
- Establish erosion control measures on areas which will be exposed for long periods of time. This is to reduce the potential impact heavy rains may have on the bare soil.

Significance of impact with mitigation measures

Mitigation measures will result in a minor reduction of visual impacts during construction but the impact rating will remain low.

1.6.5.2. Potential Impact 2 (Operational Phase)

Nature of the impact

- Potential alteration of the visual character of the area.
- Potential visual intrusion resulting from infrastructure located on ridge lines and higher plateaus.
- Potential alteration of the night time visual environment as a result operational and security lighting at proposed substations.
- Potential visual intrusion on farmsteads / homesteads within the visual assessment zone.

Significance of impact without mitigation measures

The proposed development could exert a visual impact by altering the visual character of the surrounding area and exposing sensitive and/or potentially sensitive visual receptor locations to visual impacts. The development may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. This is especially true for the power line towers, which are tall structures and will most likely be visible for greater distances. However, where existing power lines are present the visual environment would already be visually ‘degraded’ and thus the introduction of a new power line in this setting may be considered to be less of a visual impact than if no existing built infrastructure were visible. Security and operational lighting at the proposed substations could result in some light pollution and glare, which could be an annoyance to surrounding viewers, although the anticipated lighting impacts are not expected to be major. The visual intrusion of the proposed development could also adversely affect farmsteads / homesteads within the visual assessment zone.

The significance of visual impacts without mitigation measures during operation are rated as low.

Proposed mitigation measures

- Where possible, limit the amount of security and operational lighting present at the substations.
- Non-reflective surfaces should be utilised where possible.

Significance of impact with mitigation measures

Mitigation measures will not result in a reduction of visual impacts during operation and therefore the impact rating will remain low.

1.6.5.3. Potential Impact 3 (Decommissioning Phase)

Nature of the impact

- Potential visual intrusion resulting from decommissioning vehicles and equipment.
- Potential impacts of increased dust emissions from decommissioning activities and related traffic.
- Potential visual scarring of the landscape as a result of decommissioning activities.
- Potential visual intrusion on farmsteads / homesteads within the visual assessment zone.

Significance of impact without mitigation measures

During the decommissioning phase, large construction vehicles and equipment will alter the natural character of the study area and expose visual receptor locations to visual impacts associated with decommissioning activities. These activities may be perceived as an unwelcome visual intrusion, particularly in more natural undisturbed settings. Gravel roads will be used to gain access to the proposed power line servitude and substation sites and if these roads are not maintained correctly during the decommissioning phase, vehicles travelling along these roads could increase dust emissions and create dust plumes. The increased traffic and the resultant dust plumes could therefore create a visual impact and may evoke negative sentiments from surrounding viewers. The visual intrusion of decommissioning activities associated with the proposed substations and power line could adversely affect farmsteads / homesteads within the visual assessment zone. Decommissioning activities could also result in surface disturbance which could visually contrast with the surrounding environment. Additionally, the temporary stockpiling of soil during decommissioning may alter the landscape and wind blowing over these disturbed areas could result in dust which would have a visual impact. Any vegetation clearance required for the decommissioning activities is expected to increase dust emissions and alter the natural character of the surrounding area, thus creating a visual impact.

The significance of visual impacts without mitigation measures during construction is however rated as low.

Proposed mitigation measures

- Carefully plan to reduce the decommissioning period.
- Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
- Vegetation clearing should take place in a phased manner.
- Maintain a neat decommissioning site by removing rubble and waste materials regularly.
- Make use of existing gravel access roads where possible.
- Limit the number of vehicles travelling to and from the substation and power line servitude, where possible.
- If dust plumes become an issue, dust suppression techniques must be implemented on gravel access roads utilised during decommissioning, where possible (unless there are water shortages).

- If dust plumes become an issue, dust suppression must be implemented in all areas where vegetation clearing has taken place (unless there are water shortages).
- Ensure that all soil stockpiles are covered in order to reduce dust.
- Stockpiled topsoil should be used to rehabilitate disturbed areas.
- Establish erosion control measures on areas which will be exposed for long periods of time to reduce the potential impact of heavy rains on the bare soil.

Significance of impact with mitigation measures

Mitigation measures will result in a minor reduction of visual impacts during decommissioning and therefore the impact rating will remain low.

1.6.5.4. Cumulative Impacts

Nature of the impact

- Combined visual impacts from several renewable energy facilities and their associated infrastructure in the broader area during the construction and operation phases could potentially alter the sense of place and visual character of the area; and
- Combined visual impacts from several renewable energy facilities and their associated infrastructure in the broader area during construction and operations phases could potentially exacerbate visual impacts on visual receptors.

Significance of impact without mitigation measures

Large construction vehicles and equipment during the construction phase of the surrounding renewable energy facilities and their associated infrastructure will contribute further to the alteration of the natural character of the study area and will also expose a greater number of visual receptor locations to visual impacts associated with construction activities, especially if some of the construction phases coincide. This is also true for the operational phase as the surrounding renewable energy facilities and their associated infrastructure would alter the visual character of the surrounding area further and expose a greater number of sensitive and potentially sensitive visual receptor locations to visual impacts. The construction and operation activities may be perceived as unwelcome visual intrusions, particularly in more natural undisturbed settings. Vehicles and trucks travelling to and from the proposed development sites during the construction phases on gravel access roads are also expected to result in an increase in dust emissions in the greater area. In addition, maintenance vehicles may need to access the surrounding renewable energy facilities and their associated infrastructure via gravel access roads and are also expected to increase dust emissions in the surrounding area in doing so. The increased traffic on these roads and the dust plumes could create a greater visual impact within the greater area and may evoke more negative sentiments from surrounding viewers. It should however be noted that the majority of the existing roads in the vicinity of the project site are also gravel. As such, the gravel access roads are not expected to contribute significantly to the overall cumulative visual impact. Surface disturbance during construction of the surrounding renewable energy facilities and their associated infrastructure would also result in a greater amount of bare soil being exposed which could result in a greater visual contrast with the surrounding environment. In addition, temporary stockpiling of soil during construction may alter the landscape further. Wind blowing over these disturbed areas could result in a greater amount of dust which would have a visual impact. Security and operational lighting will be required for the operation of the surrounding renewable energy facilities and their associated infrastructure. This could therefore result in a greater amount of light pollution and glare within the surrounding area, which could be a significant annoyance to surrounding viewers.

The significance of the cumulative visual impacts without mitigation measures during construction and operation are rated as moderate.

Proposed mitigation measures

- Carefully plan to reduce the construction period.
- Minimise vegetation clearing and rehabilitate cleared areas as soon as possible.
- Vegetation clearing should take place in a phased manner.
- Maintain a neat construction site by removing rubble and waste materials regularly.
- Make use of existing gravel access roads, where possible.
- Limit the number of vehicles and trucks travelling to and from the proposed development site, where possible.
- If dust plumes become an issue, dust suppression techniques must be implemented on gravel access roads utilised during construction, where possible (unless there are water shortages).
- If dust plumes become an issue, dust suppression must be implemented in all areas where vegetation clearing has taken place (unless there are water shortages).
- Unless there are water shortages, ensure that dust suppression techniques are implemented on all soil stockpiles.
- Ensure that all soil stockpiles are covered in order to reduce dust.
- Establish erosion control measures on areas which will be exposed for long periods of time. This is to reduce the potential impact heavy rains may have on the bare soil.
- Where possible, temporarily fence-off the construction areas (for the duration of the construction period).
- Light fittings for security at night should reflect the light toward the ground and prevent light spill.
- Where possible, limit the amount of security and operational lighting present at the substations.
- As far as possible, limit the number of maintenance vehicles using the access roads.
- Select the alternatives that will have the least impact on visual receptor locations.

Significance of impact with mitigation measures

Mitigation measures will not result in a reduction of cumulative visual impacts during construction and operation. Moderate cumulative visual impacts are still expected during the construction and operational phases.

1.7. IMPACT ASSESSMENT SUMMARY

The BA process requires that an overall rating for visual impact be provided to allow the visual impact to be assessed alongside other environmental parameters. The CSIR has developed an impact rating matrix for this purpose. The assessment of impacts and recommendation of mitigation measures as discussed above are collated in *Table 7* - **Table 10** below.

Please refer to **Appendix A** for an explanation of the impact rating methodology.

Table 7: Impact assessment summary table for the Construction Phase

Impact pathway	Nature of potential impact/risk	Status[1]	Extent[2]	Duration[3]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
VISUAL															
CONSTRUCTION PHASE															
Direct Impacts															
Construction Activities	Visual intrusion and dust emissions	Negative	Local	Short-Term	Moderate	Very likely	High	Moderate	Low	No	Yes	- Carefully plan to reduce the construction period. - Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. - Vegetation clearing should take place in a phased manner. - Maintain a neat construction site by removing rubble and waste materials regularly. - Make use of existing gravel access roads where possible. - Limit the number of vehicles and trucks travelling to and from the proposed site, where possible. - If dust plumes become an issue, dust suppression techniques must be implemented on gravel access roads utilised during construction, where possible (unless there are water shortages). - If dust plumes become an issue, dust suppression must be implemented in	Low	4	Medium

[1] Status: Positive (+) ; Negative (-)
[2] Site; Local (<10 km); Regional (<100); National; International
[3] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Impact pathway	Nature of potential impact/risk	Status[1]	Extent[2]	Duration[3]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
												all areas where vegetation clearing has taken place (unless there are water shortages). - Ensure that all soil stockpiles are covered in order to reduce dust. - Establish erosion control measures on areas which will be exposed for long periods of time. This is to reduce the potential impact heavy rains may have on the bare soil.			

Table 8: Impact assessment summary table for the Operational Phase

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
VISUAL															
OPERATIONAL PHASE															
Direct Impacts															
Operation activities	Alteration of visual character, visual intrusion, dust emissions	Negative	Local	Long term	Moderatel	Very likely	High	Moderate	Low	No	Yes	- Where possible, limit the amount of security and operational lighting present at the substations. - - Non-reflective surfaces should be utilised where possible.	Low	4	Medium

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
	and light pollution and glare														

Table 9: Impact assessment summary table for the Decommissioning Phase

Impact pathway	Nature of potential impact/risk	Status[4]	Extent[5]	Duration[6]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
VISUAL															
DECOMMISSIONING PHASE															
Direct Impacts															
Decommissioning Activities	Visual intrusion and dust emissions	Negative	Local	Short-Term	Moderate	Very likely	High	Moderate	Low	No	Yes	- Carefully plan to reduce the decommissioning period. - Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. - Vegetation clearing should take place in a phased manner.	Low	4	Medium

[4] Status: Positive (+) ; Negative (-)
[5] Site; Local (<10 km); Regional (<100); National; International
[6] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Impact pathway	Nature of potential impact/risk	Status[4]	Extent[5]	Duration[6]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
												- Maintain a neat decommissioning site by removing rubble and waste materials regularly. - Make use of existing gravel access roads where possible. - Limit the number of vehicles travelling to and from the substation and power line servitude, where possible. - If dust plumes become an issue, dust suppression techniques must be implemented on gravel access roads utilised during decommissioning, where possible (unless there are water shortages). - If dust plumes become an issue, dust suppression must be implemented in all areas where vegetation clearing has taken place (unless there are water shortages).			

Impact pathway	Nature of potential impact/risk	Status[4]	Extent[5]	Duration[6]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
												- Ensure that all soil stockpiles are covered in order to reduce dust. - Stockpiled topsoil should be used to rehabilitate disturbed areas. - Establish erosion control measures on areas which will be exposed for long periods of time to reduce the potential impact of heavy rains on the bare soil.			

Table 10: Cumulative impact assessment summary table

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
VISUAL															
CUMULATIVE IMPACTS															
Construction Activities	Alteration of visual character,	Negative	Regional	Short-Term	Substantial	Very likely	Moderate	Moderate	Moderate	No	Yes	- Carefully plan to reduce the construction period.	Moderate	3	Medium

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
	visual intrusion and dust emissions											- Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. - Vegetation clearing should take place in a phased manner. - Maintain a neat construction site by removing rubble and waste materials regularly. - Make use of existing gravel access roads, where possible. - Limit the number of vehicles and trucks travelling to and from the proposed development site, where possible. - If dust plumes become an issue, dust suppression techniques must be implemented on gravel access roads utilised during construction, where possible (unless there are water shortages). - If dust plumes become an issue, dust suppression must be			

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
												implemented in all areas where vegetation clearing has taken place (unless there are water shortages). - Unless there are water shortages, ensure that dust suppression techniques are implemented on all soil stockpiles. - Ensure that all soil stockpiles are covered in order to reduce dust. - Establish erosion control measures on areas which will be exposed for long periods of time. This is to reduce the potential impact heavy rains may have on the bare soil. - Where possible, temporarily fence-off the construction sites (for the duration of the construction period). - Buildings and similar structures must be in keeping with regional planning policy documents, especially the principles of critical			

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
												regionalism (namely sense of place, sense of history, sense of nature, sense of craft and sense of limits).			
Operational Activities	Alteration of visual character, visual intrusion, dust emissions and light pollution and glare	Negative	Regional	Long Term	Substantial	Very likely	Moderate	Moderate	Moderate	No	Yes	- Light fittings for security at night should reflect the light toward the ground (except for aviation lighting) and prevent light spill. - Where possible, limit the amount of security and operational lighting present at the substations. - Non-reflective surfaces should be utilised where possible. - Buildings should not be illuminated at night, if possible. - If possible and practically feasible, the buildings should be painted with natural tones that fit with the surrounding environment[7]. In	Moderate	3	Medium

[7] Depending on the building design, the developer may find it preferable to paint the building white in order to reflect heat and keep the interior of the building cool

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
												addition, non-reflective surfaces should be utilised where possible. - As far as possible, limit the number of maintenance vehicles, which are allowed to access the sites. - Select the alternatives that will have the least impact on visual receptor locations.			

1.8. COMPARATIVE ASSESSMENT OF ALTERNATIVES

As previously stated, three (3) power line route alternatives have been identified for assessment during the BA process. These alternatives are as follows:

- Route Alternative 1: Approximately 56.6kms in length linking the proposed Phase 1 Kuruman WEF substation to Ferrum substation.
- Route Alternative 2: Approximately 13.9kms in length linking the proposed Phase 1 Kuruman WEF substation to Segame substation.
- Route Alternative 3: Approximately 8.5.1kms in length linking the proposed Phase 1 Kuruman WEF substation to the proposed Phase 2 Kuruman WEF substation. This Option would only be required in the event that only Phase 2 Kuruman WEF is constructed.

A comparative assessment of alternatives was undertaken in order to determine which of the above-mentioned alternatives would be preferred from a visual perspective. The preference rating for each alternative is provided in **Table *11*** below. The alternatives are rated as preferred; not-preferred; favourable or no-preference.

The degree of visual impact and the preference rating has been determined based on the following factors:

- The location of the power line in relation to areas of high elevation, especially ridges, koppies or hills;
- The location of the power line in relation to sensitive receptor locations; and
- The location of the power line in relation to areas of natural bushveld vegetation (clearing site for the development worsens the visibility).

KEY

PREFERRED	The alternative will result in a low impact / reduce the impact
FAVOURABLE	The impact will be relatively insignificant
NOT PREFERRED	The alternative will result in a high impact / increase the impact
NO PREFERENCE	The alternative will result in equal impacts

Table 11: Comparative Assessment of Alternatives

Alternative	Preference	Reasons (incl. potential issues)
Route Alternative 1: Phase 1 Kuruman WEF substation to Ferrum substation.	Not preferred	Although sections of the route are on higher ground, much of the route runs along valley lines and across the lower plains. Hence the power lines will only be moderately exposed on the skyline. This route is the longest of the three alternatives and traverses areas which are largely rural-natural in character. The development of a new power line in these areas is expected to contrast with the surrounding landscape and alter the character of the surrounding area to some degree. The visual contrast will however be reduced by the presence of existing power lines in the area. Two potentially sensitive receptors are within 500m of this route alternative (VR43 and VR46), although the receptor impact for both of these sites is only rated as medium. A medium impact rating is also associated with all five of the potentially sensitive receptors located between 500m and 2km of this route alternative. This alternative is therefore not fatally flawed, but is not the preferred route alignment from a visual perspective.
Route Alternative 2: Phase 1 Kuruman WEF substation to Segame substation.	Preferred	Much of this route seems to run along a valley line and across the the lower plains around the Segame substation and as such the level of visual exposure of the power lines will be marginal. A major portion of this route traverses an area which is largely rural-natural in character and as

Alternative	Preference	Reasons (incl. potential issues)
		such the power line will contrast with the surrounding landscape and alter the visual character to some degree. It should be noted however that the areas of high visual contrast along this route are mostly located in a steep-sided valley which will greatly reduce the visibility of the power lines. There are no potentially sensitive receptors within 500m of this route alignment and only three (3) potentially sensitive receptor locations between 500m and 2kms from this route alternative. Of these three, one receptor has been assigned a medium impact rating while the other two have been assigned a low impact rating. In light of the above, and the fact that this route alternative is significantly shorter than Alternative 1, this alternative is considered to be preferred from a visual perspective.
Route Alternative 3: Phase 1 Kuruman WEF substation to Phase 2 Kuruman WEF subbstation.	Favourable	This route alternative follows the same alignment as the northern-most section of Alternative 1 and the entire route appears to be located in a steep-sided valley. Although the proposed power lines will contrast significantly with the natural features in the landscape, the location of the lines in the valley will greatly reduce the visibility of the power lines from the surrounding landscape. In light of the above, this route is considered favourable from a visual perspective.

1.9. INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAM

It should be noted that there are no specific conditions or monitoring recommendations which need to be included in the EA from a visual perspective. General mitigation measures and/or recommendations for inclusion in the Environmental Management Programme (EMPr) have however been provided in the table below and should be given consideration.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
A. CONSTRUCTION PHASE					
A.1. VISUAL IMPACTS					
Potential impact on the visual environment as a result of the construction of the proposed electrical infrastructure .	Avoid or minimize impacts on visual environment and visual receptor locations in surrounding area during construction.	▪ Minimise vegetation clearing and rehabilitate cleared areas as soon as possible. ▪ Vegetation clearing should take place in a phased manner. ▪ Ensure that all soil stockpiles are covered in order to reduce dust. ▪ Dust suppression techniques must be implemented on gravel access roads utilised during construction, where possible (unless there are water shortages). ▪ Dust suppression must be implemented in all areas where vegetation clearing has taken place (unless there are water shortages).	▪ Ensure that the mitigation measures are taken into consideration by Main Contractor and all Sub-contractors during construction.	▪ Can be monitored monthly or bi-monthly, as agreed between project Developer / Main Contractor and Environmental Control Officer (ECO).	▪ Project Developer / Main Contractor and Appointed Environmental Control Officer (ECO)

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
B. OPERATIONAL PHASE					
B.1. VISUAL IMPACTS					
Potential impact on the visual environment as a result of the operation of the proposed electrical.	Avoid or minimize impacts on visual environment and visual receptor locations in surrounding area during operation.	▪ Where possible, limit the amount of security and operational lighting present at the substations.	▪ Ensure that the mitigation measures are taken into consideration by Developer (as well as anyone doing maintenance on site) during operation.	▪ Can be monitored monthly or bi-monthly, as agreed between project Developer / Main Contractor and Environmental Control Officer (ECO).	▪ Project Developer and Appointed Environmental Control Officer (ECO)
C. DECOMMISSIONING PHASE					
C.1. VISUAL IMPACTS					
Potential impact on the visual environment as a result of the decommissioning of the proposed electrical	Avoid or minimize impacts on visual environment and visual receptor locations in surrounding area during decommissioning.	▪ Rehabilitate areas where vegetation was cleared as soon as possible. ▪ Dust suppression techniques must be implemented on gravel access roads utilised during decommissioning phase, where possible (unless there are water shortages). ▪ Ensure that all structures associated with the proposed development are removed.	▪ Ensure that the mitigation measures are taken into consideration by Main Contractor and all Sub-contractors during decommissioning.	▪ Can be monitored monthly or bi-monthly, as agreed between project Developer / Main Contractor and Environmental Control Officer (ECO).	▪ Project Developer / Main Contractor and Appointed Environmental Control Officer (ECO)

1.10. CONCLUSION AND RECOMMENDATIONS

A BA level study has been conducted in order to identify the potential visual impact and issues related to the development of the proposed electrical infrastructure near Kuruman in the Northern Cape Province. Although the majority of the study area has a largely natural, untransformed visual character, it is characterised by the presence of typical rural / pastoral infrastructure and is not typically valued or utilised for its tourism significance. In addition, the study area is characterised by the presence of high levels of human transformation / disturbance in the northern and south-westerns sections of the study area respectively, in the vicinity of the town of Kuruman, the suburb of Wrenchville and the town of Kathu. These areas will thus not be significantly impacted by the visual impacts associated with the proposed development. This is especially true for the south-western section of the study area which is characterised by the presence of large scale mining activities. The rest of the study area has however seen limited transformation / disturbance and is considered to be largely natural / scenic. These undisturbed / natural areas will therefore be impacted significantly from a visual perspective as a result of the development of the proposed electrical infrastructure. It should also be noted that there are several renewable energy developments (solar and wind) being proposed and/or constructed within 50kms of the proposed development. These facilities and their associated infrastructure, will significantly alter the visual character and baseline in the study area once constructed and give rise to a more industrial-type visual character. Due to the presence of urban built-up areas and low levels of leisure-based or nature based tourism activities in the assessment area, no sensitive visual receptor locations were identified within the study area. It was however ascertained that the proposed development is likely to visually impact thirty-one (31) potentially sensitive receptors. The only potentially sensitive receptor road identified within the study area is the N14 national route. This road is valued or utilised for its scenic or tourism potential and as a result it is regarded as a sensitive receptor road. It is considered unlikely that the R31 road would be widely used by tourists and as such it is not regarded as being visually sensitive.

In order to assess the impact of the proposed development on the potentially sensitive receptor locations identified within the study area, a receptor impact rating was undertaken. In terms of the potentially sensitive visual receptor locations, the proposed development would result in a medium visual impact on the majority of the receptor locations (19 in total). In addition, it was found that it would result in a low visual impact on twelve (12) of the potentially sensitive receptor locations. It should be noted that the proposed development would not result in a high visual impact on any of the sensitive or potentially sensitive receptor locations.

An overall impact rating was also conducted in order to allow the visual impact to be assessed alongside other environmental parameters. The impact rating revealed that overall the proposed development is expected to have a low negative visual impact rating during construction, operation and decommissioning, with relatively few mitigation measures available. The significance of the cumulative impacts associated with the proposed development in addition to the other renewable energy developments (including their associated infrastructure) proposed nearby were also rated according to the significance rating methodology. The impact assessment revealed that the cumulative visual impacts of the proposed development in addition to the other renewable energy developments (including associated infrastructure) proposed nearby would have a moderate negative visual impact rating during both construction and operation, with relatively few mitigation measures available. These impacts would however remain moderate after the implementation of the relevant mitigation measures, due to the nature of the impacts.

Overall it can be concluded that the visual impact of the proposed development would be reduced due to the lack of sensitive visual receptors present and the high levels of transformation / disturbance. However, it is expected that the proposed development would alter the largely natural / scenic character of much of the study area and contrast with the typical land use and/or pattern and form of human elements present in the undisturbed / natural areas of the study area. As previously mentioned, several renewable energy developments (both wind and solar) are being proposed within a 50km radius of the proposed development. These renewable energy developments and their associated infrastructure would reduce the overall natural / scenic character of the study area, however they would increase the cumulative visual impacts, should some or all of these developments be constructed. The relatively large number of renewable energy facilities within the surrounding area and their potential for large scale visual impacts could thus significantly alter the sense of place and visual character in the study area, as well as exacerbate the visual impacts on surrounding visual receptors.

No fatal flaws were identified for any of the route alternatives and Alternative 2 (Phase 1 Kuruman WEF substation to Segame substation) was determined to be the preferred route from a visual perspective, due to the fact that it is shorter and will affect fewer potentially sensitive receptors.

1.10.1. Visual Impact Statement

It is SiVEST's opinion that the visual impacts associated with the proposed electricity infrastructure development are of low significance. From a visual perspective therefore, the project is deemed acceptable and the EA should be granted. SiVEST is of the opinion that the impacts associated with the construction, operation and decommissioning phases can be mitigated to acceptable levels provided the recommended mitigation measures are implemented.

No fatal flaws were identified for any of the route alternatives and Alternative 2 (Phase 1 Kuruman WEF substation to Segame substation) was determined to be the preferred route from a visual perspective,

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1.12. APPENDICES

Appendix A

IMPACT RATING METHODOLOGY PROVIDED BY CSIR

Specialist Impact Assessment Criteria

The identification of potential impacts and risks should include impacts that may occur during the construction, operational and decommissioning phases of the activity. The assessment of impacts is to include direct, indirect, as well as cumulative impacts.

In order to identify potential impacts (both positive and negative) it is important that the nature of the proposed activity is well understood so that the impacts associated with the activity can be understood. The process of identification and assessment of impacts will include:

- Determine the current environmental conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- Determine future changes to the environment that will occur if the activity does not proceed;
- An understanding of the activity in sufficient detail to understand its consequences; and
- The identification of significant impacts which are likely to occur if the activity is undertaken.

As per DEA *Guideline 5: Assessment of Alternatives and Impacts* the following methodology is to be applied to the prediction and assessment of impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:

- **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.

- **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

- **Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

- **Nature of impact** - this reviews the type of effect that a proposed activity will have on the environment and should include "what will be affected and how?"

- **Status** - Whether the impact on the overall environment (social, biophysical and economic) will be:
  - Positive - environment overall will benefit from the impact;
  - Negative - environment overall will be adversely affected by the impact; or
  - Neutral - environment overall will not be affected.

- **Spatial extent** – The size of the area that will be affected by the risk/impact:
  - Site;
  - Local (<10 km from site);
  - Regional (<100 km of site);
  - National; or
  - International (e.g. Greenhouse Gas emissions or migrant birds).

- **Duration** – The timeframe during which the risk/impact will be experienced:

- Very short term (instantaneous);
- Short term (less than 1 year);
- Medium term (1 to 10 years);
- Long term (the impact will occur for the project duration); or
- Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient (i.e. the impact will occur beyond the project decommissioning)).

- **Reversibility of impacts -**
  - High reversibility of impacts (impact is highly reversible at end of project life, i.e. this is the most favourable assessment for the environment. For example, the nuisance factor caused by noise impacts associated with the operational phase of an exporting terminal can be considered to be highly reversible at the end of the project life);
  - Moderate reversibility of impacts;
  - Low reversibility of impacts; or
  - Impacts are non-reversible (impact is permanent, i.e. this is the least favourable assessment for the environment. The impact is permanent. For example, the loss of a palaeontological resource on the site caused by building foundations could be non-reversible).

- **Irreplaceability of resource loss caused by impacts –**
  - High irreplaceability of resources (project will destroy unique resources that cannot be replaced, i.e. this is the least favourable assessment for the environment. For example, if the project will destroy unique wetland systems, these may be irreplaceable);
  - Moderate irreplaceability of resources;
  - Low irreplaceability of resources; or
  - Resources are replaceable (the affected resource is easy to replace/rehabilitate, i.e. this is the most favourable assessment for the environment).

Using the criteria above, the impacts will further be assessed in terms of the following:

- **Probability** – The probability of the impact occurring:
  - Extremely unlikely (little to no chance of occurring);
  - Very unlikely (<30% chance of occurring);
  - Unlikely (30-50% chance of occurring)
  - Likely (51 – 90% chance of occurring); or
  - Very Likely (>90% chance of occurring regardless of prevention measures).

- **Consequence**–The anticipated severity of the impact:
  - Extreme (extreme alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they permanently cease);
  - Severe (severe alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Substantial (substantial alteration of natural systems, patterns or processes, i.e. where environmental functions and processes are altered such that they temporarily or permanently cease);
  - Moderate (notable alteration of natural systems, patterns or processes, i.e. where the environment continues to function but in a modified manner); or

- Slight (negligible alteration of natural systems, patterns or processes, i.e. where no natural systems/environmental functions, patterns, or processes are affected).
-

- **Significance** – To determine the significance of an identified impact/risk, the consequence is multiplied by probability (qualitatively as shown in Figure 1 below). The approach incorporates internationally recognised methods from the Intergovernmental Panel on Climate Change (IPCC) (2014) assessment of the effects of climate change and is based on an interpretation of existing information in relation to the proposed activity, to generate an integrated picture of the risks related to a specified activity in a given location, with and without mitigation. Risk is assessed for each significant stressor (e.g. physical disturbance), on each different type of receiving entity (e.g. the municipal capacity, a sensitive wetland), qualitatively (very low, low, moderate, high, very high) against a predefined set of criteria (as shown in Figure 1 below).

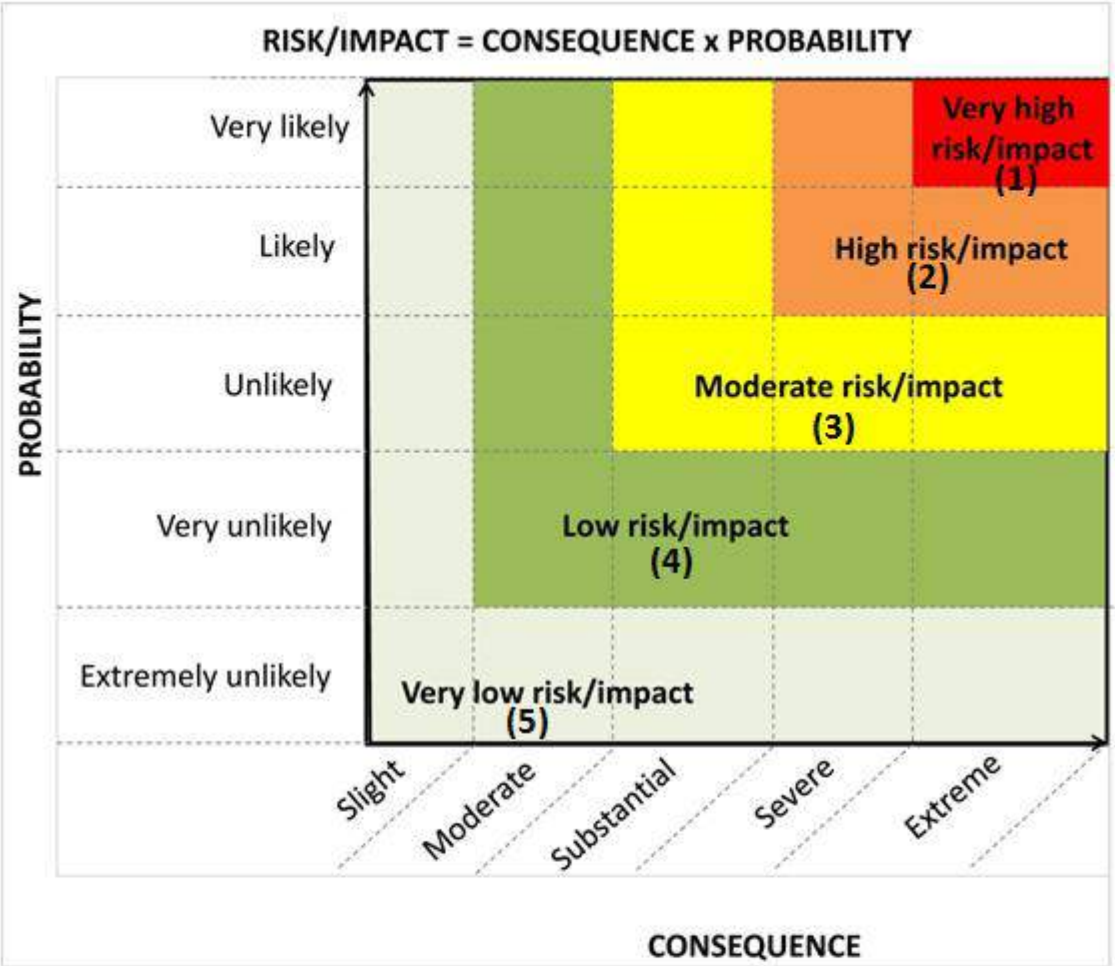


Figure 1: Guide to assessing risk/impact significance as a result of consequence and probability.

- **Significance** – Will the impact cause a notable alteration of the environment?
  - Very low (the risk/impact may result in very minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);
  - Low (the risk/impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making);

- Moderate (the risk/impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated); or
  - High (the risk/impacts will result in a considerable alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making).
  - Very high (the risk/impacts will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making (i.e. the project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating)).

The above assessment must be described in the text (with clear explanation provided on the rationale for the allocation of significance ratings) and summarised in an impact assessment Table in a similar manner as shown in the example below (Table 1).

- **Ranking -** With the implementation of mitigation measures, the residual impacts/risks must be ranked as follow in terms of significance:
  - Very low = 5;
  - Low = 4;
  - Moderate = 3;
  - High = 2; and
  - Very high = 1.

- **Confidence** – The degree of confidence in predictions based on available information and specialist knowledge:
  - Low;
  - Medium; or
  - High.

Impacts will then be collated into an EMPr and these will include the following:

- Management actions and monitoring of the impacts;
- Identifying negative impacts and prescribing mitigation measures to avoid or reduce negative impacts; and
- Positive impacts will be identified and enhanced where possible.

Other aspects to be taken into consideration in the assessment of impact significance are:

- Impacts will be evaluated for the construction, operational and decommissioning phases of the development. The assessment of impacts for the decommissioning phase will be brief, as there is limited understanding at this stage of what this might entail. The relevant rehabilitation guidelines and legal requirements applicable at the time will need to be applied;
- The impact evaluation will, where possible, take into consideration the cumulative effects associated with this and other facilities/projects which are either developed or in the process of being developed in the local area; and
- The impact assessment will attempt to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. Where appropriate, national standards are to be used as a measure of the level of impact.

- Impacts should be assessed for all layouts and project components.
- **IMPORTANT NOTE FROM THE CSIR: IMPACTS SHOULD BE DESCRIBED BOTH BEFORE AND AFTER THE PROPOSED MITIGATION AND MANAGEMENT MEASURES HAVE BEEN IMPLEMENTED. THE ASSESSMENT OF THE POTENTIAL IMPACT "BEFORE MITIGATION" SHOULD TAKE INTO CONSIDERATION ALL MANAGEMENT ACTIONS THAT ARE ALREADY PART OF THE PROJECT DESIGN (WHICH ARE A GIVEN). THE ASSESSMENT OF THE POTENTIAL IMPACT "AFTER MITIGATION" SHOULD TAKE INTO CONSIDERATION ANY ADDITIONAL MANAGEMENT ACTIONS PROPOSED BY THE SPECIALIST, TO MINIMISE NEGATIVE OR ENHANCE POSITIVE IMPACTS.**

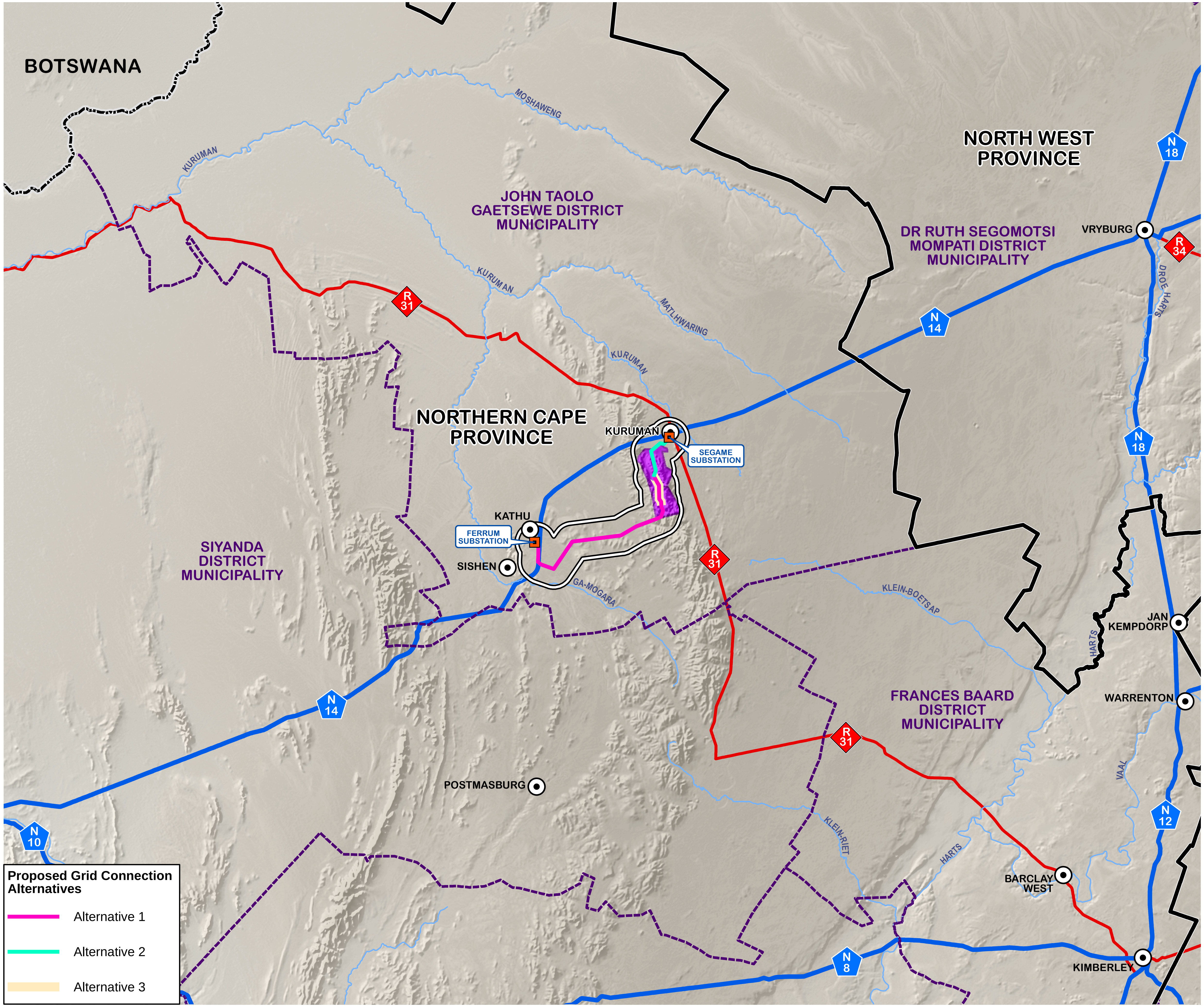
Appendix B

PROJECT MAPS

PROPOSED CONSTRUCTION OF A 132kV POWER LINE TO SERVE THE PROPOSED KURUMAN WIND ENERGY FACILITY

NEAR KURUMAN, NORTHERN CAPE PROVINCE

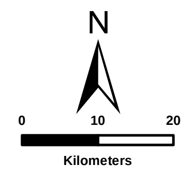
VISUAL ASSESSMENT: REGIONAL CONTEXT



Legend

- Main Towns
- Existing Substations
- National Boundary
- Provincial Boundaries
- District Municipal Boundaries
- National Routes
- Main Arterial Routes
- Main Rivers
- Kuruman WEF Phases 1 and 2 Application Sites
- 5km Visual Assessment Zone

SOURCE:
MUNICIPAL DEMARCATION BOARD, 2011
NGI, 2014



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14869	KLS	20/06/2018
Map Ref No	**Revision**	**Date**
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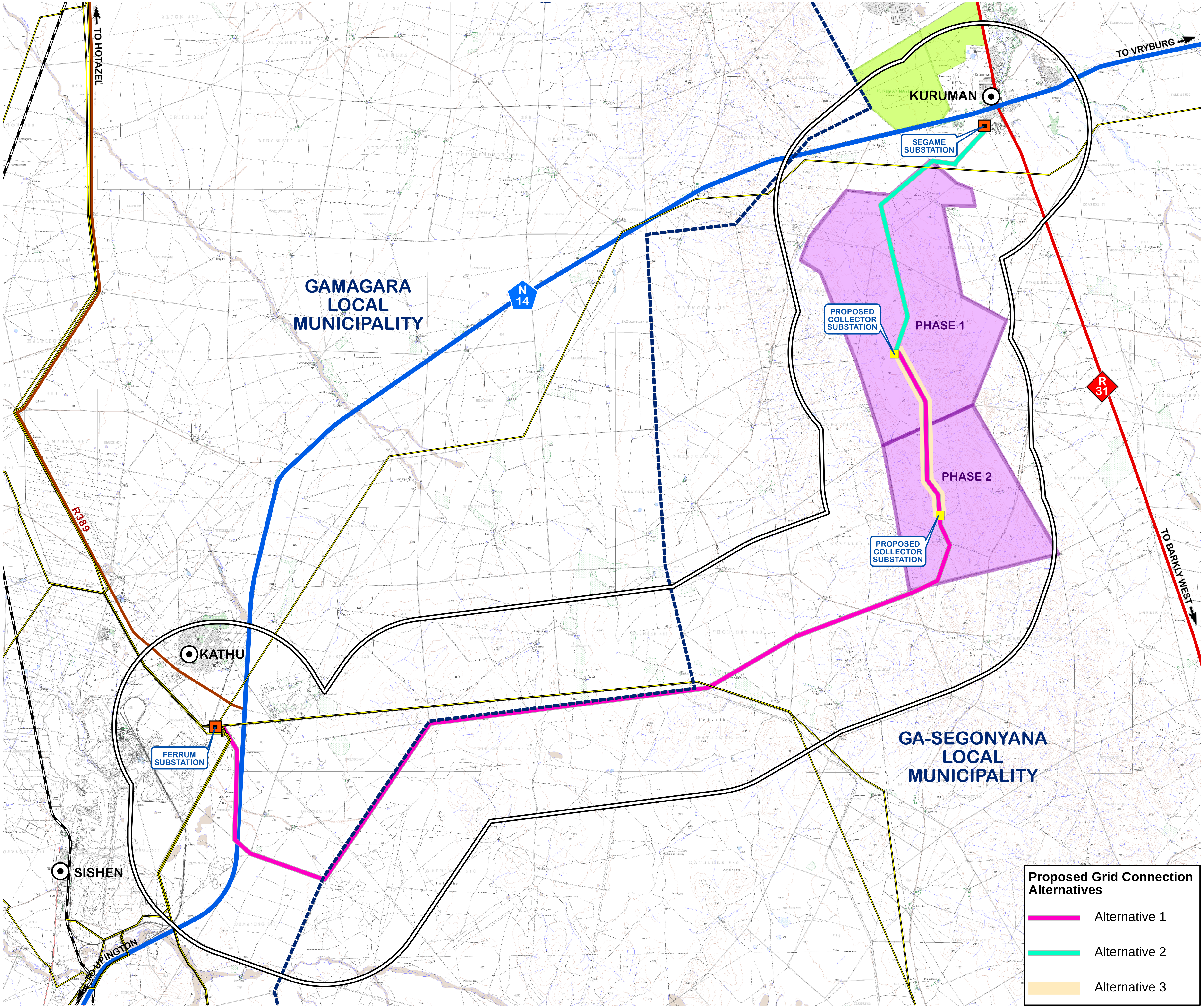

PROPOSED CONSTRUCTION OF A 132kV POWER LINE TO SERVE THE PROPOSED KURUMAN WIND ENERGY FACILITY

NEAR KURUMAN, NORTHERN CAPE PROVINCE

VISUAL ASSESSMENT: ROUTE OVERVIEW

Legend

- Main Towns
- Local Municipal Boundaries
- National Route (N14)
- Main Arterial Route
- Main Road
- Railways
- Existing High Voltage Power Lines (>=132kV)
- Existing Substations
- Proposed Collector Substations
- Rivers
- Nature Reserve
- Kuruman WEF Phases 1 and 2 Application Sites
- 5km Visual Assessment Zone

SOURCE:
ESKOM, 2012
MUNICIPAL DEMARCATION BOARD, 2011
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Project No	Prepared By	Date
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Map Ref No	**Revision**	**Date**
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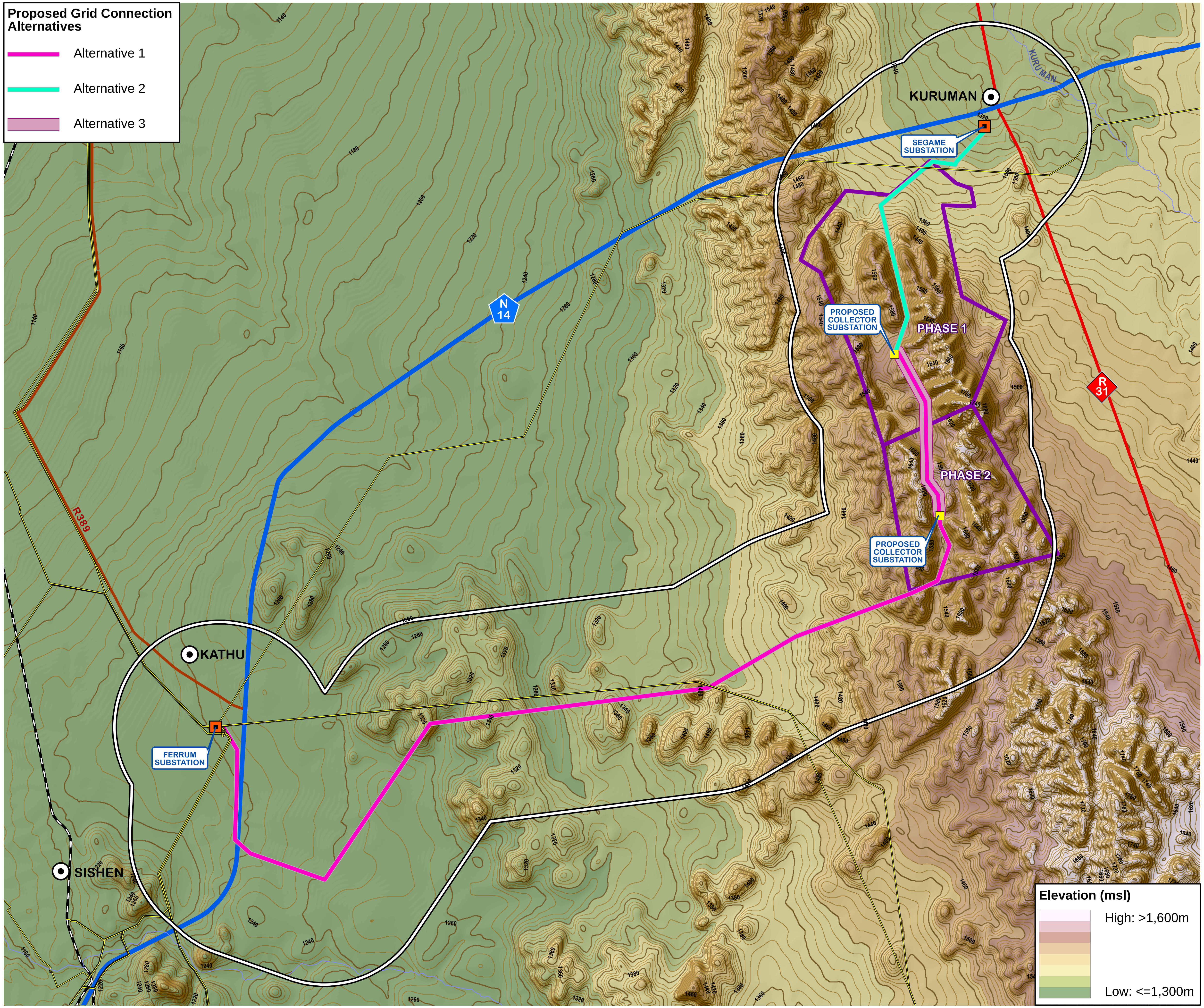

PROPOSED CONSTRUCTION OF A 132kV POWER LINE TO SERVE THE PROPOSED KURUMAN WIND ENERGY FACILITY

NEAR KURUMAN, NORTHERN CAPE PROVINCE

VISUAL ASSESSMENT: TOPOGRAPHY

Legend

- Main Towns
- National Route (N14)
- Main Arterial Route
- Main Road
- Railways
- Existing High Voltage Power Lines (>=132kV)
- Rivers
- Contours (20m Interval)
- Contours (5m Interval)
- Existing Substations
- Proposed Collector Substations
- Kuruman WEF Phases 1 and 2 Application Sites
- 5km Visual Assessment Zone

SOURCE:
ESKOM, 2012
NFEPA, 2011
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Project No	Prepared By	Date
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Map Ref No	**Revision**	**Date**
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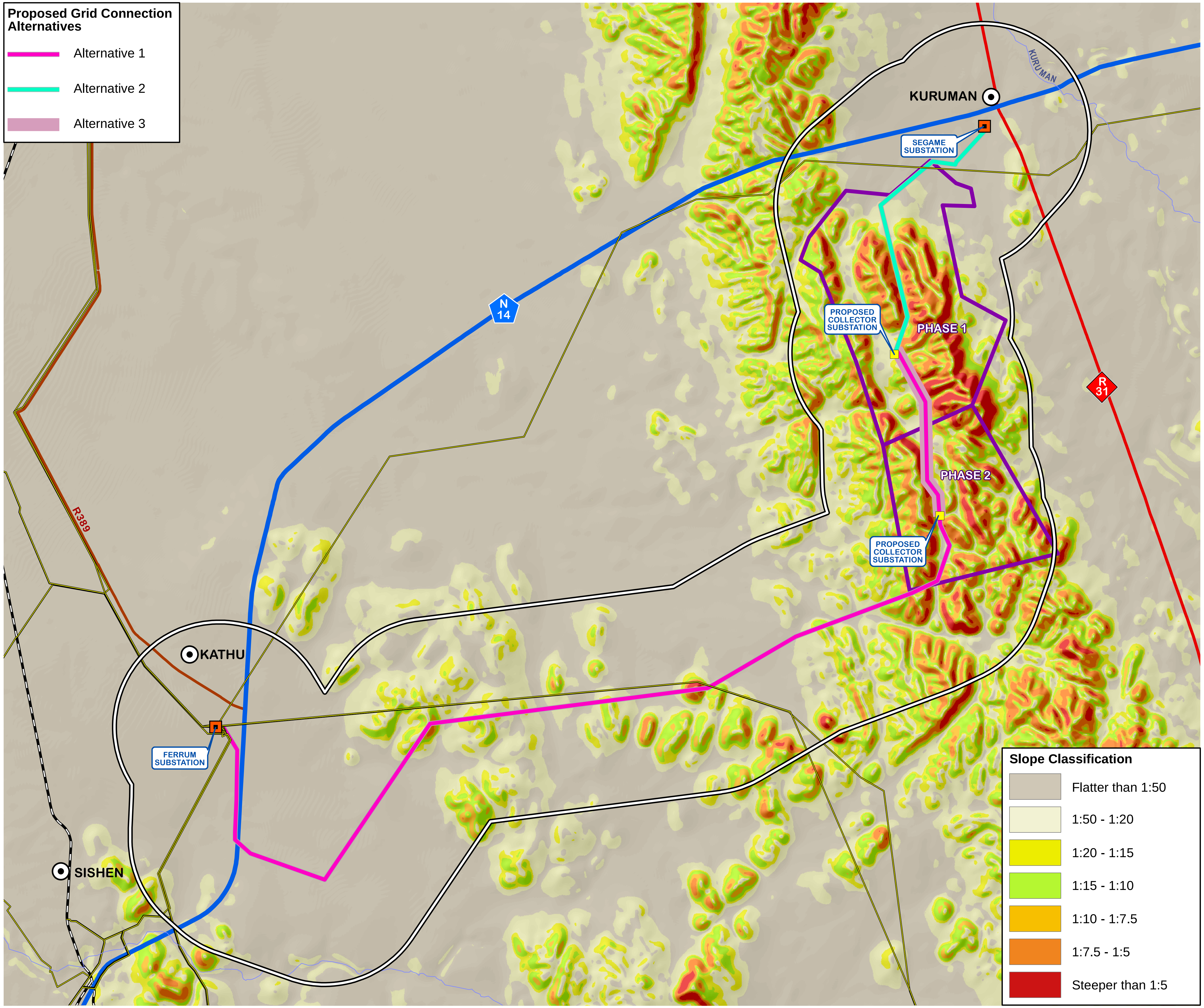

PROPOSED CONSTRUCTION OF A 132kV POWER LINE TO SERVE THE PROPOSED KURUMAN WIND ENERGY FACILITY

NEAR KURUMAN, NORTHERN CAPE PROVINCE

VISUAL ASSESSMENT: SLOPE CLASSIFICATION

Legend

- Main Towns
- National Route (N14)
- Main Arterial Route
- Main Road
- Railways
- Existing High Voltage Power Lines (>=132kV)
- Rivers
- Existing Substations
- Proposed Collector Substations
- Kuruman WEF Phases 1 and 2 Application Sites
- 5km Visual Assessment Zone

SOURCE:
ESKOM, 2012
NFEPA, 2011
NGI, 2014

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14869	KLS	20/06/2018
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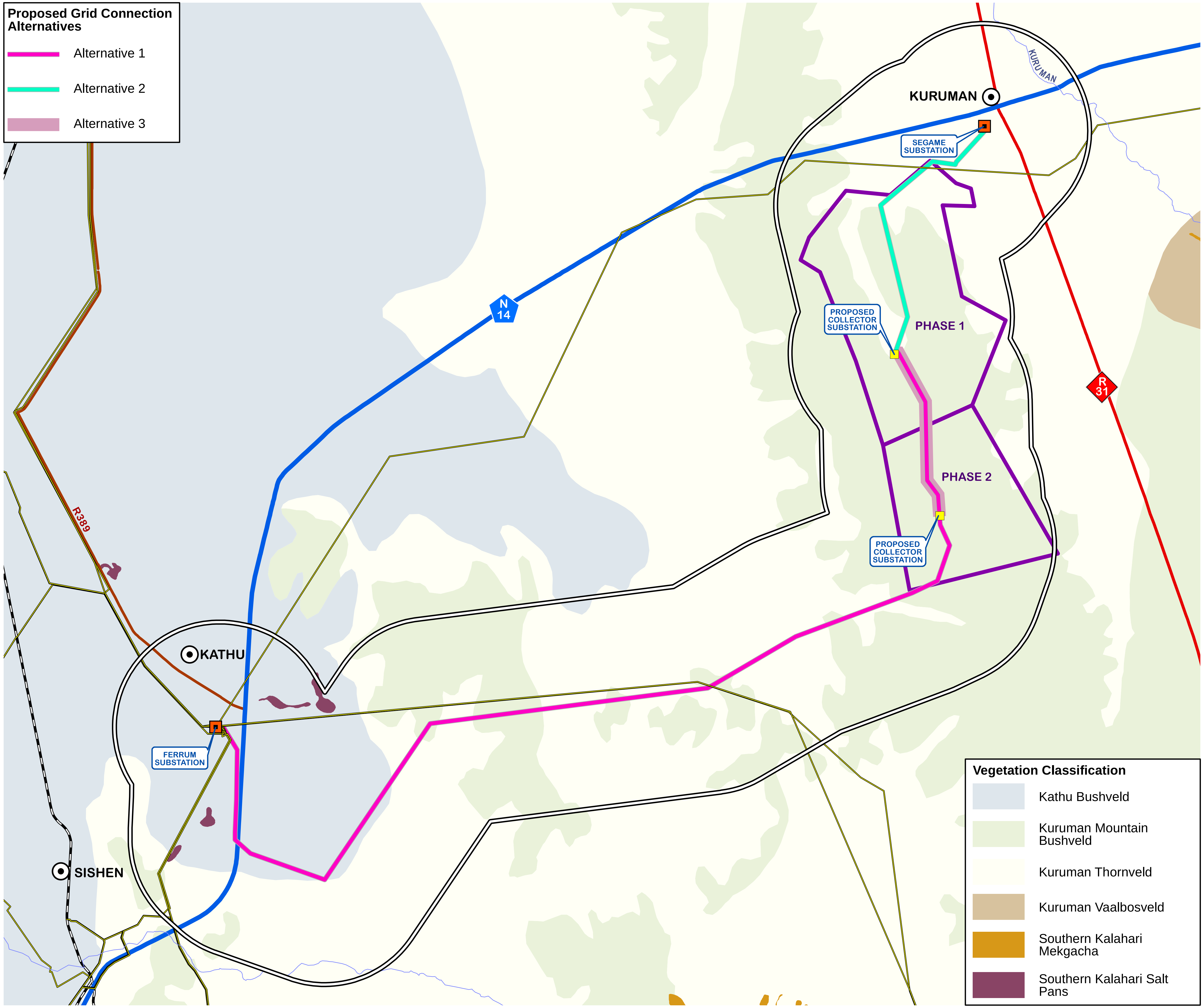

PROPOSED CONSTRUCTION OF A 132kV POWER LINE TO SERVE THE PROPOSED KURUMAN WIND ENERGY FACILITY

NEAR KURUMAN, NORTHERN CAPE PROVINCE

VISUAL ASSESSMENT: VEGETATION CLASSIFICATION

Legend

- Main Towns
- National Route (N14)
- Main Arterial Route
- Main Road
- Railways
- Existing High Voltage Power Lines (>=132kV)
- Rivers
- Existing Substations
- Proposed Collector Substations
- Kuruman WEF Phases 1 and 2 Application Sites
- 5km Visual Assessment Zone

SOURCE:
ESKOM, 2012
NFEPA, 2011
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Project No	Prepared By	Date
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Map Ref No	**Revision**	**Date**
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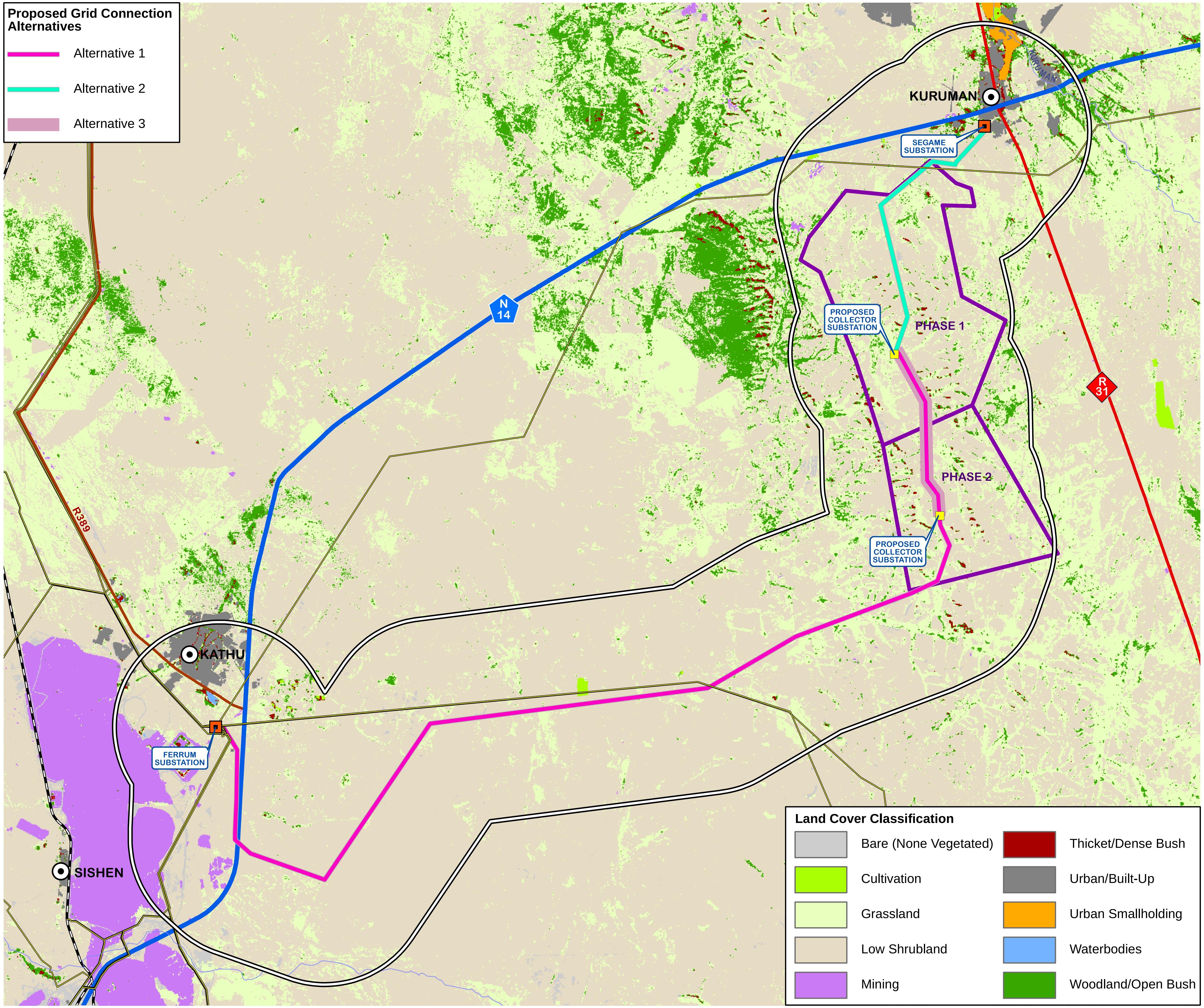

PROPOSED CONSTRUCTION OF A 132kV POWER LINE TO SERVE THE PROPOSED KURUMAN WIND ENERGY FACILITY

NEAR KURUMAN, NORTHERN CAPE PROVINCE

VISUAL ASSESSMENT: BROAD LAND COVER CLASSIFICATION

Legend

- Main Towns
- National Route (N14)
- Main Arterial Route
- Main Road
- Railways
- Existing High Voltage Power Lines (>=132kV)
- Rivers
- Existing Substations
- Proposed Collector Substations
- Kuruman WEF Phases 1 and 2 Application Sites
- 5km Visual Assessment Zone

SOURCE:
NFEPA, 2011
2013-2014 SA NATIONAL LAND COVER
(© GEOTERRAIMAGE - 2014)

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Project No	Prepared By	Date
14869	KLS	20/06/2018
Map Ref No	**Revision**	**Date**
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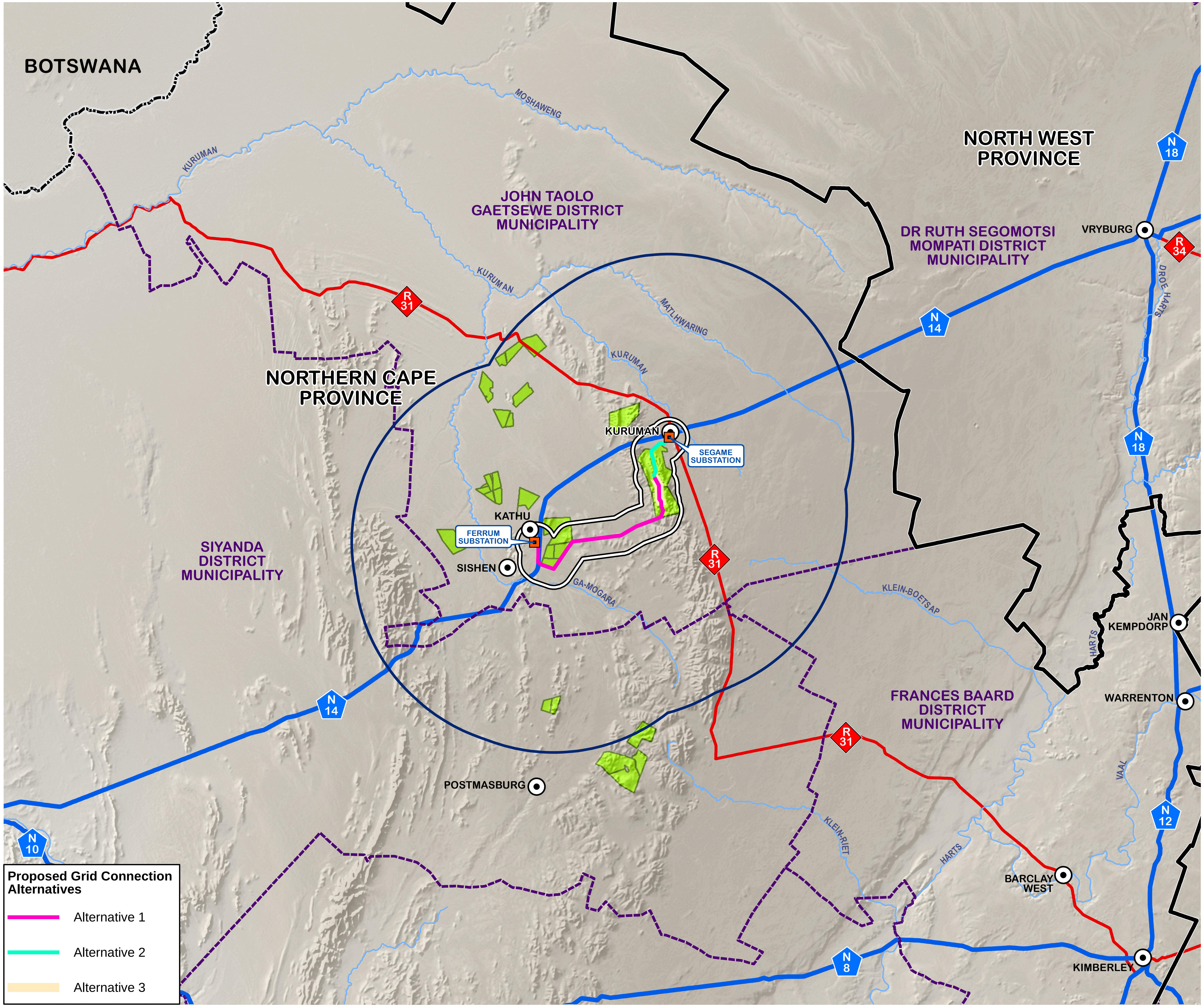

PROPOSED CONSTRUCTION OF A 132kV POWER LINE TO SERVE THE PROPOSED KURUMAN WIND ENERGY FACILITY

NEAR KURUMAN, NORTHERN CAPE PROVINCE

VISUAL ASSESSMENT: RENEWABLE ENERGY DEVELOPMENTS WITHIN 50KM RADIUS

Legend

- Main Towns
- Existing Substations
- National Boundary
- Provincial Boundaries
- District Municipal Boundaries
- National Routes
- Main Arterial Routes
- Main Rivers
- 5km Visual Assessment Zone
- 50km Radius
- Renewable Energy Application Sites

SOURCE:
MUNICIPAL DEMARCATION BOARD, 2011
NGI, 2014

N
0 10 20
Kilometers

SiVEST
ENVIRONMENTAL DIVISION
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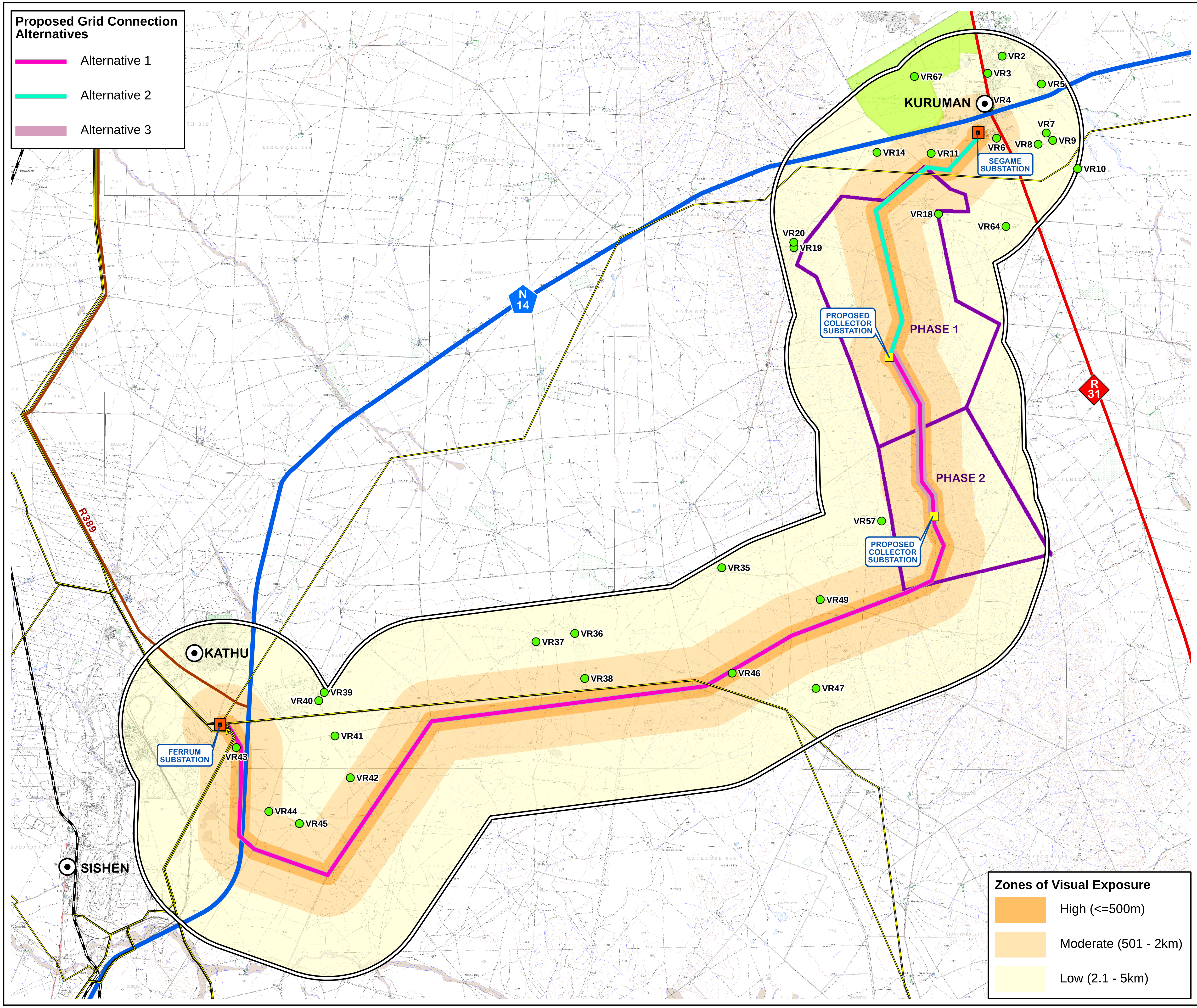
Project No	Prepared By	Date
14869	KLS	20/06/2018
Map Ref No	**Revision**	**Date**
14869/BA_09	0	



PROPOSED CONSTRUCTION OF A 132kV POWER LINE TO SERVE THE PROPOSED KURUMAN WIND ENERGY FACILITY

NEAR KURUMAN, NORTHERN CAPE PROVINCE

VISUAL ASSESSMENT: POTENTIALLY SENSITIVE VISUAL RECEPTOR LOCATIONS

Legend

- Main Towns
- National Route (N14)
- Main Arterial Route
- Main Road
- Railways
- Existing High Voltage Power Lines (>=132kV)
- Existing Substations
- Proposed Collector Substations
- Rivers
- Nature Reserve
- Kuruman WEF Phases 1 and 2 Application Sites
- 5km Visual Assessment Zone
- Potentially Sensitive Receptor Locations

SOURCE:
ESKOM, 2012
NFEPA, 2018
NGI, 2014

N
0 2 4
Kilometers

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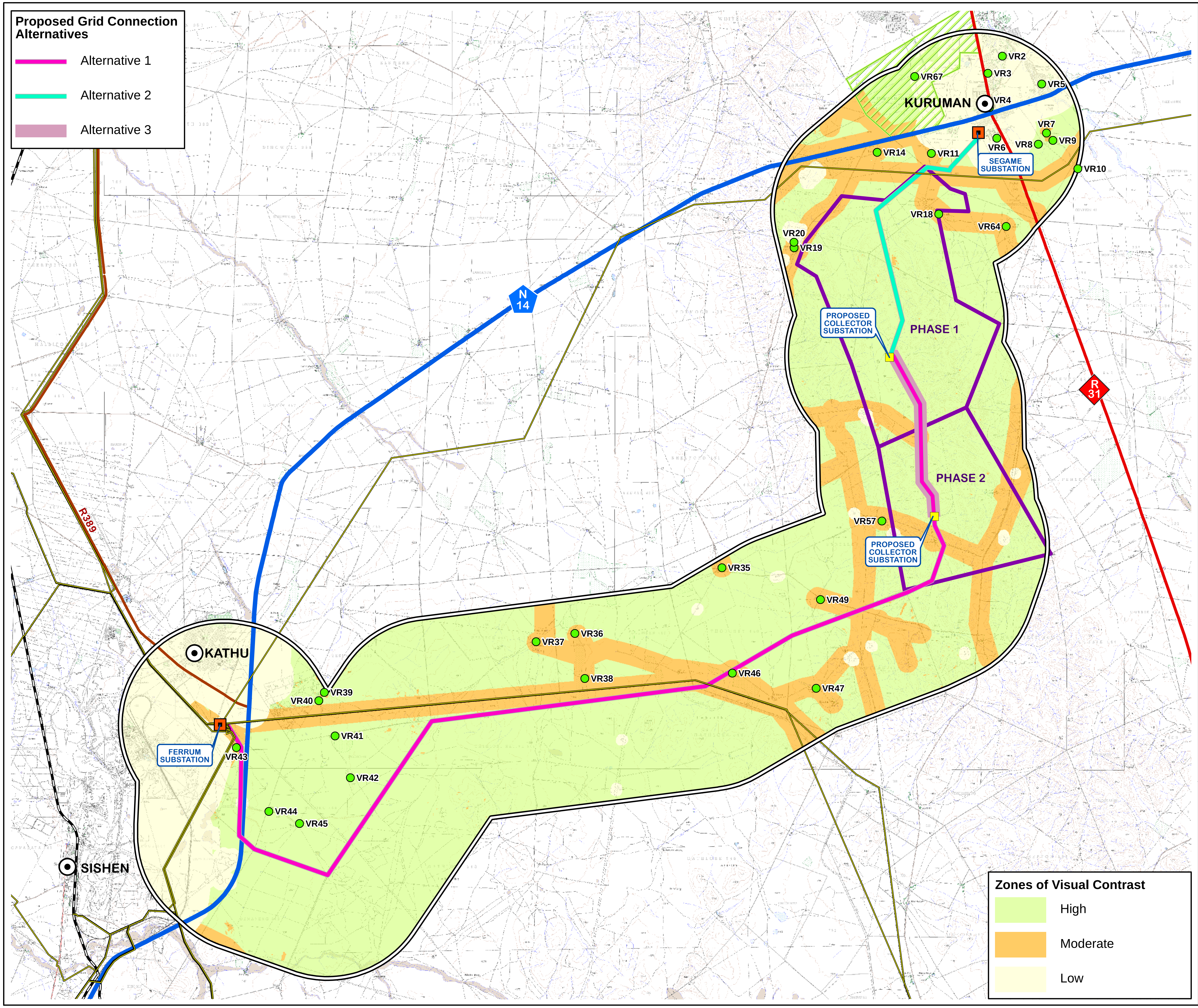
Project No	Prepared By	Date
14869	KLS	20/06/2018
Map Ref No	**Revision**	**Date**
14869/BA_07	0	



PROPOSED CONSTRUCTION OF A 132kV POWER LINE TO SERVE THE PROPOSED KURUMAN WIND ENERGY FACILITY

NEAR KURUMAN, NORTHERN CAPE PROVINCE

VISUAL ASSESSMENT: ZONES OF VISUAL CONTRAST

Legend

- Main Towns
- National Route (N14)
- Main Arterial Route
- Main Road
- Railways
- Existing High Voltage Power Lines (>=132kV)
- Existing Substations
- Proposed Collector Substations
- Rivers
- Nature Reserve
- Kuruman WEF Phases 1 and 2 Application Sites
- 5km Visual Assessment Zone
- Potentially Sensitive Receptor Locations

SOURCE:
ESKOM, 2012
NFEPA, 2018
NGI, 2014

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0 2 4
Kilometers

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Project No	Prepared By	Date
14869	KLS	20/06/2018
Map Ref No	**Revision**	**Date**
14869/BA_08	0	

Appendix C

SPECIALIST CV

CURRICULUM VITAE

Name	Andrea Gibb
Profession	Environmental Practitioner
Name of Firm	SiVEST SA (Pty) Ltd
Present Appointment	Senior Manager Environmental Division
Years with Firm	7 Years
Date of Birth	29 January 1985
ID Number	8501290020089
Nationality	South African

Education

Matriculated 2003, Full Academic Colours, Northcliff High School, Johannesburg, South Africa

Professional Qualifications

BSc (Hons) Environmental Management (University of South Africa 2008-2010)
Coursework**:** Project Management, Environmental Risk Assessment and Management, Ecological and Social Impact Assessment, Fundamentals of Environmental Science, Impact Mitigation and Management, Integrated Environmental Management Systems & Auditing, Integrated Environmental Management, Research Methodology.
Research Proposal**:** Golf Courses and the Environment

BSc Landscape Architecture (with distinction) (University of Pretoria 2004-2007)
Coursework: Core modules focused on; design, construction, environmental science, applied sustainability, shifts in world paradigms and ideologies, soil and plant science, environmental history, business law and project management.
Awards: Cave Klapwijk prize for highest average in all modules in the Landscape Architecture programme, ILASA book prize for the best Landscape Architecture student in third year design, Johan Barnard planting design prize for the highest distinction average in any module of plant science.

ArcGIS Desktop 1 (ESRI South Africa December 2010)
Environmental Impact Assessment (EIA) 2014 Legal Regime Workshop (Imbewu 2015)

Employment Record

Aug 2010 – to date	SiVEST SA (Pty) Ltd: Environmental Practitioner
Jan 2008 – July 2010	Cave Klapwijk and Associates: Environmental Assistant and Landscape Architectural Technologist
Feb 2006 – Dec 2006	Cave Klapwijk and Associates: Part time student

Language Proficiency

LANGUAGE	SPEAK	READ	WRITE
English	Fluent	Fluent	Fluent

Key Experience

Specialising in the field of Environmental Management and Visual Assessment.

Andrea has 10 years' work experience and is employed by SiVEST Environmental as the Senior Manager heading up the Johannesburg office. She is primarily involved with managing large scale multifaceted Environmental Impact Assessments (EIAs) and Basic Assessments (BAs) (incl. Amendment Applications), undertaken according to International Finance Corporation (IFC) standards and Equator Principles, within the renewable energy generation and electrical distribution sectors. Andrea has extensive experience in overseeing public participation and stakeholder engagement processes and has also been involved in environmental feasibility and sensitivity analyses. She further specialises in undertaking and overseeing visual impact and landscape character assessments.

<u>Skills include:</u>

- Project Management (MS Project)
- Environmental Impact Assessment (EIA)
- Basic Assessment (BA)
- Public Participation Management
- Visual Impact Assessment (VIA)
- Landscape Assessment
- Strategic Environmental Planning
- Documentation / Quality Control
- Project Level Financial Management

Projects Experience

<u>Aug 2010 – to date</u>

<u>ENVIRONMENTAL IMPACT ASSESSMENT (EIA) / BASIC ASSESSMENT (BA)</u>

- EIA for the proposed construction of the Grasskoppies Wind Farm near Loeriesfontein, Northern Cape Province.
- EIA for the proposed construction of the Ithemba Wind Farm near Loeriesfontein, Northern Cape Province.
- EIA for the proposed construction of the Hartebeest Leegte Wind Farm near Loeriesfontein, Northern Cape Province.
- EIA for the proposed construction of the !Xha Boom Wind Farm near Loeriesfontein, Northern Cape Province.
- Application for an Amendment of the Environmental Authorisation (EA) for the proposed construction of the Droogfontein II PV Plant near Kimberley, Northern Cape Province.
- Amendment and Resubmission of the FBAR for the Eskom Longdown Substation and Vyeboom 66kV Turn-in Power Lines near Villiersdorp, Western Cape Province.
- BA for the proposed construction of the Leeuwbosch Power Plant near Leeudoringstad, North West Province.
- BA for the proposed construction of the Wildebeestkuil Power Plant near Leeudoringstad, North West Province.
- EIA for the proposed development of the Tlisitseng 1 and 2 75MW Solar Photovoltaic (PV) Energy Facilities near Lichtenburg, North West Province.
- EIAs for the proposed development of the Sendawo 1, 2, and 3 75MW Solar PV Energy Facilities near Vryburg, North West Province.
- EIA for the proposed construction of the Sendawo Common Collector Substation and power line near Vryburg, North West Province.
- EIA for the proposed construction of the Aletta 140MW Wind Energy Facility near Copperton, Northern Cape Province.

- Application for an Amendment of the Environmental Authorisation (EA) for the proposed construction of the 100MW Limestone Solar Thermal Power Project near Danielskuil, Northern Cape Province.
- Applications for the Amendment of the EAs for the proposed construction of three 75MW solar PV facilities near Prieska, Northern Cape Province.
- Applications for the Amendment of the EAs for the proposed construction of the 75MW Arriesfontein and Wilger Solar Power Plants near Danielskuil, Northern Cape Province.
- Completion and submission of the final EIA report for the proposed Rooipunt PV Solar Power Park Phase 1 and proposed Rooipunt PV Solar Power Park Phase 2 near Upington, Northern Cape Province.
- EIAs for the proposed construction of the Helena 1, 2 and 3 75MW Solar PV Energy Facilities near Copperton, Northern Cape Province.
- EIA for the proposed construction of the Nokukhanya 75MW Solar PV Power Plant near Dennilton, Limpopo Province.
- EIA for the proposed development of the Dwarsrug Wind Farm near Loeriesfontein, Northern Cape Province.
- BA for the proposed construction of two 132kV power lines and associated infrastructure from the Redstone Solar Thermal Power Project site to the Olien MTS near Lime Acres, Northern Cape Province.
- BA for the proposed construction of two 132kV power lines and associated infrastructure from Silverstreams DS to the Olien MTS near Lime Acres, Northern Cape Province.
- BA for the proposed Construction of the SSS1 5MW Solar PV Plant on the Western Part of Portion 6 (Portion of Portion 5) of Farm Spes Bona 2355 near Bloemfontein, Free State Province.
- BA for the proposed Construction of the SSS2 5MW Solar PV Plant on the Eastern Part of Portion 6 (Portion of Portion 5) of Farm Spes Bona 2355 near Bloemfontein, Free State Province.
- BA for the proposed Mookodi Integration Phase 2: Proposed Construction of a 132kV power line from the proposed Bophirima Substation to the existing Schweizer-Reneke Substation, North West Province.
- BA for the proposed Mookodi Integration Phase 2: Proposed Construction of a 132kV power line from the Mookodi Substation to the existing Magopela Substation, North West Province.
- BA for the proposed Mookodi Integration Phase 2: Proposed Construction of the Mookodi - Ganyesa 132kV power line, proposed Ganyesa Substation and Havelock LILO, North West Province.
- Amendment of the Final Environmental Impact Report for the Proposed Mookodi 1 Integration Project near Vryburg, North West Province.
- BA for the proposed 132kV power line and associated infrastructure for the proposed Redstone Solar Thermal Energy Plant near Lime Acres, Northern Cape Province.
- BA for the proposed construction of a 132kV power line and substation associated with the 75MW PV Plant on the Farm Droogfontein (PV 3) in Kimberley, Northern Cape Province.
- BA for the proposed establishment of a Learning and Development Retreat and an Executive Staff and Client Lodge at Mogale’s Gate, Gauteng Province.
- Application for an Amendment of the EA to increase the output of the proposed 40MW PV Facility on the farm Mierdam to 75MW, Northern Cape Province.
- BA for the proposed construction of a power line and substation near Postmasburg, Northern Cape Province.
- BA for the proposed West Rand Strengthening Project – 400kV double circuit power line and substation extension in the West Rand, Gauteng.
- EIA for the proposed construction of a wind farm and PV plant near Prieska, Northern Cape Province.
- Public Participation assistance as part of the EIA for the proposed Thyspunt Transmission Lines Integration Project – EIA for the proposed construction of 5 x 400kV transmission power lines between Thyspunt to Port Elizabeth, Eastern Cape Province.
- EIA assistance for the proposed construction of three Solar Power Plants in the Northern Cape Province.

- Public Participation as part of the EIA for the proposed Delareyille Kopela Power Line and Substation, North West Province.
- Public Participation as part of the EIA for the Middelburg Water Reclamation Project, Mpumalanga Province.

VISUAL IMPACT ASSESSMENT (VIA)

- VIA for the proposed construction of the Grasskoppies Wind Farm near Loeriesfontein, Northern Cape Province.
- VIA for the proposed construction of the Ithemba Wind Farm near Loeriesfontein, Northern Cape Province.
- VIA for the proposed construction of the Hartebeest Leegte Wind Farm near Loeriesfontein, Northern Cape Province.
- VIA for the proposed construction of the !Xha Boom Wind Farm near Loeriesfontein, Northern Cape Province.
- VIA for the proposed Phezukomoya Wind Energy Facility near Noupoort, Northern Cape Province.
- VIA for the proposed San Kraal Wind Energy Facility near Noupoort, Northern Cape Province
- VIA for the proposed Assagay Valley Mixed Use Development, KwaZulu-Natal Province.
- VIA for the proposed Kassier Road North Mixed Use Development, KwaZulu-Natal Province.
- VIA for the proposed construction of a power line and associated infrastructure for the proposed Kalkaar Solar Thermal Power Plant near Kimberley, Free State and Northern Cape Provinces.
- VIA (Scoping Phase) for the proposed construction of a 3000MW Wind Farm and associated infrastructure near Richmond, Northern Cape Province.
- VIA for the proposed construction of the Aletta 140MW Wind Energy Facility near Copperton, Northern Cape Province.
- VIA for the proposed construction of a power line and associated infrastructure for the proposed Rooipunt Solar Thermal Power Plant near Upington, Northern Cape Province.
- VIAs (Impact Phase) for the proposed construction of the Sendawo 1, 2 and 3 solar PV energy facilities near Vryburg, North West Province.
- VIA (Impact Phase) for the proposed construction of the Sendawo substation and associated power line near Vryburg, North West Province.
- VIAs (Impact Phase) for the proposed construction of the Tlisitseng 1 and 2 solar PV energy facilities near Lichtenburg, North West Province.
- VIA for the proposed construction of the Tlisitseng substation and associated 132kV power line near Lichtenburg, North West Province.
- VIA (Scoping Phase) for the proposed construction of the Sendawo substation and associated power line near Vryburg, North West Province.
- VIA (Scoping Phase) for the proposed construction of the Sendawo 1, 2 and 3 solar PV energy facilities near Vryburg, North West Province.
- VIA (Scoping Phase) for the proposed construction of the Tlisitseng 1 and 2 solar PV energy facilities near Lichtenburg, North West Province.
- Visual recommendations for Phase 1 of the proposed Renishaw Estate Mixed Use Development, KwaZulu-Natal Province.
- VIA for the proposed Tinley Manor South Banks Development, KwaZulu-Natal Province.
- VIAs (Impact Phase) for the proposed construction of the Helena 1, 2 and 3 75MW Solar PV Energy Facilities near Copperton, Northern Cape Province.
- VIA (Scoping Phase) for the proposed construction of the Helena 1, 2 and 3 75MW Solar PV Energy Facilities near Copperton, Northern Cape Province.
- Visual Due Diligence Report for the possible rapid rail extensions to the Gauteng network, Gauteng Province.
- Visual Status Quo and Constraints Report for the possible rapid rail extensions to the Gauteng network, Gauteng Province.
- VIA for the proposed agricultural components of the Integrated Sugar Project in Nsoko, Swaziland.

- VIA for the proposed Tweespruit to Welroux power lines and substation, Free State Province.
- VIA for the proposed construction of the Nokukhanya 75MW Solar PV Power Plant near Dennilton, Limpopo Province.
- VIA (Impact Phase) for the proposed development of the Dwarsrug Wind Farm near Loeriesfontein, Northern Cape Province.
- VIA for the proposed amendment to the authorised power line route from Hera Substation to Westgate Substation, Gauteng Province.
- VIA (Impact Phase) for the Eastside Junction Mixed Use Development near Delmas, Mpumalanga Province.
- VIA for the proposed construction of two 132kV power lines and associated infrastructure from the Redstone Solar Thermal Power Project site to the Olien MTS near Lime Acres, Northern Cape Province.
- VIA for the proposed construction of two 132kV power lines and associated infrastructure from Silverstreams DS to the Olien MTS near Lime Acres, Northern Cape Province.
- VIA (Scoping Phase) for the proposed development of the Dwarsrug Wind Farm near Loeriesfontein, Northern Cape Province.
- VIA for the proposed Rorqual Estate Development near Park Rynie on the South Coast of KwaZulu Natal.
- VIA (Scoping Phase) for the proposed construction of a Coal-fired Power Station, Coal Mine and Associated Infrastructure near Colenso, KwaZulu-Natal Province.
- VIA for the proposed Mookodi Integration Phase 2: Proposed Construction of the Mookodi - Ganyesa 132kV power line, proposed Ganyesa Substation and Havelock LILO, North West Province.
- VIA for the proposed construction of the Duma transmission substation and associated Eskom power lines, KwaZulu-Natal Province.
- VIA for the proposed construction of the Madlanzini transmission substation and associated Eskom power lines, Mpumalanga Province.
- VIA for the proposed rebuild of the 88kV power line from Normandie substation to Hlungwane substation, Mpumalanga and KwaZulu-Natal Provinces.
- VIA for the proposed construction of the Nzalo transmission substation and associated Eskom power lines, KwaZulu-Natal Province.
- VIA for the proposed construction of the Sheepmoor traction substation with two 20MVA transformer bays and a new associated 88kV turn-in power line, Mpumalanga Province.
- VIA for the proposed rebuild of the 88kV power line from Uitkoms substation to Antra T-off, Mpumalanga Province.
- VIA for the proposed rebuild of the 88kV power line from Umfolozi substation to Eqwasha traction substation including an 88kV turn-in power line to Dabula traction substation, Kwazulu-Natal Province.
- VIA for the proposed construction of the new 88/25kV Vryheid traction substation with two 20MVA transforma bays and a new associated 88kV turn-in power line, KwaZulu-Natal Province.
- VIA for the proposed construction of a 132kV power line and substation associated with the 75MW PV Plant on the Farm Droogfontein (PV 3) in Kimberley, Northern Cape Province.
- VIA (Impact Phase) for the proposed Construction of a Solar PV Power Plant near De Aar, Northern Cape Province.
- VIA for the (Impact Phase) proposed Construction of the Renosterberg Wind Farm near De Aar, Northern Cape Province.
- VIA for the (Impact Phase) proposed Construction of the Renosterberg Solar PV Power Plant near De Aar, Northern Cape Province.
- VIA for the proposed construction of a 132kV power line for the Redstone Thermal Energy Plant near Lime Acres, Northern Cape Province.
- VIA for the proposed Mookodi Integration phase 2 132kV power lines and Ganyesa substation near Vryburg, North West Province.
- VIA for the proposed 132kV power lines associated with the PV Plants on Droogfontein Farm near Kimberley, Northern Cape Province.
- VIA (Scoping phase) for the Eastside Junction Mixed Use Development near Delmas, Mpumalanga Province.

- VIA for the proposed development of a learning and development retreat and an executive and staff lodge at Mogale's Gate, Gauteng Province.
- VIA for the proposed construction of a substation and 88kV power line between Heilbron (via Frankfort) and Villiers, Free State Province.
- Visual Status Quo Assessment for the Moloto Development Corridor Feasibility Study in the Gauteng Province, Limpopo Province and Mpumalanga Province.
- VIA the West Rand Strengthening Project – 400kV double circuit power line and substation extension in the West Rand, Gauteng.
- VIA for the proposed construction of a wind farm and solar photovoltaic plant near Loeriesfontein, Northern Cape Province.
- Visual sensitivity mapping exercise for the proposed Mogale's Gate Expansion, Gauteng.
- VIA (Scoping Phase) for the proposed Renosterberg Solar PV Power Plant and Wind Farm near De Aar, Northern Cape Province.
- Scoping level VIAs for the proposed construction of three Solar Power Plants in the Northern Cape Province.
- VIAs for the Spoornet Coallink Powerline Projects in KZN and Mpumalanga.
- Visual Constraints Analysis for the proposed establishment of four Wind Farms in the Eastern and Northern Cape Province.
- VIA (Scoping Phase) for the proposed development of a solar energy facility in De Aar, Northern Cape.
- VIA (Scoping Phase) for the proposed development of a solar energy facility in Kimberley, Northern Cape.

STRATEGIC ENVIRONMENTAL PLANNING

- Assistance with the Draft Environmental Management Framework for the Mogale City Local Municipality, Gauteng Province.
- Sensitivity Negative Mapping Analysis for the proposed Mogale's Gate Development, Gauteng Province.

Name	Kerry Lianne Schwartz
Profession	GIS Specialist
Name of Firm	SiVEST SA (Pty) Ltd
Present Appointment	Senior GIS Consultant: Environmental Division
Years with Firm	30 Years
Date of Birth	21 October 1960
ID No.	6010210231083
Nationality	South African

Professional Qualifications

BA (Geography), University of Leeds 1982

Membership to Professional Societies

South African Geomatics Council – GTc GISc 1187

Employment Record

1994 – Present	SiVEST SA (Pty) Ltd - Environmental Division: GIS/Database Specialist.
1988 - 1994	SiVEST (formerly Scott Wilson Kirkpatrick): Town Planning Technician.
1984 – 1988	Development and Services Board, Pietermaritzburg: Town Planning Technician.

Language Proficiency

LANGUAGE	SPEAK	READ	WRITE
English	Fluent	Fluent	Fluent

Key Experience

Kerry is a GIS specialist with more than 20 years' experience in the application of GIS technology in various environmental, regional planning and infrastructural projects undertaken by SiVEST.

Kerry's GIS skills have been extensively utilised in projects throughout South Africa in other Southern African Countries. These projects have involved a range of GIS work, including:

- Design, compilation and management of a demographic, socio-economic, land use, environmental and infrastructural databases.
- Collection, collation and integration of data from a variety of sources for use on specific projects.
- Manipulation and interpretation of both spatial and alphanumeric data to provide meaningful inputs for a variety of projects.
- Production of thematic maps and graphics.
- Spatial analysis and 3D modelling, including visual and landscape assessments.

Projects Experience

STRATEGIC PLANNING PROJECTS

Provision of database, analysis and GIS mapping support for the following:

- Water Plan 2025: Socio-economic, Land Use and Demographic Update – Umgeni Water (KwaZulu-Natal).
- Eskom Strategic Plan – Eskom (KwaZulu-Natal).
- Umgeni Water Quality Management Plan – Department of Water Affairs and Umgeni Water (KwaZulu-Natal).
- KwaZulu-Natal Development Perspective – Department of Economic Affairs (KwaZulu-Natal).
- Indlovu Regional Integrated Plan – Department of Local Government and Housing (KwaZulu-Natal).
- Umgeni Water and Sanitation Needs Analysis – Umgeni Water (KwaZulu-Natal).
- Metro Waste Water Management Plan – Durban Waste Water management, City of Durban (KwaZulu-Natal).
- KwaZulu-Natal Electrification Prioritisation Model – Eskom (KwaZulu-Natal).
- Umzinyathi Regional Development Plan – Umzinyathi Regional Council (KwaZulu-Natal).
- GIS driven model to assess future population growth in quaternary catchments under different growth scenarios – Umgeni Water (KwaZulu-Natal).
- Ubombo Master Water Plan Study – Mhlathuze Water Board (KwaZulu-Natal).
- Development strategy for local economic development and social reconstruction of the Germiston-Daveyton Activity Corridor – Eastern Gauteng Services Council (Gauteng).
- Structure Plan for the Cities of Beira and Dondo in Mozambique – World Bank.
- Land identification study for low cost housing in the Indlovu Region – Indlovu Regional Council (KwaZulu-Natal).
- Local Development Plan for Manzini – Manzini Town Council (Swaziland).
- Indlovu Project Prioritisation Model – Indlovu Regional Council (KwaZulu-Natal).
- Structure Plans for the Cities of Ndola and Luanshya - Ministry of Local Government and Housing (Zambia).
- Database development for socio-economic and health indicators arising from Social Impact Assessments conducted for the Lesotho Highlands Development Association – Lesotho.
- Development Plan for the adjacent towns of Kasane and Kazungula - Ministry of Local Government, Land and Housing (Botswana).
- Development Plan for the rural village of Hukuntsi - Ministry of Local Government, Land and Housing (Botswana).
- Provision of data platform for the spatial analysis of water supply, demand and affordability in Bulawayo – City of Bulawayo and NORAID (Zimbabwe).
- Integrated Development Plans for various District and Local Municipalities including:
  - Nquthu Local Municipality (KwaZulu-Natal)
  - Newcastle Local Municipality (KwaZulu-Natal)
  - Amajuba District Municipality (KwaZulu-Natal)
  - Jozini Local Municipality (KwaZulu-Natal)
  - Umhlabuyalingana Local Municipality (KwaZulu-Natal)
- uMhlathuze Rural Development Initiative – uMhlathuze Local Municipality (KwaZulu-Natal).
- Rural roads identification – uMhlathuze Local Municipality (KwaZulu-Natal).
- Mapungubwe Tourism Initiative – Development Bank (Limpopo Province).
- Northern Cape Tourism Master Plan – Department of Economic Affairs and Tourism (Northern Cape Province).

- Spatial Development Framework for Gert Sibande District Municipality (Mpumalanga) in conjunction with more detailed spatial development frameworks for the 7 Local Municipalities in the District, namely:
  - Albert Luthuli Local Municipality
  - Msukaligwa Local Municipality
  - Mkhondo Local Municpality
  - Pixley Ka Seme Local Municipality
  - Dipaleseng Local Municipality
  - Govan Mbeki Local Municipality
  - Lekwa Local Municipality
- Land Use Management Plans/Systems (LUMS) for various Local Municipalities including:
  - Nkandla Local Municipality (KwaZulu-Natal)
  - Hlabisa Local Municipality (KwaZulu-Natal)
  - uPhongolo Local Municipality (KwaZulu-Natal)
  - uMshwathi Local Municipality
- Spatial Development Framework for uMhlathuze Local Municipality (KwaZulu-Natal).
- Spatial Development Framework for Greater Clarens – Maloti-Drakensberg Transfrontier Park (Free State).
- Land use study for the Johannesburg Inner City Summit and Charter – City of Johannesburg (Gauteng).
- Port of Richards Bay Due Diligence Investigation – Transnet
- Jozini Sustainable Development Plan – Jozini Local Municipality (KwaZulu-Natal)
- Spatial Development Framework for Umhlabuyalingana Local Municipality (KwaZulu-Natal)

BUILT INFRASTRUCTURE

- EIA and EMP for a 9km railway line and water pipeline for manganese mine – Kalagadi Manganese (Northern Cape Province).
- EIA and EMP for 5x 440kV Transmission Lines between Thyspunt (proposed nuclear power station site) and several substations in the Port Elizabeth area – Eskom (Eastern Cape Province).
- Initial Scoping for the proposed 750km multi petroleum products pipeline from Durban to Gauteng/Mpumalanga – Transnet Pipelines.
- Detailed EIA for multi petroleum products pipeline from Kendall Waltloo, and from Jameson Park to Langlaagte Tanks farms –Transnet Pipelines.
- Environmental Management Plan for copper and cobalt mine (Democratic Republic of Congo).
- EIA and Agricultural Feasibility study for Miwani Sugar Mill (Kenya).
- EIAs for Concentrated Solar and Photovoltaic power plants and associated infrastructure (Northern Cape, Free State, Limpopo and North West Province).
- EIAs for Wind Farms and associated infrastructure (Northern Cape and Western Cape).
- Basic Assessments for 132kV Distribution Lines (Free State, KwaZulu-Natal, Mpumalanga and North West Province).
- Environmental Assessment for the proposed Moloto Development Corridor (Limpopo).
- Environmental Advisory Services for the Gauteng Rapid Rail Extensions Feasibility Project.
- Environmental Screening for the Strategic Logistics and Industrial Corridor Plan for Strategic Infrastructure Project 2, Durban-Free State-Gauteng Development Region.

STATE OF THE ENVIRONMENT REPORTING

- 2008 State of the Environment Report for City of Johannesburg.

- Biodiversity Assessment – City of Johannesburg.

STRATEGIC ENVIRONMENTAL ASSESSMENTS AND ENVIRONMENTAL MANAGEMENT FRAMEWORKS

- SEA for Greater Clarens – Maloti-Drakensberg Transfrontier Park (Free State).
- SEA for the Marula Region of the Kruger National Park, SANParks.
- SEA for Thanda Private Game Reserve (KwaZulu-Natal).
- SEA for KwaDukuza Local Municipality (KwaZulu-Natal).
- EMF for proposed Renishaw Estate (KwaZulu-Natal).
- EMF for Mogale City Local Municipality, Mogale City Local Municipality (Gauteng).
- SEA for Molemole Local Municipality, Capricorn District Municipality (Limpopo).
- SEA for Blouberg Local Municipality, Capricorn District Municipality (Limpopo).

WETLAND STUDIES

- Rehabilitation Planning for the Upper Klip River and Klipspruit Catchments, City of Johannesburg (Gauteng).
- Wetland assessments for various Concentrated Solar and Photovoltaic power plants and associated infrastructure (Limpopo, Northern Cape, North West Province and Western Cape).
- Wetland assessments for Wind Farms and associated infrastructure (Northern Cape and Western Cape).
- Wetland assessments for various 132kV Distribution Lines (Free State, KwaZulu-Natal, Mpumalanga and North West Province).

VISUAL IMPACT ASSESSMENTS

- VIA for the redevelopment of the Newmarket Racecourse in Alberton (Gauteng).
- VIA for the Thyspunt Transmission Lines Integration Project (Eatern Cape).
- VIA s for various Solar Power Plants (Northern Cape, Free State, Limpopo and North West Province).
- VIAs for various Wind Farms (Northern Cape and Western Cape).
- VIAs for various 132kV Distribution Lines (Free State, KwaZulu-Natal, Mpumalanga and North West Province).
- VIA for the proposed Rorqual Estate Development near Park Rynie on the South-Coast of KwaZulu-Natal Province.
- VIA for the proposed Assagay Valley Mixed Use Development (KwaZulu-Natal).
- VIA for the proposed Kassier Road North Mixed Use Development (KwaZulu-Natal).
- VIA for the proposed Tinley Manor South Banks Development (KwaZulu-Natal).
- VIA for the proposed Tinley Manor South Banks Beach Enhancement Solution, (KwaZulu-Natal).
- VIAs for the proposed Mlonzi Hotel and Golf Estate Development (Eastern Cape Province).
- VIA for the Eastside Junction Mixed-use development near Delmas (Mpumalanga).
- Visual sensitivity mapping exercise for the proposed Mogale’s Gate Lodge Expansion (Gauteng).
- Analysis phase visual assessment for the proposed Renishaw Estate Environmental Management Framework in the Scottburgh Area (KwaZulu-Natal).
- Landscape Character Assessment for Mogale City Environmental Management Framework (Gauteng).

CURRICULUM VITAE

Name	Stephan Hendrik Jacobs
Profession	Environmentalist
Name of Firm	SiVEST SA (Pty) Ltd
Present Appointment	Environmental Consultant
Years with Firm	3 years
Date of Birth	28 May 1991
ID Number	9105285065080
Nationality	South African

Education

Pretoria Boys High, Pretoria, South Africa, Matriculated 2009.

Professional Qualification

- B.Sc. Hons Environmental Management and Analysis, (Post Graduate) University Of Pretoria Honours (2014).
- B.Sc. Environmental Sciences (Undergraduate) University Of Pretoria (2012-2013)

Employment Record

May 2015 – current	SiVEST SA (Pty) Ltd – Graduate Environmental Consultant
Nov 2014 – Feb 2015	Sodwana Bay Fishing Charters – Assistant Manager
Oct 2014 – Mar 2015	Ufudu Turtle Tours – Tour Guide

Language Proficiency

LANGUAGE	SPEAK	READ	WRITE
English	Excellent	Excellent	Excellent
Afrikaans	Good	Good	Good

Key Experience

Stephan joined SiVEST in May 2015 and holds the position of Environmental Consultant in the Johannesburg office.

Stephan specialises in the field of Environmental Management and has been extensively involved in Environmental Impact Assessment (EIA) and Basic Assessment (BA) processes for various types of projects / developments. As such, Stephan has vast experience with regards to the compilation of Environmental Impact Assessments (EIAs) and Basic Assessments (BAs). Additionally, Stephan has extensive experience in undertaking public participation and stakeholder engagement processes. Stephan has also assisted extensively in the undertaking of field work and the compilation of reports for specialist studies such as Surface Water and Visual Impact Assessments. Stephan also has experience in Environmental Compliance and Auditing and has acted as an Environmental Control Officer (ECO) for several infrastructure projects.

Stephan has been educated and achieved his degrees (B.Sc. and B.Sc. Hons) at the University of Pretoria in Environmental Sciences (Environmental Management & Analysis).

Skills include:
- Strong computer skills (Work, excel, PowerPoint etc.);
- Strong Proposal and report writing skills;
- Report compilation skills for Environmental Impact Assessments (EIAs) and Basic Assessments (BAs);
- Report compilation skills for Environmental Management Plans/Programmes (EMPr);
- Compilation and conducting Visual Impact Assessments;
- Assisting in Surface Water / Wetland Delineations and Assessments.

Key experience includes:
- Environmental Impact Assessment (EIA) of small, medium and large-scale infrastructure projects,
- Basic Assessment (BA), of small, medium and large-scale infrastructure projects,
- Environmental Management Plans (EMPr), of small, medium and large-scale infrastructure projects,
- Undertaking of Public Participation and Stakeholder Engagement Processes
- Proposal and tender compilation,
- Environmental Compliance and Auditing (ECO);
- Various site inspections, and
- Visual Impact Assessments (Field work and report compilation).

Projects Experience

Stephan is responsible for the following activities: report writing, proposal writing, assisting in specialist surface water delineation and functional assessments, assisting in visual impact assessments and environmental compliance and auditing procedures. Current and completed projects / activities are outlined in detail below:

- Environmental Control Officer (ECO) for the Polokwane Integrated Rapid Public Transport System (IRPTS), Limpopo Province.

- Basic Assessment (BA) for the construction of a Non-Motorised Transport (NMT) Training and Recreational Park adjacent to the Peter Mokaba Stadium in Polokwane, Limpopo Province.

- Basic Assessment (BA) for the Proposed Expansion of the Tissue Manufacturing Capacity at the Twinsaver Kliprivier Operations Base, Gauteng Province.

- Basic Assessment (BA) for the Proposed Construction of a New SPAR Distribution Centre on Erf 1092 at Redhouse in Port Elizabeth, Eastern Cape Province.

- Basic Assessment (BA) for the Proposed Construction of the Graskoppies Substation, Linking Substation and Associated 132kV Power Line near Loeriesfontein, Northern Cape Province.

- Basic Assessment (BA) for the Proposed Construction of the Hartebeest Leegte Substation, Linking Substation and Associated 132kV Power Line near Loeriesfontein, Northern Cape Province.

- Basic Assessment (BA) for the Proposed Construction of the Ithemba Substation, Linking Substation and Associated 132kV Power Line near Loeriesfontein, Northern Cape Province.

- Basic Assessment (BA) for the Proposed Construction of the !Xha Boom Substation, Linking Substation and Associated 132kV Power Line near Loeriesfontein, Northern Cape Province

- Environmental Impact Assessment (EIA) for the Proposed Construction of the Graskoppies Wind Farm near Loeriefontein, Northern Cape Province.

- Environmental Impact Assessment (EIA) for the Proposed Construction of the Hartebeest Leegte Wind Farm near Loeriefontein, Northern Cape Province.
- Environmental Impact Assessment (EIA) for the Proposed Construction of the Ithemba Wind Farm near Loeriefontein, Northern Cape Province.
- Environmental Impact Assessment (EIA) for the Proposed Construction of the !Xha Boom Wind Farm near Loeriefontein, Northern Cape Province.
- Environmental Control Officer (ECO) for Phase 1 and Phase 2 of the Newmarket Retail Development, Gauteng Province.
- Environmental Control Officer (ECO) for the proposed NuPay Office Block development at the Newmarket Retail Development, Gauteng Province.
- Environmental Control Officer (ECO) for the proposed Construction of the Decathlon Building at the Newmarket Retail Development, Gauteng Province.
- Environmental Control Officer (ECO) for the External Road Upgrades at the Newmarket Retail Development, Gauteng Province.
- Environmental Review of the Xakwa Coal Operations, adjacent to the proposed Eastside Junction Development.
- Environmental Due Diligence for the Woodlands and Harrowdene Office Parks in Woodmead, Gauteng Province.
- Visual Impact Assessment for the Helena Solar PV Plant, Northern Cape Province.
- Visual Impact Assessment for the Nsoko Msele Integrated Sugar Project, Swaziland.
- Visual Impact Assessments for the proposed construction of the Sendawo Solar 1, Sendawo Solar 2 and Sendawo Solar 3 Photovoltaic (PV) Energy Facilities near Vryburg, North West Province.
- Visual Impact Assessments for the proposed construction of the Sendawo Substation and Associated 400kV Power Line near Vryburg, North West Province.
- Visual Impact Assessments for the proposed construction of the Tlisitseng Solar 1 and Tlisitseng Solar 2 Photovoltaic (PV) Energy Facilities near Lichtenburg, North West Province.
- Visual Impact Assessment for the proposed construction of the Tlisitseng 1 132kV Substation and associated 132kV Power Line near Lichtenburg, North West Province.
- Visual Impact Assessment for the proposed construction of the Tlisitseng 2 132kV Substation and associated 132kV Power Line near Lichtenburg, North West Province.
- Visual Impact Assessment for the proposed construction of the 3000MW PhilCo Green Energy Wind Farm and Associated Infrastructure near Richmond, Northern Cape Province.
- Visual Impact Assessment for the proposed construction of the Aletta 140MW Wind Energy Facility neat Copperton, Northern Cape Province.
- Visual Impact Assessment for the proposed construction of the Aletta 132kV Substation and associated 132kV Power Line near Copperton, Northern Cape Province.

- Visual Impact Assessment for the proposed construction of the Eureka 140MW Wind Energy Facility and associated Infrastructure near Copperton, Northern Cape Province.
- Visual Impact Assessment for the proposed construction of the Eureka 400kV Substation and 400kV Power Line neat Copperton, Northern Cape Province.
- Visual Impact Assessment for the Proposed Construction of the Graskoppies Wind Farm near Loeriesfontein, Northern Cape Province.
- Basic Visual Impact Assessment for the Proposed Construction of the Graskoppies Substation, Linking Substation and Associated 132kV Power Line near Loeriesfontein, Northern Cape Province.
- Visual Impact Assessment for the Proposed Construction of the Hartebeest Leegte Wind Farm near Loeriesfontein, Northern Cape Province.
- Basic Visual Impact Assessment for the Proposed Construction of the Hartebeest Leegte Substation, Linking Substation and Associated 132kV Power Line near Loeriesfontein, Northern Cape Province.
- Visual Impact Assessment for the Proposed Construction of the Ithemba Wind Farm near Loeriesfontein, Northern Cape Province.
- Basic Visual Impact Assessment for the Proposed Construction of the Ithemba Substation, Linking Substation and Associated 132kV Power Line near Loeriesfontein, Northern Cape Province.
- Visual Impact Assessment for the Proposed Construction of the !Xha Boom Wind Farm near Loeriesfontein, Northern Cape Province.
- Basic Visual Impact Assessment for the Proposed Construction of the !Xha Boom Substation, Linking Substation and Associated 132kV Power Line near Loeriesfontein, Northern Cape Province.
- Visual Impact Assessment for the Proposed Construction of the 315MW Phezukomoya Wind Energy Facility near Noupoort, Northern Cape Province.
- Visual Impact Assessment for the Proposed Construction of the 390MW Sankraal Wind Energy Facility near Noupoort, Northern Cape Province.
- Visual Impact Assessment for the proposed development of the Phase 1 Kuruman Wind Energy Facility, Kuruman, Northern Cape Province
- Visual Impact Assessment for the proposed development of the Phase 2 Kuruman Wind Energy Facility, Kuruman, Northern Cape Province
- Basic Visual Impact Assessment for the proposed development of Supporting Electrical Infrastructure to the Phase 1 and Phase 2 Kuruman Wind Energy Facilities, Kuruman, Northern Cape Province
- Visual Impact Assessment for the Proposed Tinley Manor South Banks Beach Enhancement Solution, KwaZulu-Natal Province.
- Visual Impact Assessment for the proposed Mlonzi Hotel and Golf Estate Development, Near Lusikisiki, Eastern Cape Province

- Visual Impact Assessment for the Proposed Assagay Valley Development, KwaZulu-Natal Province.
- Visual Impact Assessment for the Proposed Kassier Road North Development, KwaZulu-Natal Province.
- Basic Visual Impact Assessment for the proposed construction of up to a 132kV Power Line and Associated Infrastructure for the Rooipunt Solar Thermal Power Plant near Upington, Northern Cape Province.
- Basic Visual Impact Assessment for the proposed construction of up to a 132kV Power Line and Associated Infrastructure for the proposed Kalkaar Solar Thermal Power Plant near Kimberly, Free State and Northern Cape Provinces.
- Surface Water Assessment for the Steve Thswete Local Municipality, Mpumalanga Province.
- Surface Water Delineation and Assessment for the proposed coal Railway Siding at the Welgedacht Marshalling Yard and associated Milner Road Upgrade near Springs, Ekurhuleni Metropolitan Municipality.

HERITAGE SPECIALIST ASSESSMENT:

Basic Assessment for the proposed development of supporting electrical infrastructure to the proposed Kuruman Phase 1 and Phase 2 Wind Energy Facilities near Kuruman in the Northern Cape

BA REPORT

Report prepared for:

CSIR – Environmental Management Services

P O Box 320

Stellenbosch

7600

Report prepared by:

CTS Heritage

34 Harries Street

Plumstead, Cape Town

7800

August 2018

Specialist Expertise

<u>Jenna Lavin</u>

Tel: 083 619 0854 (c)
E-mail address: jenna.lavin@ctsheritage.com
ID number: 8512050014089

<u>EDUCATION</u>:
Tertiary

2014	M.Phil in Conservation of the Built Environment (University of Cape Town) - Not completed as of 2018
2011	Continued Professional Development Course in Urban Conservation Management (University of Cape Town) Part I and Part II
2010	M.Sc. with Distinction in Archaeology (University of Cape Town) Title: *Palaeoecology of the KBS member of the Koobi Fora Formation: Implications for Pleistocene Hominin Behaviour*.
2007	B.Sc. Honours in Archaeology (University of Cape Town) Title: *The Lost Tribes of the Peninsula: An Investigation into the historical distribution of Chacma baboons (<u>Papio ursinus</u>) at the Cape Peninsula, South Africa.* Koobi Fora Field School, Rutgers University (U.S.A.)/ National Museums of Kenya
2006	B.Sc. Archaeology (University of Cape Town) B.Sc. Environmental and Geographic Science (University of Cape Town)

<u>EMPLOYMENT HISTORY:</u>

PROFESSIONAL DEVELOPMENT
Environmental and Heritage Management:

Director: Heritage for CTS heritage and member of OpenHeritage NPC.
July 2016 to present

Assistant Director for Policy, Research and Planning at Heritage Western Cape (HWC).
August 2014 to June 2016

Heritage Officer for Palaeontology and for the Mpumalanga Province at the South African Heritage Resources Agency (SAHRA).
January 2013 to June 2014

Heritage Officer for Archaeology, Palaeontology and Meteorites at Heritage Western Cape (HWC).
September 2010 to December 2012

Heritage Officer for the Archaeology, Palaeontology and Meteorites Unit of the South African Heritage Resources Agency (SAHRA) as part of a three month contract.
January 2010 to March 2010

SPECIALIST DECLARATION

I, Jenna Lavin., as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- act as the independent specialist in this application;
- 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- 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;
- will comply with the Act, Regulations and all other applicable legislation;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- have no vested interest in the proposed activity proceeding;
- 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;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist: ______________________________

Name of Specialist: _Jenna Lavin__________________________

Date: _____20 July 2018_______________________________

EXECUTIVE SUMMARY

Mulilo Renewable Project Developments (Pty) Ltd (hereafter, “Mulilo”) has proposed to build the Kuruman Wind Energy Facility (WEF). The WEF will be connected to the grid via one 132kV overhead powerline.

Three routing alternatives are applicable:

· Alternative 1: 132kV overhead line from the Kuruman WEF Substation Phase 1 to the Ferrum Substation (56.8 km line) in the event that both wind farms are constructed.

· Alternative 2: 132kV overhead line from the Kuruman WEF Phase 1 Substation to the Segame Substation (14 km line) in the event that only WEF Phase 1 is constructed.

· Alternative 3: 132kV overhead line from the Kuruman WEF Phase 2 Substation to Segame Substation (22 km line) in the event that only WEF Phase 2 is constructed.

Height: 15m

Width of service road below line(s): Jeep track

The proposed powerline route is not a sensitive archaeological landscape, despite it crossing several eco-zones. Long stretches of the route, for example, from Bothaskop till the district gravel road, cross mostly flat lands covered in knee high dry grasses and dense Acacia thicket vegetation on a substrate of loose, red sands. Extensive scatters and patches of ironstone gravels occur in places, where only a few isolated tools were noted, but no settlement or occupation sites were located. Indications are that these tools represent mostly discarded flakes and/or flake debris.

The route, from the district gravel road, over the hilltops to Bramcote Farm is also not a sensitive archaeological landscape. Most of the route passes through Woodstock Farm towards the Eskom substation at Kuruman. It crosses flat lands covered in tall dry grasses, with small pockets of dense thicket (Acacia) vegetation (closer to Kuruman), on a substrate of red sands with virtually no surface stone occurring. However, patches and scatters of banded ironstone do occur in places, where a few isolated tools in banded iron stone were identified, however these are mostly discarded flakes and flake debris. Some of these occurrences are located outside of the study area, and were not given GPS locations.

It is interesting to note that fine grained CCS / translucent chert flakes were also noted in the powerline route between Hartlands Farm and the Kuruman Eskom substation, and on Bothaskop (located outside of the study area).

In terms of palaeontological heritage resources, the impact significance of the Kuruman WEF 132 kV grid connection is low (negative), both before and after mitigation. This assessment applies to both 132 kV grid connection options under consideration and is based on (1) the low overall low palaeosensitivity of the 132 kV grid connection study region (including both corridor alternatives) as well as (2) the small footprint of the individual electrical pylon footings and associated service roads (i.e. small volume of bedrock excavations or surface clearance entailed). There is no preference on palaeontological heritage grounds for either one of the grid connection route options. Significant impacts during the operational and de-commissioning phases of the 132 kV grid connection are not anticipated. Confidence levels for this assessment are medium, given the low levels of bedrock exposure. In the context of other alternative energy and associated powerline developments in the broader Kathu – Kuruman region, cumulative impacts posed by the Kuruman WEF 132 kV grid connection project are of low significance.

Recommendations

No mitigation is required prior to construction activities occurring.

Should any unmarked human burials/remains or ostrich eggshell water flask caches be uncovered, or exposed during preparation of the lands for cultivation, these must immediately be reported to the South African Heritage Resources Agency (Ms Natasha Higgit 021 462 4502), or the McGregor Museum (Att Dr David Morris 053 8392707 / 082 2224777). Burials, etc. must not be removed or disturbed until inspected by the archaeologist

Should substantial fossil remains be encountered at surface or exposed during construction, the ECO should safeguard these, preferably *in situ*. They should then alert the South African Heritage Resources Agency as soon as possible (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone : +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). This is to ensure that appropriate action (*i.e.* recording, sampling or collection of fossils, recording of relevant geological data) can be taken by a professional palaeontologist at the proponent's expense. A procedure for Chance Fossil Finds is tabulated in Appendix 2. These recommendations must be incorporated in the Environmental Management Programme for the WEF project.

The above recommendations must be incorporated into the Environmental Management Programme (EMPr) for the proposed development.

LIST OF ABBREVIATIONS

AIA	Archaeological Impact Assessment
CSIR	Council for Scientific and Industrial Research
DARD	Department of Agriculture and Rural Development (KwaZulu-Natal)
DEA	Department of Environmental Affairs (National)
DEADP	Department of Environmental Affairs and Development Planning (Western Cape)
DEDEAT	Department of Economic Development, Environmental Affairs and Tourism (Eastern Cape)
DEDECT	Department of Economic Development, Environment, Conservation and Tourism (North West)
DEDT	Department of Economic Development and Tourism (Mpumalanga)
DEDTEA	Department of economic Development, Tourism and Environmental Affairs (Free State)
DENC	Department of Environment and Nature Conservation (Northern Cape)
DMR	Department of Mineral Resources (National)
EMPr	Environmental Management Programme
HIA	Heritage Impact Assessment
MPRDA	Mineral and Petroleum Resources Development Act, no 28 of 2002
NEMA	National Environmental Management Act, no 107 of 1998
NHRA	National Heritage Resources Act, no 25 of 1999
PIA	Palaeontological Impact Assessment
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
VIA	Visual Impact Assessment

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- (a) details of- (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Page 1 and Appendix 5
(b) declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 2
(c) an indication of the scope of, and the purpose for which, the report was prepared;	1.1
(cA) an indication of the quality and age of base data used for the specialist report;	1.3, 1.4, 1.5
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	2
(d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	1.3
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	1.3
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	5.2
(g) an identification of any areas to be avoided, including buffers;	8
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	6.1
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	1.4
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	6
(k) any mitigation measures for inclusion in the EMPr;	8
(l) any conditions for inclusion in the environmental authorisation;	8
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	8
(n) a reasoned opinion- (i) as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	9
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	NA
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	NA

(q) any other information requested by the competent authority.	Appendix HIA Report
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Noted

Table of Contents

TABLES AND FIGURES

Heritage Impact Assessment

1. INTRODUCTION AND METHODOLOGY

1.1. Scope and Objectives

Mulilo Renewable Project Developments (Pty) Ltd (hereafter, "Mulilo") has proposed to build the Kuruman Wind Energy Facility (WEF). The WEF will be connected to the grid via one 132kV overhead powerline.

Three routing alternatives are applicable:
· Alternative 1: 132kV overhead line from the Kuruman WEF Substation Phase 1 to the Ferrum Substation (56.8 km line) in the event that both wind farms are constructed.
· Alternative 2: 132kV overhead line from the Kuruman WEF Phase 1 Substation to the Segame Substation (14 km line) in the event that only WEF Phase 1 is constructed.
· Alternative 3: 132kV overhead line from the Kuruman WEF Phase 2 Substation to Segame Substation (22 km line) in the event that only WEF Phase 2 is constructed.
Height: 15m
Width of service road below line(s): Jeep track

The objective of this assessment is to provide insight into the possible impacts of th to proposed 132kV powerline to heritage resources, including the identification of these resources within the proposed development area as well as recommended mitigation strategies.

1.2 Terms of Reference

The Terms of Reference for this specialist study includes:

- A description of the regional and local heritage resources,
- A field survey to identify sites and areas of heritage significance that may be directly or indirectly impacted by the proposed development
- Mapping of the identified heritage resources and an assessment of their cultural significance,
- Assessing (identifying and rating) the potential direct and cumulative impacts of the proposed development on these heritage resources,
- Assessing alternatives,
- Identification of relevant legislation and legal requirements; and
- Providing recommendations on possible mitigation measures and management guidelines.

1.3 Approach and Methodology

Heritage Screening Assessment

As part of the Scoping Phase, a Heritage Screening Assessment was conducted for the proposed development (Appendix A). The Heritage Screener summarises the heritage impact assessments and studies previously undertaken within the area of the proposed development and its surroundings. Heritage resources identified in these reports were then assessed by our team during the screening process.

Based on the results of the Heritage Screening Assessment, it was recommended that, as the proposed development is likely to impact on heritage resources, a complete Heritage Impact Assessment including a detailed field assessment is required that assesses impacts to landscape character, secondary (and possibly primary) impacts on built environment resources, archaeological resources, graves and burial grounds, fossil heritage and mining heritage.

Field Assessment

An archaeologist conducted a survey of the area and its environs in June 2018 to determine what heritage resources are likely to be impacted by the proposed development (Appendix 1 to the HIA), and a Palaeontological Field Assessment was completed in February 2018 to assess likely impacts to palaeontology (Appendix 2 to the HIA).

The identified heritage resources were assessed to evaluate their heritage significance in terms of the grading system outlined in section 3 of the NHRA (Act 25 of 1999). These identified resources have been mapped relative to the proposed development layout to determine likely impacts and to inform relevant buffers areas, no-go zones and other mitigation strategies.

1.4 Assumptions and Limitations

The following aspects have a direct bearing on the investigation and the resulting report:

- The *significance* of the sites and artefacts is determined by means of their historical, social, aesthetic, technological and scientific value in relation to their uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

- It should be noted that archaeological deposits often occur below ground level. Should artefacts or skeletal material be revealed at the site during construction, such activities should be halted, and it would be required that the heritage consultants are notified for an investigation and evaluation of the find(s) to take place.

However, despite these challenges, sufficient time and expertise was allocated to provide an accurate assessment of the archaeological sensitivity of the area.

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.
2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant ("mappable") bedrock units as well as major areas of superficial "drift" deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil etc), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.

3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information;
4. The extensive relevant palaeontological “grey literature” - in the form of unpublished university theses, impact studies and other reports (e.g. of commercial mining companies) - that is not readily available for desktop studies;
5. Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.
6. In the case of palaeontological desktop studies without supporting field assessments these limitations may variously lead to either:
    a. underestimation of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
    b. overestimation of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium etc).

Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study usually entails inferring the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist. In the present case, site visits to the various loop and borrow pit study areas in some cases considerably modified our understanding of the rock units (and hence potential fossil heritage) represented there.

In the case of the present study area near Kuruman in the Northern Cape exposure of potentially fossiliferous bedrocks is very limited, due to extensive cover by superficial sediments and vegetation. However, sufficient exposures were examined to allow a confident assessment of their palaeontological sensitivity (See Appendix 1 of the HIA) so confidence levels for this assessment are medium. Comparatively few academic palaeontological studies have been carried out in the region so any new data from impact studies here are of scientific interest.

1.4a Limiting/Restricting factors

The investigation has been influenced by the following factors related to the overall EIA:

- Availability and reliability of baseline information about the affected area;
- Unpredictability of buried archaeological/palaeontological remains (absence of evidence does not mean evidence of absence);

1.5 Source of Information

Field work

Archaeological and Palaeontological fieldwork was undertaken for the BA Phase of the project. This study draws on desktop research from several approved heritage impact assessments and specialist studies from the area as well as from the results of the field assessments.

In addition, the combined desktop and field-based Heritage Impact Assessment report is based on:
- A review of the relevant scientific literature, including previous archaeological and palaeontological impact assessments in the broader region;

- Published topographical and geological maps and accompanying sheet explanations (1: 250 000 Sheet 2722 Kuruman) as well as Google Earth© satellite imagery;
- Two Heritage Scoping reports for the Kuruman WEF projects (CTS Heritage 2018a, 2018b) *plus* a preceding short palaeontological heritage screening report (CTS Heritage 2017);
- A five-day field study of the consolidated Kuruman WEF and associated transmission line study area by an archaeologist and palaeontologist
- The palaeontological specialists extensive field experience with the formations concerned and their palaeontological heritage (*cf* Almond *et al.* 2008).
- The archaeological specialists extensive field experience with the formations concerned and their archaeological heritage

Desktop study

Information was obtained from various impact assessment reports and specialist studies. The body of literature is listed below in the reference section.

2. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO HERITAGE IMPACTS

Activities associated with the development of the proposed powerline that are likely to impact on heritage resources include:

- Vegetation clearing
- Road construction
- Excavation and dredging activities
- Infrastructure construction activities

The proposed 132kv powerline route is located on a number of farms in the vicinity of Kuruman in the Northern Cape and had not been surveyed previously. We expect similar findings will be made such as ruined farm infrastructure, possible old mines, ESA, MSA and LSA open site scatters of artefacts, possibly more rock art sites in overhangs and a number of visual impacts will have to be assessed in terms of the cultural landscape encompassed by the inner valley and boundary hills containingthe proposed WEF and powerline. Wonderwerk Cave, a National Heritage Site containing archaeological traces stretching back over 2 million years, is located ~25km to the southeast of the WEF.

In terms of geology, the powerline footprint is underlain by Precambrian sediments and lavas of the Transvaal Supergroup, including the Ghaap Group (marine carbonates of the Campbell Rand Subgroup followed by banded iron formations of the Asbestos Hills Subgroup) and Postmasburg Group (Ongeluk Formation lavas). Most of these rock units are of low palaeontological sensitivity. However, the Campbell Rand carbonates near Kuruman may be stromalite-rich (high sensitivity). Late Caenozoic superficial sediments include windblown sands (Kalahari Group), colluvial and other surface gravels, alluvium and pedocretes (e.g. calcretes). Most of these younger sediments are of low sensitivity but older alluvial deposits along major drainage lines as well as calcretes need to be inspected for fossils (e.g. mammalian remains).

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

The Kuruman Hills have historically been used for small scale pastoralist farming activities with goats and sheep, a practice which extends back possibly as much as 2000 years ago when Khoekhoe herders first entered the area. Three sites with possible herder art (TK1, TK3 & TK5) were found in association with

Later Stone Age artefact assemblages on the Tierkop farm. These sites were recorded during a survey by Dave Halkett and Jayson Orton (Halkett 2009) for the potential impacts of iron and manganese ore mining on Bramcote farm (No 446).

The inclusion zone is situated within the Savanna Biome. The Savanna Biome comprises 46 percent of southern Africa's land mass, therefore is the largest Biome in southern Africa. This Biome is characterized by C4-type grasses in plains areas, which is indicative of a summer rainfall zone. In addition, distinct upper layer of woodland and bushveld are observable on mountainous and intermediate areas respectively. The Kruger and Kalahari Gemsbok National Parks contain this vegetation type; therefore, Savanna Biome vegetation is effectively conserved. However, only 5 percent of the total vegetation Biome is formally conserved.

Approximately 35km to the southwest of the inclusion zone is Kathu, where a large Camel Thorn Tree (*Vachellia erioloba*) forest is conserved. Known as the Kathu Forest, it is approximately 4000ha and has been declared a National Heritage Site. Camel Thorns provide ecological support for the Sociable Weaver and their large nests and are depended upon by several other bird and animal species, many of which are listed endemic and protected species. As the inclusion zone is proximal to the Kathu forest, it likely also hosts areas of vegetation that is ecologically sensitive.

The archaeologist who conducted the field assessment indicated that the proposed powerline route is not a sensitive archaeological landscape, despite it crossing several eco-zones. Long stretches of the route, for example, from Bothaskop till the district gravel road, cross mostly flat lands covered in knee high dry grasses and dense Acacia thicket vegetation on a substrate of loose, red sands. Extensive scatters and patches of ironstone gravels occur in places, where only a few isolated tools were noted, but no settlement or occupation sites were located. Indications are that these tools represent mostly discarded flakes and/or flake debris.

The route, from the district gravel road, over the hilltops to Bramcote Farm is also not a sensitive archaeological landscape. Most of the route passes through Woodstock Farm towards the Eskom substation at Kuruman. It crosses flat lands covered in tall dry grasses, with small pockets of dense thicket (Acacia) vegetation (closer to Kuruman), on a substrate of red sands with virtually no surface stone occurring. However, patches and scatters of banded ironstone do occur in places, where a few isolated tools in banded iron stone were identified, however these are mostly discarded flakes and flake debris. Some of these occurrences are located outside of the study area, and were not given GPS locations.

It is interesting to note that fine grained CCS / translucent chert flakes were also noted in the powerline route between Hartlands Farm and the Kuruman Eskom substation, and on Bothaskop (located outside of the study area).

4. APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

Section 38 of the National Heritage Resources Act (25 of 1999) applies.

This study constitutes a heritage scoping investigation linked to the environmental impact scoping and impact assessment required for the development. The proposed development is a listed activity in terms of Section 38 (1) of the NHRA.

Section 38 (2)(a) of the National Heritage Resources Act (Act 25 of 1999) requires the submission of a heritage impact assessment report for authorization purposes to the responsible heritage resources agency, SAHRA. Heritage conservation and management in South Africa (excluding KwaZulu-Natal on a provincial level) is governed by the National Heritage Resources Act (Act 25 of 1999) (NHRA) and falls under the jurisdiction of the South African Heritage Resources Agency (SAHRA) and its provincial offices and counterparts.

Section 38 of the NHRA requires a Heritage Impact Assessment (HIA) be conducted by an independent heritage management consultant for the following development categories:

38. (1) Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as—

> (a) the construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
> (b) the construction of a bridge or similar structure exceeding 50m in length;
> (c) any development or other activity which will change the character of a site—
>> (i) exceeding 5 000 m^2 in extent; or
>> (ii) involving three or more existing erven or subdivisions thereof; or
>> (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
>> (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
>
> (d) the re-zoning of a site exceeding 10 000 m^2 in extent; or
> (e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

Should the proposed development fall within any of the categories described in Section 38(1), the appropriate heritage authority may require a Heritage Impact Assessment in terms of Section 38(3) of the NHRA. According to Section 38(3);

The responsible heritage resources authority must specify the information to be provided in a heritage report required provided that the following must be included:

> (a) The identification and mapping of all heritage resources in the area affected;
> (b) an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;
> (c) an assessment of the impact of the development on such heritage resources;
> (d) an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;
> (e) the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;
> (f) if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and
> (g) plans for mitigation of any adverse effects during and after the completion of the proposed development.

As the proposed development is subject to an EIA in terms of NEMA, Section 38(8) of the NHRA applies. Section 38(8) states that:

“The provisions of this section do not apply to a development as described in subsection (1) if an evaluation of the impact of such development on heritage resources is required in terms of the Environment Conservation Act, 1989 (Act No. 73 of 1989), or the integrated environmental management guidelines issued by the Department of Environment Affairs and Tourism, or the Minerals Act, 1991 (Act No. 50 of 1991), or any other legislation: Provided that the consenting authority must ensure that the evaluation fulfils the requirements of the relevant heritage resources authority in terms of subsection (3), and any comments and recommendations of the relevant heritage resources authority with regard to such development have been taken into account prior to the granting of the consent."

In addition, section 38(10) states that: "Any person who has complied with the other requirements referred to in subsection (8), must be exempted from compliance with all other protections in terms of this Part, but any existing heritage agreements made in terms of section 42 must continue to apply."

5. IDENTIFICATION OF KEY ISSUES

5.1 Key Issues Identified

Based on the previously mentioned historical significance regarding the Kuruman Hills history of small scale pastoralist farming activities with goats and sheep, along with three sites where possible herder art were found in association with Later Stone Age artefact assemblages on the Tierkop farm, the potential footprint of the proposed development will impact heritage resources.

- Destruction of archaeological artefacts.
- Destruction of pastoralist cultural landscape of heritage and historical significance.
- Destruction of palaeontological material (mainly of Precambrian Stromatolites).
- Destruction of burial grounds and graves, and sacred spaces
- Destruction of archaeological artefacts during operational activities or upgrades.
- Destruction of pastoralist cultural landscape of heritage and historical significance. A loss of 'sense of place'.
- Destruction of palaeontological material (mainly of Precambrian Stromatolites) during operational activities or upgrades.
- Destruction of burial grounds and graves, and sacred spaces
- Changes in the aesthetics of the cultural landscape.
- Destruction of other heritage resources

5.2 Identification of Potential Impacts

The potential impacts identified during the BA assessment are:

5.2.1 Construction Phase

- Destruction of archaeological artefacts.
- Destruction of pastoralist cultural landscape of heritage and historical significance.
- Destruction of palaeontological material (mainly of Precambrian Stromatolites).
- Destruction of burial grounds and graves, and sacred spaces

5.2.2 Operational Phase

- Destruction of archaeological artefacts during operational activities or upgrades.
- Destruction of pastoralist cultural landscape of heritage and historical significance. A loss of 'sense of place'.
- Destruction of palaeontological material (mainly of Precambrian Stromatolites) during operational activities or upgrades

5.2.3 Decommissioning Phase

- Destruction of heritage resources

5.2.4 Cumulative impacts

- Changes in the aesthetics of the cultural landscape.
- Destruction of heritage resources

6. ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

6.1 Results of the Field Study

Archaeology and the built environment

The proposed powerline route is not a sensitive archaeological landscape, despite it crossing several eco-zones. Long stretches of the route, for example, from Bothaskop till the district gravel road, cross mostly flat lands covered in knee high dry grasses and dense Acacia thicket vegetation on a substrate of loose, red sands. Extensive scatters and patches of ironstone gravels occur in places, where only a few isolated tools were noted, but no settlement or occupation sites were located. Indications are that these tools represent mostly discarded flakes and/or flake debris.

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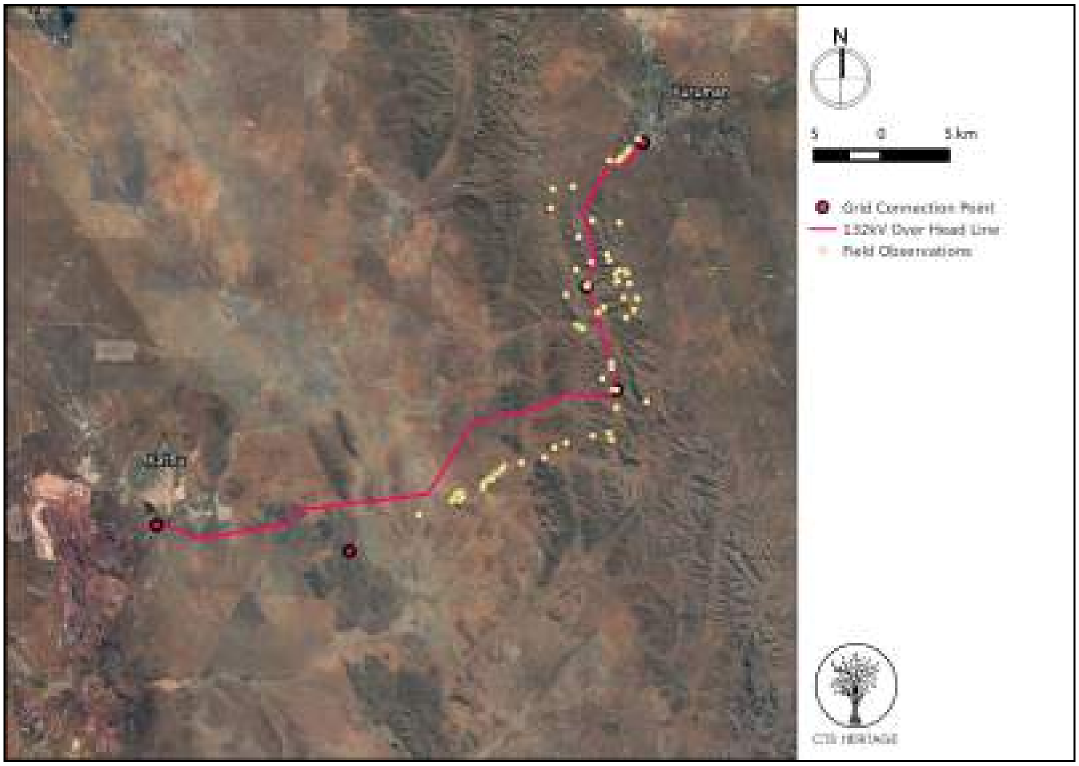


Figure 1: Map of all archaeological observations in relation to the proposed development

Palaeontology

In terms of palaeontological heritage resources, the impact significance of the Kuruman WEF 132 kV grid connection is low (negative), both before and after mitigation. This assessment applies to both 132 kV grid connection options under consideration and is based on (1) the low overall low palaeosensitivity of the 132 kV grid connection study region (including both corridor alternatives) as well as (2) the small footprint of the individual electrical pylon footings and associated service roads (i.e. small volume of bedrock excavations or surface clearance entailed). There is no preference on palaeontological heritage grounds for either one of the grid connection route options. Significant impacts during the operational and de-commissioning phases of the 132 kV grid connection are not anticipated. Confidence levels for this assessment are medium, given the low levels of bedrock exposure. In the context of other alternative energy and associated powerline developments in the broader Kathu – Kuruman region, cumulative impacts posed by the Kuruman WEF 132 kV grid connection project are of low significance.

No palaeontologically-sensitive rock units are traversed by the alternative 132 kV grid connection corridor to Ferrum Substation near Kathu. No fossil remains were recorded during the field-based assessment of the corridor.

Table 1: Fossil heritage in the Kuruman WEF and grid connection study area

GEOLOGICAL UNIT	ROCK TYPES & AGE	FOSSIL HERITAGE	PALAEONTOLOGICAL SENSITIVITY	RECOMMENDED SPECIALIST MITIGATION

Gordonia Formation KALAHARI GROUP **Plus** **SURFACE CALCRETE, CALC TUFA**	Mainly aeolian sands plus minor fluvial gravels, freshwater pan deposits, calcretes, calc tufa / flow stone, karstic fissure infill breccias PLIO-PLEISTOCENE to RECENT	calcretised rhizoliths & termitaria, ostrich egg shells, land snail shells, rare mammalian and reptile (e.g. tortoise, micromammal) bones, teeth, plant remains. freshwater units associated with diatoms, molluscs, stromatolites etc	GENERALLY LOW with exception of rare pockets of fossiliferous fissure infill, karst breccia **(HIGH sensitivity)**	None recommended Any substantial fossil finds to be reported by ECO to SAHRA
Makganyene & Ongeluk Fms **POSTMASBURG GROUP**	Glacial diamictites (tillites), volcanic lavas, dolomites, ironstones EARLY PROTEROZOIC (c. 2.2 Ga)	Stromatolites associated with glacial deposits within the Makganyene Formation (Prieska Sub-basin)	GENERALLY LOW with exception of stromatolitic units	Reporting and documentation of ancient stromatolites in surface exposures of Makganyene Fm
Asbestos Hills Subgroup (Kuruman & Daniëlskuil Fms) **GHAAP GROUP**	BIF (banded iron formations) with cherty bands EARLY PROTEROZOIC (c. 2.5-2.4 Ga)	Important early microfossil biotas No macrofossils reported to date	LOW	None recommended
Campbell Rand Subgroup (Kogelbeen, Gamohaan & Tsineng Fms) **GHAAP GROUP**	Limestones, dolomites, subordinate cherts & tuffs LATE ARCHAEAN – EARLY PROTEROZOIC (c. 2.6-2.5 Ga)	Range of microbialites including various forms of stromatolite, organic-walled microfossils within cherts	**HIGH**	Stromatolite-rich exposures to be protected as No-Go areas. Specialist recording and mitigation of Chance Fossil Finds.

Cumulative Impacts

Of the 72 known heritage studies conducted within 50km of the proposed development area (Table 3), none are for Wind Energy Facilities and only 5 relate to the proposed development of electricity infrastructure (highlighted in blue). The remaining assessments relate to the development of housing, road and PV facility infrastructure associated with the expansion of Kathu town and the development of new mines and the extension of existing mines. As such, cumulative impacts on the cultural landscape are limited at this stage. Comparatively few palaeontological impact assessments are available for proposed and authorised alternative energy projects within a 50 km radius of the Kuruman WEF project area; most impact assessments in this region refer to mining and railway developments. Reports by Almond (2015a, 2015b, 2018) refer to small-scale solar energy projects near Kathu, while Almond (2012b, 2014a and preceding PIA reports listed therein) dealt with solar energy developments in the Postmasburg – Daniëlskuil region, situated some 75 km south of the present study area. Field studies on similar Precambrian bedrock units to those encountered in the Kuruman WEF project area – notably the Campbell Rand and Asbestos Hills Subgroups - are covered by Almond (2012b, 2013a and 2014b) in particular. In general, the carbonate bedrocks proved to be stromatolitic, and hence palaeontologically sensitive, while the BIF of the Kuruman and Daniëlskuil Formations contained no identifiable macrofossils. It is concluded that, in the context of these other alternative energy developments in the broader region, cumulative impacts posed by the Kuruman WEF (Phase 1), which are almost entirely underlain by unfossiliferous Asbestos Hills Subgroup BIFs, are of *low* impact significance.

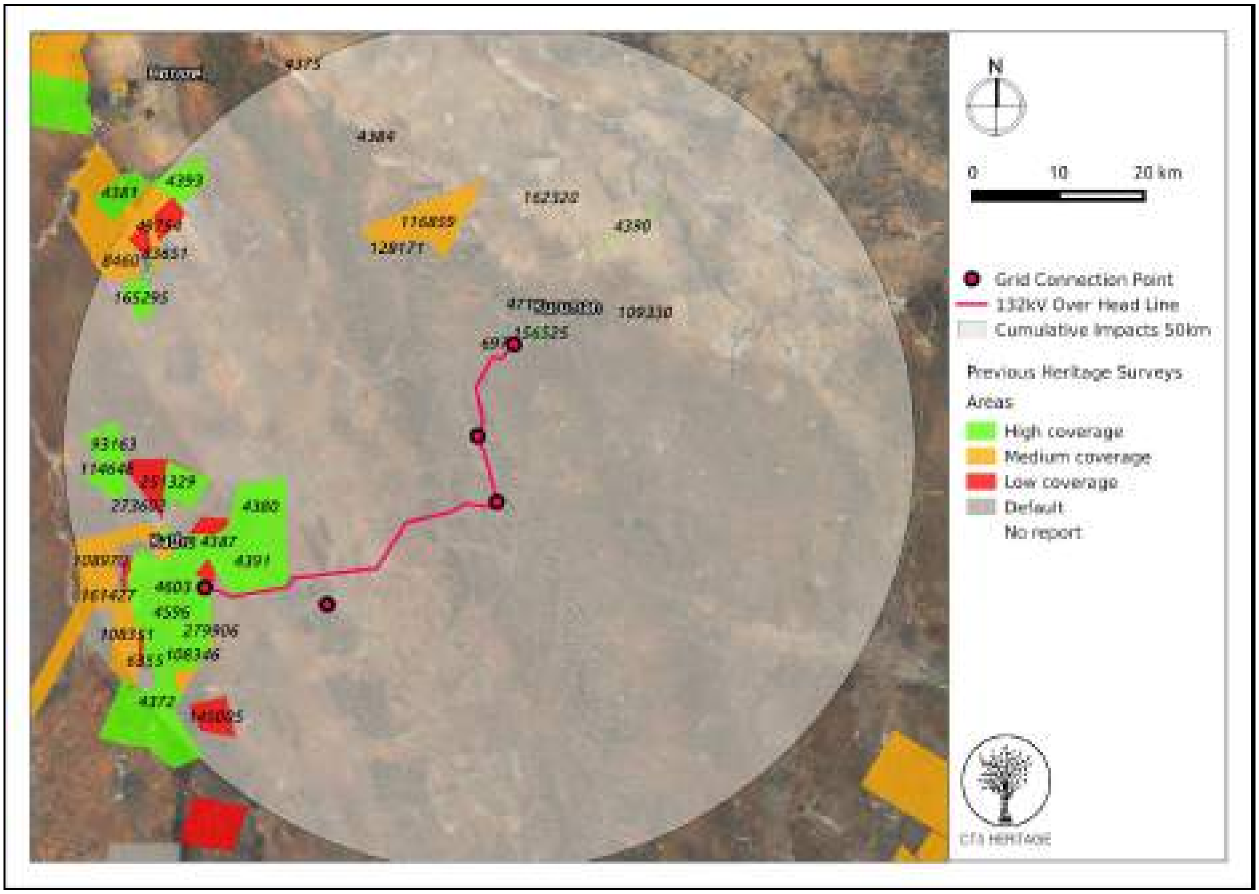


Figure 2: Map of all known heritage studies conducted within 50km of the proposed development area

Table 3: HIA's conducted within 50km of the proposed development area

Heritage Impact Assessments within 50km				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
471	AIA Phase 1	Anton Pelser	01/06/2012	A REPORT ON ARCHAEOLOGICAL IMPACT ASSESSMENTS (AIA'S) FOR PROPOSED HOUSING DEVELOPMENTS ON ERVEN 83 AND 2467, KURUMAN, IN THE NORTHERN CAPE
697	AIA Phase 1	Udo Kusel	02/06/2011	Cultural Heritage Resources Impact Assessment of Erf 5041 (Portion of Erf 1) Kuruman Municipality Ga-Segonyana Administrative District Northern Cape
4116	AIA Phase 1	Peter Beaumont	06/02/2008	Phase 1 Heritage Impact Assessment Report on a Portion of the Remainder of the Farm Sekgame 461, Kathu, Gamagara Municipality, Northern Cape Province
4117	AIA Phase 1	Peter Beaumont	07/02/2008	Phase 1 Heritage Impact Assessment Report on Portion 463/8 of the Farm Uitkoms 463, near Kathu, Kgalagadi Municipality, Northern Cape Province
4372	AIA Phase 1	David Morris	01/02/2005	Report on a Phase 1 Archaeological Assessment of Proposed Mining Areas of the Farms Bruce, King, Mokaning and Parson, Between Postmasburg and Kathu, Northern Cape
4373	AIA Phase 1	Cobus Dreyer	20/06/2005	Archaeological and Historical Investigation of the Proposed New Road from Vergenoeg to Maruping (Moropeng), Kuruman District, Northern Cape

4374	AIA Phase 1	Cobus Dreyer	20/06/2005	Archaeological and Historical Investigation of the Site for the Proposed New Maruping Sport Stadium, Kuruman District, Northern Cape
4375	AIA Phase 1	Cobus Dreyer	20/06/2005	Archaeological and Historical Investigation of the Proposed New Sport Stadium at Geelboom, Kuruman District, Northern Cape
4376	AIA Phase 1	Peter Beaumont	30/04/2006	Phase 1 Heritage Impact Assessment Report on Erf 1439, Remainder of Erf 2974 and Remainder of Portion 1 of the Farm Uitkoms No 463, and Farms Kathu 465 and Sims 462 at and near Kathu in the Northern Cape Province
4378	AIA Phase 1	Peter Beaumont	30/05/2006	Phase 1 Heritage Impact Assessment Report on Portion 5 of the Farm Uitkoms 463, Kgalagadi District, Northern Cape Province
4379	AIA Phase 1	Peter Beaumont	31/05/2006	Phase 1 Heritage Impact Assessment Report on Portions A and B of the Farm Sims 462, Kgalagadi District, Northern Cape Province
4380	AIA Phase 1	Cobus Dreyer	28/06/2006	First Phase Archaeological and Cultural Heritage Assessment of the Proposed Residential Developments at the Farm Hartnolls 458, Kathu, Northern Cape
4381	AIA Phase 1	Julius CC Pistorius	01/08/2006	A Phase 1 Heritage Impact Assessment (HIA) Study for the Proposed New United Manganese of Kalahari (Umk) Mine on the Farms Botha 313, Smartt 314 and Rissik 330 near Hotazhel in the Northern Cape Province of South Africa
4383	AIA Phase 1	Peter Beaumont	17/01/2007	Supplementary Archaeological Impact Assessment Report on Sites near or on the Farm Hartnolls 458, Kgalagadi District Municipality, Northern Cape Province
4384	AIA Phase 1	Peter Beaumont	06/03/2007	Phase 1 Heritage Impact Assessment Report on Six Borrow Pits on Communal Ground Along the D320 Road from Batlharos to Tsineng, near Kuruman, in the Northern Cape Province
4387	AIA Phase 1	Peter Beaumont	12/06/2008	Phase 1 Archaeological Impact Assessment Report on Portion 459/49 of the Farm Bestwood 459 at Kathu, Kgalagadi District Municipality, Northern Cape Province
4390	AIA Phase 1	Jonathan Kaplan	01/08/2008	An Archaeological Assessment of Three Borrow Pits Alongside D300 Mothibistad, Northern Cape Province
4391	AIA Phase 1	Cobus Dreyer	11/08/2008	First Phase Archaeological and Cultural Heritage Assessment of the Proposed Residential Developments at a Portion of the Remainder of the Farm Bestwood 459 Rd, Kathu, Northern Cape
4393	HIA Phase 1	Lita Webley, Dave Halkett	01/10/2008	Phase 1 Heritage Impact Assessment: Proposed Prospecting on the Farms Adams 328 and Erin 316, Kuruman, Ga-Segonyana Municipality in the Northern Cape
4596	AIA Phase 1	Peter Beaumont	01/05/2004	Heritage EIA of Two Areas at Sishen Iron Ore Mine
4597	AIA Phase 1	Peter Beaumont	01/10/2005	Heritage Impact Assessment of an Area of the Sishen Iron Ore Mine that may be Covered by the Vliegveldt Waste Dump
4598	HIA Letter of Exemption	Peter Beaumont	15/10/2005	Heritage Impact Assessment for EMPR Amendment for Crusher at Sishen Iron Ore Mine
4603	AIA Phase 1	David Morris	01/09/2008	Archaeological and Heritage Phase 1 Impact Assessment for Proposed Upgrading of Sishen Mine Diesel Depot Storage Capacity at Kathu, Northern Cape
6355	AIA Phase 1	Cobus	10/12/2008	First Phase Archaeological and Cultural Heritage Assessment of the Proposed

		Dreyer		Bourke Project, Ballast Site and Crushing Plant at Bruce Mine, Dingleton, near Kathu, Northern Cape
6639	AIA Phase 1	Jonathan Kaplan	01/09/2008	Phase 1 Archaeological Impact Assessment: Proposed Housing Development, Erf 5168, Kathu, Northern Cape Province
6720	HIA Letter of Exemption	Julius CC Pistorius	01/04/2008	A Phase I Heritage Impact Assessment (HIA) Study for a Proposed New Power Line for the United Manganese of Kalahari (UMK) Mine near Hotazel in the Northern Cape Province of South Africa
6804	AIA Phase 1	Peter Beaumont	01/04/2000	Archaeological Impact Assessment: Archaeological Scoping Survey for the Purpose of an EMPR for the Sishen Iron Ore Mine
7038	AIA Phase 1	David Morris	07/11/2010	PROPOSED KATHU-SISHEN SOLAR ENERGY FACILITIES. SPECIALIST INPUT FOR THE ENVIRONMENTAL IMPACT ASSESSMENT PHASE AND ENVIRONMENTAL MANAGEMENT PLAN FOR THE PROPOSED KATHU SISHEN SOLAR ENERGY FACILITIES, NORTHERN CAPE
7930	AIA Phase 1	Thomas Huffman	01/04/2001	Draft Archaeological Survey of the Smartt/Rissik Mine, Northern Cape
8460	HIA Phase 1	H Steyn	25/03/2009	Heritage Impact Assessment: Ntsimbintle Mining (Pty) Ltd on Portions 1, 2, 3 and 8 of the Farm Mamatwan 331 and the Farm Moab 700 in the Kgalagadi District Municipality of the Northern Cape Province
8944	PIA Phase 1	John Pether	17/01/2011	BRIEF PALAEONTOLOGICAL IMPACT ASSESSMENT (Desktop Study) PROPOSED KATHU & SISHEN SOLAR ENERGY FACILITIES Portions 4 & 6 of the Farm WINCANTON 472 Kuruman District, Northern Cape
49754	Heritage Scoping	Tobias Coetzee	31/07/2012	ARCHAEOLOGICAL SCOPING REPORT FOR THE PROPOSED PROSPECTING FOR IRON ORE AND MANGANESE ORE FOR AMARI MANGANESE (PTY) LTD ON THE FARMS CONSTANTIA 309, SIMONDIUM 308 AND PORTIONS 1, 2, 3 AND 8 OF THE FARM GOOLD 329 IN THE VICINITY OF District Municipality:
83651	Archaeologica l Specialist Reports	Anton Pelser	01/04/2012	REPORT ON A HERITAGE IMPACT ASSESSMENT (AIA) FOR THE PROPOSED PHOTO-VOLTAIC SOLAR POWER GENERATION PLANT ON THE FARM ADAMS 328 NEAR HOTAZEL IN THE NORTHERN CAPE
93163	HIA Phase 1	Stephan Gaigher	09/05/2012	Heritage Impact Assessment Report Environmental Impact Assessment Phase: Proposed Establishment of the San Solar Energy Facility, Located North of Kathu on a Portion of Farm Wincanton 472, Northern Cape Province
104467	HIA Phase 1	Udo Kusel	02/06/2011	CULTURAL HERITAGE RESOURCES IMPACT ASSESSMENT OF ERF 5041 (PORTION OF ERF 1) KURUMAN MUNICIPALITY GA-SEGONYANA ADMINISTRATIVE DISTRICT NORTHERN CAPE PROVINCE
108346	AIA Phase 1	Christine Vivier	12/11/2009	Phase 1 archaelogical impact assessment report on a portion of the farm Lylyveld 545 near Kathu, Kagalagadi District Municipality, Northern Cape province.
108351	AIA Phase 1	Neels Kruger	01/04/2012	Archaeological impact assessment (AIA) of demarcated surface areas on the farms Fritz 540, Gamagara 541, Sishen 543 and Parsons 564, Sishen Iron Ore Mine Complex, Kgalagadi District Municipality, Northen Cape province.
110652	HIA Phase 1	Stephan Gaigher	01/02/2013	HERITAGE IMPACT ASSESSMENT REPORT ENVIRONMENTAL IMPACT ASSESSMENT PHASE Proposed establishment of the San Solar Energy Facility located south of Kathu on a Portion of the Farm Wincanton 472,

				Northern Cape Province
108970	AIA Phase 1	Nelius Kruger	01/09/2012	ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) OF DERMACAED SURFACE AREAS ON THE FARMS GAMAGARA 541, ONVERWACHT 540 (FRITZ 540 PORTION 1) AND NOOITGEDACHT 469 (WOON 469), SISHEN IRON ORE MINE, KGALAGADI DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE.
109330	AIA Phase 1	Jaco van der Walt	12/12/2012	AIA REPORT FOR THE PROPOSED EXTENSION OF AN ABANDONED GRAVEL PIT ON THE FARM HARVARD 171 IN THE KUDUMANE MAGISTERIAL DISTRICT 13KM EAST OF KURUMAN
109484	Heritage Statement	Stephan Gaigher	09/05/2012	HERITAGE IMPACT ASSESSMENT REPORT ENVIRONMENTAL IMPACT ASSESSMENT PHASE Proposed establishment of the San Solar Energy Facility located south of Kathu on a Portion of the Farm Wincanton 472, Northern Cape Province.
110765	HIA Phase 1	Stephan Gaigher	26/02/2013	HERITAGE IMPACT ASSESSMENT REPORT ENVIRONMENTAL IMPACT ASSESSMENT PHASE Proposed establishment of the San Solar Energy Facility located north of Kathu on a Portion of the Farm Wincanton 472, Northern Cape Province
114648	PIA Desktop	John E Almond	01/09/2012	Palaeontological specialist assessment: desktop study PROPOSED 16 MTPA EXPANSION OF TRANSNET'S EXISTING MANGANESE ORE EXPORT RAILWAY LINE & ASSOCIATED INFRASTRUCTURE BETWEEN HOTAZEL AND THE PORT OF NGQURA, NORTHERN & EASTERN CAPE. Part 1: Hotazel to K
116859	AIA Phase 1	Munyadzi wa Magoma	08/04/2013	PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT SPECIALIST STUDY REPORT FOR THE PROPOSED PROSPECTING FOR MINING OF MINERALS ON PORTIONS 1, 2 REMAINDER EXTENT OF THE FARM 219 AND LOWER KURUMAN 219 IN KURUMAN AREA WITHIN GA-SEGONYANA LOCAL MUNICIPALITY, JOHN GAET
123399	AIA Phase 2	Peter Beaumont	15/05/2013	PHASE 2 ARCHAEOLOGICAL PERMIT MITIGATION REPORT ON A ~0.7 HA PORTION OF THE FARM BESTWOOD 549, SITUATED ON THE EASTERN OUTSKIRTS OF KATHU, JOHN TAOLO GAETSEWE DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE.
128171	AIA Phase 1	Jaco van der Walt	08/08/2013	Archaeological Impact Assessment For The Proposed Prospecting Right of a Quarry On The Farm Gamohaan 438 Portion 1 In The Kuruman Magisterial District
129751	HIA Phase 1	Elize Becker	20/02/2013	Phase 1 Heritage Impact Assessment Hotazel to Kimberley and De Aar to Port of Ngqura
145005	AIA Phase 1	Munyadzi wa Magoma	01/07/2013	Phase 1 Archaeological Impact Assessment specialist study report for the proposed development of prospecting rights of iron ore and manganese on remaining extent of Mashwening 557 in Khathu, within the Local Municipality of Gamagara, John Taolo Gaetsewe
152157	HIA Phase 1	Johnny Van Schalkwyk	15/05/2012	Heritage impact assessment for the proposed estate development on the farm Kalahari Golf and Jag Landgoed 775, KATHU, NORTHERN CAPE PROVINCE
152170	Heritage Impact	Robert de Jong	03/09/2008	HERITAGE IMPACT ASSESSMENT REPORT: PROPOSED RESIDENTIAL DEVELOPMENT AND ASSOCIATED INFRASTRUCTURE ON A 200 HA

	Assessment Specialist Reports			PORTION OF THE FARM BESTWOOD 429 RD AT KATHU, NORTHERN CAPE PROVINCE
152171	AIA Phase 1	Cobus Dreyer	11/08/2008	FIRST PHASE ARCHAEOLOGICAL AND CULTURAL HERITAGE ASSESSMENT OF THE PROPOSED RESIDENTIAL DEVELOPMENTS AT A PORTION OF THE REMAINDER OF THE FARM BESTWOOD 459RD, KATHU, NORTHERN CAPE
153307	Heritage Impact Assessment Specialist Reports	Robert de Jong	22/02/2011	Kalahari Solar Power Project Heritage Impact Assessment Report and Heritage Management Plan developed by Robert De Jong and Associates
156525	AIA Phase 1		02/09/2013	Archaeological Impact Assessment for Assmang Ltd - Black Rock Mine Operations on a demarcated section of Erf 01 Kuruman
156617	AIA Phase 1	David Morris	01/02/2014	Rectification and/or regularistion of activities relating to the Bestwood Township development near Kathu, Northern Cape: Phase 1 Archaeological Impact Assessment
157923	Heritage Scoping	R. C. De Jong	10/12/2010	Heritage Scoping Report for the Proposed Kalahari Solar Project on Portions of the Farm Kathu 465, Kuruman Registration Division, Gamagara Local Municipality, Northern Cape Province
159473	AIA Phase 1	Johnny Van Schalkwyk		Archaeological impact survey report for THE PROPOSED DEVELOPMENT OF A SOLAR POWER PLANT ON THE FARM BESTWOOD 459, KATHU REGION, NORTHERN CAPE PROVINCE
160089	AIA Phase 1	Johnny Van Schalkwyk		Archaeological impact survey report for THE PROPOSED KALAHARI SOLAR PARK DEVELOPMENT ON THE FARM KATHU 465, NORTHERN CAPE PROVINCE
160188	AIA Phase 1	Tobias Coetzee	02/09/2013	Archaeological Impact Assessment for the proposed Mamatwan Manganese Mine
161427	HIA Phase 1	Stephan Gaigher	15/04/2014	Proposed Establishment of Several Electricity Distribution Lines within the Northern Cape Province
162320	HIA Letter of Exemption		19/04/2014	Request: Exemption from having to conduct an archaeological assessment, the proposed reuse of an existing borrow pit at Mothibistad near Kuruman, Northern Cape
165295	AIA Phase 1	Neels Kruger	18/05/2014	ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) OF A DEMARCATED SURFACE PORTION ON THE FARM SHIRLEY 367 FOR THE PROPOSED SHIRLEY PHOTOVOLTAIC POWER PLANT AND POWER LINE DEVELOPMENT, GAMAGARA LOCAL MUNICIPALITY, JOHN TAOLO GAETSEWE DISTRICT MUNICIPALITY, NORTHERN
167779	Heritage Impact Assessment Specialist Reports	Jonathan Kaplan	30/06/2014	HERITAGE IMPACT ASSESSMENT PROPOSED MIXED USE DEVELOPMENT IN KATHU, NORTHERN CAPE PROVINCE Remainder & Portion 1 of the Farm Sims 462, Kuruman RD
170455	AIA Phase 1	Neels Kruger	31/03/2014	ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) OF DEMARCATED SURFACE PORTIONS ON THE FARMS SACHA 468, SIMS 462 AND

				SEKGAME 461 FOR THE PROPOSED STORMWATER INFRASTRUCTURE (CLEAN WATER CUT-OFF BERM & GROUNDWATER DAM) FOR THE SISHEN MINE, KATHU, NORTHERN CAPE PROVI
170460	AIA Phase 1	Neels Kruger	31/01/2014	ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) OF DEMARCATED SURFACE PORTIONS ON THE FARMS SACHA 468 AND WOON 469 FOR THE PROPOSED HIGH ENERGY FUEL PLANT AND RAILWAY SIDING, SISHEN IRON ORE MINE, JOHN TAOLO GAETSEWE DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE
174359	AIA Phase 1	Neels Kruger	25/08/2014	ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) OF DEMARCATED SURFACE PORTIONS ON THE FARMS SACHA 468 AND WOON 469 FOR THE PROPOSED HIGH ENERGY FUEL PLANT AND RAILWAY SIDING, SISHEN IRON ORE MINE, JOHN TAOLO GAETSEWE DISTRICT MUNICIPALITY, NORTHERN CAPE PROVINCE
251329	Heritage Impact Assessment Specialist Reports	Jayson Orton	20/02/2015	Heritage Impact Assessment for a Proposed 132 kV Power Line, Kuruman Magisterail District, Northern Cape
252975	Heritage Impact Assessment Specialist Reports	Marko Hutten, Polke Birkholtz	18/07/2014	Heritage Impact Assessment for the Proposed Kathu Supplier Park on parts of the Remainder and on Portion 9 of the Farm Sekgame 461 on the southern side of the town of Kathu in the Gamagara Local Municipality, Northern Cape.
272118	Archaeologica l Specialist Reports	Jayson Orton, Steven Walker	20/04/2015	Archaeological Survey for the Proposed Kalahari Solar Project, Kuruman Magisterial District, NC Province
273602	Heritage Impact Assessment Specialist Reports	Polke Birkholtz	20/04/2015	Heritage Impact Assessment for the Proposed Establishment of a Grazing Project on a Portion of the Farm Marsh 467, Dingleton, Gamagara Local Municipality, Northern Cape.
279906	AIA Phase 1	Neels Kruger	02/12/2014	ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) OF DEMARCATED SURFACE PORTIONS ON THE FARM SEKGAME 461 FOR THE PROPOSED SEKGAME ELECTRICITY INFRASTRUCTURE EXPANSION PROJECT, SISHEN MINE, NORTHERN CAPE PROVINCE
294454	AIA Phase 1	Neels Kruger	05/04/2015	ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA) OF AREAS DEMARACTED FOR THE PROPOSED LYLEVELD NORTH WASTE ROCK DUMP EXPANSION AND LYLEVELD SOUTH HAUL ROAD EXTENSION PROJECT, SISHEN MINE, NORTHERN CAPE PROVINCE

6.2 Potential Impact 1 (Construction Phase)

Nature of impact:

- Destruction of archaeological artefacts.
- Destruction of pastoralist cultural landscape of heritage and historical significance.
- Destruction of palaeontological material (mainly of Precambrian Stromatolites).

- Destruction of burial grounds and graves, and sacred spaces

Significance of impact without mitigation measures: Low

Proposed mitigation measures:

- None required

Significance of impact with mitigation measures: Low

6.3 Potential Impact 2 (Operational Phase)

Nature of impact:

- Destruction of archaeological artefacts during operational activities, maintenance or upgrades.
- Destruction of pastoralist cultural landscape of heritage and historical significance. A loss of ‘sense of place’ resulting from the wind turbine placement on the landscape
- Destruction of palaeontological material (mainly of Precambrian Stromatolites) during operational activities, maintenance or upgrades.
- Limitations regarding access to burial grounds and graves for friends and family

Significance of impact without mitigation measures: Low

Proposed mitigation measures:

- None required

Significance of impact with mitigation measures: Low

6.4 Decommissioning Phase

Nature of impact:

- Destruction of heritage resources during decommissioning (archaeological and palaeontological resources)

Significance of impact without mitigation measures: Low

Proposed mitigation measures:

- None required

Significance of impact with mitigation measures: Low

6.5 Cumulative Impacts

Nature of impact:

- Changes in the aesthetics of the cultural landscape.
- Destruction of heritage resources

Significance of impact without mitigation measures: Low

Proposed mitigation measures:

- Careful mapping and avoidance of identified heritage resources

Significance of impact with mitigation measures: Low

7. IMPACT ASSESSMENT SUMMARY

Overall, the proposed activity <u>will not directly impact</u> on significant archaeological, palaeontological or built environment heritage. The heritage impact significance is rated as being low. No mitigation is required prior to construction activities occurring.

Should any unmarked human burials/remains or ostrich eggshell water flask caches be uncovered, or exposed during preparation of the lands for cultivation, these must immediately be reported to the South African Heritage Resources Agency (Ms Natasha Higgit 021 462 4502), or the McGregor Museum (Att Dr David Morris 053 8392707 / 082 2224777). Burials, etc. must not be removed or disturbed until inspected by the archaeologist

Should substantial fossil remains be encountered at surface or exposed during construction, the ECO should safeguard these, preferably *in situ*. They should then alert the South African Heritage Resources Agency as soon as possible (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Phone : +27 (0)21 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). This is to ensure that appropriate action (*i.e.* recording, sampling or collection of fossils, recording of relevant geological data) can be taken by a professional palaeontologist at the proponent's expense. A procedure for Chance Fossil Finds is tabulated in Appendix 2. These recommendations must be incorporated in the Environmental Management Programme for the WEF project.

The above recommendations must be incorporated into the Environmental Management Programme (EMPr) for the proposed development.

Table 1-1 Impact assessment summary table for the Construction Phase

Construction Phase													
Direct Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Construction of roads and infrastructure related to the 132kV powerline	Destruction of heritage resources including archaeology palaeontology and cultural landscape resources and burial grounds and graves, and sacred spaces	Negative	Site	Long-Term	Substantial	Unikely	Low	High	None required	LOW	Low	3	HIgh

Table 1-2 Impact assessment summary table for the Operational Phase

Operational Phase													
Indirect Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Activities related to the 132kV powerline	Destruction of heritage resources including archaeology palaeontology and cultural landscape resources and burial grounds and graves, and sacred spaces	Negative	Site	Long-Term	Substantial	Unlikely	Low	High	None required	LOW	Low	3	High

Table 1-3 Impact assessment summary table for the Decommissioning Phase

Decommissioning Phase													
Indirect Impacts													
Aspect/ Impact Pathway	**Nature of Potential Impact/ Risk**	**Status**	**Spatial Extent**	**Duration**	**Consequence**	**Probability**	**Reversibility of Impact**	**Irreplaceability**	**Potential Mitigation Measures**	**Significance of Impact and Risk**		**Ranking of Residual Impact/ Risk**	**Confidence Level**
										Without Mitigation/ Management	**With Mitigation/ Management (Residual Impact/ Risk)**		
Activities related to the Decommissioning of the 132kV powerline	Destruction of heritage resources including archaeology palaeontology and cultural landscape resources and burial grounds and graves, and sacred spaces	Negative	Site	Long-Term	Substantial	Unlikely	Low	High	None Required	LOW	Low	3	High

Table 1-4 Cumulative impact assessment summary table

Cumulative Impacts													
Aspect/ Impact Pathway	Nature of Potential Impact/ Risk	Status	Spatial Extent	Duration	Consequence	Probability	Reversibility of Impact	Irreplaceability	Potential Mitigation Measures	Significance of Impact and Risk		Ranking of Residual Impact/ Risk	Confidence Level
										Without Mitigation/ Management	With Mitigation/ Management (Residual Impact/ Risk)		
Construction of roads and infrastructure related to the 132kV powerline	Destruction of heritage resources including archaeology palaeontology and cultural landscape resources and and burial grounds and graves, and sacred spaces	Negative	Site	Long-Term	Substantial	Unikely	Low	High	Careful mapping and avoidance of identified heritage resources.	LOW	Low	3	Medium

8. INPUT INTO THE ENVIRONMENTAL MANAGEMENT PROGRAM

Impact	Mitigation/Management Objectives	Mitigation/Management Options	Monitoring		
			Methodology	**Frequency**	**Responsibility**
Design Phase:					
None	NA	NA	NA	NA	NA
Construction Phase:					
Destruction of heritage resources including archaeology palaeontology and cultural landscape resources and burial grounds and graves, and sacred spaces	Prevent destruction of heritage resources including archaeology palaeontology and cultural landscape resources and burial grounds and graves, and sacred spaces	Implement a buffer zone around significant resources identified Implement Fossil Chance Finds Procedure	Ensure that this is taken into consideration in the planning and design phase	During construction phase	ECO
Operational Phase:					
Destruction of heritage resources including archaeology palaeontology and cultural landscape resources and burial grounds and graves, and sacred spaces	Prevent destruction of heritage resources including archaeology palaeontology and cultural landscape resources and burial grounds and graves, and sacred spaces	Allow access to burial grounds for relatives and friends of deceased	NA	During operational phase	Heritage Practitioner
Decommissioning Phase:					
Destruction of heritage resources including archaeology palaeontology and cultural landscape resources and burial grounds and graves, and sacred spaces	Prevent destruction of heritage resources including archaeology palaeontology and cultural landscape resources and burial grounds and graves, and sacred spaces	Proactive management strategies to prevent impacts	NA	During decommissioning Phase	Heritage Practitioner

9. CONCLUSION AND RECOMMENDATIONS

Mulilo Renewable Project Developments (Pty) Ltd (hereafter, "Mulilo") has proposed to build the Kuruman Wind Energy Facility (WEF). The WEF will be connected to the grid via one 132kV overhead powerline.

Three routing alternatives are applicable:
· Alternative 1: 132kV overhead line from the Kuruman WEF Substation Phase 1 to the Ferrum Substation (56.8 km line) in the event that both wind farms are constructed.
· Alternative 2: 132kV overhead line from the Kuruman WEF Phase 1 Substation to the Segame Substation (14 km line) in the event that only WEF Phase 1 is constructed.
· Alternative 3: 132kV overhead line from the Kuruman WEF Phase 2 Substation to Segame Substation (22 km line) in the event that only WEF Phase 2 is constructed.
Height: 15m
Width of service road below line(s): Jeep track

The proposed powerline route is not a sensitive archaeological landscape, despite it crossing several eco-zones. Long stretches of the route, for example, from Bothaskop till the district gravel road, cross mostly flat lands covered in knee high dry grasses and dense Acacia thicket vegetation on a substrate of loose, red sands. Extensive scatters and patches of ironstone gravels occur in places, where only a few isolated tools were noted, but no settlement or occupation sites were located. Indications are that these tools represent mostly discarded flakes and/or flake debris.

The route, from the district gravel road, over the hilltops to Bramcote Farm is also not a sensitive archaeological landscape. Most of the route passes through Woodstock Farm towards the Eskom substation at Kuruman. It crosses flat lands covered in tall dry grasses, with small pockets of dense thicket (Acacia) vegetation (closer to Kuruman), on a substrate of red sands with virtually no surface stone occurring. However, patches and scatters of banded ironstone do occur in places, where a few isolated tools in banded iron stone were identified, however these are mostly discarded flakes and flake debris. Some of these occurrences are located outside of the study area, and were not given GPS locations.

It is interesting to note that fine grained CCS / translucent chert flakes were also noted in the powerline route between Hartlands Farm and the Kuruman Eskom substation, and on Bothaskop (located outside of the study area).

Given the overall low palaeosensitivity of the proposed footprint, it is concluded that in terms of palaeontological heritage resources the impact significance of the 132kV powerline is *low* (*negative*), both before and after mitigation. Significant impacts during the operational and de-commissioning phases are not anticipated. None of the fossil sites identified fall within the proposed powerline alignment and no specialist palaeontological mitigation is therefore proposed here. Small stromatolite-rich outcrop areas of Campbell Rand carbonates to the east of the WEF footprint should be designated as No-Go Areas and protected from any disturbance or development.

Recommendations
No mitigation is required prior to construction activities occurring. There is no heritage objection to the proposed development proceeding.

10. REFERENCES

Heritage Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
123045	AIA	Cobus Dreyer	26/06/2013	Report Eskom Garona Ferrum Mercury
152170	HIA	Robert de Jong	03/09/2008	Heritage Impact Assessment Report: Proposed Residential Development And Associated Infrastructure On A 200 Ha Portion Of The Farm Bestwood 429 Rd At Kathu, Northern Cape Province
152171	AIA	Cobus Dreyer	11/08/2008	First Phase Archaeological And Cultural Heritage Assessment Of The Proposed Residential Developments At A Portion Of The Remainder Of The Farm Bestwood 459rd, Kathu, Northern Cape
156617	AIA	David Morris	01/02/2014	Rectification and/or regularisation of activities relating to the Bestwood Township development near Kathu, Northern Cape: Phase 1 Archaeological Impact Assessment
163959	HIA	Anton van Vollenhoven	17/03/2014	HIA Eskom Manganore to Ferrum Scoping Phase
170455	AIA	Neels Kruger	31/03/2014	Archaeological Impact Assessment Of Demarcated Surface Portions On The Farms Sacha 468, Sims 462 And Sekgame 461 For The Proposed Stormwater Infrastructure (clean Water Cut-off Berm & Groundwater Dam) For The Sishen Mine, Kathu, Northern Cape Province.
170660	AIA	Cobus Dreyer	31/01/2014	First Phase Archaeological & Heritage Assessment Of the Proposed Vaal-gamagara Water Pipeline Project, Northern Cape
170664	AIA	Cobus Dreyer	28/09/2012	First Phase Archaeological And Heritage Assessment Of the Proposed Vaal-gamagara Water Pipeline Project, Northern Cape
170666	AIA	Cobus Dreyer	31/12/2013	First Phase Archaeological And Heritage Assessment Of The Proposed Vaal-gamagara Water Pipeline Project, Northern Cape
279906	AIA	Neels Kruger	02/12/2014	Archaeological Impact Assessment Of Demarcated Surface Portions On The Farm Sekgame 461 For The Proposed Sekgame Electricity Infrastructure Expansion Project, Sishen Mine, Northern Cape Province
294454	AIA	Neels Kruger	05/04/2015	Archaeological Impact Assessment Of Areas Demaracted For The Proposed Lyleveld North Waste Rock Dump Expansion And Lyleveld South Haul Road Extension Project, Sishen Mine, Northern Cape Province
324952	HIA	Lloyd Rossouw	07/07/2015	Phase 1 Heritage Impact Assessment of the 2.3 km long 40478 Vaal-Gamagara water pipeline alternative route around Kathu Pan, Northern Cape Province
329708	HIA	Anton van Vollenhoven	01/11/2014	HIA Eskom Manganore-Ferrum for EIA Phase
6339	**AIA**	**David Halkett**	**24/08/2009**	**An archaeological scoping assessment of the remainder and portion 1 (Tierkop) of farm Bramcote 446, Northern Cape Priovince.**

Palaeontological Impact Assessments				
Nid	**Report Type**	**Author/s**	**Date**	**Title**
114648	PIA	John E Almond	01/09/2012	Palaeontological Specialist Assessment: Desktop Study Proposed 16 Mtpa Expansion Of Transnet's Existing Manganese Ore Export Railway Line &

				Associated Infrastructure Between Hotazel And The Port Of Ngqura, Northern & Eastern Cape.

Web References
http://pza.sanbi.org/vegetation/nama-karoo-biom http://pza.sanbi.org/vachellia-erioloba http://pza.sanbi.org/sites/default/files/info_library/camelthorns_khathu_pdf.pdf http://www.museumsnc.co.za/aboutus/depts/education/GuidePlants.pdf https://www.sciencedirect.com/science/article/pii/S0195925509000857

SOILS AND AGRICULTURAL POTENTIAL ASSESSMENT:

Basic Assessment for the proposed development of supporting electrical infrastructure to the proposed Kuruman Phase 1 and Phase 2 Wind Energy Facilities near Kuruman in the Northern Cape

BA REPORT

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services	Johann Lanz – Soil Scientist
PO Box 320	P.O. Box 6209
Stellenbosch	Stellenbosch, 7599
7600	South Africa

23 July 2018

Johann Lanz
Curriculum Vitae

Education

M.Sc. (Environmental Geochemistry)	University of Cape Town	1996 - June 1999
B.Sc. Agriculture (Soil Science, Chemistry)	University of Stellenbosch	1992 - 1995
BA (English, Environmental & Geographical Science)	University of Cape Town	1989 - 1991
Matric Exemption	Wynberg Boy's High School	1983

Professional work experience

I am registered as a Professional Natural Scientist (Pri.Sci.Nat.) in the field of soil science, registration number 400268/12, and am a member of the Soil Science Society of South Africa.

Soil Science Consultant	**Self employed**	**2002 - present**

I run a soil science consulting business, servicing clients in both the environmental and agricultural industries. Typical consulting projects involve:

Soil specialist study inputs to EIA's, SEA's and EMPR's. These have focused on impact assessments and rehabilitation on agricultural land, rehabilitation and re-vegetation of mining and industrially disturbed and contaminated soils, as well as more general aspects of soil resource management. Recent clients include: Aurecon; CSIR; SiVEST; SRK Consulting; Juwi Renewable Energies; Mainstream Renewable Power; Subsolar; Tiptrans; Planscape; Afrimat; Savannah Environmental; Red Cap Investments; MBB Consulting Engineers; Enviroworks; Haw & Inglis.

Soil resource evaluations and mapping for agricultural land use planning and management. Recent clients include: Cederberg Wines; Unit for Technical Assistance - Western Cape Department of Agriculture; Vogelfontein Citrus; De Grendel Estate; Zewenwacht Wine Estate; Goedgedacht Olives;, Lourensford Fruit Company; Kaarsten Boerdery; Wedderwill Estate; Thelema Mountain Vineyards; Rudera Wines; Flagstone Wines; Solms Delta Wines; Dornier Wines.

I have conducted several research projects focused on conservation farming, soil health and carbon sequestration.

Soil Science Consultant	**Agricultural Consultors International (Tinie du Preez)**	**1998 - end 2001**

Responsible for providing all aspects of a soil science technical consulting service directly to clients in the wine, fruit and environmental industries all over South Africa, and in Chile, South America.

Contracting Soil Scientist	**De Beers Namaqualand Mines**	**July 1997 - Jan 1998**

Completed a contract to make recommendations on soil rehabilitation and re-vegetation of mined areas.

Publications

- Lanz, J. 2012. Soil health: sustaining Stellenbosch's roots. In: M Swilling, B Sebitosi & R Loots (eds). *Sustainable Stellenbosch: opening dialogues*. Stellenbosch: SunMedia.
- Lanz, J. 2010. Soil health indicators: physical and chemical. *South African Fruit Journal*, April / May 2010 issue.
- Lanz, J. 2009. Soil health constraints. *South African Fruit Journal*, August / September 2009 issue.
- Lanz, J. 2009. Soil carbon research. *AgriProbe*, Department of Agriculture.
- Lanz, J. 2005. Special Report: Soils and wine quality. *Wineland Magazine.*

I am a reviewing scientist for the *South African Journal of Plant and Soil*.

Specialist Declaration

I, Johann Lanz, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Name of Specialist: Johann Lanz

Signature of the specialist:

Date: 23 July 2018

Executive summary

Transmission lines have very little impact on the agriculture of the study area because all agricultural activities that are viable in this environment (grazing) can continue completely unhindered underneath transmission lines. The only possible source of impact is minimal disturbance to the land during construction and decommissioning.

The findings of this study are:

- Soils of the proposed development are dominated by rock outcrops and shallow, sandy, red soils on underlying rock and hardpan, which are predominantly of the Hutton soil form.
- The major limitations to agriculture are the shallow, rocky soils and the limited climatic moisture availability.
- As a result of these limitations, the study area is totally unsuitable for cultivation and agricultural land use is limited to grazing.
- The transmission line routes predominantly cross land capability evaluation values of between 4 and 6, which are very low to moderate.
- There are no agriculturally sensitive areas and no parts of the proposed routes need to be avoided by the development.
- The only potential impact of the development on agricultural resources and productivity was identified as:
    - Minimal soil and land degradation as a result of land disturbance during construction and decommissioning.
- This impact was assessed as having very low significance.
- Cumulative impact is also assessed as very low.
- The recommended mitigation measure is to include implementation of an effective system of storm water run-off control, where necessary, to mitigate erosion.
- Due to the very low agricultural impact, there are no restrictions relating to agriculture which preclude authorisation of the proposed development and therefore, from an agricultural impact point of view, the development should be authorised.
- There are no conditions resulting from this assessment that need to be included in the Environmental Authorisation, should this be granted.
- The overall significance of the impact on agriculture for the construction, operation and decommissioning phase is assessed as **very low**.

Table of Contents

List of figures

Index of Tables

Table 1: Compliance with the Appendix 6 of the 2014 EIA Regulations (as Amended)

Requirements of Appendix 6 – GN R326 EIA Regulations 7 April 2017	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Title page CV in the beginning of report
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 3
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1.1 & 1.1.2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.1.5
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 1.3.6 & 1.6.4
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.1.3
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.1.3
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1.3.4, 1.3.8 & Figure 3
g) an identification of any areas to be avoided, including buffers;	Section 1.3.8
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figure 3, Section 1.3.4
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.1.4
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 1.6
k) any mitigation measures for inclusion in the EMPr;	Section 1.8
l) any conditions for inclusion in the environmental authorisation;	Section 1.9.2
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 1.8
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 1.9 Section 1.8
2. a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not applicable

1.1 Introduction and methodology

1.1.1 Scope and objectives

This report presents the Soil and Agricultural Potential Assessment undertaken by Mr. Johann Lanz (an independent consultant), appointment by the CSIR, as part of the Basic Assessment for the proposed development of supporting electrical infrastructure to the proposed Kuruman Phase 1 and Phase 2 Wind Energy Facilities near Kuruman in the Northern Cape (see Figure 1). The proposed powerline routes alternatives that were considered for the assessment are:

- Alternative 1: runs from the Kuruman Phase 1 substation to the Kuruman Phase 2 substation to the Ferrum substation (located in Kathu).
- Alternative 2: runs from Kuruman Phase 1 substation to Segame substation (located in Kuruman)
- Alternative 3: runs from Kuruman Phase 2 substation to Kuruman Phase 1 substation to the Segame substation (located in Kuruman).

The objectives of the study are to identify and assess all potential impacts of the proposed development on agricultural resources including soils and agricultural production potential, and to provide recommended mitigation measures, monitoring requirements, and rehabilitation guidelines for all identified potential impacts.

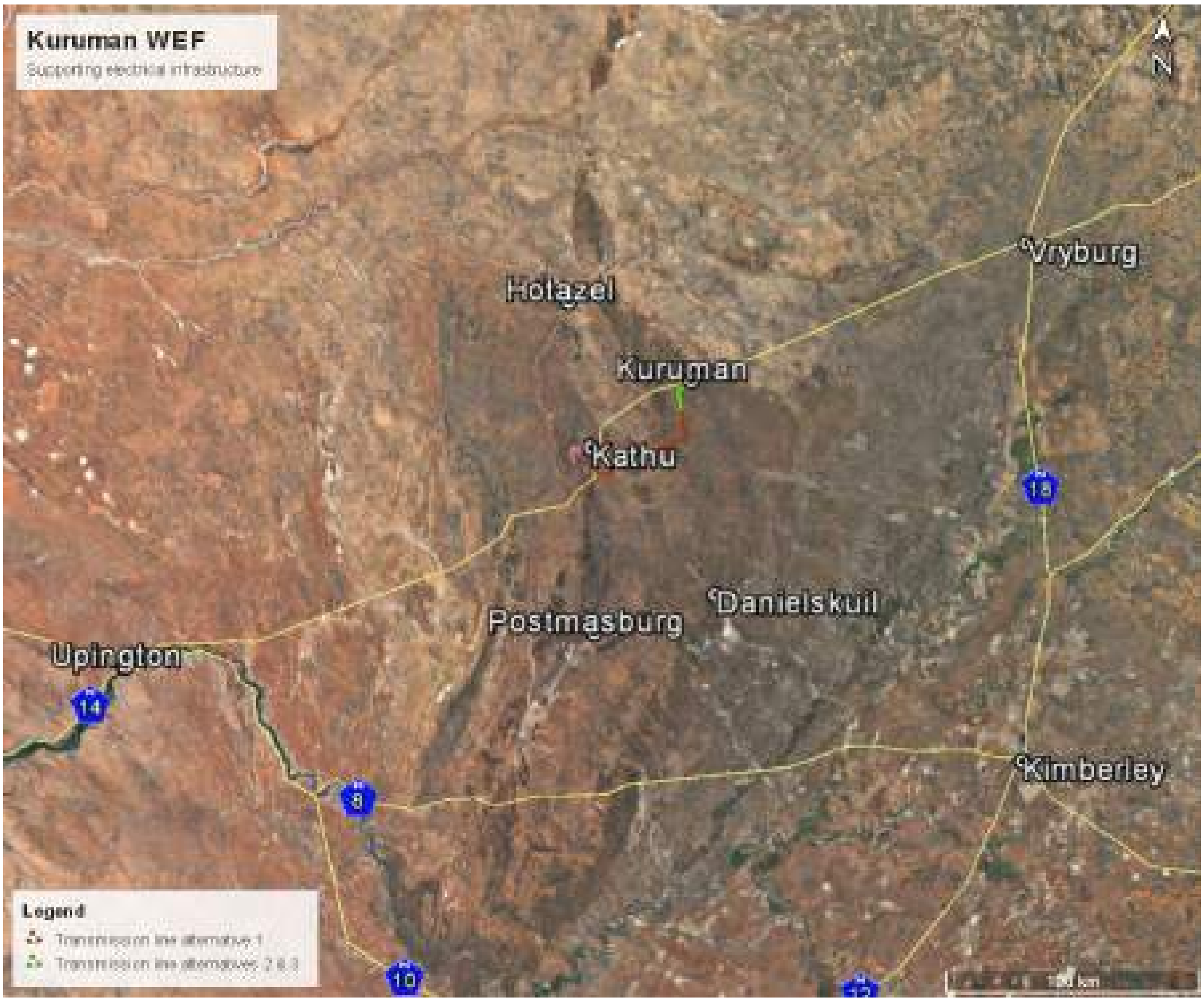


Figure 1: Location of the proposed transmission lines for the proposed Kuruman Wind Farm Facilities, between Kuruman and Kathu in the Northern Cape.

1.1.2 Terms of Reference

The following Terms of Reference (ToR) apply to this study:

The report fulfils the ToR for an agricultural study as set out in the National Department of Agriculture's document, *Regulations for the evaluation and review of applications pertaining to renewable energy on agricultural land*, dated September 2011. DEA's requirements for an agricultural study are taken directly from this document, but use an older version of the document and not the most recent version, which was updated in 2011.

The study applies an appropriate level of detail for the agricultural suitability on site and for the level of impact of the proposed development on agricultural land. A detailed soil survey, as per the requirement in the above document, is appropriate for a significant footprint of impact on arable land. It is not appropriate for this site, where soil and climate constraints make cultivation completely non-viable. Conducting a soil survey at the required level of detail would be very time consuming but would also be unnecessary as it would add no value to the impact assessment. The level of soil assessment that was conducted for this report (reconnaissance ground proofing of land type data) is considered more than adequate for a thorough assessment of all agricultural impacts.

The above requirements together with requirements for an EIA specialist report may be summarised as follow:

- Based on existing data as well as a field soil survey, describe and map soil types (soil forms) and characteristics (soil depth, soil colour, limiting factors, and clay content of the top and sub soil layers).
- Describe the topography of the site.
- Describe historical and current land use, agricultural infrastructure, as well as possible alternative land use options.
- Describe the erosion, vegetation and degradation status of the land.
- Determine and map the agricultural potential across the site.
- Determine and map the agricultural sensitivity to development across the site, including "no-go" areas, setbacks/buffers, as well as any red flags or risks associated with soil and agricultural impacts.
- Identify relevant legislation and legal requirements relating to soil and agricultural potential impacts.
- Identify and assess all potential impacts (direct, indirect and cumulative) of the construction, operational and decommissioning phases of the proposed development on soils and agricultural potential, and note the economic consequences of the proposed development on soils and agricultural potential.
- Provide recommended mitigation measures, management actions, monitoring requirements, and rehabilitation guidelines for all identified impacts.

1.1.3 Approach and Methodology

The pre-fieldwork assessment was based on the existing Agricultural Geo-Referenced Information System (AGIS) data, as well as Google Earth satellite imagery for the site. The AGIS data was supplemented by a field investigation. This was aimed at ground-proofing the AGIS data and achieving an understanding of specific soil and agricultural conditions, and the variation of these across the site. The field investigation involved a drive and walk over of the site using assessment of surface conditions and existing exposures. The field assessment was done on 20 February 2018, during summer. An assessment of soils (soil mapping) and long term agricultural potential is in no way affected by the season in which the assessment is made, and the timing of the assessment therefore has no bearing on its results. Soils were classified according to Soil Classification Working Group (1991).

The field investigation also included a visual assessment of erosion and erosion potential on site. The level of field investigation for this assessment is considered more than adequate for the purposes of this study (see section 1.1.2).

The potential impacts identified in this specialist study have been assessed based on the criteria and methodology outlined in Chapter 4 of the Draft BA Report. The ratings of impacts are based on the specialist's knowledge and experience of the field conditions and the impact of disturbances on those.

1.1.4 Assumptions, knowledge gaps and Limitations

The following assumptions were used in this specialist study:

- The study assumes that water for irrigation is not available across the site. This is based on the assumption that a long history of farming experience in an area will result in the exploitation of viable water sources if they exist, and none have been exploited in this area.
- Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 50 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts are listed in Appendix B.

The following limitation was identified in this study:

- The assessment rating of impacts is not an absolute measure. It is based on the subjective considerations and experience of the specialist, but is done with due regard and as accurately as possible within these constraints.

There are no other specific limitations or knowledge gaps relevant to this study.

1.1.5 Source of information

All data on land types, land capability, grazing capacity etc. was sourced from the online Agricultural Geo-Referenced Information System (AGIS), produced by the Institute of Soil, Climate and Water (Agricultural Research Council, 2007). Current and historical satellite imagery was all sourced from Google Earth. Rainfall and temperature data was sourced from The World Bank Climate Change Knowledge Portal (2015).

Soil data on AGIS originates from the land type survey that was conducted from the 1970's until 2002. It is the most reliable and comprehensive national database of soil information in South Africa and although the data was collected some time ago, it is still entirely relevant as the soil characteristics included in the land type data do not change within time scales of hundreds of years.

Land capability data was sourced from DAFF (2017).

1.2 Applicable legislation and permit requirements

Agricultural consent is required for power line servitudes in terms of the Subdivision of Agricultural Land Act, Act 70 of 1970, if Eskom is not the applicant. However, if they are the applicant, Eskom is currently exempt from agricultural consent for power line servitudes. The registration of a servitude needs to be done per farm portion.

1.3 Description of the affected environment: Soils and agricultural capability

This section is organised in sub headings based on the requirements of an agricultural study as detailed in section 1.1.2 of this report.

A satellite image map of the study site is given in Figure 3 and photographs of site conditions are given in Figures 4 to 7.

1.3.1 Climate and water availability

The site has a low rainfall of 400 mm per annum (The World Bank Climate Change Knowledge Portal, 2015). The average monthly rainfall distribution is shown in Figure 2. The low rainfall is a significant agricultural constraint that limits the level of agricultural production (including grazing) which is possible.

There are wind pumps with stock watering points across the area, but no other water or water storage infrastructure.

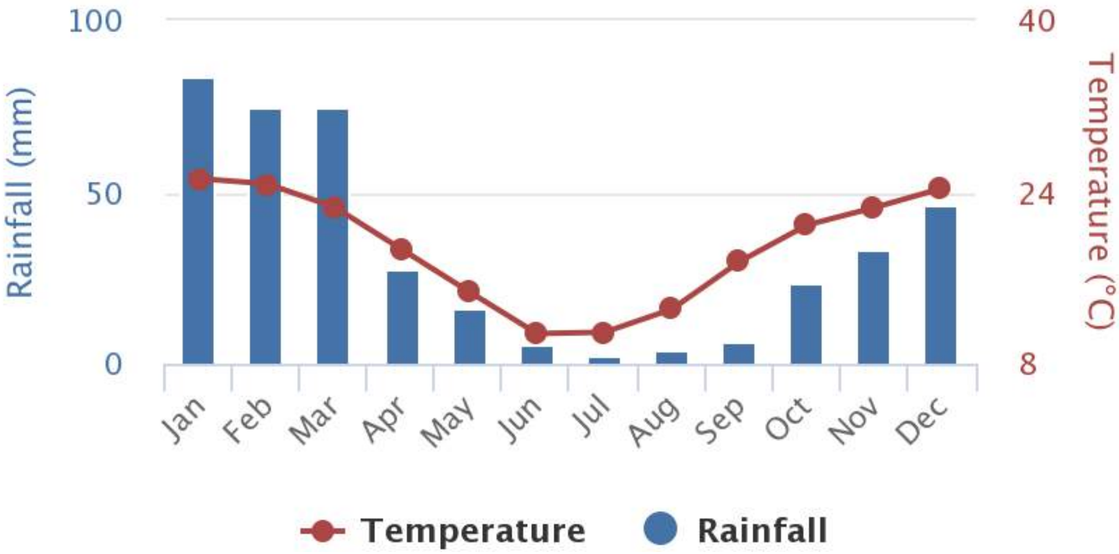


Figure 2: Average monthly temperature and rainfall for location (-27.59, 23.40), which is on the site, from 1991 – 2015 (The World Bank Climate Change Knowledge Portal, 2015).

1.3.2 Terrain, topography and drainage

The proposed transmission lines are located mostly on a fairly flat plateau at an altitude of between 1,200 metres and 1,400 metres. The lines do cross some hills, particularly in the vicinity of the wind farm. Although slopes are mostly gentle, they do vary widely across the routes.

The underlying geology of the area is yellow-brown banded or massive jaspilite with crocidolite, and banded ironstone with subordinate amphibolite, crocidolite and ferruginous brecciated banded ironstone. Red wind-blown sand and surface limestone of Tertiary to Recent age occur at the surface in places.

No perennial drainage features occur in the study area, but all the route alternatives cross several non-perennial drainage lines.

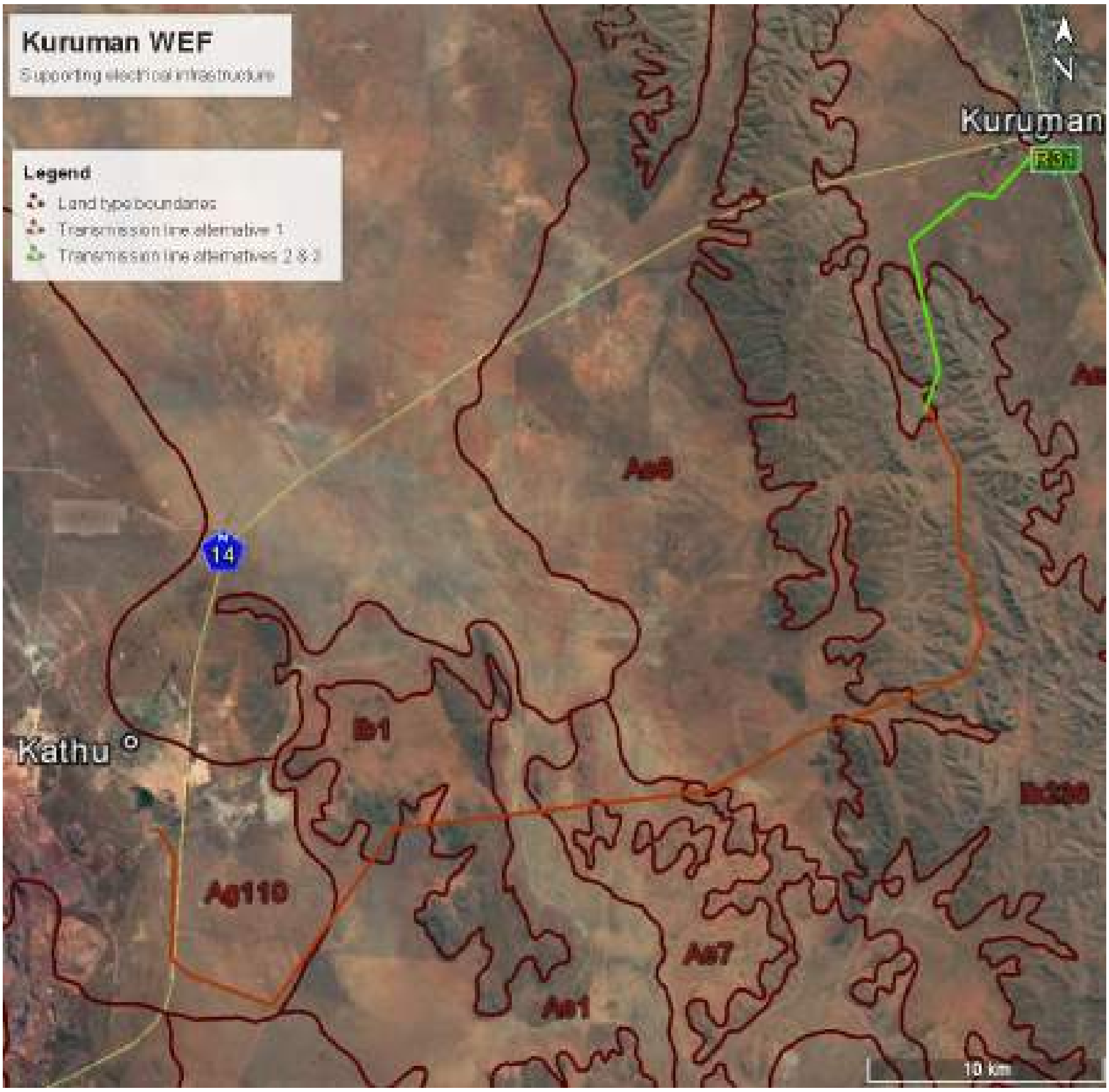


Figure 3: Satellite image site map of the proposed transmission lines showing land type distribution.

Figure 4: Photograph showing typical landscape and veld conditions of the proposed transmission line

Figure 5: Photograph showing typical landscape and veld conditions of the proposed transmission line

1.3.3 Soils

The land type classification is a nationwide survey that groups areas of similar soil, terrain and climatic conditions into different land types. The transmission line alternative options to Kuruman (Alternative 2 and 3) cross only two land types, namely Ib236 across the hilly terrain of the wind farm site and land type Ae2 across the flatter land beyond that.

Land type Ib236 is dominated (71% of the surface) by rock outcrop. The soils between the rock outcrops are red, sandy soils on underlying hard rock, of the Hutton soil form. They are predominantly shallow, but patches of deeper sands occur. The soils of Ae2 are shallow to deep, red, sandy soils on underlying rock or hardpan carbonate and are of the Hutton or Plooysburg soil forms. The soils would fall into the Oxidic and Calcic (underlying hardpan carbonate) soil groups according to the classification of Fey (2010).

The Alternative 1 (Kathu) route crosses several land types, mostly Ae land types and one Ag land type all of which are similar in terms of dominant soils to Ae2 above. The patches of more hilly terrain are land type Ib1 which is similar to Ib236 above.

A summary detailing soil data for the land types is provided in Appendix B. The field investigation confirmed that the dominant soil types are as described in the land type data.

The environment does not pose a particularly high erosion risk. Mitigating factors are the rock outcrops, permeability of the sandy soils and adequate vegetation cover. However, any surface disturbance always poses an erosion risk. Because the soils have a sandy texture, they are susceptible to wind erosion.

1.3.4 Agricultural capability

Land capability is defined as the combination of soil, climate and terrain suitability factors for supporting rainfed agricultural production. It is an indication of what level and type of agricultural production can sustainably be achieved on any land. The higher land capability classes are suitable as arable land for the production of cultivated crops, while the lower suitability classes are only suitable as non-arable grazing land, or at the lowest extreme, not even suitable for grazing. In 2017 DAFF released updated and refined land capability mapping across the whole of South Africa. This has greatly improved the accuracy of the land capability rating for any particular piece of land anywhere in the country. The new land capability mapping divides land capability into 15 different categories with 1 being the lowest and 15 being the highest. Values of below 8 are generally not suitable for production of cultivated crops. Detail of this land capability scale is shown in Table 2.

The proposed routes are classified with a range of land capability evaluation values predominantly of between 4 and 6. There is a small patch of land on the Alternative 1 route that has a maximum value of 7. The areas of more hilly terrain have a range of values below 5. The land capability of the routes is therefore classified as being entirely unsuitable for the rainfed production of cultivated crops. The land capability is limited by the shallow, rocky soils, but even in the patches of deeper soils, land capability is still very limited by the climatic moisture availability.

The grazing capacity of the area is classified at approximately 20 hectares per large stock unit.

Table 2: Details of the 2017 Land Capability classification for South Africa.

Land capability evaluation value	**Description**
1	Very Low
2	
3	Very Low to Low
4	
5	Low
6	Low to Moderate
7	
8	Moderate
9	Moderate to High
10	
11	High
12	High to Very High
13	
14	Very High
15	

1.3.5 Land use and development on and surrounding the site

The area is a cattle farming area. The climate does not support any cultivation and grazing is the only viable agricultural activity. The only agricultural infrastructure present in the study area are wind pumps, stock watering points and fencing surrounding grazing camps.

1.3.6 Status of the land

The vegetation has been grazed but there was no significant erosion or other land degradation identified in the area.

1.3.7 Possible land use options for the site

The low climatic moisture availability and shallow, rocky soils mean that grazing is the only possible agricultural land use for the study area.

1.3.8 Agricultural sensitivity

Agricultural sensitivity is a direct function of the capability of the land for agricultural production. This is because a negative impact on land of higher agricultural capability is more detrimental to agriculture than the same impact on land of low agricultural capability. Also, arable land is a scarce resource in South Africa and is therefore preservation worthy, and as a result has a high sensitivity. Land that is only suitable as grazing land however is not a particularly scarce resource and therefore has a low sensitivity. Because the land is not suitable for cultivation, it has a low agricultural sensitivity to development.

Agricultural sensitivity of a particular development is also a function of the severity of the impact which that development poses to agriculture. In the case of transmission lines, the impact is negligible (see impact assessment section). This even further reduces the agricultural sensitivity of the study area for the proposed development.

Agricultural conditions and potential are fairly uniform across the study area, with variation related to topography. The choice of placement of infrastructure therefore has negligible influence on the significance of agricultural impacts. No agriculturally sensitive areas occur within the study area and no parts of it therefore need to be avoided by the development. There are no required buffers.

1.4 Description of project aspects relevant to agricultural impacts

The project involves the development of a 132kV overhead transmission line. Transmission lines do not really impact the agriculture of the study area because all agricultural activities that are viable in this environment (grazing) can continue completely unhindered underneath transmission lines. The only possible source of impact is minimal disturbance to the land during construction and decommissioning.

1.5 Identification of key issues

Because of the uniformity of agricultural conditions and the low sensitivity environment, the impact assessment below is applicable to all three alternatives.

1.5.1 Identification of potential impacts

The potential impacts identified during the assessment are:

1.5.1.1 Construction phase

- Soil and land degradation caused by construction excavation and vehicle passage.

1.5.1.2 Operational phase

- Zero impact

1.5.1.3 Decommissioning phase

- Soil and land degradation caused by construction excavation and vehicle passage.

1.5.1.4 Cumulative impact

- Soil and land degradation caused by construction excavation and vehicle passage.

1.6 Assessment of impacts and identification of management actions

The significance of all potential agricultural impacts is low due to two important factors.

1. The actual footprint of disturbance is negligible and all agricultural activities will be able to continue unaffectedly underneath the transmission lines.
2. The proposed route is on land of limited agricultural potential that is only viable for grazing. These factors also mean that cumulative regional effects as a result of other surrounding developments, also have low significance.

All identified impacts are considered to be direct impacts. No indirect impacts were identified.

1.6.1 Construction phase

Soil and land degradation

Aspect / Activity	Construction excavation and vehicle passage.
Type of impact	Direct
Potential Impact	Land surface disturbance including vegetation removal, vehicle passage and

	excavation may lead to erosion. However, the environment does not pose a particularly high erosion risk.
Mitigation Required	Implement an effective system of storm water run-off control, where it is required. It would only be required where land disturbance could potentially lead to run-off accumulation that might then lead to down slope erosion. The system should control water movement by means of bunds and ditches, so that it safely disperses and disseminates any run-off accumulation into the veld.
Impact Significance (Pre-mitigation)	Very low
Impact Significance (Post-Mitigation)	Very low

1.6.2 Operational phase

There is zero impact during the operational phase.

1.6.3 Decommissioning phase

The decommissioning phase would involve very similar activities to the operational phase and the impacts and impact assessment would therefore be identical.

Aspect / Activity	Construction excavation and vehicle passage.
Type of impact	Direct
Potential Impact	Land surface disturbance including vegetation removal, vehicle passage and excavation may lead to erosion. However, the environment does not pose a particularly high erosion risk.
Mitigation Required	Implement an effective system of storm water run-off control, where it is required. It would only be required where land disturbance could potentially lead to run-off accumulation that might then lead to down slope erosion. The system should control water movement by means of bunds and ditches, so that it safely disperses and disseminates any run-off accumulation into the veld.
Impact Significance (Pre-mitigation)	Very low
Impact Significance (Post-Mitigation)	Very low

1.6.4 Cumulative impacts

The cumulative impact of a development is the impact that development will have when its impact is considered together with the impacts of other proposed developments that will affect the same environment. The most important concept related to a cumulative impact is that of an acceptable level of change to an environment. A cumulative impact only becomes relevant when the impact of the proposed development will directly lead to the sum of proposed developments that impact an environment causing an acceptable level of change to be exceeded.

For formal assessment purposes, in terms of the NEMA regulations, cumulative impacts are assessed by taking all known, proposed, similar developments within a certain distance of the development being assessed, into account. Restricting the cumulative impacts to similar developments is entirely arbitrary (but perhaps administratively necessary), because all developments, regardless of their type and similarity, will contribute to exceeding an acceptable level of change.

Because of the very low impact of transmission lines on the agricultural environment of the study area, this environment could accommodate many times more transmission lines than currently exist or are ever likely to be proposed, before acceptable levels of change have any likelihood of being exceeded. Acceptable levels of change in terms of other areas of impact such as visual impact would be exceeded long before agricultural levels of change came anywhere near to being exceeded.

The cumulative agricultural impact of the proposed project is therefore of absolutely no issue.

1.7 Impact assessment summary

Table 3: Impact assessment summary table - Construction phase direct impacts

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment / resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/impact (after mitigation)	Ranking of impact/ risk	Confidence level
Land disturbance	Soil and land degradation	Negative	Site	Medium term	Slight	Unlikely	Low	Low	Very low	No	Yes	Implement an effective system of storm water run-off control.	Very low	5	High

Table 4: Impact assessment summary table - Decommissioning phase direct impacts

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment / resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/impact (after mitigation)	Ranking of impact/ risk	Confidence level
Land disturbance	Soil and land degradation	Negative	Site	Medium term	Slight	Unlikely	Low	Low	Very low	No	Yes	Implement an effective system of storm water run-off control.	Very low	5	High

Table 5: Impact assessment summary table - Cumulative impacts

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment / resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/impact (after mitigation)	Ranking of impact/ risk	Confidence level
Land disturbance	Soil and land degradation	Negative	Site	Medium term	Slight	Unlikely	Low	Low	Very low	No	Yes	Implement an effective system of storm water run-off control.	Very low	5	High

1.8 Input to the Environmental Management Programme (EMPr)

There are no inputs to the Environmental Management Programme for the design and operational phases.

Table 6: Management Plan for the Construction Phase

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
A. OPERATIONAL PHASE					
A.1. AGRICULTURAL IMPACTS					
Erosion	That disturbance causes no erosion on or downstream of the site.	Implement an effective system of storm water run-off control, where it is required. It would only be required where land disturbance could potentially lead to run-off accumulation that might then lead to down slope erosion. The system should control water movement by means of bunds and ditches, so that it safely disperses and disseminates any run-off accumulation into the veld.	Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	Monthly	Environmental Control Officer (ECO)

Table 7: Management Plan for the Decommissioning Phase

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
B. OPERATIONAL PHASE					
B.1. AGRICULTURAL IMPACTS					
Erosion	That disturbance causes no erosion on or downstream of the site.	Implement an effective system of storm water run-off control, where it is required. It would only be required where land disturbance could potentially lead to run-off accumulation that might then lead to down slope erosion. The system should control water movement by means of bunds and ditches, so that it safely disperses and disseminates any run-off accumulation into the veld.	Undertake a periodic site inspection to verify and inspect the effectiveness and integrity of the storm water run-off control system and to specifically record the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	Monthly	Environmental Control Officer (ECO)

1.9 Conclusions and recommendations

The proposed development is on land of limited agricultural potential that is only viable for grazing. Transmission lines do not really impact the agriculture of the study area because all agricultural activities that are viable in this environment (grazing) can continue completely unhindered underneath transmission lines. The only possible source of impact is minimal disturbance to the land during construction and decommissioning. Minimal soil and land degradation could result from such disturbance. All potential agricultural impacts including cumulative impacts are assessed as very low.

Because of the very low agricultural impact, there are no material differences between the agricultural impacts of any of the alternatives. Therefore, from an agricultural impact perspective, there is no preferred alternative and any of the alternatives is acceptable.

There are no agriculturally sensitive areas that need to be avoided by the development.

1.9.1 Final statement by the specialist - should the proposed activities be authorised?

Due to the low agricultural potential of the site, and the important fact that transmission lines have such little impact on agriculture, the impact of the development is assessed as very low. There are therefore no restrictions relating to agriculture which preclude authorisation of the proposed development and therefore, from an agricultural impact point of view, the development should be authorised.

1.9.2 Recommended conditions to be included in the environmental authorisation

There are no conditions resulting from this assessment that need to be included in the Environmental Authorisation should this be granted.

2 References

Agricultural Research Council. 2007. AGIS Agricultural Geo-Referenced Information System available at http://www.agis.agric.za/.

Department of Agriculture, Forestry and Fisheries, 2017. National land capability evaluation raster data layer, 2017. Pretoria.

Fey, M. 2010. Soils of South Africa. Cambridge University Press, Cape Town.

Soil Classification Working Group. 1991. Soil classification: a taxonomic system for South Africa. Soil and Irrigation Research Institute, Department of Agricultural Development, Pretoria.

The World Bank Climate Change Knowledge Portal available at
http://sdwebx.worldbank.org/climateportal/

Appendix A: Soil data

Table 8: Land type soil data for site.

Land type	Soil series (forms)	Depth (mm)			Clay % A horizon			Clay % B horizon			Depth limiting layer	% of land type
Ae1	Hutton	750	>	1200	2	-	6	4	-	9	R,ka	44.0
Ae1	Hutton	600	-	1200	2	-	6	4	-	10	R,ka	29.0
Ae1	Hutton	100	-	400	2	-	6	4	-	9	R,ka	8.0
Ae1	Mispah	100	-	250	2	-	10				ka	6.3
Ae1	Hutton	100	-	350	2	-	6	4	-	10	R,ka	4.4
Ae1	Rock outcrop											4.1
Ae1	S											1.8
Ae1	Hutton	500	-	800	6	-	10	15	-	20	R,ka	1.8
Ae1	Katspruit	400	-	900	2	-	15	4	-	20	gc	0.7
Ae2	Hutton	600	>	1200	2	-	6	4	-	10	R	26.0
Ae2	Hutton	750	>	1200	2	-	6	4	-	9	R,ka	23.0
Ae2	Hutton	300	-	600	2	-	6	4	-	10	R	16.0
Ae2	Hutton	100	-	300	4	-	8	4	-	10	R	15.0
Ae2	Hutton	300	-	600	2	-	6	4	-	9	R,ka	10.0
Ae2	Rock outcrop											4.0
Ae2	Hutton	450	-	750	10	-	15	15	-	20	R,ka	2.0
Ae2	Clovelly	750	-	1200	2	-	6	4	-	10	ka	1.0
Ae2	Mispah	50	-	250	4	-	10				ka	1.0
Ae7	Hutton	300	>	1200	12	-	20	25	-	35	R	31.3
Ae7	Hutton	100	-	300	12	-	20	25	-	35	R	23.0
Ae7	Rock outcrop											18.0
Ae7	Hutton	300	>	1200	10	-	15	15	-	25	R	7.4
Ae7	Hutton	600	>	1200	6	-	12	6	-	15	R	7.0
Ae7	Hutton	100	-	300	8	-	18	12	-	25	R	6.5
Ae7	Hutton	300	-	750	8	-	18	12	-	25	R	3.0
Ae7	Oakleaf	300	-	1000	8	-	20	15	-	25	R	2.6
Ae7	S											1.2
Ae8	Hutton	600	>	1200	2	-	6	4	-	10	R	26.3

Land type	Soil series (forms)	Depth (mm)			Clay % A horizon			Clay % B horizon			Depth limiting layer	% of land type
Ae8	Hutton	750	>	1200	2	-	6	4	-	9	R,ka	23.3
Ae8	Hutton	300	-	600	2	-	6	4	-	10	R	16.1
Ae8	Hutton	100	-	300	4	-	8	4	-	10	R	14.8
Ae8	Hutton	300	-	600	2	-	6	4	-	9	R,ka	9.8
Ae8	Rock outcrop											4.2
Ae8	Hutton	450	-	750	10	-	15	15	-	20	R,ka	1.9
Ae8	S											1.5
Ae8	Clovelley	750	-	1200	2	-	6	4	-	10	ka	1.4
Ae8	Mispah	50	-	250	4	-	10				ka	0.9
Ag110	Hutton	20	-	300	2	-	6	4	-	8	ka,R	55.0
Ag110	Mispah	0	-	300	6	-	15				ka	21.7
Ag110	Hutton	450	-	900	4	-	8	6	-	15	R,ka	13.8
Ag110	Hutton	450	-	700	8	-	15	15	-	25	R,ka	4.7
Ag110	Mispah	0	-	300	6	-	15				R	4.5
Ag110	S											0.3
Ib1	Rock outcrop											67.0
Ib1	Hutton	100	-	450	3	-	6	4	-	10	R	18.7
Ib1	Hutton	450	-	900	4	-	6	6	-	10	R	8.3
Ib1	Mispah	100	-	250	6	-	10				R	4.9
Ib1	Mispah	100	-	250	6	-	10				ka	1.1
Ib236	Rock outcrop											71.0
Ib236	Hutton	50	-	300	2	-	6	4	-	10	R	22.0
Ib236	Hutton	300	-	1200	2	-	6	4	-	10	R	6.0

Depth limiting layers: R = hard rock; ka = hardpan carbonate, gc = dense clay horizon that is frequently saturated.

Appendix B: Projects to be considered in terms of cumulative impacts

DEA_REF	PROJ_TITLE	APPLICANT	EAP	TECHNOLOGY	MEGAWATT
14/12/16/3/3/2/819	The 75 MW AEP Legoko Photovoltaic Solar Facility on Portion 2 of the Farm Legoko 460, Kuruman Rd within the Gamagara Local Municipality in the Northern Cape Province	AEP Lekogo Solar (Pty) Ltd	Cape Environmental Assessment Practitioners	Solar PV	75
14/12/16/3/3/2/820	The 75 MW AEP Mogobe Photovoltaic Solar Facility on portion 1 of the farm Legoko 460 and farm Sekgame 461, Kuruman Rd within the Gamagara Local Municipality in the Northern Cape Province	AEP Mogobe Solar (Pty) Ltd	Cape Environmental Assessment Practitioners	Solar PV	75
12/12/20/1858/1	Kathu Solar Energy Facility	Renewable Energy Investments South Africa Pty Ltd	Savannah Environmental Consultants (Pty) Ltd	Solar PV	75
12/12/20/1858/2	Kathu Solar Energy Facility 25MW 2	Lokian Trading and Investments	Savannah Environmental Consultants (Pty) Ltd	Solar PV	25
12/12/20/1860	Proposed establishment of the Sishen Solar Farm on Portion 6 of Wincanton 472, NC	VentuSA Energy Pty Ltd	Savannah Environmental Consultants (Pty) Ltd	Solar PV	74
12/12/20/1906	Proposed construction of solar farm for Bestwood, Kgalagadi District Municipality, NC	Katu Property Developers Pty Ltd	Rock Environmental Consulting (Pty) Ltd	Solar PV	0
12/12/20/1994 12/12/20/1994/1 12/12/20/1994/2 12/12/20/1994/3	The Proposed Construction Of Kalahari Solar Power Project On The Farm Kathu 465, Northern Cape Province	Group Five Pty Ltd	WSP Environmental (Pty) Ltd	Solar PV	480
12/12/20/2566	A 19MW Photovoltaic Solar Power Generation Plant On The Farm Adams 328 Near Hotazel, Northern Cape Province	To review	To review	Solar PV	19
12/12/20/2567	The Proposed 150mw Adams Photo-Voltaic Solar Energy Facility On The Farm Adams 328 Near Hotazel Northern Cape Province	To review	To review	Solar PV	75
14/12/16/3/3/1/474	Construction of the Roma Energy Mount Roper Solar Plant on the Farm Moutn Roper 321, Kuruman, Ga-Segonyana Local Municipality	To review	EnviroAfrica Environmental Consultants (Pty) Ltd	Solar PV	10
14/12/16/3/3/1/475	The Proposed Construction Of Keren Energy Whitebank Solar Plant On Farm Whitebank 379, Kuruman, Northern Cape Province	To review	EnviroAfrica Environmental Consultants (Pty) Ltd	Solar PV	10
14/12/16/3/3/2/273	The Proposed San Solar Energy Facility And Associated Infrastructure On A Site Near Kathu, Gamagara Local Municipality, Northern Cape Province	To review	Savannah Environmental Consultants (Pty) Ltd	Solar PV	75
14/12/16/3/3/2/616	Proposed renewable energy genеartion project on Portion 1 of	Danax Energy (Pty)	AGES Limpopo (Pty) Ltd	Solar PV	75

DEA_REF	PROJ_TITLE	APPLICANT	EAP	TECHNOLOGY	MEGAWATT
	the Farm Shirley No. 367, Kuruman RD, Gamagara Local Municipality, Shirley Solar Park	Ltd			
14/12/16/3/3/2/761	Proposed 75 MW Perth-Kuruman Solar Farm on the remainder of the farm Perth 276 within the Joe Morolong Local Municipality, Northern Cape Province	Agulhas-Hotazel Solar Power (Pty) Ltd	Strategic Environmental Focus (Pty) Ltd	Solar PV	75
14/12/16/3/3/2/762	The 75MW Perth-Hotazel Solar Farm and its associated infrastructure on the Remainder of the Farm Perth 276 within the Joe Morolong Local Municipality in Northern Cape Province	Agulhus-Hotazel Solar Power (Pty) Ltd	Strategic Environmental Focus	Solar PV	75
14/12/16/3/3/2/911	Proposed 75MW AEP Kathu Solar PV Energy Facility on the Remainder of the Farm 460 Legoko near Kathu within the Gamagara local Municipality in the Northern Cape Province	AEP Kathu Solar (Pty) Ltd	Cape Eprac	Solar PV	75
14/12/16/3/3/2/934	Kagiso Solar Power Plant near Hotazel, Northern Cape Province	Kagiso Solar Power Plant (RF) (Pty) Ltd	Environamics	Solar PV	115
14/12/16/3/3/2/935	Proposed 115 Megawatt (MW) Boitshoko Solar Power Plant on the Remaining Extent of Portion 1 of The Farm Lime Bank no. 471 Near Kathu in the Gamagara Local Municipality	Boitshoko Solar Power Plant (RF) (Pty) Ltd	Environamics cc	Solar PV	115
14/12/16/3/3/2/936	Tshepo Solar Power Plant near Hotazel, Northern Cape	Tshepo Solar Power Plant (RF) (Pty) Ltd	Environamics cc	Solar PV	115

SOCIO-ECONOMIC STUDY:

Basic Assessment for the proposed development of supporting electrical infrastructure to the proposed Kuruman Phase 1 and Phase 2 Wind Energy Facilities near Kuruman in the Northern Cape: BA REPORT

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services	Urban-Econ Development Economists
P O Box 17001	P O Box 13554
Congella, Durban, 4013	Hatfield
South Africa	0028

09 July 2018

SPECIALIST EXPERTISE

Elena Broughton

Profession: Unit Manager: Innovation and Sustainable Development; Senior Development Economist

Experience: 14 years

Professional Registration: SAPOA Urban-Econ Development Economists

Key Skills: Socio-Economic Impact Assessments; Economic Impact Assessments; Economic Modelling; Project Management

Brief Profile: Elena Broughton is a senior professional and the manager of the Innovation & Sustainable Development Unit at Urban-Econ. She has extensive knowledge in various fields of economic development that includes 14 years of experience in undertaking socio-economic impact assessment studies for a variety of private clients spanning the mining, manufacturing, energy, infrastructure, and retail sectors. She also acted as a peer reviewer in several socio-economic impact assessment studies and completed a few strategic socio-economic impact assessments. Her involvement in the field allowed her to develop a sound understanding of the South African environmental legislation and developmental policies and equipped her with a widespread knowledge of socio-economic implications and benefits of various new developments.

Education:

University of Pretoria - 2011	MSc (Technology Management)
University of Pretoria - 2007	BScHons (Technology Management) (*cum laude*)
Nizhny Novgorod University, Russia - 2002	BComHons (Economics)

Ndivhuwo Malemagoba

Profession: Development Economist

Experience: 3 years

Professional Registration: SAPOA Urban-Econ Development Economists

Key Skills: Socio-Economic Impact Assessments; Economic Impact Assessments; Qualitative and Quantitative Research

Brief Profile: Ndivhuwo is a Development Economist with a sturdy background in development planning. Her endeavours include project management in built environment solution provision. Her robust experience in qualitative and quantitative research has equipped her with data collection, analysis and interpretation skills. This has led to her contribution to numerous development research studies in the academic and private sector arena.

Education:

University of the Witwatersrand- 2016	MSc (Development Planning)
University of the Witwatersrand - 2014	BSc Hons (Urban and Regional Planning) (*with distinction*)
University of the Witwatersrand - 2013	BSc (Urban and Regional Planning)

SPECIALIST DECLARATION

I, Elena Broughton, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Name of Specialist: Elena Broughton

Date: 09 July 2018

SPECIALIST DECLARATION

I, Ndivhuwo Malemagoba, as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favorable to the applicant;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the
- competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist: ______________

Name of Specialist: Ndivhuwo Malemagoba

Date: 09 July 2018

EXECUTIVE SUMMARY

Mulilo Renewable Project Developments proposes to develop supporting electrical infrastructure for Phase 1 and 2 Kuruman Wind Farms. The proposed transmission line spans the Ga-Segonyana and Gamagara Local Municipalities of the Northern Cape, near Kuruman and Kathu. Three alternative layouts were considered, which are not mutually exclusive and dependent on the approval of one or both phases of the wind farm.

- Alternative 1 is the connects to both Phase 1 and Phase 2 Wind Energy Facilities and is the longest transmission line. Therefore:
- It affects the largest number of farm portions and land activities.
- It results in the greatest accruement of economic benefits during construction. Due to the extensive distance (56km) it covers, the capital expenditure is the greatest and will therefore stimulate the economy and increase production far greater than alternatives 2 and 3.
- It poses the highest health risk as it spans in high proximity to unrehabilitated asbestos mines.
- Alternative 2 and 3 both cover a 14km span, and as a result affect the least number of farm portions and land activities.
- These two layouts will require relatively less capital expenditure and will result in relatively less economic stimulation and production.
- In addition, these alternatives will be constructed in the cases if only one of the two phases of the Kuruman Wind Farms are approved and developed.
- The transmission line is further away from unrehabilitated mines compared to Alternative 1 but is still in a no-go asbestos area.
- All alternatives span across certain farms portions and will cause a temporary disturbance to activities undertaken on the farms during the construction phase. Nonetheless, no property or structures will require demolition.

The review of key national, provincial and local policy documents and strategies indicates that the development of economic infrastructure is salient for economic growth and attracting investment. The Northern Cape has attracted the lion's share of renewable energy projects which will require supporting electrical infrastructure such as transmission lines. Twenty renewable energy projects are planned to be located within a 50km radius from the existing Eskom substations. Therefore, the cumulative impacts will be notable if all projects are approved and commence with construction at a similar time period.

The electrical infrastructure will usher in positive impacts and contribute in the provision of new electrical infrastructure. Such economic infrastructure contributes to the development of the region. The injection of capital expenditure during construction will stimulate production, create business opportunity and boost the economy, albeit for a temporary period. Furthermore, jobs created during construction can be made available to local labour which will alter the unemployment issue, lead to household income and enhance skills development.

On the contrary, negative impacts are also expected to ensue. The increased number of vehicular and pedestrian traffic on the proposed project site may potentially lead to stock theft, thus increasing criminal activity and causing loss for victims. Furthermore, the asbestos mines pose a health risk for employees. Alternative 1 transmission line approaches the unrehabilitated asbestos mines. Pursuing this option would increases the potential health risks for on-site personnel during construction and maintenance phases, which will require implementation of an appropriate action plan aimed to prevent any health risks associated with asbestos pollutants.

Nonetheless, the net effect of the proposed project is positive as it ultimately leads to improved energy infrastructure in the province. This subsequently contributes to improved service delivery and aids socio-economic development. To improve the positive impact, particularly for the local municipality, it is highly recommended that local procurement and employment is concentrated herein, as far as is feasible. <u>From a socio-economic perspective therefore, no objections are made with regard to the</u>

proposed project. Furthermore, considering the nature of the alternatives either of the options could be developed to evacuate power from the operating wind farms, provided that the developer takes into account the concerns and preferences of the affected land owners during construction and servitude maintenance periods, as well as ensuring that an appropriate health risk prevention plan is devised to be implemented during construction and maintenance periods.

The overall socio-economic significance rating is Low positive.

The following table summarises the reviewed socio-economic impacts and provides an indication of the significance before and after mitigation.

Table 1-1: Summary of socio-economic impacts

Socio-economic impact	Impact significance without mitigation	Impact significance with mitigation
Construction Phase		
Increase in production and GDP	Low (+)	Low (+)
Temporary employment creation	Very Low (+)	Very Low (+)
Potential increase in criminal activity	Low (-)	Very Low (-)
Potential asbestos related health risks	Very low (-)	Very low (-)
Operations phase		
Long-term employment creation	Very low (+)	Very low (+)
Decommissioning Phase		
Local economy stimulation	Very low (+)	Very low (+)
Employment creation	Very low (+)	Very low (+)
Cumulative Impacts		
Increased production and GDP	High (+)	High (+)
Employment creation	Moderate (+)	Moderate (+)

LIST OF ABBREVIATIONS

DEA	Department of Environmental Affairs
CAGR	Compounded Annual Growth Rate
CAPEX	Capital Expenditure
DM	District Municipality
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
HV	High Voltage
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IRP	Integrated Resource Plan
LM	Local Municipality
MV	Medium Voltage
MW	Megawatt
NDP	National Development Plan
NGPF	New Growth Path Framework
OPEX	Operating Expenditure
PV	Photovoltaic
SDF	Spatial Development Framework

GLOSSARY

Definitions	
Not Economically Active	The portion of the population who are neither employed nor unemployed but include discouraged job seekers.
Gross Domestic Product	The sum of value added created by all residents within a certain period, which is commonly a year.
Working Age Population	The portion of the population aged between 15 and 64.
Compounded Annual Growth Rate	A measure of growth over multiple time periods.
Capital Expenditure	The cost of developing or providing non-consumable parts for the product or system.
Operating Expenditure	Ongoing costs for running a product, business or system.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Specialist expertise
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Specialist declaration
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1.1 and 1.1.2
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.1.4 and 1.1.5
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 1.4 and section 1.5
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 1.1.4
e) a description of the methodology adopted in preparing the report or carrying out the specialized process inclusive of equipment and modelling used;	Section 1.1.3
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 1.7
g) an identification of any areas to be avoided, including buffers;	Not applicable
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Refer to Map 1-6 on asbestos mines
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 1.1.4
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Section. 1.6
k) any mitigation measures for inclusion in the EMPr;	Section 1.8
l) any conditions for inclusion in the environmental authorisation;	None
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 1.8
n) a reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 1.9
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 1.2 and 1.1.5
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not received
q) any other information requested by the competent authority.	Not applicable
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Yes

TABLE OF CONTENTS

1 SOCIO-ECONOMIC BASIC ASSESSMENT

1.1 INTRODUCTION AND METHODOLOGY

1.1.1 Scope and Objectives

This document is prepared by **Urban-Econ Development Economists** (**Urban-Econ**) in response to a request by the **Council for Scientific and Industrial Research** (**CSIR**) to undertake a Socio-Economic Basic Assessment for the proposed development of supporting electrical infrastructure to Phase 1 and Phase 2 Kuruman Wind Farm Facilities near Kuruman, in the Northern Cape.

The purpose of the socio-economic Basic Assessment is to determine the potential socio-economic implications of the proposed project activities at the proposed project path. The basic assessment report addresses the impacts as set out in the guidelines in terms of the Environmental Impact Assessment Regulations of 2014. The purpose of the socio-economic Basic Assessment is as follows:

- Undertake a policy review and assess the alignment of the proposed project with the national, provincial and local socio-economic policies, with a focus on the compatibility of the project with the spatial planning, development objectives and land use management plans of the respective authorities.
- Create a socio-economic profile for the study area using secondary data. The guidelines for Basic Assessment specifically call for information on the level of unemployment and skills available in the local community, as well as the economic profile of the local municipality.
- Identify and analyse the potential socio-economic value of the proposed project considering alternatives.
- Evaluate the potential positive impacts versus any negative socio-economic effects that may ensue as a result of the change in status quo of the affected and benefiting communities and economies.
- Recommend, if applicable, the preferred alternative from a socio-economic perspective.

1.1.2 Terms of Reference

The scope of work for the socio-economic specialist involves:

- the identification, prediction, and evaluation of the geographical, social, economic, and cultural aspects of the environment that may be affected by the associated project infrastructure; and
- advise on the alternatives to best avoid negative impacts or allow to manage and minimise them to acceptable levels, while optimising positive effects.

The specific objectives of the study include:

- Determining the affected communities and economies located in the zone of influence and the identification of sensitive receptors within the delineated study area, i.e. communities, land uses and economic activities that could be directly or indirectly negatively affected by the proposed development or benefit from it;
- Review secondary data
- Collect primary social and economic data of the parties that may be directly or indirectly affected (positively or negatively) by the proposed development
- Create profiles for the communities and economies representing the study areas and the environmentally affected zone;
- Identify, predict, and evaluate the potential positive and negative impacts associated with the project following the environmental specialist’s methodology;

- Develop a mitigation plan by proposing mitigation measures for negative effects and enhancement measures for positive impacts.

1.1.3 Approach and Methodology

- Data gathering

Impact assessment requires the knowledge of the socio-economic environment that will be affected by the proposed project. In order to create a comprehensive understanding of the socio-economic environment that might be affected by the proposed development, a socio-economic profile of the study areas as well as the zone of influence was developed.

- Data analysis

A description of the study area and the zone of influence is given in terms of selected socio-economic variables. The developed profile is used to interpret the impacts and measure the extent of socio-economic impacts that could be derived from the proposed activities in the context of the local, provincial, and national economies.

- Impact identification, evaluation and alternative recommendation

This step includes the description and evaluation of socio-economic impacts that could be expected during the construction and maintenance phases of the proposed supporting electrical infrastructure. Where applicable, the anticipated impacts were analysed in the context of each of the possible route alternatives. The assessment of impacts is done following the methodology prescribed by the environmental consultant. It should be noted that due to the nature of alternatives (they are not mutually exclusive and dependent on the phases developed), no recommendation for the preferred route was provided.

The season of the site investigation does not have an effect on the outcomes of the study as data gained from the interviews is representative of all seasons throughout the year (i.e. economic activity during different seasons is obtained).

1.1.4 Assumptions and Limitations

- The secondary data sources used to compile the socio-economic baseline, although not exhaustive, can be viewed as being indicative of broad trends within the study area.
- Possible impacts and stakeholder responses to these impacts cannot be predicted with complete accuracy, even when circumstances are similar, and these predictions are based on research and years of experience, taking the specific set of circumstances into account.
- It is assumed that the motivation and ensuing planning and feasibility studies for the project were done with integrity and that all information provided to the specialist by the project proponent and its consultants to date is accurate.
- With regard to the telephonic and email interviews undertaken, the following assumptions are made:
- Questions asked during the interviews were answered accurately.
- Not all landowners of farm portions that the proposed transmission line may traverse or located along the farm boundary were possible to engage with during the project. This is a notable limitation; therefore, lack of concerns or objections highlighted in this report should be viewed in this context. Worth noting, though, that no comments from Interested and Affected Parties (I&APs) outside the interviews were received during the conduct of this study. Therefore, all impacts assessed are premised from primary and secondary data collected as well as previous experience of powerline developments.
- The rating of impacts is based on Alternative 1, which is associated with the largest number of potential socio-economic positive and negative impacts.

- It is assumed that all the approved energy projects will have supporting electrical infrastructure.

The approved and proposed energy developments within a 50km radius will be taken into consideration as they have the potential to create supplementary positive or negative socio-economic impacts identified in this study or vice versa.

The **projects considered for the cumulative assessment** include:

- The 75MW AEP Legoko PV Solar Facility
- The 75MW AEP Mogobe Photovoltaic Solar Facility
- Kathu Solar Energy Facility
- Kathu Solar Energy Facility 25MW 2
- Sishen Solar Farm
- Solar farm for Bestwood
- Kalahari Solar Power Project
- A 19MW PV Solar Power Generation Plant
- 150MW Adams PV Solar Energy Facility
- Roma Energy Mount Roper Solar Plant
- Keren Energy Whitebank Solar Plant
- San Solar Energy Facility and associated infrastructure
- Renewable energy generation project – Shirley Solar Park
- 75MW Perth-Kuruman Solar Farm
- 75MW Perth-Hotazel Solar Farm and associated infrastructure
- 75MW AEP Kathu Solar PV Energy Facility
- Kagiso Solar Power Plant near
- 115MW Boitshoko Solar Power Plant
- Tshepo Solar Power Plant

1.1.5 Sources of Information

The project made use of both primary and secondary data in order to assess the impacts and desirability of the project.

Indirect data analysed was mainly derived from the following sources and programmes:

- Stats SA Census, 2011
- Quantec Research Standardised Regional Data, 1995-2017
- John Taolo Gaetsewe District Municipality Integrated Development Plan 2012-2017
- John Taolo Gaetsewe District Municipality Spatial Development Framework 2017
- Ga-Segonyana Local Municipality Integrated Development Plan 2015/16 Review
- Gamagara Local Municipality Integrated Development Plan 2017- 2022
- National Development Plan (NDP) 2030
- Security and Crime statistics
- Mapable 2018
- Project data and maps obtained from client
- EIA and scoping documents for surrounding projects

The primary data gathering for this project was done via telephonic interviews and email questionnaires as these means were indicated to be preferred methods of communication by the key respondents. The interviews took place from the 08th to the 09th of March 2018 and included engagements with the following landowners who will be affected (directly) by the transmission line development and operation:

- Clive Albutt, the owner of the following potentially directly affected farm portions:
    - Portion 1 and 2 of Farm Hartland 381
    - Remainder of Farm Woodstock 441
    - Remainder of Farm Rossdale 382
- Sarel Du Plessis, the owner of the following potentially directly affected farm portions:
    - Portion 1 of Farm Bramcote 446
    - Portion 3 of Farm Newstead 449

1.2 DESCRIPTION OF THE AFFECTED ENVIRONMENT

The site-related information section will investigate the various dynamics of the proposed project location. The aspects covered are land use, land capability, the economy, services and infrastructure and crime statistics. The study area is composed of portions from two municipalities, namely Ga-Segonyana Local Municipality and Gamagara Local Municipality, both of which are located in the John Taolo Gaetsewe District.

1.2.1 Alternative layouts of Transmission lines

Three possible option are considered for the development of transmission lines, depending on the approval of the Kuruman WEF and its phases:

- Alternative 1 encompasses a route that starts at Point C and continues to Point A in Kathu. This alternative will be required if both Phase 1 and Phase 2 of the proposed Kuruman WEF are approved for development and constructed. Due to technical considerations, this alternative will not be considered if only Phase 1 is approved and developed and if Alternative 2 for the transmission line is not approved.
- In the event that only Phase 1 WEF is constructed, Alternative 1 would be too expensive and, therefore, from a technical perspective Alternative 2 (C – D) would be considered.
- Alternative 3 would be required if only Phase 2 WEF is constructed.

Map 1-1 below demonstrates the alternative layouts for the proposed transmission lines to be connected to the Kuruman WEF.

Map 1-1: Transmission line layout alternatives

The farm portions below will be affected by the alternative transmission line layouts in the following manner:

Table 1-1: Farm portions affected by transmission lines per alternative layout

Farm portion	Alternative 1	Alternative 2	Alternative 3
	56 km in length	14 km in length	21 km in length
Erf 1 of Kuruman	Yes-through	Yes-through	Yes-through
Portion 2 of Farm Hartland 381	Yes-along the perimeter	Yes- along the perimeter	Yes-along the perimeter
Portion 1 of Farm Hartland 381	Yes- through	Yes- through	Yes- through
Remainder of Farm Rossdale 382	Yes-through	Yes-through	Yes-through
Remainder of Farm Woodstock 441	Yes- halfway through	Yes- halfway through	Yes- halfway through
Portion 1 of Farm Bramcote 446	Yes-through		Yes- halfway through
Remainder of Farm Mainsfield 445	Yes- along the perimeter		
Portion 3 of Farm Newstead 449	Yes- along the perimeter		
Portion 1 of Farm Newstead 449	Yes- along the perimeter		
Portion 4 of Farm Thoresby 450	Yes- through		
Portion 3 of Farm Thoresby 450	Yes- through		
Remainder of Farm Hartnolls 458	Yes- along the perimeter		
Remainder of Farm Demaneng 546	Yes- along the perimeter		
Remainder of Farm Lylveld 545	Yes- along the perimeter		
Remainder of Farm Sekgame 461	Yes-through		
Portion 10 of Farm Sekgame 461	Yes- along the perimeter		

The Alternative 1 transmission line passes across eight (8) farm portions. This denotes that the line is not along the boundaries of the farm portions but cuts through the farm portions. Nonetheless, no structures are affected by the line. On the remaining seven (7) farm portions, the transmission line is located along the borders of the site and therefore does not prohibit land activities to a large extent.

Alternatives 2 and 3 cut across less farm portions relative to Alternative 1, as indicated below:

Table 1-2: Summary of affected farm portions- alternative 1

Indicator	Description		
	Alternative 1	Alternative 2	Alternative 3
Length	• 56km	• 14km	• 14km
Affected # of farm portions	• 16	• 5	• 6
Affected land uses	• Commercial livestock and/or game breeding • Tourism • Military training centre • Crop production • Mining • Residential • Game hunting and viewing • Game breeding	• Commercial livestock and/or game breeding • Tourism • Crop production • Residential • Game hunting and viewing • Game breeding	• Commercial livestock and/or game breeding • Tourism • Crop production • Residential • Game hunting and viewing • Game breeding

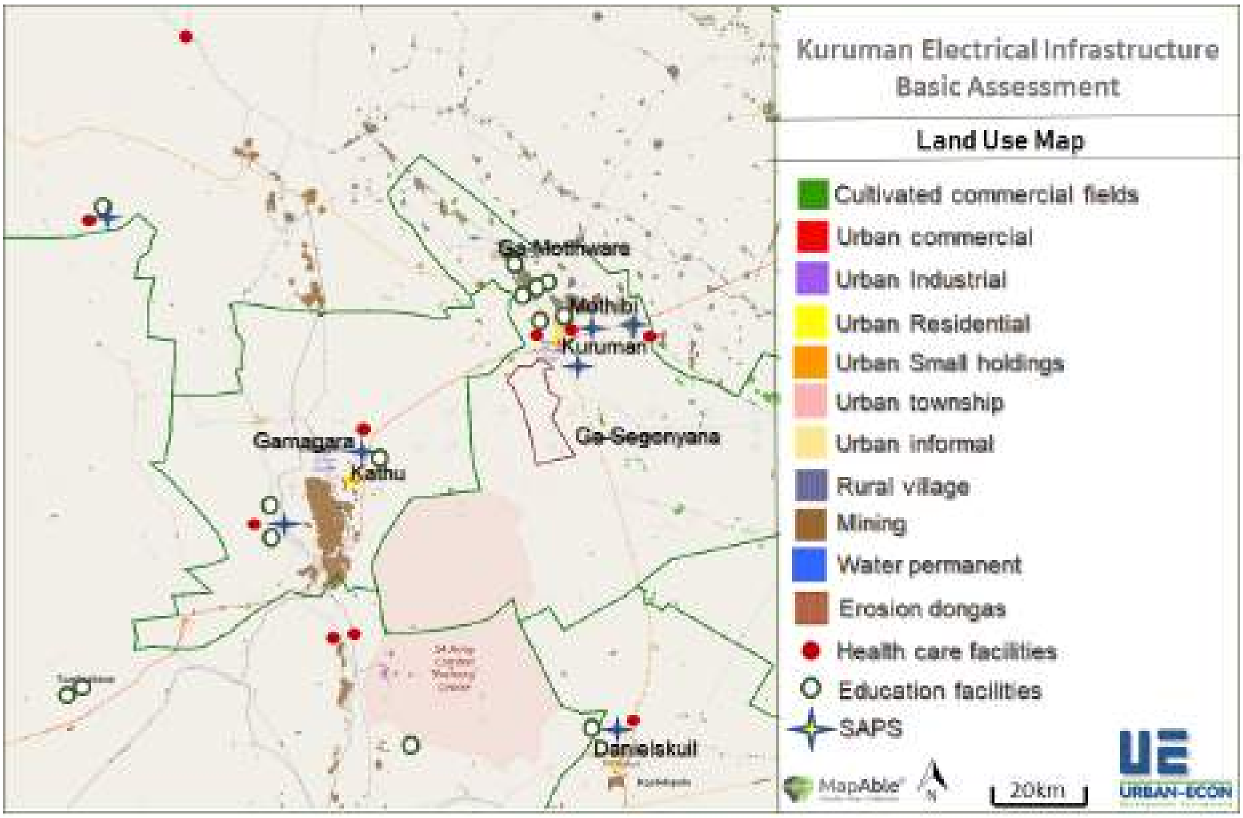
From the table above, it is evident that Alternative 1 would affect the largest number of farms portions (16), Alternative 2 would affect 5 farm portions, while Alternative 3 would affect 6 farm portions.

According to land owners interviewed, the proposed projects will not prohibit nor disturb the current economic activities observed on their land portions. No concerns have been raised by landowners who were possible to engage with during the study. Additionally, no loss in employment is expected.

1.2.2 Land Use Profile in Study Area

Map 1-2 below serves to demonstrate the land uses on the proposed project path and the surrounding area. In addition, the map serves to illustrate the locations of social facilities. It shows that limited activities are taking place in the zone of influence of the proposed transmission line routes and are largely concentrated at the start or the end points of the alternatives. To the south-east of the alternative transmission line routes, additional activity includes military functions and mining. Furthermore, commercial and retail activities feature in the residential and business districts of Kathu and Kuruman.

With regard to social facilities, there are numerous educational facilities serving the communities. In terms of healthcare, one private hospital is located near Kathu. Additional health facilities such as clinics and public hospitals are concentrated in Kuruman. Lastly, six police stations are within 15km from the proposed project path, from the end points.



Map 1-2: Land Use Map and Social Facilities

In terms of accessibility, the project site is accessible from the N14 which connects to Springbok to the south-west and Pretoria to the north-east.

1.2.3 The Economy

Interpretation of economic impacts requires a sound understanding of the size of the economy and its dynamics in the past. Several indicators exist that can describe the economy of a region or an area. The most common variables that are used for the analysis include production and Gross Domestic Product per Region (GDP-R) or Gross Value Added (GVA). The former represents the total value of sales of goods and services or the turnover of all economic agents in a region; while the latter, using the output approach, means the sum of value added created by all residents within a certain period, which is typically a year. The trend at which the GDP-R has been changing in the past is also referred to as an economic growth indicator. It is a measure of both the performance of an area and the well-being of the citizens of an area.

In 2016, The Ga-Segonyana Local Municipality (LM) economy was valued at R7 101 million in constant prices. The LM contributes a quarter to the economy of the John Taolo District Municipality and 6% to the economy of the Northern Cape (Quantec, 2017). Over a period of six years (2010-2016), the municipality's economy grew at a positive compounded annual growth rate (CAGR) of 3% per year. This is similar to the district and provincial growth of 2% and 3%, respectively.

The Gamagara LM economy was valued at R14 526 in 2016 and contributes 46% to the district and 12% to the province. Over a period of six years (2010-2016), the municipality's economy grew at a positive compounded annual growth rate (CAGR) of 4% per year.

Table 1-3: Gamagara and Ga-Segonyana LM structure of economies (2010 prices)

Economic Sector	Gamagara			Ga-Segonyana		
	GDP (R'mil)	% of GDP	CAGR (2010-2016)	GDP (R'mil)	% of GDP	CAGR (2010-2016)
Agriculture, forestry and fishing	R278	2%	0%	R371	5%	3%
Mining and quarrying	R7 775	54%	2%	R1 880	26%	3%
Manufacturing	R619	4%	0%	R500	7%	1%
Electricity, gas and water	R257	2%	2%	R215	3%	1%
Construction	R385	3%	2%	R390	5%	3%
Trade	R1 479	10%	2%	R905	13%	3%
Transport and communication	R1 125	8%	3%	R730	10%	5%
Finance and business services	R1 097	8%	3%	R988	14%	5%
General government	R1 001	7%	2%	R726	10%	1%
Personal services	R511	4%	3%	R397	6%	3%
TOTAL	R14 526	100%	2%	R7 101	100%	3%

Urban-Econ calculations based on Quantec data

The economic sector with the greatest contribution to the GDP-R of the Northern Cape is mining and quarrying. Similarly, mining is the highest contributing economic sector in the Ga-Segonyana LM and contributes to over half of the GDP in Gamagara LM (Quantec, 2017). This indicates the dependence of the municipal economies on mining and subsequent vulnerability in the case of a crisis in the mining sector. Electricity, gas and water is the economic sector with the least contribution to the GDP-R for both municipalities (Quantec, 2017). Between 2008 and 2010, most economic sectors experienced a decrease in GDP-R as a result of the economic crisis. However, construction, trade, finance and business services and general government did not have a decline in GDP-R during that period.

1.2.4 Labour Force Composition

Employment is the primary means by which individuals who are of working age may earn an income that will enable them to provide for their basic needs and improve their standard of living. As such, employment and unemployment rates are important indicators of socio-economic well-being. The following paragraphs examine the study area's labour market from a number of perspectives, including the employment rate and sectoral employment patterns.

According to Census 2011 data, the working age population of Ga-Segonyana LM was close to 59 000, while it was nearly half of this number in Gamagara. The unemployment rate in Gamagara LM of 15 % is less than half of that in Ga-Segonyana LM (35%). The employment situation in Gamagara is therefore relatively better.

Table 1-4: Labour Profile in John Taolo Gaetsewe DM and Ga-Segonyana LM

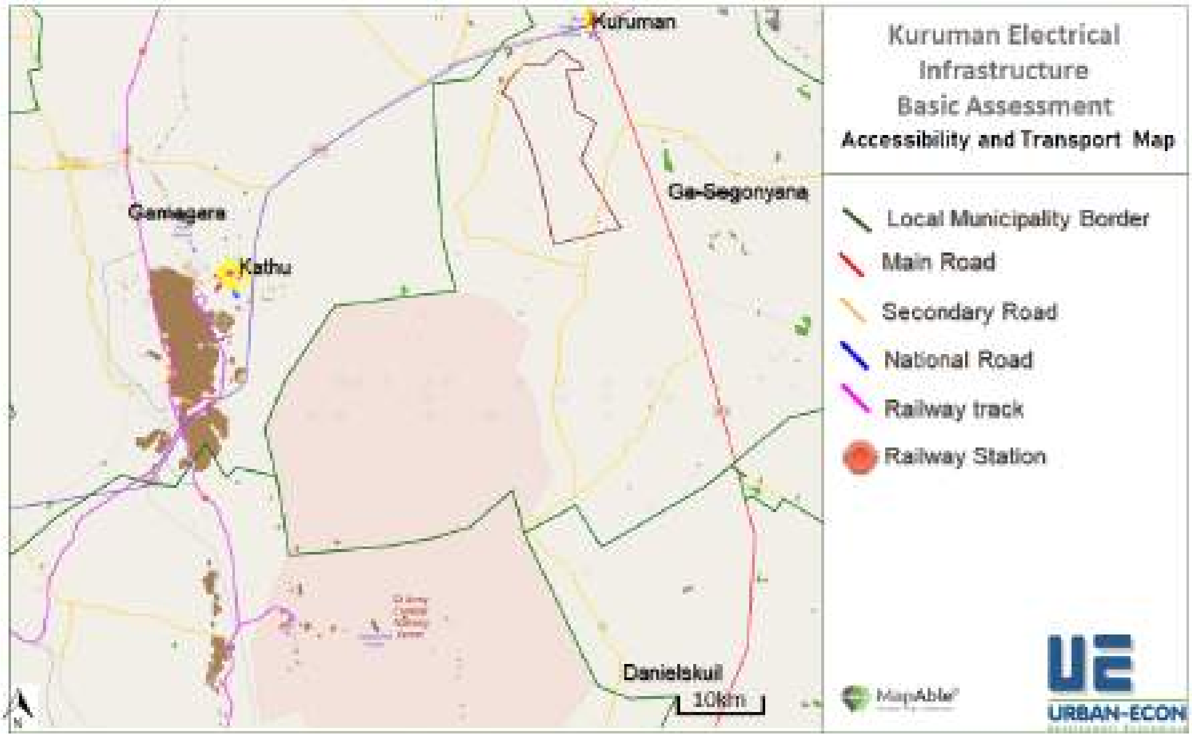
Indicator	John Taolo Gaetsewe DM	Ga-Segonyana LM	Gamagara LM
Total (Number)	237 529	94 498	41 431
Working age	144 710	58 943	30 052
Formal and informal - Total (Number)	49 031	18 945	18 378
Employed - Formal - Total (Number)	38 130	14 048	15 067
Employed - Informal (Number)	10 901	4 897	3 311
Unemployed (Number)	18 765	10 257	2 903
Not economically active (Number)	76 914	29 741	8 771
Unemployment rate (Percentage)	28%	35%	13%
Labour force participation rate (Percentage)	47%	50%	70%

(Stats SA, 2017)

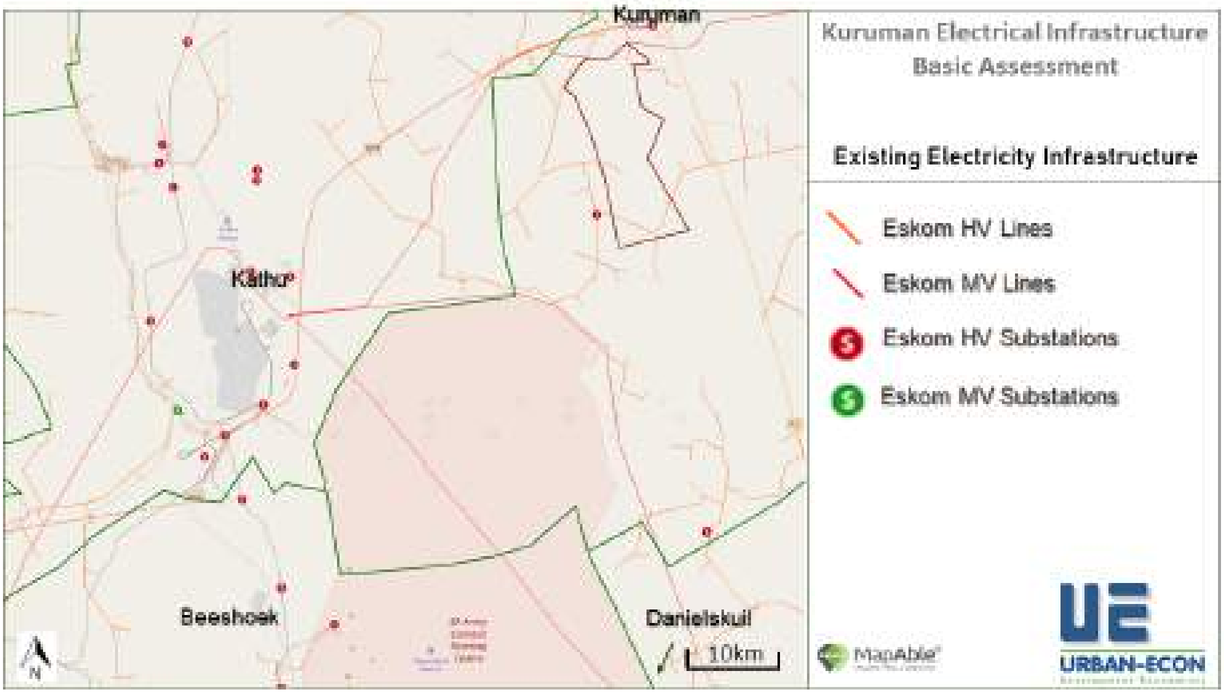
1.2.5 Services and Infrastructure

The Ga-Segonyana LM has backlogs in all basic services, with refuse removal having the largest backlog of 37% (Stats SA, 2017). Nonetheless, the overall service delivery is moderate. The Gamagara Local Municipality has an 8% backlog in the provision of sanitation, and 12% backlog for electricity, while water and refuse removal have no backlogs (Stats SA, 2017).

According to the Ga-Segonyana's IDP, main roads are in good condition, however gravel roads serving as access routes to the rural areas are in poor condition. The roads, electricity infrastructure and water infrastructure are poorly managed. Moreover, illegal electricity connections have been rife. Furthermore, there are areas such as Gantantelang that have no electricity connection for over 17 years. New electricity connections are planned as well as maintenance and upgrading (Ga-Segonyana Local Municpality, 2015).



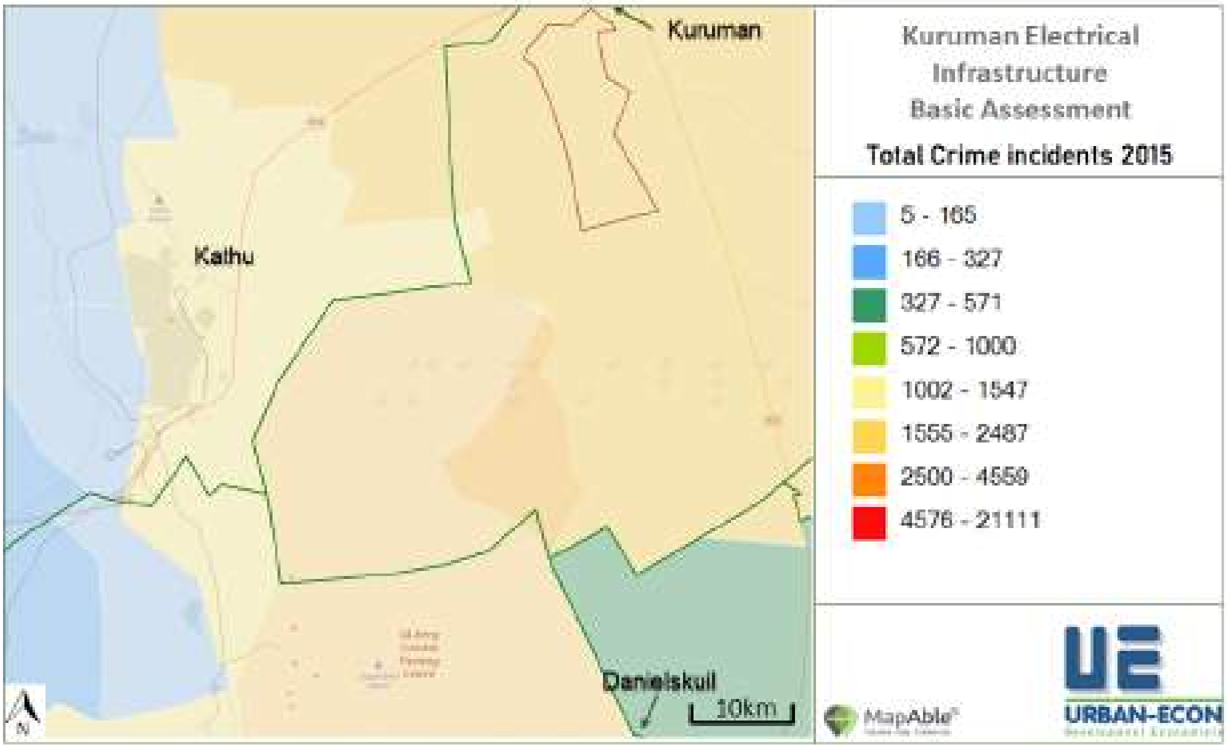
Map 1-3: Accessibility and Transport in the zone of influence (Mapable, 2018)



Map 1-4: Existing Electricity Infrastructure in the zone of influence (Mapable, 2018)

1.2.6 Crime Statistics in study area

Map 1-5 below demonstrates the total number of total crime incidents reported per police precinct in 2015.



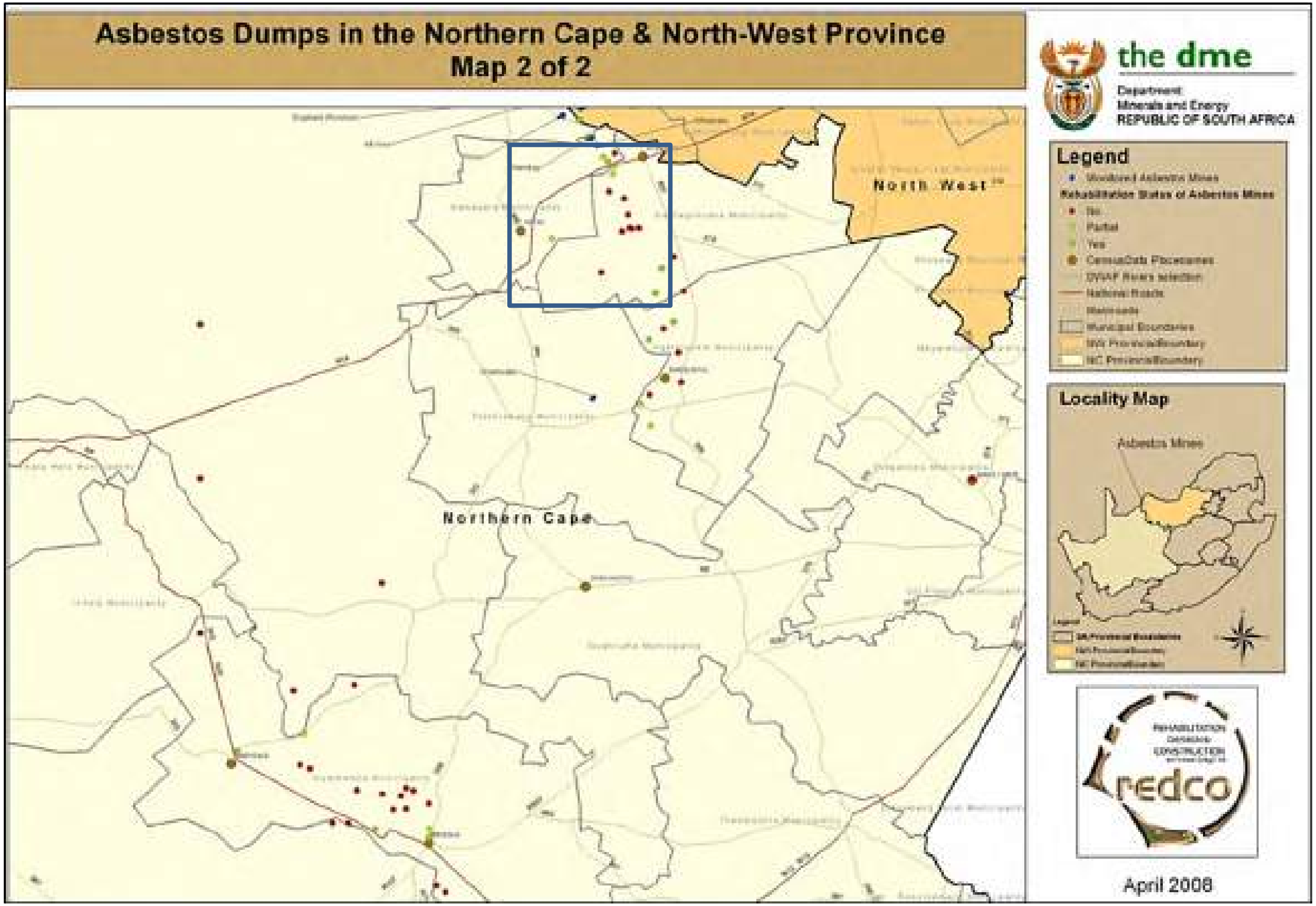
Map 1-5: A spatial representation of the Total Crime incidents reported in 2015 (Institute for Security Studies, 2015)

As mentioned, there are six police stations within 15km from the proposed transmission line route. Evidently, the precinct where the proposed project site is located had had 1 002 to 1 547 reported crime incidents in 2015. The most pertinent crimes in the precinct were theft out of motor vehicle (307 – 441 incidents); burglary at business premises (136 – 587 incidents); and stock theft (49 – 240 incidents) (Institute for Security Studies, 2015):

1.2.7 Environmental Sensitivity Map

The quantification of the risk associated with a specific polluted site is a prerequisite for development in any asbestos polluted region (John Taolo Gaetsewe DM, 2017). As indicated in Map 1-6 below, the area where the proposed transmission line is to be located is characterised by a concertation unrehabilitated asbestos mines, as well as partially and fully rehabilitated asbestos mines. These mines have been decommissioned due to the prevalence of a hazardous substance in asbestos (John Taolo Gaetsewe DM, 2017). An area in circumference to these mines has been identified by the John Taolo Gaetsewe District Municipality in its Spatial Development Framework of 2017, where development is prohibited.

Local government does allow minimal land use activities on rehabilitated areas and does not allow extensive development; the proposed project though is not considered to be an extensive development as it will not be associated with a large number of people present on site for a prolonged duration. Having said this, the need for rehabilitation of asbestos pollution through the quantification of risks associated with a specific pollution site is a pre-requisite for development in any asbestos polluted areas (John Taolo Gaetsewe DM, 2017). This recommendation has also been included in this study.



Map 1-6: Asbestos dumps in the Northern Cape

1.3 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

A policy review plays an integral role in the early stages of a project. The review provides a high-level indication of whether a project is aligned with the goals and aspirations of the developmental policy within a country through to the local level. Furthermore, the analysis indicates any red-flag or developmental concerns that could jeopardise the development of the project. This assists in amending and preventing costly and unnecessary delays. Table 1-5 below outlines the objectives and main relevant ideas stipulated per policy, as well as the alignment of the proposed project with these.

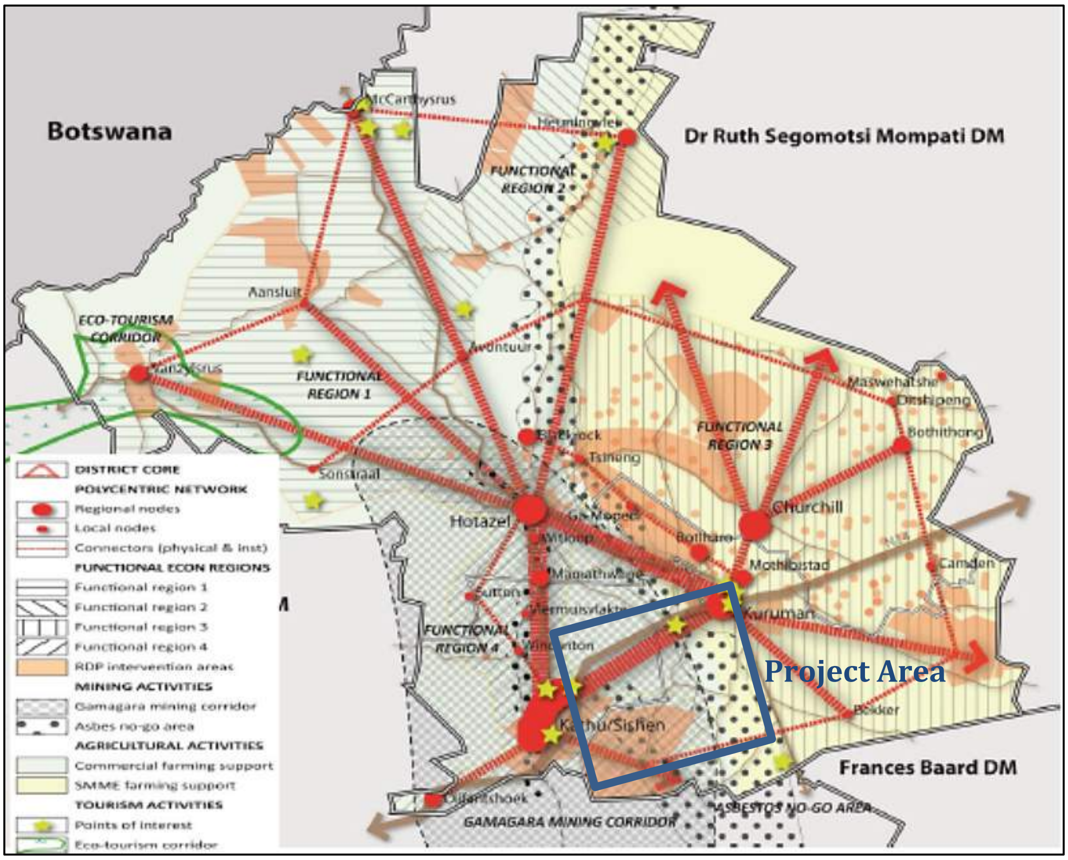
Table 1-5: Project alignment with policy objectives

Policy	Key Policy Objectives	Source
National Policy: South Africa		
National Development Plan 2030	✓ Creating jobs and livelihoods ✓ Expanding infrastructure ✓ Transforming urban and rural spaces • Transitioning to a low-carbon economy • Improving education and training • Providing quality health care • Building a capable state • Transforming society and uniting the nation • Fighting corruption and enhancing accountability	(NPC, 2011)
New Growth Path Framework 2011	✓ Infrastructure investment • Main economic sectors as employment sectors • Seizing the potential of new economies ✓ Investing in social capital and public services ✓ Fostering rural development and regional integration	(Department of Economic Development, 2011)
Renewable Energy Vision 2030 South Africa	• Renewable energy as an exceptional source of flexible supply within the context of uncertain energy demand • Comprehensive renewable energy base will support a resilient South African future • A sustainable energy mix that excludes undue risks for the environment of society	(World Wildlife Fund, 2014)
Integrated Energy Plan 2016	• South Africa should continue to track a diversified energy mix which lessens reliance on a few primary energy sources • In addition to solar energy facilities, wind energy should continue to contribute in the generation of electricity ✓ Allocations to safeguard the development of wind energy projects aligned with the Integrated Resource Plan 2010 should continue to be pursued ✓ Ensure energy security and supply • Reduce environmental impacts ✓ Endorse job creation and localisation • Lessen cost of energy • Reduce water consumption • Diversify supply sources ✓ Promote energy efficiency • Promote energy access	(Department of Energy, 2016)
The Constitution of South Africa 1996	• "Everyone has the right to an environment that is no harmful to their health or well-being" (S24) • The environment should be protected for the benefit o present and future generations, through reasonabl legislative and other measures that: o Prevent pollution and ecological degradation o Promote conservation o Secure ecologically sustainable development an	(Republic of South Africa, 1996)

Policy	Key Policy Objectives	Source
	use of natural resources while promoting justifiable economic and social development	
White Paper on Energy Policy of the Republic of South Africa 1998	• Seeks to ensure that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options ✓ Aims to create energy security by diversifying the energy supply and energy carriers	(Department of Minerals and Energy, 1998)
White Paper on the Renewable Energy Policy of RSA 2003	• Pledges government support for the development, demonstration and implementation of renewable energy sources for both small and large-scale applications	(Department of Minerals and Energy, 2003)
Provincial Policy: Northern Cape		
Northern Cape Provincial Development and Resource Management Plan 2012	✓ Seeks to create a prosperous, sustainable and expanding provincial economy to eradicate poverty and improve social development • Aims to create a continuous network of natural resource areas throughout the province that maintain ecological processes and provide ecosystem services ✓ Aims to endorse and institute innovative energy technologies to improve access to reliable, sustainable and affordable energy services with the objective to realise sustainable economic growth and development	(Office of the Premier of the Northern Cape, 2012)
Municipal Policy: John Taolo Gaetsewe District Municipality		
John Taolo Gaetsewe District Municipality Integrated Development Plan 2016	Strategic objectives for the municipality are: • Water and sanitation • Roads and transport ✓ Local Economic Development ✓ Land development and reform • Integrated human settlements ✓ Sustainable development-oriented municipality • Promotion of health • Disaster management • Environmental management, conservation and climate change management	(John Taolo Gaetsewe District Municipality, 2016)
Local Municipality: Ga-Segonyana Local Municipality		
Ga-Segonyana Local Municipality Integrated Development Plan 2015/16 Review	• An integrated municipality that is committed to the creation of a better life through sustainable development for the people of Ga-Segonyana • Aims to provide democratic and accountable government for local communities ✓ Aims to ensure the provision of services to communities in a sustainable manner • Aims to promote social and economic development • Aims to promote a safe and healthy environment • Aims to encourage the involvement of communities and community organisations in the matters of local government • Aims to structure and manage its administration, budgeting and planning processes to give priority to the basic needs of the community and to promote the social and economic development of the community • Aims to participate in national and provincial development programmes ✓ Aims to create an enabling environment for economic	(Ga-Segonyana Local Municipality, 2015)

Policy	Key Policy Objectives	Source
	growth and to reduce unemployment and alleviate poverty	
Ga-Segonyana Service Delivery and Budget Implementation Plan 2017	✓ Progressive sustainable development • Skills development ✓ Aims to develop and maintain infrastructure and community services • Aims to enhance revenue and financial management	(Ga-Segonyana Local Municipality, 2017)
Gamagara Local Municipality IDP 2017-2022	✓ Providing universal access to basic services • Attain safe and healthy environment • Strengthening stakeholder relations • Promoting active citizenry in Local Government affairs ✓ Providing sustainable services to communities • Being a developmentally focused institution ✓ Promote social and economic development	(Gamagara Local Municipality, 2017)

A correlation between the proposed electrical infrastructure and some of the goals of strategic documents is evident. Provincial policy seeks to create an enabling environment for economic growth and environmental preservation. Lastly, local policy places emphasis on service delivery improvement and enhancing the socio-economic conditions for residents some of which can be achieved due to the proposed project.



Map 1-7: John Taolo Gaetsewe DM Spatial Development Framework (John Taolo Gaetsewe DM, 2017)

Furthermore, at a local municipality level, the Ga-Segonyana LM SDF seeks to develop a regional node comprising of social facilities, a diversified housing provision, a minimum of one shopping centre and light industry (Ga-Segonyana Local Municpality, 2015). Moreover, the SDF aims to retain and strengthen the game farming and tourism-based economies, which is relevant for some of the directly affected farm portions.

1.4 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO SOCIO-ECONOMIC IMPACTS

The socio-economic impacts are triggered by aspects emanating from the proposed development of the electrical infrastructure and maintenance of its servitude. These include the following:

- During construction:
    - Procurement of goods and services required for the construction and development of powerlines and supporting infrastructure
    - Transportation of machinery, equipment and other components from various locations in South Africa to the project site
    - Expenditure on site/path clearance
    - Heavy machinery movement on site
    - Electrical infrastructure mounting and installation
    - Hiring of labour - locally and outside the local area
    - Presence of vehicles and personnel on farms
- During operation:
    - Hiring of labour to support operations and maintenance
    - Periodic presence of maintenance personnel
- During decommissioning:
    - Procurement of goods and services required for the decommissioning of the powerlines
    - Hiring of labour

1.5 IDENTIFICATION OF KEY ISSUES

Considering the nature of the proposed transmission line development, the following potential socio-economic impacts were identified and are examined in greater detail in the next section:

- **Construction Phase**
    - Increase in production and GDP-R due to capital expenditure
    - Temporary employment creation due to construction activities
    - Potential increase in theft related crimes due to high unemployment rate, and increased movement of people in area
    - Impact on current land use activities
    - Potential health risk for employees due to asbestos prevalence in the region
- **Operational/Maintenance Phase**
    - Long-term employment creation due to operation and maintenance activities
    - Presence of employees on farms
- **Decommissioning Phase**
    - Local economy stimulation due to decommissioning costs
    - Employment creation
- **Cumulative impacts**
    - Increase in production and GDP
    - Employment creation

1.6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

1.6.1 Results of the Field Study

From the interviews and secondary data, the land activities on affected farm portions are:

- Commercial farming:
- Livestock farming 22 500 ha
- Game hunting and viewing 7 600 ha
- Game breeding 7 700 ha
- Dry land crop production 2 ha
- Irrigation crop production 2 ha
- Game range
- Wedding venue and conference centre
- Tourist lodge
- Military training centre
- Mining

The economic activities hosted on the envisaged project along alternatives 2 and 3 are agriculture and tourism related. The main source of income herein is derived from game hunting and the accommodation offering lodge. With regard to visitation for game hunting, about 20 international and 50 domestic visitors stay for an average of five days. The game hunting is not limited to specific seasons and is constant throughout the year.

The additional economic activity observed on the potentially directly affected farm portions is the lodge, which caters for accommodation purposes and is active throughout the year. In addition, provision for weddings and events and conferences is made. On a minimal scale, there is dry land and irrigated crop production; a shared 4 ha is dedicated to this. The total staff permanently employed on these farm portions are 15, none of which reside on the premises. They currently earn R150 per day. Four family members permanently reside on the premises.

The latter points of alternative 2 and 3 host livestock farming. This takes place on 22 000 ha of land, and the livestock is cattle. There are no additional economic activities taking place on this land. Three of the family members reside on the premises.

The stretch of alternative 1, not included in alternatives 2 and 3, hosts similar economic activity. In addition, the South African Army Combat Training Centre (158 000ha) offers conventional and integrated training on divisional level.

According to land owners interviewed, the proposed projects will not prohibit nor disturb the current economic activities observed on their land portions. No concerns linked to the socio-economic aspects of the project have been raised by either of the land owners interviewed or through public meetings conducted by the environmental practitioner.

1.6.2 Stimulation of the local economy

The establishment of the electrical infrastructure will be associated with numerous capital expenses. During construction, expenses would usually include expenditure on transport and electrical and grid connection, foundation, civil works and construction of supporting structures. If goods and services are procured locally, i.e. within South Africa, it increases the production of the respective industries. This has a positive impact on the national economy and economies of the municipalities where inputs are procured.

The size of the Ga-Segonyana LM's economy was estimated at R7 101 million in current prices while that in the Gamagara LM is over double this value. The economies are primarily comprised of mining and financial services sectors. Considering the structure of the local economy, the opportunities for the procurement of goods and services within the local economy will be very limited.

However, given that the Northern Cape has attracted the lion's share of renewable energy projects in the country, it is highly likely that local supply of key components will be established in the province over time. Having said this, it is likely that some of the local businesses will benefit from sub-contracting opportunities, consumer expenditure of the construction crew, and an increase in income of locals who are directly employed in the construction and operation activities or who benefit from the project through local procurement.

The significance of the impact will remain the same before and after enhancement measures of local procurement are applied. The expenditure for alternative 1 will be the highest given that it is the only layout that connects to both Phase 1 and Phase 2 wind farms, and it covers the longest distance (50km). As a result, the stimulation of the economy will be greater. The expenditure will be relatively less in the other two alternatives due to the electrical infrastructure solely connecting to Phase 1 and the short distance of 14km of the transmission lines. This will have relatively less economic stimulation.

1.6.3 Creation of employment

The construction of electrical and associated infrastructure will require temporary employment of construction workers, foremen, and engineers on-site and long-term operations staff. Considering the current skills profile of the local municipalities, a good portion of the low to semi-skilled jobs are likely to be filled by people from the local communities.

During operations, periodic employment will be required for the maintenance of the servitude. The alternative 1 (56km) transmission line will require more time for maintenance, while alternatives 2 and 3 (14km) will require less maintenance time. This insinuates a higher income prospective in the case that alternative 1 is constructed. In addition to improved standard of living during construction and operations, an improvement in skills will also prevail.

In addition to those benefitting from direct employment created at the project, various multiplier effects will assist in supporting existing jobs in the businesses offering services and goods that will be procured during construction activities. The increased income earned by these businesses will in turn stimulate consumption spending, creating another round of the multiplier effect.

As an enhancement measure, a local skills desk, wherein skills of interested and prospective employees are captured, ought to be implemented. This will assist the HR process of identifying skills at a local level and recruiting at a local level. Therefore, the awareness of the skills desk to the local communities is salient.

1.6.4 Potential increase in theft related crimes

The most common incidents in the project area include stock theft, burglary, and theft out of motor vehicle. The construction and operations will create additional movement of people and vehicles to the site, which can also increase the chances of theft along the project path. This negative impact is moderate and can cause the loss of livestock or valuables. To mitigate this potential negative impact, access to the project site should be controlled wherein only authorised staff are permitted entry. Moreover, movement to and from the project site should be controlled wherein construction workers are transported to and from the designated pick-up area and project site. Potentially affected parties have indicated their concerns over their safety and the safety of their property. Therefore, a local community safety forum could be established to provide surveillance for adjacent properties. It is proposed that the developer considers forming a local safety forum, which will develop solutions suitable to immediate community members with regard to safety and address any concerns related to possible crime escalation.

The longer the transmission lines path, the greater the number of farms affected and therefore, the greater the exposure to stock or valuables theft. Therefore, alternative 1 increases the risk due to the higher exposure. However, if mitigation measures are applied, the impact ought to be reduced and highly unlikely, thus reducing the significance from Low (negative) to Very Low (negative).

1.6.5 Potential health risk for employees due to asbestos prevalence in the region

The proposed project is located in close proximity to several rehabilitated, partially rehabilitated and un-rehabilitated asbestos mines, all of which continue to pose health risks to surrounding communities and land uses (Liebenberg-Weyers, 2010). Eleven asbestos mines have been rehabilitated in the Northern Cape since 2008 (Patsy Beangstrom, 2017). Due to the carcinogenic nature of asbestos, numerous diseases can result due to exposure to the asbestos fibres for prolonged periods. Asbestosis is an occupational disease confined to the workplace wherein continuous inhalation of asbestos fibres weakens the lungs. An additional disease linked to asbestos is mesothelioma, which occurs as a result of trivial exposure to asbestos fibres (Journeyman.tv, 2002).

No health statistics in terms of the number of asbestos-related illnesses are available from the local and regional health facilities. However, it is known that South Africa reports an average of 200 cases of mesothelioma per year (Patsy Beangstrom, 2017). Nearly 30% of Mesothelioma cases are tied to environmental exposure, most commonly in the Northern Cape. Even with the last asbestos mine closed, the Northern Cape still faces the challenge of exposure risks from the region's 82 remaining asbestos mines (Patsy Beangstrom, 2017).

For the proposed project, therefore, this is a potential negative impact particularly with respect to the exposure of workers during the construction phase of the electrical infrastructure. From data gathered, it is deduced that prolonged exposure in the area for the workers increases their likelihood of acquiring asbestos-related illnesses (such as asbestosis) but of the risks are reduced as they will not be working within the asbestos mines. All alternatives will be exposed to this health risk as they will follow a route in very close proximity to several un-rehabilitated asbestos mines located south of Kuruman (refer to Map 1-6).

To circumvent the potential health risk posed, it is recommended that an air quality specialist and a health specialist are employed and tasked to determine potential risk levels of exposure and devise an adequate safety and health plan for the employees working on site. This is imperative as the proximity to unrehabilitated mines increases. To circumvent the potential health risk posed, it is recommended that an air quality specialist and a health specialist are employed and tasked to determine potential risk levels of exposure and devise an adequate safety and health plan for the employees working on site.

1.6.6 Cumulative Impacts

The proposed electrical infrastructure is set to be connected to Kuruman Wind Energy Facility/Facilities. Likewise, the proposed and authorised energy projects will have some form of grid connection. Other constructed and proposed projects in the zone, depending on their timing in relation to the project which is the subject of this impact study, may influence the manifestation and significance of socio-economic impacts that could result from the current project. As such, knowledge of such projects is required in order to accurately predict and rate socio-economic impacts.

The Department of Environmental Affairs and Tourism's guidelines (DEAT, 2004) suggest that the identification of cumulative effects should focus on important and meaningful issues as "it is not practical to analyse the cumulative effects of an action on every environmental receptor". Furthermore, it is advised that the analysis should focus on "what is needed to ensure long-term productivity or sustainability of the resource" (DEAT, 2004).

Considering the above, the expected cumulative impacts assessed are:

- Job creation
- Economic stimulus and GDP growth

1.6.7 Employment creation due to numerous developments

To conduct and fulfil objectives of all proposed and authorised development, labour will be required. This requirement denotes that employment will be created. The exact number of employment opportunities to be made available by the 20 projects is not known, but it can be stated with confidence that the combined figure would contribute to a notable increase in employment figures. This positive impact can be augmented in the case that the majority of labour is sourced locally, which could then assist in reducing the 35% unemployment rate in the Ga-Segonyana and improving 13% unemployment rate in Gamagara.

1.6.8 Stimulation of economy due to capital expenditure from projects

The injection of investment from all proposed projects will have a multiplier effect on the economy, wherein numerous economic sectors such as the transport and manufacturing will benefit. The combined expenditure will be notable and will have a notable impact on GDP and production. Local business will not have the capacity to supply all required services and materials; therefore, the local economies will only benefit to a limited extent.

1.7 IMPACT ASSESSMENT SUMMARY

The assessment of impacts and recommendation of mitigation measures as discussed above are surmised in Table 1-6 to 1-9 below.

As indicted previously, alternative 1 is associated with the largest number of farm portions to be affected and the longest route. In order to be conservative in the assessment, this alternative was used to determine the possible impact ratings. Any other chosen alternative will render lower positive or lower negative effects that what is provided is the table below. Importantly, though, considering the nature of the project in general, these changes are unlikely to lead to the changes of the ratings themselves were the assessment done for other two alternatives.

Table 1-6. Impact assessment summary table for the Construction Phase

Impact pathway	Nature of potential impact/risk	Status[1]	Extent[2]	Duration[3]	Conse-quence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
SOCIO-ECONOMIC															
CONSTRUCTION PHASE															
Direct Impacts															
Increase in production and GDP-R	Economy will be stimulated due to capital investment and resultant increased production	Positive	National	Medium-term	Moderate	Very likely	High reversibility	Replaceable	Low	No	Yes	Investigate the prospect of local procurement. Where feasible, procure goods and services from the local municipality.	Low	3	High
Temporary employment creation	Unemployment figures will slightly decrease due to jobs created	Positive	National	Medium-term	Slight	Very likely	High reversibility	Replaceable	Very Low	No	Yes	Set-up of a skills desk at accessible location. Use skills database to recruit local labour. Offer training to increase local employability.	Very Low	5	High
Indirect Impacts															
Increase in theft related crimes	The increased number of people on site creates potential for theft, particularly livestock theft.	Negative	Local	Medium term	Moderate	Likely	Low reversibility	High irreplace-ability	Low	Yes	Yes	Implement controlled access to project site control movement to and from sites. surrounding sites. Facilitate set-up of local community safety forum.	Very Low	5	High
Potential health risks for employees due to asbestos prevalence	Hazardous emissions from inactive asbestos mines pose a health risk for personnel that	Negative	Regional	Medium term	Moderate	Likely	Low reversibility	Moderate irreplace-ability	Very low	No	Yes	Undertake a health risks assessment to quantify the potential risks associated with the possible pollution of the site by asbestos;	Very Low	4	Medium

[1] Status: Positive (+) ; Negative (-)
[2] Site; Local (<10 km); Regional (<100); National; International
[3] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Impact pathway	Nature of potential impact/risk	Status[1]	Extent[2]	Duration[3]	Conse-quence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
	will be working on site.											Formulation of an adequate safety and health plan for the employees working on site.			

Table 1-7. Impact assessment summary table for the Operational Phase

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Conse-quence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
SOCIO-ECONOMIC															
OPERATIONAL PHASE															
Direct Impacts															
Long term employment creation	Maintenance activities will create periodic long-term job opportunities.	Positive	Regional	Long-term	Slight	Likely	High reversibility	Replaceable	Very Low	No	Yes	Set-up of a skills desk at accessible location. Use skills database to recruit local labour.	Very Low	5	High

Table 1-8. Impact assessment summary table for the Decommissioning Phase

Impact pathway	Nature of potential impact/risk	Status[4]	Extent[5]	Duration[6]	Conse-quence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
SOCIO-ECONOMIC															
DECOMMISSIONING PHASE															
Direct Impacts															
Local Economy stimulation	The cost of the removal and disconnection of the powerlines will	Positive	National	Medium term	Slight	Likely	High reversibility	Replaceable	Very Low	Yes	Yes	Continuously improve and maintain electrical infrastructure to	Very Low	4	High

[4] Status: Positive (+) ; Negative (-)
[5] Site; Local (<10 km); Regional (<100); National; International
[6] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Impact pathway	Nature of potential impact/risk	Status[4]	Extent[5]	Duration[6]	Conse-quence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
	stimulate economic activity.											prolong operation span.			
Temporary employment creation	Jobs will be required to fulfil the required decommissioning activities.	Positive	National	Short-term	Moderate	Very likely	High reversibility	Replaceable	Very Low	No	Yes	Offer training to increase local employability. Use skills database to recruit from local areas.	Very Low	5	High

Table 1-9. Cumulative impact assessment summary table

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Conse-quence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
SOCIO-ECONOMIC															
CUMULATIVE IMPACTS															
Employment creation	The numerous projects will create a notable number of jobs	Positive	National	Long-term	Substantial	Likely	Moderate reversibility	Replaceable	Moderate	No	Yes	Offer skills development programme to serve energy market in region and create local employability.	Moderate	2	High
Stimulation of Economy	Capital and operating expenditure of numerous projects will increase production in the economy.	Positive	National	Long-term	Severe	Very Likely	High reversibility	Replaceable	High	No	Yes	Procure goods and services, as far as practically possible, from the local municipality.	High	2	High

1.8 INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAM

Below is a description of the key monitoring recommendations for each applicable mitigation measure identified for all phases of the project for inclusion in the EMPr or Environmental Authorisation.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
A. Design					
A.1 SOCIO-ECONOMIC IMPACTS					
Employment creation for construction, operation and decommissioning activities.	To reduce the unemployment rate in local municipality.	Advise on the set-up of a skills desk and where it will be situated. Provide awareness of skills desk for local communities.	▪ Create a skills requirement profile for both construction and operations ▪ Set-up skills desk at an central an accessible location. ▪ Create awareness of skills desk through posters and media announcements. ▪ Skills desk should serve to record local job seeker skills. ▪ Identify potential candidates and fill vacancies	▪ Once- only during design phase ▪ Once- only during design phase ▪ Once a month during design phase ▪ Daily ▪ Prior to each phase	**Human Resources**
B. Construction					
B.1. SOCIO-ECONOMIC IMPACTS					
Increase in production and GDP-R	To maximize economic benefit to the local municipality.	Procure goods and services, as far as practically possible, from the local municipality.	▪ Run a supplier day in Kuruman and identify prospective companies to engage with during construction ▪ Keep record of companies and businesses supplying goods and services ▪ Calculate split percentage of local and national/international companies	▪ Once ▪ Bi-annually ▪ Once	**Developer**

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
Increase in theft related crime	To prohibit theft of stock and valuables on directly and adjacent farm portions	Initiate site access control and monitor movement to and from project site.	▪ Each employed personnel ought to have an access card/ apparel for identification purposes ▪ Security should be located at the entrance to only permit authorised personnel ▪ A pick-up point ought to be established wherein, employees will be transported to and from the site ▪ Develop a local community safety forum to establish monitoring methods for surrounding community	▪ Once ▪ Beginning and end of shift; beginning and end if lunch break ▪ Once ▪ Once	▪ Security personnel ▪ Driver
Potential health risks for employees due to asbestos prevalence	To prohibit any illness emerging from asbestos exposure.	To be developed by air and health specialist	▪ To be developed by air and health specialist	▪ To be developed by air and health specialist	▪ To be developed by air and health specialist

1.9 CONCLUSION AND RECOMMENDATIONS

Mulilo Renewable Project Developments proposes to develop supporting electrical infrastructure for the supporting electrical infrastructure to the Phase 1 and 2 Kuruman Wind Farms. The transmission line spans the Ga-Segonyana and Gamagara Local Municipalities of the Northern Cape, near Kuruman and Kathu. Three alternative layouts were considered but are not mutually exclusive and are dependent on the number of phases developed and which of the phases is developed.

The electrical infrastructure will usher in positive impacts and contribute in the provision of new electrical infrastructure. Such economic infrastructure contributes to the development of the region both in terms of direct and most importantly indirect way through opportunity creation. Furthermore, jobs created during construction can be made available to local labour which will alter the unemployment issue, lead to household income and enhance skills development.

On the contrary, negative impacts are also expected to ensue. The increased number of vehicular and pedestrian traffic on the proposed project site may potentially lead to stock theft, thus increasing criminal activity in the area. Furthermore, the closed asbestos mines pose a health risk for employees working in the area during various stages of project development. Implementation of appropriate mitigation measures will reduce the exposure to these risks and assist in preventing them.

No land owners interviewed objected to the development and considering all potential positive and negative socio-economic impacts, the net effect of the project will be positive and is recommended for approval. The overall socio-economic significance rating is Low (positive).

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TRANSPORT STUDY:

Basic Assessment for the proposed development of supporting electrical infrastructure to the proposed Kuruman Phase 1 and Phase 2 Wind Energy Facilities near Kuruman in the Northern Cape: BA REPORT

Report prepared for:	*Report prepared by:*
CSIR – Environmental Management Services	**JG AFRIKA (PTY) LTD**
P O Box 17001	Branch: Cape Town
Congella, Durban, 4013	PO Box 38561
South Africa	7430

10 July 2018

VERIFICATION PAGE	Form 4.3.1
	Rev 13

TITLE:

TRANSPORT STUDY: BASIC ASSESSMENT FOR THE PROPOSED DEVELOPMENT OF SUPPORTING ELECTRICAL INFRASTRUCTURE TO THE PROPOSED KURUMAN PHASE 1 AND PHASE 2 WIND ENERGY FACILITIES NEAR KURUMAN IN THE NORTHERN CAPE: BA REPORT

JGA REF. NO.	**DATE:**	**REPORT STATUS**
4686	13/09/2018	Final Issue

CARRIED OUT BY:	**COMMISSIONED BY:**
JG AFRIKA (PTY) LTD **Cape Town**	**CSIR** **Environmental Management Services**
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AUTHOR	**CLIENT CONTACT PERSON**
Adrian Johnson *PrTechEng*	Surina Laurie

SYNOPSIS

Preparation of a Transport Study for the Basic Assessment for the proposed development of the supporting electrical infrastructure to the proposed Kuruman Wind Energy Facility near Kuruman in the Northern Cape, pertaining to all relevant traffic and transportation engineering aspects.

KEY WORDS:

Wind Energy Facility, Transport Study, Basic Assessment

QUALITY VERIFICATION

This report has been prepared under the controls established by a quality management system that meets the requirements of ISO9001: 2008 which has been independently certified by DEKRA Certification under certificate number 90906882

Verification	Capacity	Name	Signature	Date
By Author	Senior Technologist	Adrian Johnson		
Checked by:	Associate	Iris Wink		
Authorised by:	Director	Harold Tiganis		

Filename:	4686/Reports/BA

IRIS SIGRID WINK

Profession	Civil Engineer (Traffic & Transportation)
Position in Firm	Associate
Area of Specialisation	Manager: Traffic & Transportation Engineering
Qualifications	PrEng, MSc Eng (Civil & Transportation)
Years of Experience	15 Years
Years with Firm	5 Years

SUMMARY OF EXPERIENCE

Iris is a Professional Engineer registered with ECSA (20110156). She joined JG Afrika (Pty) Ltd. in 2012. Iris obtained a Master of Science degree in Civil Engineering in Germany and has more than 15 years of experience in a wide field of traffic and transport engineering projects. Iris left Germany in 2003 and has worked as a traffic and transport engineer in South Africa and Germany. She has technical and professional skills in traffic impact studies, public transport planning, non- motorised transport planning and design, design and development of transport systems, project planning and implementation for residential, commercial and industrial projects and providing conceptual designs for the abovementioned. She has also been involved with transport assessments for renewable energy projects and traffic safety audits.

PROFESSIONAL REGISTRATIONS & INSTITUTE MEMBERSHIPS

PrEng - Registered with the Engineering Council of South Africa No. 20110156
Registered Mentor with ECSA for the Cape Town Office of JG Afrika
MSAICE - Member of the South African Institution of Civil Engineers
ITSSA - Member of ITS SA (Intelligent Transport Systems South Africa)
SAWEA - Member of the South African Wind Energy Association
SARF - South African Road Federation: Committee Member of Council

EDUCATION

1996 - Matric – Matric (Abitur) – Carl Friedrich Gauss Schule, Hemmingen, Germany
1998 - Diploma as Draughtsperson – Lower Saxonian State Office for Road and Bridge Engineering
2003 - MSc Eng (Civil and Transportation) – Leibniz Technical University of Hanover, Germany

SPECIFIC EXPERIENCE

JG Afrika (Pty) Ltd (Previously Jeffares & Green (Pty) Ltd)
2016 – Date
Position – Associate

- **Coega West Windfarm** – Transportation and Traffic Management Plan for the Coega Windfarm in Coega, Port Elizabeth – Client: Electrawinds Coega
- **Traffic and Parking Audits** for the Suburb of Groenvallei in Cape Town – Client: City of Cape Town Department of Property Management.

- **Road Safety Audit** for the Upgrade of N1 Section 4 Monument River – Client: Aurecon on behalf of SANRAL
- **Sonop Windfarm** – Traffic Impact Assessment for the Sonop Windfarm, Coega, Port Elizabeth – Client: Founders Engineering
- **Univeral Windfarm -** Traffic Impact Assessment for the Universal Windfarm, Coega, Port Elizabeth – Client: Founders Engineering
- **Road Safety Audit** for the Upgrade of N2 Section 8 Knysna to Wittedrift – Client: SMEC on behalf of SANRAL
- **Road Safety Audit** for the Upgrade of N1 Section 16 Zandkraal to Winburg South – Client: SMEC on behalf of SANRAL
- **Traffic and Road Safety Studies** for the Improvement of N7 Section 2 and Section 3 (Rooidraai and Piekenierskloof pass) – Client: SANRAL
- **Road Safety Appraisal**s for Northern Region of Cape Town – Client: Aurecon on behalf of City of Cape Town (TCT)
- **Traffic Engineering Services** for the Enkanini Informal Settlement, Kayamandi - Client: Stellenbosch Municipality
- **Lead Traffic Engineer** for the Upgrade of a 150km Section of the National Route N2 from Kangela to Pongola in KwaZulu-Natal, Client: SANRAL
- **Traffic Engineering Services** for the Kosovo Informal Settlement (which is part of the Southern Corridor Upgrade Programme), Client: Western Cape Government
- **Traffic and Road Safety Studies** for the proposed Kosovo Informal Housing Development (part of the Southern Corridor Upgrade Program), Client: Western Cape Government.
- **Road Safety Audit** Stage 3 – Upgrade of the R573 Section 2 between Mpumalanga/Gauteng and Mpumalanga/Limpopo, Client: AECOM on behalf of SANRAL
- **Road Safety Audit** Stage 1 and 3 – Upgrade of the N2 Section 5 between Lizmore and Heidelberg, Client: Aurecon on behalf of SANRAL
- **Traffic Safety Studies** for Roads Upgrades in Cofimvaba, Eastern Cape – Client: Cofimvaba Municipality
- **Road Safety Audit** Stage 1 and 3 – Improvement of Intersections between Olifantshoek and Kathu, Northern Cape, Client: Nadeson/Gibb on behalf of SANRAL
- **Road Safety Audit** Stage 3 – Upgrade of the Beacon Way Intersection on the N2 at Plettenberg Bay, Client: AECOM on behalf of SANRAL
- **Traffic Impact Assessment** for a proposed Primary School at Die Bos in Strand, Somerset West, Client: Edifice Consulting Engineers
- **Road Safety Audit** Stage 1 and 3 – Improvement of R75 between Port Elizabeth and Uitenhage, Eastern Cape, Client: SMEC on behalf of SANRAL

SPECIALIST DECLARATION

I, **IRIS WINK** as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

- I act as the independent specialist in this application;
- I 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;
- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 and any specific environmental management Act;
- 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 have no vested interest in the proposed activity proceeding;
- 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;
- I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- all the particulars furnished by me in this specialist input/study are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist: ________________________________

Name of Specialist: IRIS WINK

Date: 13 September 2018

EXECUTIVE SUMMARY

This transport study was commissioned to assess the potential impact of activities related to the supporting electrical infrastructure for the construction, operation and decommissioning phases of the proposed Kuruman Wind Energy Facility (WEF).

The main transport impacts will be during the installation of the infrastructure, where the delivery of the infrastructure will generate traffic, albeit low volumes. The duration of the installation is short term i.e. the impact of the traffic on the surrounding road network is temporary and when the WEF is operational, do not add any significant traffic to the road network. The traffic impact on the surrounding network is therefore deemed low.

Traffic generated by the installation of the supporting electrical infrastructure will create dust and noise pollution that will have a low (short term) impact during the construction and decommissioning phases. Proposed mitigation measures include:

- Staggered delivery and trips can be scheduled to occur outside of peak traffic periods.
- Dust suppression
- Regular maintenance of gravel roads during the construction and decommissioning phases. The roads are generally maintained by the Contractor during these phases.
- The use of mobile batch plants and quarries in close proximity to the site would decrease the impact on the surrounding road network.
- Staff and general trips should occur outside of peak traffic periods.

The development is supported from a transport perspective provided that the recommendations and mitigations are adhered to.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R326 EIA Regulations of 7 April 2017	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Yes. See attached CV
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Yes. See attached declaration
c) an indication of the scope of, and the purpose for which, the report was prepared;	Yes. See section 1.1
(cA) an indication of the quality and age of base data used for the specialist report;	n/a
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Yes. See section 1.6
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	n/a
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Yes. See section 1.1
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Yes. Section 1.3
g) an identification of any areas to be avoided, including buffers;	Yes. Section 1.3
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	n/a
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Yes. Section 1.1
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities;	Yes. Section 1.5
k) any mitigation measures for inclusion in the EMPr;	Yes. Section 1.6
l) any conditions for inclusion in the environmental authorisation;	n/a
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	n/a
n) a reasoned opinion- i. as to whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Yes. Section 1.6
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	n/a
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	n/a
q) any other information requested by the competent authority.	n/a
2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	n/a

TABLE OF CONTENTS

TABLES AND FIGURES

TRANSPORT STUDY

1.1. INTRODUCTION AND METHODOLOGY

1.1.1. Scope and Objectives

Mulilo Renewable Project Developments (Pty) Ltd is proposing to develop the Kuruman Wind Energy Facility just south of Kuruman and approximately 34km east of Kathu in the Northern Cape. The WEF will be developed in two phases – Phase 1 with 47 turbines and Phase 2 with 52 turbines. As part of the Environmental Impact Assessment (EIA) and Basic Assessment (BA) stages, the services of a Transportation Specialist are required to conduct respective Transportation Studies.

The proposed transmission line and associated infrastructure will include a 132kV transmission line, a substation, 33kV underground cables and the use of existing service and access roads for maintenance purposes. The main objective of this report is to prepare a transport study (traffic and transport risk assessment and route investigation) for the supporting electrical infrastructure to the proposed Kuruman WEF site.

The following two main transportation activities will be investigated:

- Abnormal load vehicles transporting electrical components to the site.
- The transportation of construction materials, equipment and people to and from the site/facility.

The transport study plan will aim to provide the following objectives:

- Activities related to traffic movement for the construction, operation, maintenance and decommissioning of the electrical infrastructure.
- Provide a main route for the transportation of the components point to the proposed site.
- Provide a preliminary transportation route for the transportation of materials, equipment and people to site.

1.1.2. Terms of Reference

The Terms of Reference for this Transport Study include the following:

- Extent of the transport study and study area;
- The proposed development;
- Trip generation;
- Traffic impact on external road network;
- National and local haulage routes between port of entry/manufacturer and site;
- Assessment of site access roads;
- Assessment of freight requirements and permitting needed for abnormal loads.

1.1.3. Approach and Methodology

The report deals with the traffic impact on the surrounding road network in the vicinity of the site during the installation of the supporting electrical infrastructure to the proposed Kuruman WEF.

This transport study includes the following tasks:

<u>Site Visit and Project Assessment</u>

- Site visit and initial meeting with the client to gain sound understanding of the project

- Overview of project background information including location maps, component specs and any resulting abnormal loads to be transported
- Research of all available documentation and information relevant to the proposed windfarm and substations

Correspondence with Authorities

- Correspondence with the relevant Authorities dealing with the external road network, such as SANRAL and Province

Traffic and Route Assessment

- Trip generation and potential traffic impact
- Possible haul routes between port of entry / manufacturing location
- Construction and maintenance (operational) vehicle trips
- Station data will be obtained as far as available from SANRAL for the closest national roads.
- Investigation of the impact of the development traffic generated during construction and operation.

Access and Internal Roads Assessment

- Assessment of the proposed access points

Report

- Preparation and submission of the report.

1.1.4. Assumptions and Limitations

The following assumptions and limitations apply:

- This study is based on the project information provided by Mulilo/CSIR and the subsequent site visit.
- Due to access constraints during the site visit and the topography of the area, certain sections of the proposed site could not be assessed, and reasonable assumptions have been made.
- It is assumed that supporting electrical infrastructure will be sourced in South Africa as far as possible and transported to the site via road transport. If components are imported, the imported elements will be transported from the most feasible port of entry, which is deemed to be Port of Ngqura.
- According to the Eskom Specifications for Power Transformers, the following dimensional limitations need to be kept when transporting the transformer – total maximum height 5 000mm, total maximum width 4 300mm and total maximum length 10 500mm.
- Maximum vertical height clearances along the haulage route is 5.2m for abnormal loads.
- All haulage trips will occur on either surfaced national and provincial roads or existing gravel roads.
- It is assumed that lifting equipment and counter weights will be on site when the installation of the supporting electrical infrastructure commences.

1.1.5. Source of Information

Information used in a transport study includes:

- Project Information and report template provided by the Client
- Google Earth.kmz provided by the Client
- Google Earth Satellite Imagery

1.2. DESCRIPTION OF PROJECT ASPECTS RELEVANT TO THE TRANSPORT STUDY

The substation components, including transformers, electrical cables and pylons, will be transported to site using appropriate National and Provincial routes and the access roads and access points to the site. It is expected that the components will generally be transported to site with normal heavy load vehicles, with the exception of the transformers which require an abnormal load vehicle.

Lifting equipment and counter weighs are required on site to assemble the substation components.

1.2.1. Abnormal Load Considerations

Abnormal permits are required for vehicles exceeding the following permissible maximum dimensions on road freight transport in terms of the Road Safety Act (Act No. 93 of 1996):

- Length: 22m for an interlink, 18.5m for truck and trailer and 13.5m for a single unit truck
- Width: 2.6m
- Height: 4.3m measured from the ground. Possible height of load – 2.7m.
- Weight: Gross vehicle mass of 56t resulting in a payload of approximately 30t
- Axle unit limitations: 18t for dual and 24t for triple-axle units
- Axle load limitation: 7.7t on front axle and 9t on single or rear axles

Any dimension / mass outside the above will be classified as an Abnormal Load and will necessitate an application to the Department of Transport and Public Works for a permit that will give authorisation for the conveyance of said load. A permit is required for each Province that the haulage route traverses.

1.2.1.1.1. Further Guideline Documentation

The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outlines the rules and conditions that apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts.

The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the Road Traffic Act and the relevant regulations.

1.2.1.1.2. Permitting – General Rules

The limits recommended in TRH 11 are intended to serve as a guide to the Permit Issuing Authorities. It must be noted that each Administration has the right to refuse a permit application or to modify the conditions under which a permit is granted. It is understood that:

a) A permit is issued at the sole discretion of the Issuing Authority. The permit may be refused because of the condition of the road, the culverts and bridges, the nature of other traffic on the road, abnormally heavy traffic during certain periods or for any other reason.

b) A permit can be withdrawn if the vehicle upon inspection is found in any way not fit to be operated.

c) During certain periods, such as school holidays or long weekends an embargo may be placed on the issuing or permits. Embargo lists are compiled annually and are obtainable from the Issuing Authorities.

1.2.1.1.3. Load Limitations

The maximum load that a road vehicle or combination of vehicles will be allowed to carry legally under permit on a public road is limited by:

- the capacity of the vehicles as rated by the manufacturer;
- the load which may be carried by the tyres;
- the damaging effect on pavements;
- the structural capacity on bridges and culverts;
- the power of the prime mover(s);
- the load imposed by the driving axles and
- the load imposed by the steering axles.

1.2.1.1.4. Dimensional Limitations

A load of abnormal dimensions may cause an obstruction and danger to other traffic. For this reason, all loads must, as far as possible, conform to the legal dimensions. Permits will only be considered for indivisible loads, i.e. loads that cannot, without disproportionate effort, expense or risk of damage, be divided into two or more loads for the purpose of transport on public roads. For each of the characteristics below there is a legally permissible limit and what is allowed under permit.

- Width
- Height
- Length
- Front Overhang
- Rear Overhang
- Front Load Projection
- Rear Load Projection
- Wheelbase
- Turning Radius
- Stability of Loaded Vehicles

1.2.2. Existing traffic impacts

There are no existing traffic impacts on the surrounding roads. The surrounding roads are primarily used by land owners to gain access to farm portions. Farming is limited to livestock and small crops, with no large-scale farming observed during the site visit.

1.2.3. Supporting Electrical Infrastructure – Trip generation

It is expected that the delivery of the supporting electrical infrastructure to the site during the construction phase will not result in a significant increase in traffic. Construction traffic will include vehicles for deliveries (pylon sections, power cables, construction materials etc.), construction staff and all other associated personnel. Abnormal load trips are limited to the transformers.

Staggered delivery and transporting components outside of the peak traffic periods (peak traffic periods for rural areas are assumed to be 6:30am – 8am and 4pm-6pm) will assist in mitigating the impact on the surrounding road network.

Trips generated by construction site staff have been assumed to less than 30 trips in the AM peak hour. This is based on a maximum of 200 workers on site per day. The impact of the staff traffic is deemed to be negligible.

It can be expected that the traffic volumes will be substantially lower than for the construction of the WEF itself. The traffic impact for the construction phase traffic is therefore regarded as low.

Traffic during the operational phase will be insignificant as trips will only be for occasional maintenance requirements.

The traffic generated during the decommissioning phase is expected to be less than the construction phase traffic and the impact on the surrounding road network will therefore be considered low.

1.3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

1.3.1. Description of the site

The proposed transmission line will connect to the proposed WEF site located near the town of Kuruman, approximately 34km east of Kathu in the Northern Cape. Three alternatives (shown in Figure 1 below) for the transmission lines have been proposed viz.

- Alternative 1: runs from the Kuruman Phase 1 substation to the Kuruman Phase 2 substation to the Ferrum substation (located in Kathu).
- Alternative 2: runs from Kuruman Phase 1 substation to Segame substation (located in Kuruman)
- Alternative 3: runs from Kuruman Phase 2 substation to Kuruman Phase 1 substation to the Segame substation (located in Kuruman).

Figure 1: Aerial View of Proposed Site

The proposed transmission line and associated infrastructure will include a 132kV transmission line, connecting to the substations in Phase 1 and Phase 2. The transmission line will connect to the Ferrum substation in Kathu or the Segame substation in Kuruman.

The infrastructure associated with this facility includes:

- Three construction yards of 200m x 100m = 2 ha;
- Roads connecting turbines will be constructed at 8m wide and existing roads will be widened to 8m;
- Collector substation;
- 33kV underground lines; and
- Supporting electrical infrastructure (Eskom metering station, transmission lines and Eskom Substation)

1.3.2. National Route to Site

Assuming certain components are imported, the most suitable port is the Port of Ngqura, which is located 1057 km travel distance from the site. This Port is a deep-water port geared for handling large container ships and has large laydown area available for storage of wind turbine components.

The preferred route for abnormal load vehicles will be from the port, heading north on the N10 to Britstown (passing Middelburg) and onto the N12 towards Kimberley. At Kimberly, the abnormal load vehicle will travel on the R31 to Barkly West. Due to geometric constraints at Barkly West, the abnormal load vehicle will take the R374, R371 and R370 gravel roads as a detour, which will connect the abnormal load vehicle to the R31. At Dansekuil, the abnormal vehicle will head north to Kuruman.

It is critical to ensure that the abnormal load vehicle will be able to move safely and without obstruction along the preferred routes. The preferred route should be surveyed to identify problem areas e.g. intersections with limited turning radii and sections of the road with sharp horizontal curves or steep gradients, that may require modification.

It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will need to be maintained during the additional loading of the construction phase and reinstated after construction is completed. This process is to be undertaken by the haulage company transporting the components and the contractor, who will modify the road and intersections to accommodate any abnormal vehicles.

Figure 2: Preferred route from Port of Entry to the proposed WEF

1.3.3. Proposed main access roads for transmission line alternative 1

The transmission line alternative 1 will connect to the Ferrum substation in Kathu. Access to the transmission line route alignment is via the N14 at Kathu and associated internal (farm) roads.
The section of the transmission route alignment passing through the proposed WEF facility can be accessed via the D3441 and D3420.

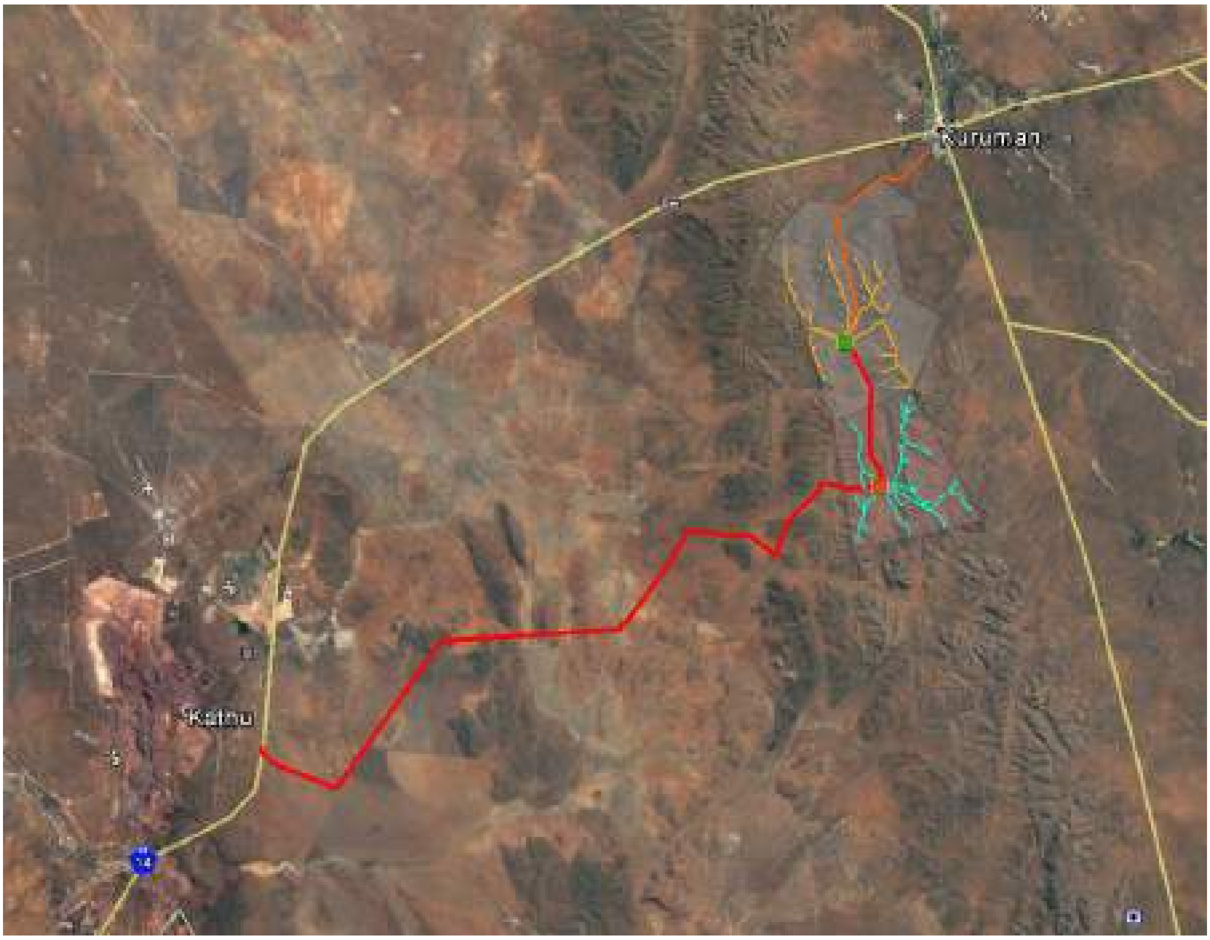

Figure 3: Proposed main access roads for transmission line alternative 1

1.3.4. Proposed main access roads for transmission line alternatives 2 and 3

The main access points to the proposed locations of the substations of Phase 1 and Phase 2 of the proposed facility are via D3441 and D3420, as shown in the figure below. Substation components can be delivered to site via an access point on D3441 (Main access point for Phase 1) and 2 access points on D3420 (main access points for Phase 2). The existing internal gravel roads and the upgraded internal roads (part of the WEF implementation) can be used during the construction and installation of the supporting electrical infrastructure.

During the site visit, the proposed WEF site could not be accessed from D3441 as no gravel roads exist. The internal roads of the proposed WEF will predominately be new gravel roads as there are few existing gravel roads.

Figure 4: Proposed main access roads for transmission line alternatives 2 and 3

It should be noted that there are additional existing gravel roads located further south on D3441. These existing gravel roads could be further investigated as alternative accesses to the proposed Phase 1 site should the proposed main access (located 3km from the N14) not be a feasible option.

For the internal roads, a minimum required road width of 4 meters needs to be kept and all turning radii must conform with the specifications needed for the haulage vehicles. It needs to be ensured that the gravel sections of the haulage routes remain in good condition and will hence need to be maintained during the additional loading of the construction phase and then reinstated after construction finishes. The gravel roads will require grading with a road grader to obtain a flat even surface and the geometric design of these gravel roads needs to be confirmed at detailed design stage. This process is to be undertaken by a civil engineering consultant or a geometric design professional. Geometric design constraints might be encountered due to the rolling, hilly topography of the area.

It should also be noted that any low hanging lines (lower than 5.1m) e.g. Eskom and Telkom lines along the gravel road will have to be moved to accommodate any abnormal load vehicles.

1.3.5. Main Route for the Transportation of Materials, Plant and People to the proposed WEF

The nearest towns in relation to the proposed WEF sites are Kuruman and Kathu. Kuruman is situated within 5km from the WEF and Kathu at 40km. The main route linking Kuruman and Kathu to the proposed WEF is the N14. It is envisaged that the majority of materials, plant and labour will be sourced from these towns and transport to the site will be via the N14.

Existing concrete batch plants and quarries are situated in Kuruman and Kathu. If these businesses were contracted to supply materials and concrete, the impact on the traffic would be reduced due to their proximity to the construction area. Alternatively, mobile concrete batch plants and temporary construction material stockpile yards could be commissioned on vacant land near the proposed site. Delivery of materials to the mobile batch plant and the stockpile yard could be staggered to minimise traffic disruptions.

It is envisaged that most materials, water, plant, services and people will be procured within a 60km radius from the proposed site.

1.4. APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

Key legal requirements pertaining to the transport requirements for the proposed WEF development are:

- Abnormal load permits,
- Port permit (if components are imported),
- Authorisation from Road Authorities to modify the road reserve to accommodate turning movements of abnormal loads at intersections.

1.5. IDENTIFICATION OF KEY ISSUES

1.5.1. Identification of Potential Impacts

The potential transport related impacts are described below.

1.5.2. Construction Phase

- *Potential impact 1*
  - Noise and dust pollution due to increased vehicle trips.

  Construction related traffic including transportation of people, construction materials, water and equipment to the site (Abnormal trucks delivering substation components to the site). This phase also includes the grading and dust suppression (by water truck) of roads, excavations of footings, trenching for electrical cables and other ancillary construction works that will temporarily generate traffic. The construction phase traffic, however, is regarded as low as components can be delivered to site as required and during off-peak hours.

1.5.3. Operational Phase

During operation, it is expected that staff and security will periodically visit the facility. No full-time employees will be based on site. The traffic generated during this phase will be minimal and will not have an impact on the surrounding road network.

1.5.4. Decommissioning Phase

- *Potential Impact 2*
  - Noise and dust pollution due to increased vehicle trips.

  Construction related traffic including transportation of people, construction materials, water and equipment (Abnormal trucks transporting components). The generated traffic, however, will be lower than the construction phase traffic and the impact on the surrounding road network will be low.

1.5.5. Cumulative impacts

- *Cumulative Potential Impact*
  - Noise and dust pollution due to increased vehicle trips.

The construction and decommissioning phases are the only traffic generators. The duration of these phases is short term i.e. the impact of the traffic on the surrounding road network is temporary and WEF and the associated electrical infrastructure, when operational, do not add any significant traffic to the road network.

1.6. ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

1.6.1. Potential Impact 1 – Noise and dust pollution due to increased traffic (Construction Phase)

- Negative impact
- Low Significance of impact without mitigation measures
- Proposed mitigation measures:
  - o Dust suppression as required.
  - o Regular maintenance of gravel roads by Contractor, as required.
  - o The delivery of electrical infrastructure components to the site can be staggered and trips can be scheduled to occur outside of peak traffic periods.
  - o The use of mobile batch plants and quarries (stone/sand for concrete and gravel for backfilling) in close proximity to the site would decrease the impact on the surrounding road network.
  - o Staff and general trips should occur outside of peak traffic periods.
- Low significance of impact with mitigation measures

1.6.2. Potential Impact 2 - Noise and dust pollution due to increased traffic (Decommissioning Phase)

- Negative impact
- Low Significance of impact without mitigation measures
- Proposed mitigation measures:
  - o Dust suppression as required.
  - o Regular maintenance of gravel roads by Contractor, as required.
  - o Removal of electrical infrastructure components can be staggered and trips can be scheduled to occur outside of peak traffic periods.
  - o Staff and general trips should occur outside of peak traffic periods as far as possible.
- Low significance of impact with mitigation measures
- This phase will result in a similar impact as the Construction Phase, however, fewer trips are expected.

1.6.3. Cumulative Impacts

- Negative impact
- Low Significance of impact without mitigation measures
- Proposed mitigation measures
  - o Dust suppression as required.
  - o Regular maintenance of gravel roads by Contractor, as required.

- Component delivery to/ removal from the site can be staggered and trips can be scheduled to occur outside of peak traffic periods.
- The use of mobile batch plants and quarries in close proximity to the site would decrease the impact on the surrounding road network.
- Staff and general trips should occur outside of peak traffic periods.

- Low significance of impact with mitigation measures

1.7. IMPACT ASSESSMENT SUMMARY

The assessment of impacts and recommendation of mitigation measures as discussed above and collated in the tables below.

Table 1. Impact assessment summary table for the Construction Phase

Impact pathway	Nature of potential impact/risk	Status[1]	Extent[2]	Duration[3]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
TRANSPORT															
CONSTRUCTION PHASE															
Direct Impacts															
Vehicle Trips	Noise and dust pollution	Negative	Local	Short-term	Moderate	Very likely	High	N/A	Low	No	Yes	- Dust Suppression - Stagger deliveries - Maintenance of gravel roads by Contractor	Low	4	High
Indirect Impacts															
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 2. Impact assessment summary table for the Operational Phase

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
TRANSPORT															
OPERATIONAL PHASE															
Direct Impacts															
The traffic generated during this phase will be minimal and will have very little, if any impact on the surrounding road network.															
Indirect Impacts															
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

[1] Status: Positive (+) ; Negative (-)
[2] Site; Local (<10 km); Regional (<100); National; International
[3] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

Table 3. Impact assessment summary table for the Decommissioning Phase

Impact pathway	Nature of potential impact/risk	Status[4]	Extent[5]	Duration[6]	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
TRANSPORT															
DECOMMISSIONING PHASE															
Direct Impacts															
Vehicle Trips	Noise and dust pollution	Negative	Local	Short-term	Moderate	Very likely	High	N/A	Low	No	Yes	- Dust Suppression - Stagger deliveries - Maintenance of gravel roads by Contractor	Low	4	High
Indirect Impacts															
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 4. Cumulative impact assessment summary table

Impact pathway	Nature of potential impact/risk	Status	Extent	Duration	Consequence	Probability	Reversibility of impact	Irreplaceability of receiving environment/ resource	Significance of impact/risk = consequence x probability (before mitigation)	Can impact be avoided?	Can impact be managed or mitigated?	Potential mitigation measures	Significance of residual risk/ impact (after mitigation)	Ranking of impact/ risk	Confidence level
TRANSPORT															
CUMULATIVE IMPACTS															
Vehicle Trips	Noise and dust pollution	Negative	Local	Short-term	Moderate	Very likely	High	N/A	Low	No	Yes	- Dust Suppression - Stagger deliveries - Maintenance of gravel roads by Contractor	Low	4	High

[4] Status: Positive (+) ; Negative (-)
[5] Site; Local (<10 km); Regional (<100); National; International
[6] Very short-term (instantaneous); Short-term (<1yr); Medium-term (1-10 years); Long-term (project duration); Permanent (beyond project decommissioning)

1.8. INPUT TO THE ENVIRONMENTAL MANAGEMENT PROGRAM

It is recommended that dust suppression and maintenance of gravel roads form part of the EMPr. This would be required during the Construction and Decommissioning phases where an increase is vehicle trips can be expected. No traffic related mitigation measures are envisaged during the Operation phase due to the negligible traffic volume generated during this phase.

No recommendations with regard to traffic has been made as there are no traffic impacts associated with the installation of the supporting electrical infrastructure.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	***Frequency***	***Responsibility***
A. CONSTRUCTION PHASE					
A.1. TRAFFIC IMPACTS					
Dust and noise pollution	Avoid or minimize impacts on road network.	▪ Dust suppression as required. ▪ Maintenance of gravel roads by Contractor as required.	▪ Regular monitoring of road surface quality of gravel haulage roads.	▪ Before construction commences and regularly during construction phase.	▪ Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	*Frequency*	*Responsibility*
B. DECOMMISIONING PHASE					
A.1. TRAFFIC IMPACTS					
Dust and noise pollution	Avoid or minimize impacts on road network.	▪ Dust suppression as required. ▪ Maintenance of gravel roads by Contractor as required.	▪ Regular monitoring of road surface quality of gravel haulage roads.	▪ Before and during the decommissioning phase.	▪ Contractor

1.9. CONCLUSION AND RECOMMENDATIONS

The potential transport related impacts for the construction, operation and decommissioning phases were assessed.

- The construction phase traffic is regarded as low as components can be delivered to site as required and during off-peak hours.
- During operation, it is expected that staff and security will periodically visit the facility. The traffic generated during this phase will be minimal and will not have an impact on the surrounding road network.
- The traffic generated during the decommissioning phases will be lower than the construction phase traffic and the impact on the surrounding road network will be low.

The potential mitigation measures mentioned in the construction and decommissioning phases are:

- Dust suppression as required.
- Regular maintenance of gravel roads by Contractor, as required.
- Component delivery to/ removal from the site can be staggered and trips can be scheduled to occur outside of peak traffic periods.
- The use of mobile batch plants and quarries in close proximity to the site would decrease the impact on the surrounding road network.
- Staff and general trips should occur outside of peak traffic periods.

The construction and decommissioning phases are the only traffic generators and therefore noise and dust pollution will be higher during these phases. The duration of these phases is short term i.e. the traffic impact on the surrounding road network is temporary and WEF and the supporting electrical infrastructure, when operational, do not add any significant traffic to the road network.

The development is supported from a transport perspective provided that the recommendations and mitigations are adhered to.

1.10. REFERENCES

- Google Earth Pro
- SANS 10280/NRS 041-1:2008 - Overhead Power Lines for Conditions Prevailing in South Africa
- Road Safety Act (Act No. 93 of 1996)
- The Technical Recommendations for Highways (TRH 11): “Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads