

Ecological Assessment Report

**Farms Bultfontein no 327 & Folmink no
331 Agricultural Development, Prieska,
Northern Cape Province**

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Compiled for:



Compiled by:

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Executive Summary

The project applicant, Nyama Yethu Holdings (Pty) Ltd proposes to develop an approximately 535 ha natural portion of virgin soil into cultivated irrigated camps and/or cultivated centre pivot lands on Portion 1 of the Farm Bultfontein no 327 and Portion 2 of the Farm Folmink no 331. The farms are situated approximately 40 km north-west of the town of Prieska, Northern Cape Province.

The purpose of the cultivation will be for planting of feed crops such as lucerne, maize and *Triticum* cultivars which will be used as fodder for livestock on the farms. Half will be used for lucerne cultivation while the balance will be used for crop rotation in order to obtain two crop harvests per annum of maize and barley or oats respectively. The feed production will be utilised partly for grazing (backgrounding) and for cash crop production for a nearby feed mill (Orange River Feeds in Prieska).

A pump station will be implemented on the banks of the Orange River along with an associated approximately 5 km pipeline which will transport water to the assessment area for irrigation purposes. The Orange River is situated approximately 3.2 km south of the assessment area.

Eco-Con Environmental was appointed by the applicant as the independent Environmental Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) process.

Due to the nature of the potential impacts of the proposed development on the local ecology, an Ecological study is required. This is required in order to determine the potential presence of ecologically significant species, habitats or wetland areas within the proposed project footprint which may be affected by the proposed development. Proposed mitigation and management measures in accordance with the NEMA (Act 107 of 1998) mitigation hierarchy must also be recommended in order to attempt to reduce/alleviate the identified potential impacts.

EcoFocus Consulting was therefore subsequently appointed by the EAP as the independent ecological specialist to conduct the required Ecological study for the proposed project. This report constitutes the Ecological Assessment. Two site visits/assessments for the proposed development footprint area were conducted on 21 & 22 August 2018. These dates form part of the winter season. It must therefore be noted that the time of the assessment was not necessarily favourable for successful identification of all plant species individuals.

Methodology

The proposed assessment area was assessed on foot and visual observations/identifications were made of habitat conditions, ecologically sensitive areas and relevant species present. Species were listed and categorised as per the Red Data Species List; Protected Species List of the National Forests Act (Act 84 of 1998), Invasive Species List of the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species Regulations, 2014 and the Provincially Protected species of the Northern Cape Nature Conservation Act (Act 9 of 2009). Georeferenced photographs were taken of ecologically sensitive areas as well as the relevant nationally or provincially protected species if encountered in order to indicate their specific locations in a Geographic Information System (GIS) mapping format.

Potential impacts of the proposed project on the surrounding natural environment were identified, evaluated and rated. The Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the proposed project area were also assessed and rated.

Study Area

The assessment area consists of a single footprint area of approximately 535 ha in size. The area is partly situated on Portion 1 of the Farm Bultfontein no 327 (SG 21 Digit Code: C0310000000032700001) and Portion 2 of the Farm Folmink no 331 (SG 21 Digit Code: C0310000000033100002) respectively. The farms are situated approximately 40 km north-west of the town of Prieska which forms part of the Siyathemba Local Municipality. This in turn, forms part of the Pixley Ka Seme District Municipality, Northern Cape Province. Access to the assessment area is obtained via the R 383 provincial road and subsequent dirt roads from the north-west.

The location of the pump station is also situated on Portion 1 of the Farm Bultfontein no 327 (SG 21 Digit Code: C0310000000032700001) while the proposed pipeline route traverses the same farm portion.

According to SANBI (2006-), the entire assessment area falls within the Northern Upper Karoo vegetation type (NKu 3) which mainly consists of flat to slightly sloping shrubland, dominated by dwarf karoo shrubs and sparse grasses. This vegetation type is classified as least threatened as very little has been transformed thus far (SANBI, 2006-).

The pump station and associated pipeline route traverses the Lower Gariep Broken Veld vegetation type (NKb 1) which constitutes hills and low mountains and slightly irregular plains dominated by sparse shrubs and dwarf shrubs (SANBI, 2006-). This vegetation type is also classified as least threatened (SANBI, 2006-).

The majority of the assessment area as well as the entire pipeline route is categorised as 'Other Natural Area' (ONA) while only a very small portion in the south-eastern corner of the assessment area falls within an Ecological Support Area (ESA) in accordance with the Northern Cape Provincial Spatial Biodiversity Plan 2016 (NCPSBP), which sets out biodiversity priority areas in the province. The location of the pump station on the banks of the Orange River falls within a Critical Biodiversity Area one (CBA 1) in accordance with the NCPSBP.

CBA's are areas that are irreplaceable or near-irreplaceable (CBA 1), or reflect an optimum configuration (CBA 2) for reaching provincial biodiversity targets for ecosystem types, species or ecological processes (Collins, 2017). Such an area must be maintained in a natural or near-natural state in order to meet biodiversity targets (Collins, 2017). ESA's are areas that must be maintained in at least fair ecological condition (semi-natural/moderately modified state) in order to support the ecological functioning of a CBA or protected area or that play an important role in delivering ecosystem services (Collins, 2017).

Results and Conclusion

The mechanical clearance and soil preparation associated with the proposed agricultural development will in all probability completely transform the majority of the existing surface vegetation on the assessment area.

Both the Northern Upper Karoo (NKu 3) and Lower Gariep Broken Veld (NKb 1) vegetation types associated with the assessment area, are classified as least threatened as very little has been transformed thus far (SANBI, 2006-). The majority of the assessment area as well as the entire pipeline route is further categorised as 'Other Natural Area' (ONA) while only a very small portion in the south-eastern corner of the assessment area falls within an Ecological Support Area (ESA) in accordance with the NCPSBP, which sets out biodiversity priority areas in the province. The location of the pump station on the banks of the Orange River falls within a Critical Biodiversity Area one (CBA 1) in accordance with the NCPSBP.

The assessment area is in a natural pristine condition and scored a very high PES value. The broader areas surrounding the assessment area, which are associated with the relevant vegetation types, are extremely vast and also largely natural and undeveloped. The size of the proposed development is therefore small relative to the surrounding natural region.

Although no Red Data Listed species of conservational significance were found to be present within the assessment area, the provincially protected species *Euphorbia burmannii* & *Aloe claviflora* were encountered within the rocky ridge outcrops. It is therefore recommended that a representative portion of the rocky ridge outcrops should be adequately buffered out of the proposed development footprint area if practicably possible. It is also expected that the assessment area will house a number of provincially protected bulb species. It is therefore further recommended that an additional ecological walkthrough be conducted prior to commencement of the project during the flowering period of underground bulb plant species. This will ensure that no provincially protected or significant species have potentially been omitted.

Furthermore, tree and shrub individuals of the nationally protected species *Boscia albitrunca* & *Vachellia erioloba* are sparsely scattered throughout the southern and central portions of the assessment area. Approximately ≤ 85 *Boscia albitrunca* individuals and ≤ 180 *Vachellia erioloba* individuals are present within these southern and central portions. The majority of individuals of the latter species are however still relatively small (≤ 3.5 m in height) within the southern and central portions.

The densities of these two nationally protected species however increase significantly within the northern portion of the assessment area and a high number of large mature individuals (≥ 7 m in height) of the species *Vachellia erioloba* are present there. Approximately ≤ 200 *Boscia albitrunca* individuals and ≤ 450 *Vachellia erioloba* individuals are present within the northern portion. Due to the presence of this well-established woody component within the northern portion, the area subsequently also houses numerous large congregated nests of sociable weavers (*Philetairus socius*) which is a provincially protected species. The area is also utilised by various raptor- and other predatory bird species for breeding, foraging and persistence purposes. The northern portion of the assessment area is therefore viewed as being of relatively high conservational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type and nationally protected tree species.

Due to the significant presence of the two nationally protected tree species within the northern portion of the assessment area, together with the area's distinctly associated avifaunal ecology, it is recommended that a theoretical development line must be drawn through the assessment area and no development should be allowed to take place north of this line. If development north of the line is still considered by the applicant, it would highly likely require the investigation and implementation of a suitable Biodiversity Offset as part of the NEMA mitigation hierarchy. A comprehensive Biodiversity Offset Feasibility Assessment and Report would therefore need to be conducted and compiled in order to identify and inform on potential areas of suitable size and similar ecological value which could meaningfully contribute to the provincial and national biodiversity targets and conservation strategies. The proposed Biodiversity Offset Feasibility Assessment and Report will have to be evaluated by the relevant competent authorities in order to inform on their approval/rejection process. It is recommended that the Department of Agriculture, Forestry and Fisheries be informed of the application as an Interested & Affected Party during the Public Participation Process in order for them to provide comment and recommendations in this regard.

Although the additional approximately 11.2 ha portion associated with Alternative 1 is situated north of the recommended development line, the location of this additional portion has specifically been chosen in an area with a lower tree density and few large mature individuals of the species *Vachellia erioloba* (≤ 15) relative to the rest of the area north of the development line. The development within this additional portion will therefore not result in the removal of a significant number of nationally protected tree individuals and should not necessarily impact significantly on the continued ecological functionality and connectivity of the broader ecosystem north of the development line.

Individuals of the two nationally protected tree species are also sparsely scattered along the pipeline route. No individuals of the two nationally protected tree species are to be removed during the pipeline construction phase and the pipeline route is to be diverted around any individuals of these two species if encountered.

The ephemeral watercourses which traverse the assessment area, form an important part of the mid to upper region of a quaternary surface water catchment and drainage area which regionally drains towards the south and eventually discharges into the Orange River situated approximately 3.2 km south of the assessment area. The ephemeral watercourses are therefore viewed as being of

relatively high conservational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type and the surface water catchment and drainage area. It is therefore recommended that the ephemeral watercourses be adequately buffered out of the proposed development footprint and that no significant development is allowed to take place within the buffer zone.

A significant number of small drainage lines feed into the directly adjacent ephemeral watercourse all along the length of the proposed pipeline route. The local catchment and drainage all along the length of the pipeline route towards the ephemeral watercourse, could therefore be significantly impeded by the construction of the aboveground pipeline. Construction and design of the proposed pipeline should take into account the significant number of small drainage lines and the pipeline must be installed in a manner so as not to permanently impact or impede on the local surface water drainage towards the ephemeral watercourse.

It is the opinion of the specialist that the potentially significant ecological impacts associated with the contamination and impeding of the flow regimes of the significant ephemeral watercourses as well as destruction of-/damage to Red Data Listed, nationally or provincially protected species individuals/habitats associated with the assessment area, can be suitably reduced and mitigated to within acceptable residual levels. The project should therefore be considered by the competent authority for environmental authorisation and approval.

Although Alternative 2 will result in the transformation of an approximately 11.2 ha smaller footprint area (total of 206.34 ha) relative to Alternative 1 (total of 217.54 ha), there is no significant difference in ecological impact ratings between the two alternatives. It is recommended that Alternative 2 rather be considered due to its slightly smaller impact footprint but either alternatives should prove to be acceptable for development.

The proposed development may however only continue if all recommended mitigations measures as per this ecological report are adequately implemented and managed for both the construction and operational phases of the proposed project. All necessary authorisations and permits must also be obtained prior to any commencement.

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Abbreviations

CARA	Conservation of Agricultural Resources Act (Act 43 of 1983)
CBA	Critical Biodiversity Area
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
MAP	Mean Annual Precipitation
NCPSBP	Northern Cape Provincial Spatial Biodiversity Plan 2016
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NEMA	National Environmental Management Act (Act 107 of 1998)
NFA	National Forests Act (Act 84 of 1998)
NWA	National Water Act (Act 36 of 1998)
ONA	Other Natural Area'
PES	Present Ecological State
WULA	Water Use License Application

Declaration of Independence

I, Adriaan Johannes Hendrikus Lamprecht, ID 870727 5043 083, declare that I:

- am the Director and Ecological Specialist of EcoFocus Consulting (Pty) Ltd
- act as an independent specialist consultant in the field of botany and ecology
- am assigned as the Ecological Specialist consultant by the Environmental Assessment Practitioner (EAP), Eco-Con Environmental, for the proposed project
- do not have or will not have any financial interest in the undertaking of the proposed project activity other than remuneration for work as stipulated in the Purchase Order terms of reference
- confirm that remuneration for my services relating to the proposed project is not linked to approval or rejection of the project by the competent authority
- have no interest in secondary or subsequent developments as a result of the authorisation of the proposed project
- have no and will not engage in any conflicting interests in the undertaking of the activity
- undertake to disclose to the applicant and the competent authority any information that has or may have the potential to influence the decision of the competent authority
- will provide the applicant and competent authority with access to all relevant project information in my possession whether favourable or not

AJH Lamprecht



Signature

1. Introduction

The project applicant, Nyama Yethu Holdings (Pty) Ltd proposes to develop an approximately 535 ha natural portion of virgin soil into cultivated irrigated camps and/or cultivated centre pivot lands on Portion 1 of the Farm Bultfontein no 327 and Portion 2 of the Farm Folmink no 331. The farms are situated approximately 40 km north-west of the town of Prieska, Northern Cape Province.

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EcoFocus Consulting was therefore subsequently appointed by the EAP as the independent ecological specialist to conduct the required Ecological study for the proposed project. This report constitutes the Ecological Assessment.

Preliminary preparations conducted prior to the ecological walkthrough/site assessment where as follows:

- Georeferenced spatial information was obtained of the proposed project area in order to determine the direct impact footprint area.
- A desktop study was conducted of the information available on the relevant vegetation types and national/provincial conservation significance status associated with the proposed footprint area.

2. Date and Season of Ecological Site Assessment

Two site visits/assessments for the proposed development footprint area were conducted on 21 & 22 August 2018. These dates form part of the winter season. It must therefore be noted that the time of the assessment was not necessarily favourable for successful identification of all plant species individuals.

3. Assessment Rational

South Africa is a country rich in natural resources and splendour and is rated as having some of the highest biodiversity in the world. Other than the pure aesthetic value which our biodiversity and natural resources provides, it also plays a significant positive role in our national economy. While continuous economic development and progress is a key national focus area, which forms a cornerstone in the socio-economic improvement of society and the livelihoods of communities and individuals, the preservation and management of the integrity and sustainability of our natural resources is also essential in achieving this objective.

Socio-economic development and progress can therefore not be completely inhibited for the sake of ensuring environmental conservation, therefore solutions and compromises rather need to be explored in order to achieve the need for socio-economic development without unreasonably jeopardising the needs of environmental conservation. A sustainable and responsible balance needs to be maintained in order to accommodate the requirements of both.

Adequate, sustainable and responsible utilisation and management of our natural resources is crucial. Finding the required balance between socio-economic development and environmental conservation, should therefore always be a priority focus point during any proposed development process.

Various environmental legislation in South Africa makes provision for the protection of our natural resources and the functionality of ecological systems in order to ensure sustainability. Such acts include the National Environmental Management: Biodiversity Act (Act 10 of 2004), National Forests Act (Act 84 of 1998), Conservation of Agricultural Resources Act (Act 43 of 1983), National Water Act (Act 36 of 1998) and framework legislation such as the National Environmental Management Act (Act 10 of 2004).

An Ecological Assessment of the proposed project area was therefore conducted in order to determine and quantify the potential impacts of the proposed development on the natural environment in the area.

4. Objectives of the Assessment

Ecological and habitat survey:

- Describe the vegetation on the assessment area and identify and list conservationally significant faunal and floral species encountered on the assessment area and list any nationally and/or provincially protected and/or Red Data Listed species.
- Determine and discuss the Present Ecological State (PES) and extent of degradation and/or transformation of the vegetation on the assessment area and surrounding areas. Also indicate the Ecological Importance and Sensitivity (EIS) of the assessment area in order to provide an indication of the conservational significance of the assessment area.
- Identify and delineate all watercourses/wetland areas potentially present on the assessment area.
- Identify, evaluate and rate the potential ecological impacts of the proposed development on the natural environment.
- Provide recommendations on mitigation and management measures in order to attempt to reduce/alleviate these identified potential ecological impacts.
- Provide recommendations on the suitability of the potential development area.
- A digital report (this document) as well as the digital KML files of any identified ecologically sensitive/conservationally significant areas will be provided to the applicant.

5. Methodology

- The proposed development area was assessed on foot and visual observations/identifications were made of habitat conditions, ecologically sensitive areas and relevant species present.
- Species were listed and categorised as per the Red Data Species List; Protected Species List of the National Forests Act (Act 84 of 1998), Invasive Species List of the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species Regulations, 2014 and the Provincially Protected species of the Northern Cape Nature Conservation Act (Act 9 of 2009).
- Georeferenced photographs were taken of ecologically sensitive areas (if any) as well as the relevant nationally or provincially protected species if encountered in order to indicate their specific locations in a Geographic Information System (GIS) mapping format.

The **Present Ecological State (PES)** of the proposed project area was assessed and rated as per the table below.

- The Present Ecological State (PES) refers to the current state or condition of an area in terms of all its characteristics and reflects the change to the area from its reference condition. The value gives an indication of the alterations that have occurred in the ecosystem.

Table 1: Criteria for PES calculations

Ecological Category	Score	Description
A	> 90-100%	Unmodified , natural and pristine.
B	> 80-90%	Largely natural . A small change in natural habitats and biota may have taken place but the ecosystem functionality has remained essentially unchanged.
C	> 60-80%	Moderately modified . Moderate loss and transformation of natural habitat and biota have occurred, but the basic ecosystem functionality has still remained predominantly unchanged.
D	> 40-60%	Largely modified . A significant loss of natural habitat, biota and subsequent basic ecosystem functionality has occurred.
E	> 20-40%	Seriously modified . The loss of natural habitat, biota and basic ecosystem functionality is extensive.
F	0-20%	Critically/Extremely modified . Transformation has reached a critical level and the ecosystem has been modified completely with a virtually complete loss of natural habitat and biota. The basic ecosystem functionality has virtually been destroyed and the transformation is irreversible.

The **Ecological Importance and Sensitivity (EIS)** of the proposed project area was assessed and rated as per the table below.

- The Ecological Importance and Sensitivity (EIS) of an area is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales, and both abiotic and biotic components of the system are taken into consideration. Sensitivity refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred.

Table 2: Criteria for EIS calculations

EIS Categories	Score	Description
Low/Marginal	D	Not ecologically important and/or sensitive on any scale. Biodiversity is ubiquitous and not unique or sensitive to habitat modifications.
Moderate	C	Ecologically important and sensitive on local or possibly provincial scale. Biodiversity is still relatively ubiquitous and not usually sensitive to habitat modifications.
High	B	Ecologically important and sensitive on provincial or possibly national scale. Biodiversity is relatively unique and may be sensitive to habitat modifications.
Very High	A	Ecologically important and sensitive on national and possibly international scale. Biodiversity is very unique and sensitive to habitat modifications.

Potential impacts of the proposed project on the surrounding natural environment were identified, evaluated and rated as per the methodology described below. The tables below indicate and explain the methodology and criteria used for the evaluation of the Environmental Risk Ratings as well as the calculation of the final Environmental Significance Ratings of the identified potential ecological impacts. Each potential environmental impact is scored for each of the Evaluation Components as per the table below.

Table 3: Scale utilised for the evaluation of the Environmental Risk Ratings

Evaluation Component	Rating Scale and Description/Criteria
Magnitude of Negative or Positive Impact	<p>10 - Very high: Bio-physical features and/or ecological functionality/processes may be severely impacted upon.</p> <p>8 - High: Bio-physical features and/or ecological functionality/processes may be significantly impacted upon.</p> <p>6 - Medium: Bio-physical features and/or ecological functionality/processes may be moderately impacted upon.</p> <p>4 - Low: Bio-physical features and/or ecological functionality/processes may be slightly impacted upon.</p> <p>2 - Very Low: Bio-physical features and/or ecological functionality/processes may be slightly impacted upon.</p> <p>0 - Zero: Bio-physical features and/or ecological functionality/processes will not be impacted upon.</p>
Duration of Negative or Positive Impact	<p>5 – Permanent: Impact will continue on a permanent basis.</p> <p>4 - Long term: Impact should cease a period (> 40 years) after the operational phase/project life of the activity.</p> <p>3 - Medium term: Impact may occur for the period of the operational phase/project life of the activity.</p> <p>2 - Short term: Impact may only occur during the construction phase of the activity after which it will cease.</p> <p>1 - Immediate: Impact may only occur as a once off during the construction phase of the activity.</p>

<p>Extent of Positive or Negative Impact</p>	<p>5 - International: Impact will extend beyond National boundaries.</p> <p>4 - National: Impact will extend beyond Provincial boundaries but remain within National boundaries.</p> <p>3 - Regional: Impact will extend beyond 5 km of the development footprint but remain within Provincial boundaries.</p> <p>2 - Local: Impact will not extend beyond 5 km of the development footprint.</p> <p>1 - Site-specific: Impact will only occur on or within 200 m of the development footprint.</p> <p>0 – No impact.</p>
<p>Irreplaceability of Natural Resources being impacted upon</p>	<p>5 – Definite loss of irreplaceable natural resources.</p> <p>4 – High potential for loss of irreplaceable natural resources.</p> <p>3 – Moderate potential for loss of irreplaceable natural resources.</p> <p>2 – Low potential for loss of irreplaceable natural resources.</p> <p>1 – Very low potential for loss of irreplaceable natural resources.</p> <p>0 – No impact.</p>
<p>Reversibility of Impact</p>	<p>5 – Impact cannot be reversed.</p> <p>4 – Low potential that impact may be reversed.</p> <p>3 – Moderate potential that impact may be reversed.</p> <p>2 – High potential that impact may be reversed.</p> <p>1 – Impact will be reversible.</p> <p>0 – No impact.</p>
<p>Probability of Impact Occurrence</p>	<p>5 - Definite: Probability of impact occurring is > 95 %.</p> <p>4 - High: Probability of impact occurring is > 75 %.</p> <p>3 - Medium: Probability of impact occurring is between 25 % - 75 %.</p> <p>2 - Low: Probability of impact occurring is between 5 % - 25 %.</p> <p>1 - Improbable: Probability of impact occurring is < 5 %.</p>
<p>Cumulative Impact</p>	<p>High: Numerous similar historic, present or future development activities in the same geographical area, have taken or are anticipated to take place which may cumulatively contribute and increase the significance of the identified impacts.</p> <p>Medium: Few similar historic, present or future development activities in the same geographical area, have taken or are anticipated to take place which may cumulatively contribute and increase the significance of the identified impacts.</p> <p>Low: Virtually no similar historic, present or future development activities in the same geographical area, have taken or are anticipated to take place which may cumulatively contribute and increase the significance of the identified impacts. The development is anticipated to be an isolated occurrence and should therefore have a negligible cumulative impact.</p> <p>None: No cumulative impact.</p>

Once the Environmental Risk Ratings have been evaluated for each potential ecological impact, the Significance Score of each potential ecological impact is calculated by using the following formula:

- **SS (Significance Score) = (magnitude + duration + extent + irreplaceable + reversibility) x probability.**

The maximum Significance Score value is 150.

The Significance Score is then used to rate the Environmental Significance of each potential ecological impact as per Table 4 below. The Environmental Significance rating process is completed for all identified potential ecological impacts both before and after implementation of the recommended mitigation measures.

Table 4: Scale used for the evaluation of the Environmental Significance Ratings

Environmental Significance Score	Environmental Significance Rating	Description/Criteria
125 – 150	Very high	An impact of very high significance after mitigation will mean that the development may not take place. The impact cannot be suitably reduced and mitigated to within acceptable levels.
100 – 124	High	An impact of high significance after mitigation should influence a decision about whether or not to proceed with the development. Additional, impact-specific mitigation measures must be implemented if the continuation of the development is to be considered.
75 – 99	Medium-high	Additional, impact-specific mitigation measures must be implemented for an impact of medium-high significance if the continuation of the development is to be considered.
50 – 74	Medium	An impact of medium significance after mitigation must be adequately managed in accordance with the mitigation measures provided by the specialist.
< 50	Low	If any mitigation measures are provided by the specialist for an impact of low significance after mitigation, the impact must be adequately managed in accordance with these measures.
+	Positive impact	A positive impact is likely to result in a beneficial consequence/effect and should therefore be viewed as a motivation for the development to proceed.

Wetlands/watercourses were identified and delineated on the proposed project area as per the methodology described below:

For the purposes of this investigation a wetland was defined according to the definition in the National Water Act (Act 36 of 1998) as: “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 in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.”

In 2005 DWAF published a wetland delineation procedure in a guideline document titled “A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas”. Guidelines for the undertaking of biodiversity assessments exist. These guidelines contain a number of stipulations relating to the protection of wetlands and the undertaking of wetland assessments.

The wetland delineation procedure identifies the outer edge of the temporary zone of the wetland, which marks the boundary between the wetland and adjacent terrestrial areas. This constitutes the part of the wetland that might remain flooded or saturated close to the soil surface for only a few weeks in the year, but long enough to develop anaerobic conditions and determine the nature of the plants growing in the soil.

The guidelines also state that the locating of the outer edge of the temporary zone must make use of four specific indicators namely:

- terrain unit indicator,
- soil form indicator,
- soil wetness indicator and
- vegetation indicator.

In addition, the wetland/watercourse and a protective buffer zone beginning from the outer edge of the wetland temporary zone, was designated as sensitive in a sensitivity map. The guidelines stipulate buffers to be delineated around the boundary of a wetland. An adequate protective buffer zone, beginning from the outer edge of the wetland temporary zone, was implemented and designated as sensitive within which no development must be allowed to occur.

6. Study Area

The assessment area consists of a single footprint area of approximately 535 ha in size. The area is partly situated on Portion 1 of the Farm Bultfontein no 327 (SG 21 Digit Code: C0310000000032700001) and Portion 2 of the Farm Folmink no 331 (SG 21 Digit Code: C0310000000033100002) respectively. The farms are situated approximately 40 km north-west of the town of Prieska which forms part of the Siyathemba Local Municipality. This in turn, forms part of the Pixley Ka Seme District Municipality, Northern Cape Province. Access to the assessment area is obtained via the R 383 provincial road and subsequent dirt roads from the north-west.

The location of the pump station is also situated on Portion 1 of the Farm Bultfontein no 327 (SG 21 Digit Code: C0310000000032700001) while the proposed pipeline route traverses the same farm portion.

See locality map below.

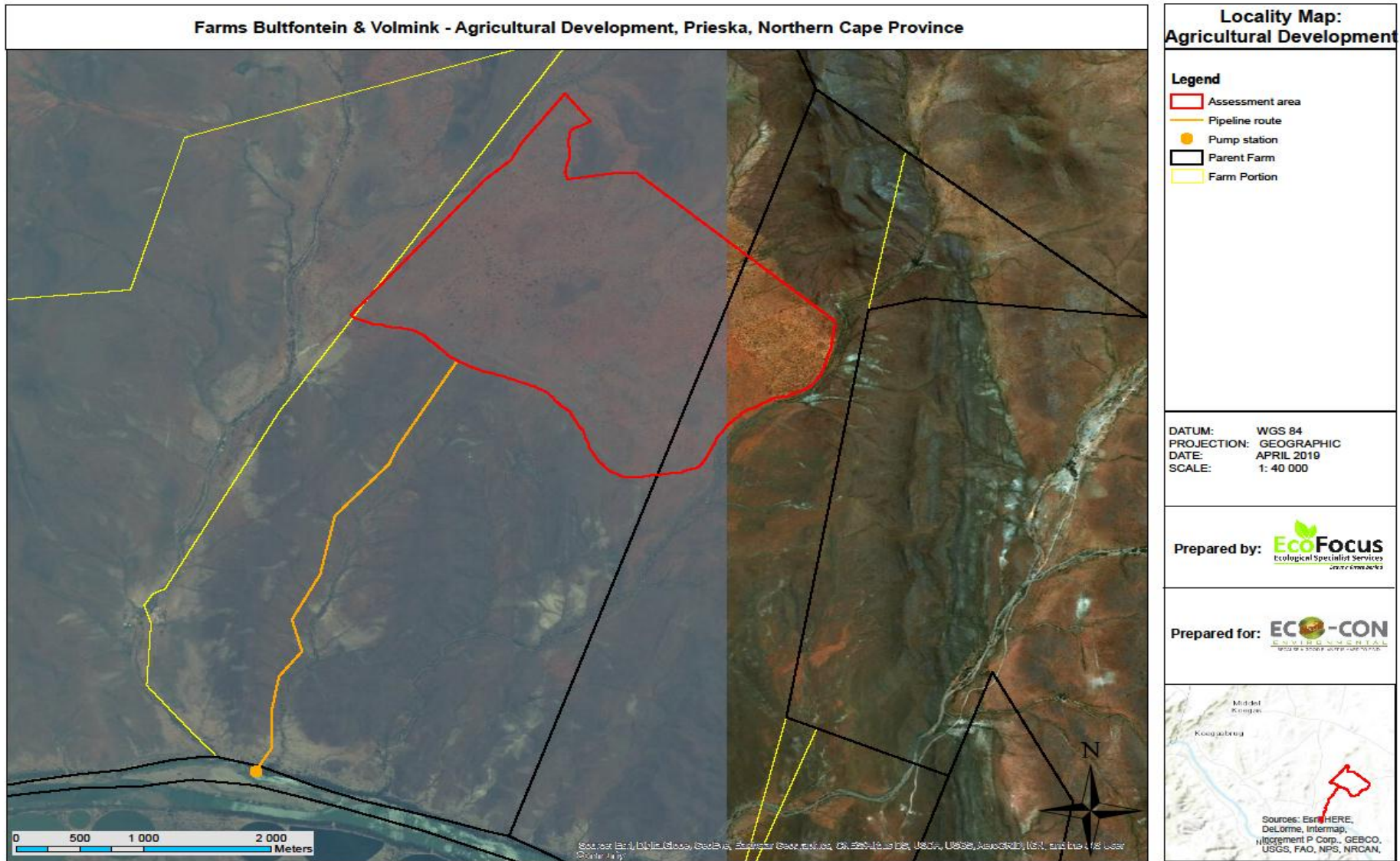


Figure 1: Locality map illustrating the assessment area as well as the pump station and associated pipeline (see A3 sized map in the Appendices)

6.1. Climate

The rainfall of the region peaks during the summer months and the Mean Annual Precipitation (MAP) of the area is approximately 244 mm (www.climate-data.org). The maximum average monthly temperature is approximately 26.9°C in the summer months while the minimum average monthly temperature is approximately 9.8°C during the winter. Maximum daily temperatures can reach up to 34.6°C in the summer months and dip to as low as 1°C during the winter.

6.2. Geology and Soils

According to Mucina & Rutherford (2006) the geology of the landscape and associated vegetation type can be described as the following:

The underlying geology is mainly formed by shales of the Volksrust Formation and to a lesser extent the Prince Albert Formation (both of the Ecca Group) as well as Dwyka Group diamictites. Broad areas are covered by superficial deposits including calcretes of the Kalahari Group. Soils are variable from shallow to deep, red-yellow apedal and freely draining with potential scattered rocky dolerite outcrops.

6.3. Vegetation and Conservation Status

According to SANBI (2006-), the entire assessment area falls within the Northern Upper Karoo vegetation type (NKu 3) which mainly consists of flat to slightly sloping shrubland, dominated by dwarf karoo shrubs and sparse grasses. This vegetation type is classified as least threatened as very little has been transformed thus far (SANBI, 2006-).

The pump station and associated pipeline route traverses the Lower Gariep Broken Veld vegetation type (NKb 1) which constitutes hills and low mountains and slightly irregular plains dominated by sparse shrubs and dwarf shrubs (SANBI, 2006-). This vegetation type is also classified as least threatened (SANBI, 2006-).

The majority of the assessment area as well as the entire pipeline route is categorised as 'Other Natural Area' (ONA) while only a very small portion in the south-eastern corner of the assessment area falls within an Ecological Support Area (ESA) in accordance with the Northern Cape Provincial Spatial Biodiversity Plan 2016 (NCPSBP), which sets out biodiversity priority areas in the province. The location of the pump station on the banks of the Orange River falls within a Critical Biodiversity Area one (CBA 1) in accordance with the NCPSBP.

CBA's are areas that are irreplaceable or near-irreplaceable (CBA 1), or reflect an optimum configuration (CBA 2) for reaching provincial biodiversity targets for ecosystem types, species or ecological processes (Collins, 2017). Such an area must be maintained in a natural or near-natural state in order to meet biodiversity targets (Collins, 2017). ESA's are areas that must be maintained in at least fair ecological condition (semi-natural/moderately modified state) in order to support the ecological functioning of a CBA or protected area or that play an important role in delivering ecosystem services (Collins, 2017).

The mechanical clearance of vegetation and soil preparation associated with the proposed agricultural development will in all probability completely transform the majority of the existing natural surface vegetation on the assessment area.

See vegetation and sensitivity maps below.

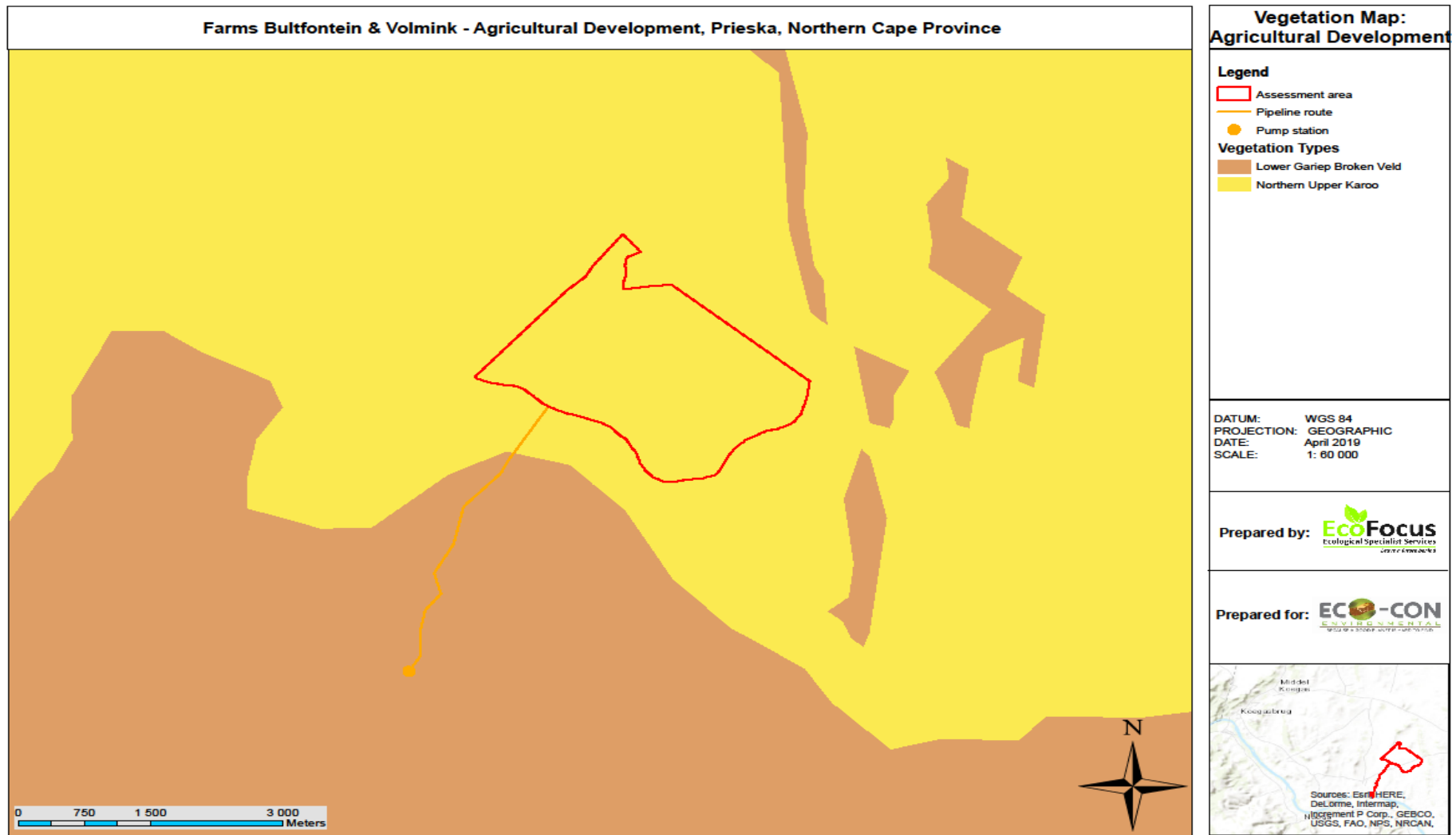


Figure 2: Vegetation map illustrating the vegetation types associated with the assessment area as well as the pump station and associated pipeline (see A3 sized map in the Appendices)

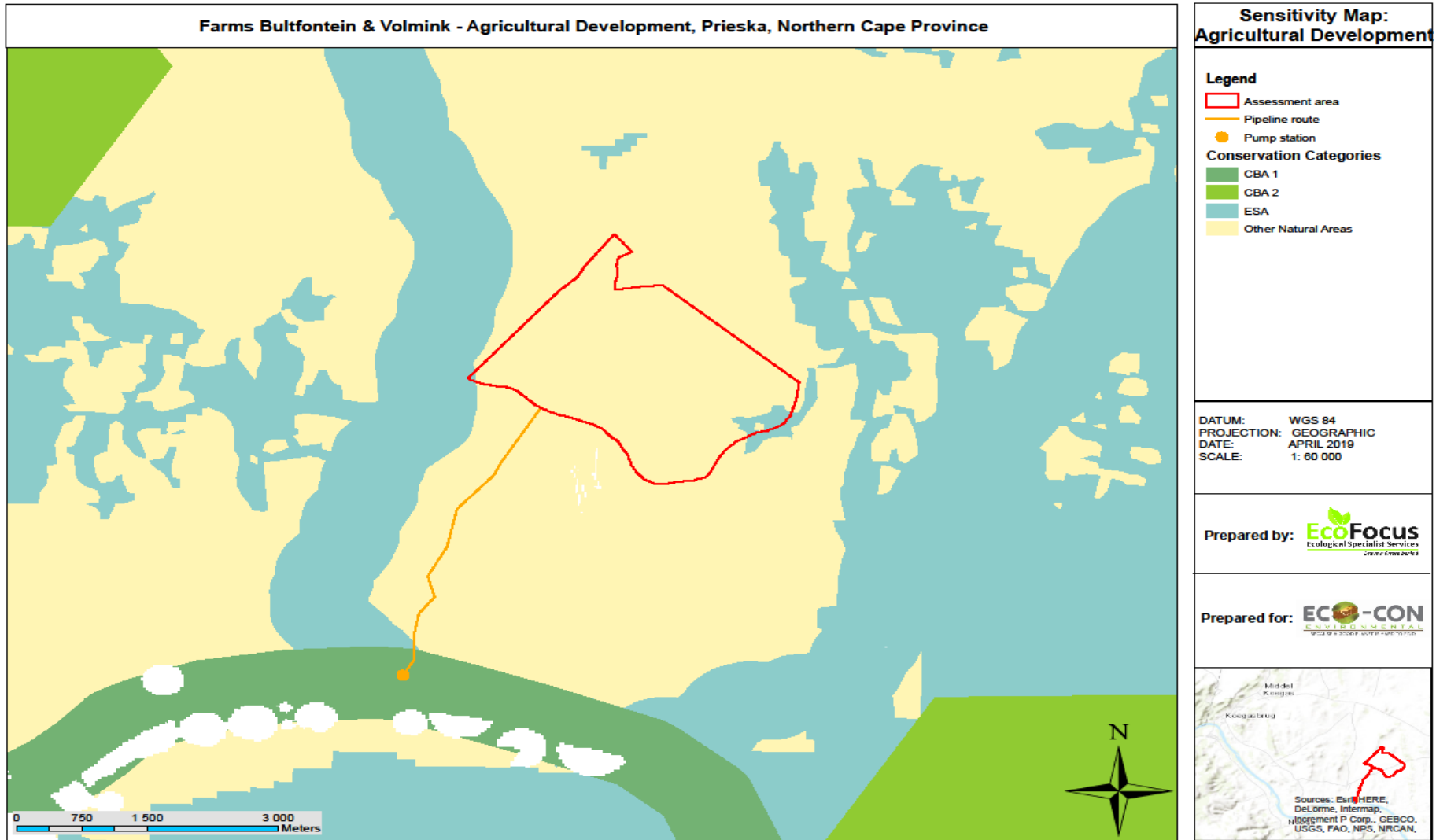


Figure 3: Sensitivity map illustrating the conservation statuses associated with the assessment area as well as the pump station and associated pipeline (see A3 sized map in the Appendices)

7. Assumptions, Uncertainties and Gaps in Knowledge

Various assumptions need to be made during the assessment process at the hand of the relevant specialist. It is therefore assumed that:

- all relevant project information provided by the applicant and engineering design team to the ecological specialist was correct and valid at the time that it was provided.
- the proposed development area as provided by the engineering design team is correct and will not be significantly deviated from as this was the only area assessed.
- strategic level investigations undertaken by the applicant prior to the commencement of the Environmental Impact Assessment process, determined that the proposed development footprint represents a potentially suitable and technically acceptable location.
- the public, local communities, relevant organs of state and landowners will receive a sufficient reoccurring opportunity to participate and comment on the proposed project during the Environmental Impact Assessment process, through the provision of adequately facilitated public participation interventions and timeframes as stipulated in the NEMA: EIA Regulations, 2014.
- the need and desirability of the proposed project is based on strategic national, provincial and local plans and policies which reflect the interests of both statutory and public viewpoints.
- the EIA process is a project-level framework and the specialists are limited to assessing the anticipated environmental impacts associated with the construction and operational phases of the proposed project.
- it is assumed that strategic level decision making by the relevant authorities will be conducted through cooperative governance principles, with the consideration of environmentally sustainable and responsible development principles underpinning all decision making.
- The dates on which the site assessments were conducted, form part of the winter season. It must therefore be noted that the time of the assessment was not necessarily favourable for successful identification of all plant species individuals.

Given that an EIA involves prediction, the uncertainty factor forms part of the assessment process. Two types of uncertainty are associated with the EIA process, namely process-related and prediction-related.

- Uncertainty of prediction is critical at the data collection phase as observations and conclusions are made, only based on professional specialist opinion. Final certainty will only be obtained upon actual implementation of the proposed development. Adequate research, specialist experience and expertise should however minimise this uncertainty.

- Uncertainty of relevant decision making relates to the interpretation of provided information by relevant authorities during the EIA process. Continual two way communication and coordination between EAP's and relevant authorities should however decrease the uncertainty of subjective interpretation. The importance of widespread/comprehensive consultation towards minimising the risk/possibility of omitting significant information and impacts is further stressed. The use of quantitative impact significance rating formulas (as utilised in this document) can further standardise the objective interpretation of results and limit the occurrence and scale of uncertainty and subjectivity.
- The principle of human nature provides for uncertainties and unpredictability with regards to the socio-economic impacts of the proposed development and the subsequent public reaction/opinion which will be received during the Public Participation Process (PPP).
- A soil suitability assessment was also conducted which has indicated certain portions of the assessment area which are unsuitable for cultivation purposes. It is therefore assumed that these areas will be excluded from the development footprint and they have also subsequently been excluded from the areas suitable for development indicated in the ecological sensitivity map under heading 8.7 of this report.

Gaps in knowledge can be attributed to:

- The ecological study process was undertaken prior to the availing of certain information which would only be derived from the final project design and layout. The design layout had not been finalised yet at the time of the ecological study.
- The potential of future similar developments in the same geographical area, which could lead to cumulative impacts cannot be meaningfully anticipated.

EcoFocus Consulting is an independent ecological specialist company. All information and recommendations as per this report are therefore provided in a fair and unbiased/objective manner based on professional specialist opinion.

8. Results and Discussion

The assessment area is approximately 535 ha in size and is in a natural pristine condition. Two layout alternatives are proposed which constitute ecologically and agriculturally suitable areas for the development namely Alternative 2 which equates to a development area of approximately 206.34 ha and Alternative 1 which includes the entire area of Alternative 2 along with an additional approximately 11.2 ha area equating to approximately 217.54 ha.

The assessment area constitutes a mosaic of flat to slightly sloping open and dense karroid shrubland mainly situated on deep red sandy Hutton soils. A sparse woody component is present in the southern and central portions of the assessment area which significantly increases in density into the northern portions. The area possesses a very sparse low growing grass layer dominated by white grasses.

A number of small but distinct slightly elevated ridge outcrops are scattered throughout the assessment area which house an increase in exposed soil surface rockiness. These outcrops subsequently constitute a slight variation in vegetation species composition relative to the surrounding sandy karroid shrubland.

Due to the slightly sloping topography of the assessment area, the entire area forms part of the mid to upper region of a quaternary surface water catchment and drainage area which regionally drains towards the south and eventually discharges into the Orange River situated approximately 3.2 km south of the assessment area. A number of significant ephemeral watercourses and small water drainage lines therefore traverse the assessment area. Due to the lack of continuous water flow through the assessment area, the watercourses possess no distinct riparian zones or variation in vegetation species composition relative to the surrounding sandy karroid shrubland.

These different ecological components will be discussed separately under headings 8.1., 8.2 & 8.3. It must however be kept in mind that although the assessment area is being artificially separated into different ecological components for practical reporting purposes, the components do not function independently and should not be viewed as separate, isolated units. They rather form part of a larger interrelated ecological network associated with the entire assessment area and broader surrounding ecosystem.

8.1. Open and dense sandy karroid shrubland

The assessment area mainly constitutes a mosaic of flat to slightly sloping open and dense sandy karroid shrubland. No distinct variation in vegetation species composition is however evident between the open and denser areas. The open karroid shrubland areas are mainly dominated by a low growing shrub layer of the species *Pteronia glauca*, *Rhigozum trichotomum* & *Senegalia mellifera*. The density of the latter two species however increases significantly within the dense karroid shrubland areas while the density of *Pteronia glauca* decreases. Other karroid shrub species also found to be present within the karroid shrubland include *Phaeoptilum spinosum*, *Eriocephalus ericoides*, *Pteronia pallens*, *Pentzia spp*, *Eriocephalus aspalathoides*, *Asparagus spp.*, *Chrysocoma obtusa* & *Crotolaria orientalis*. Woody shrub species which are sparsely scattered throughout the area include *Grewia flava* & *Parkinsonia africana*.

The sparse grass layer is mainly dominated by the species *Centropodia glauca*, *Stipagrostis obtusa* & *Enneapogon desvauxii*. Other grass species also found to be present but to a significantly lesser extent include *Arisitda spp.*, *Schmidtia pappophoroides* & *Eragrostis lehmanniana*.

Numerous bulb plant species individuals were found to be present within the assessment area but the timing of the site visit made successful species identification impossible. It is however expected that the assessment area will house a number of provincially protected bulb species and it is therefore recommended that an additional ecological walkthrough be conducted prior to the commencement of the project during the flowering period of underground bulb plant species. This will ensure that no provincially protected or significant species have potentially been omitted.





Figure 4: Two images illustrating the open and dense sandy karroid shrubland respectively

Tree and shrub individuals of the nationally protected species *Boscia albitrunca* & *Vachellia erioloba* are sparsely scattered throughout the southern and central portions of the assessment area. Approximately ≤ 85 *Boscia albitrunca* individuals and ≤ 180 *Vachellia erioloba* individuals are present within the southern and central portions. The majority of individuals of the latter species are however still relatively small (≤ 3.5 m in height) within the southern and central portions.

The densities of these two nationally protected tree species however increase significantly within the northern portion of the assessment area and a high number of large mature individuals (≥ 7 m in height) of the species *Vachellia erioloba* are present there. Approximately ≤ 200 *Boscia albitrunca* individuals and ≤ 450 *Vachellia erioloba* individuals are present within the northern portion. Due to the presence of this well-established woody component within the northern portion, the area subsequently also houses numerous large congregated nests of sociable weavers (*Philetairus socius*) which is a provincially protected species. The area is also utilised by various raptor- and other predatory bird species for breeding, foraging and persistence purposes.

Due to the significant presence of the two nationally protected tree species within the northern portion of the assessment area, together with the area's distinctly associated avifaunal ecology, it is recommended that this northern portion must be left undeveloped. A theoretical development line must be drawn through the assessment area and no development should be allowed to take place north of this line. If development north of the line is still considered by the applicant, it would highly likely require the investigation and implementation of a suitable Biodiversity Offset as part of the

NEMA mitigation hierarchy. A comprehensive Biodiversity Offset Feasibility Assessment and Report would therefore need to be conducted and compiled in order to identify and inform on potential areas of suitable size and similar ecological value which could meaningfully contribute to the provincial and national biodiversity targets and conservation strategies. The proposed Biodiversity Offset Feasibility Assessment and Report will have to be evaluated by the relevant competent authorities in order to inform on their approval/rejection process. It is recommended that the Department of Agriculture, Forestry and Fisheries be informed of the application as an Interested & Affected Party during the Public Participation Process in order for them to provide comment and recommendations in this regard.

The additional approximately 11.2 ha portion associated with Alternative 1 is situated north of the recommended development line. The location of this additional portion has however specifically been chosen in an area with a lower tree density and few large mature individuals of the species *Vachellia erioloba* (≤ 15) relative to the rest of the area north of the development line. The development within this additional portion will therefore not result in the removal of a significant number of nationally protected tree individuals and should not necessarily impact significantly on the continued ecological functionality and connectivity of the broader ecosystem north of the development line.

Due to the natural pristine state of the assessment area, the area is utilised by a wide variety of common and specialised small antelope as well as burrowing and predatory mammals for breeding, foraging and persistence purposes. The mobility of such faunal species along with the broad, continuous surrounding natural landscape however allows for individuals to simply leave an area where disturbance is taking place and disperse to other similar, adequate areas.



Figure 5: Two images illustrating the significantly higher density of large mature individuals of the nationally protected species *Vachellia erioloba* within the northern portion of the assessment area



Figure 6: Two images illustrating the presence of numerous large congregated nests of provincially protected sociable weavers (*Philetairus socius*) within the northern portion of the assessment area

8.2. Rocky ridge outcrops

The small but distinct slightly elevated rocky ridge outcrops which are scattered throughout the assessment area, constitute a slight variation in vegetation species composition relative to the surrounding sandy karroid shrubland. Similar to the surrounding open karroid shrubland, the rocky ridge outcrops are mainly dominated by a low growing shrub layer of the species *Rhigozum trichotomum* & *Senegalia mellifera*. The shrub layer of the rocky ridge outcrops is however even sparser than that of the surrounding open karroid shrubland. The species *Pteronia glauca* which is dominant within the surrounding open karroid shrubland, as well as the woody shrub species *Grewia flava* & *Parkinsonia africana*, are further absent from the rocky ridge outcrops.

The grass layer is similar to that of the surrounding sandy karroid shrubland but is even sparser. Diagnostic forb species associated with the rocky ridge outcrops and which are mainly absent from the surrounding sandy karroid shrubland include *Barleria macrostegia*, *Euphorbia burmannii* (provincially protected), *Blepharis mitrada*, *Aptosimum spinescens* & *Thesium hystrix*. Only two individuals of the provincially protected species *Aloe claviflora* were also found to be present within the rocky ridge outcrops.

Although the nationally protected tree species *Boscia albitrunca* is prominent within the rocky ridge outcrops, the other nationally protected tree species found within the assessment area, *Vachellia erioloba*, is completely absent as it mainly prefers the deep sandy soils of the surrounding karroid shrubland.

Although not necessarily being conservationally significant, these rocky ridge outcrops possess locally distinct faunal habitat attributes due their increased soil surface rockiness and it is also reasonably expected that these areas are utilised by various specialised reptilian species as refuge and for breeding, foraging and persistence purposes. It is therefore recommended that a representative portion of the rocky ridge outcrops should be adequately buffered out of the proposed development footprint area if practicably possible.



Figure 7: Two images illustrating the increase in exposed soil surface rockiness within the rocky ridge outcrops

8.3. Ephemeral watercourses and water drainage lines

Due to the slightly sloping topography of the assessment area, the entire area forms part of the mid to upper region of a quaternary surface water catchment and drainage area which regionally drains towards the south and eventually discharges into the Orange River situated approximately 3.2 km south of the assessment area. The ephemeral watercourses which traverse the assessment area, therefore form an important part of the quaternary surface water catchment and drainage. The majority of the small water drainage lines traversing the assessment area, however eventually dissipate into the surrounding sandy karroid shrubland but also form part of the water catchment and drainage area (although less significant).

The lack of continuous water flow through the assessment area, has resulted in the watercourses not possessing any distinct riparian zones or variation in vegetation species composition relative to the surrounding sandy karroid shrubland. However, due to the significance of the quaternary surface water catchment and drainage area, it is recommended that the ephemeral watercourses be adequately buffered out of the proposed development footprint and that no significant development is allowed to take place within the buffer zone.





Figure 8: Two images illustrating examples of the significant ephemeral watercourses which traverse the assessment area





Figure 9: Two images illustrating examples of the small water drainage lines which traverse the assessment area and eventually dissipate into the surrounding sandy karroid shrubland

8.4. Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS)

The Present Ecological State (PES) of the assessment area is classified as Class A as it is unmodified, natural and pristine.

The Northern Upper Karoo vegetation type (NKu 3) associated with the assessment area, is classified as least threatened as very little has been transformed thus far (SANBI, 2006-). The majority of the assessment area is further categorised as 'Other Natural Area' (ONA) while only a very small portion in the south-eastern corner of the assessment area falls within an Ecological Support Area (ESA) in accordance with the NCPSBP, which sets out biodiversity priority areas in the province.

Although no Red Data Listed species of conservational significance were found to be present within the assessment area, the provincially protected species *Euphorbia burmannii* & *Aloe claviflora* were encountered within the rocky ridge outcrops. It is also expected that the assessment area will house a number of provincially protected bulb species. Furthermore, tree and shrub individuals of the nationally protected species *Boscia albitrunca* & *Vachellia erioloba* are sparsely scattered throughout the southern and central portions of the assessment area. The majority of individuals of the latter species are however still relatively small (≤ 3.5 m in height) within the southern and central portions.

The densities of these two nationally protected species however increase significantly within the northern portion of the assessment area and a high number of large mature individuals (≥ 7 m in height) of the species *Vachellia erioloba* are present there. Due to the presence of this well-established woody component within the northern portion, the area subsequently also houses numerous large congregated nests of sociable weavers (*Philetairus socius*) which is a provincially protected species. The area is also utilised by various raptor- and other predatory bird species for breeding, foraging and persistence purposes.

Due to the slightly sloping topography of the assessment area, the entire area forms part of the mid to upper region of a quaternary surface water catchment and drainage area which regionally drains towards the south and eventually discharges into the Orange River situated approximately 3.2 km south of the assessment area. The ephemeral watercourses which traverse the assessment area therefore form an important part of the quaternary surface water catchment and drainage.

The Ecological Importance and Sensitivity (EIS) of the northern portion of the assessment area is classified as Class B (high) as it is ecologically important and sensitive on provincial or possibly

national scale mainly due to the significant presence of individuals of the two nationally protected tree species, together with the area's distinctly associated avifaunal ecology as well as the significant ephemeral watercourses. Biodiversity is locally relatively unique/distinct and may be sensitive to habitat modifications. The northern portion of the assessment area is therefore viewed as being of relatively high conservational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type, nationally protected tree species and the surface water catchment and drainage area.

The Ecological Importance and Sensitivity (EIS) of the southern and central portions of the assessment area is classified as Class C (moderate) as they are ecologically important and sensitive on local or possibly provincial scale mainly due to the presence of the provincially protected species *Euphorbia burmannii* & *Aloe claviflora* within the rocky ridge outcrops and sparse presence of individuals of the two nationally protected tree species as well as the ephemeral watercourses. Biodiversity is still relatively ubiquitous. The southern and central portions of the assessment area are therefore merely viewed as being of moderate conservational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type, nationally protected tree species and the surface water catchment and drainage area.

8.5. Pump station and associated pipeline route

The pump station will be implemented on the lower banks of the Orange River within the riparian zone which is in a natural pristine condition. The lower banks of the river mainly constitute narrow alluvial sandbanks dominated by the aquatic grass species *Phragmites australis* as well as the grass species *Cynodon dactylon*. The riparian zone up the river banks to the terrestrial plateau consists of a dense tree canopy dominated by the species *Vachellia karroo*, *Searsia leptodictya*, *S lancea*, *Ziziphus mucronata* & *Lycium bosciifolium*. A distinct lack of any significant herbaceous vegetation or graminoids underneath the dense tree canopy is evident.

The footprint of the pump station will be very small and confined. Minimal clearance of vegetation for the associated pipeline up the river banks to the terrestrial plateau will therefore be required. It is recommended that no large mature tree individuals be removed during construction of the pump station and associated pipeline up the river banks but that pipeline infrastructure be constructed underneath the dense tree canopy. This will also assist in protecting the pumping and pipeline infrastructure against potential flood events.





Figure 10: Three images illustrating the lower banks of the river mainly constituting narrow alluvial sandbanks as well as the riparian zone up the river banks with a dense tree canopy and a distinct lack of any significant herbaceous vegetation or graminoids underneath the canopy

The associated pipeline which will transport water to the assessment area for irrigation purposes, will run aboveground from the pump station alongside a significant ephemeral watercourse to the assessment area. From there a pipeline network will distribute irrigation water to the various cultivated lands. In accordance with the information received from the EAP, the proposed development will require approximately 10 756 m³ of irrigation water per hectare per annum in order to irrigate adequately. This equates to a total of approximately 2 339 860 m³ irrigation water required per annum for Alternative 1 or 2 219 393 m³ for Alternative 2.

A significant number of small drainage lines feed into the directly adjacent ephemeral watercourse all along the length of the proposed pipeline route. The local catchment and drainage all along the length of the pipeline route towards the ephemeral watercourse, could therefore be significantly impeded by the construction of the aboveground pipeline. Construction and design of the proposed pipeline should take into account the significant number of small drainage lines and the pipeline must be installed in a manner so as not to permanently impact or impede on the local surface water drainage towards the ephemeral watercourse.

The vegetation along the pipeline route alongside the ephemeral watercourse is similar to that of the open and dense sandy karroid shrubland. Individuals of the nationally protected tree species *Boscia albitrunca* & *Vachellia erioloba* are therefore sparsely scattered throughout the area. No individuals of these two species are however to be removed during the pipeline construction phase and the pipeline route is to be diverted around any individuals of these two species if encountered.



Figure 11: Image illustrating the vegetation along the pipeline route which is similar to that of the open and dense sandy karroid shrubland

8.6. Species List for the Assessment Area and Pump station location

Table 5: Species list for the assessment area and pump station location (Provincially protected species highlighted in yellow; nationally protected species highlighted in orange)

Graminoids	Forbs	Shrubs & trees
<i>Aristida spp.</i>	<i>Aloe claviflora</i>	<i>Asparagus spp.</i>
<i>Centropodia glauca</i>	<i>Aptosimum spinescens</i>	<i>Boscia albitrunca</i>
<i>Cynodon dactylon</i>	<i>Barleria macrostegia</i>	<i>Crotolaria orientalis</i>
<i>Enneapogon desvauxii</i>	<i>Blepharis mitrada</i>	<i>Chrysocoma obtusa</i>
<i>Eragrostis lehmanniana</i>	<i>Euphorbia burmannii</i>	<i>Eriocephalus aspalathoides</i>
<i>Phragmites australis</i>	<i>Thesium hystrix</i>	<i>Eriocephalus ericoides</i>
<i>Schmidtia pappophoroides</i>	Numerous bulb species	<i>Grewia flava</i>
<i>Stipagrostis obtusa</i>	-	<i>Lycium bosciifolium</i>
-	-	<i>Parkinsonia africana</i>
-	-	<i>Pentzia spp.</i>
-	-	<i>Phaeoptilum spinosum</i>
-	-	<i>Pteronia glauca</i>
-	-	<i>Pteronia pallens</i>
-	-	<i>Rhigozum trichotomum</i>
-	-	<i>Senegalia mellifera</i>
-	-	<i>Searsia lancea</i>
-	-	<i>Searsia leptodictya</i>
-	-	<i>Vachellia erioloba</i>
-	-	<i>Vachellia karroo</i>
-	-	<i>Ziziphus mucronata</i>

8.7. Ecological Sensitivity Map

The sensitivity map below illustrates the theoretical development line north of which no development should be allowed to take place. It also illustrates the buffer zones to be implemented around the significant ephemeral watercourses as well as the locations of the drainage lines and rocky ridge outcrops. It finally illustrates the agriculturally unsuitable soils and the recommended suitable development areas.

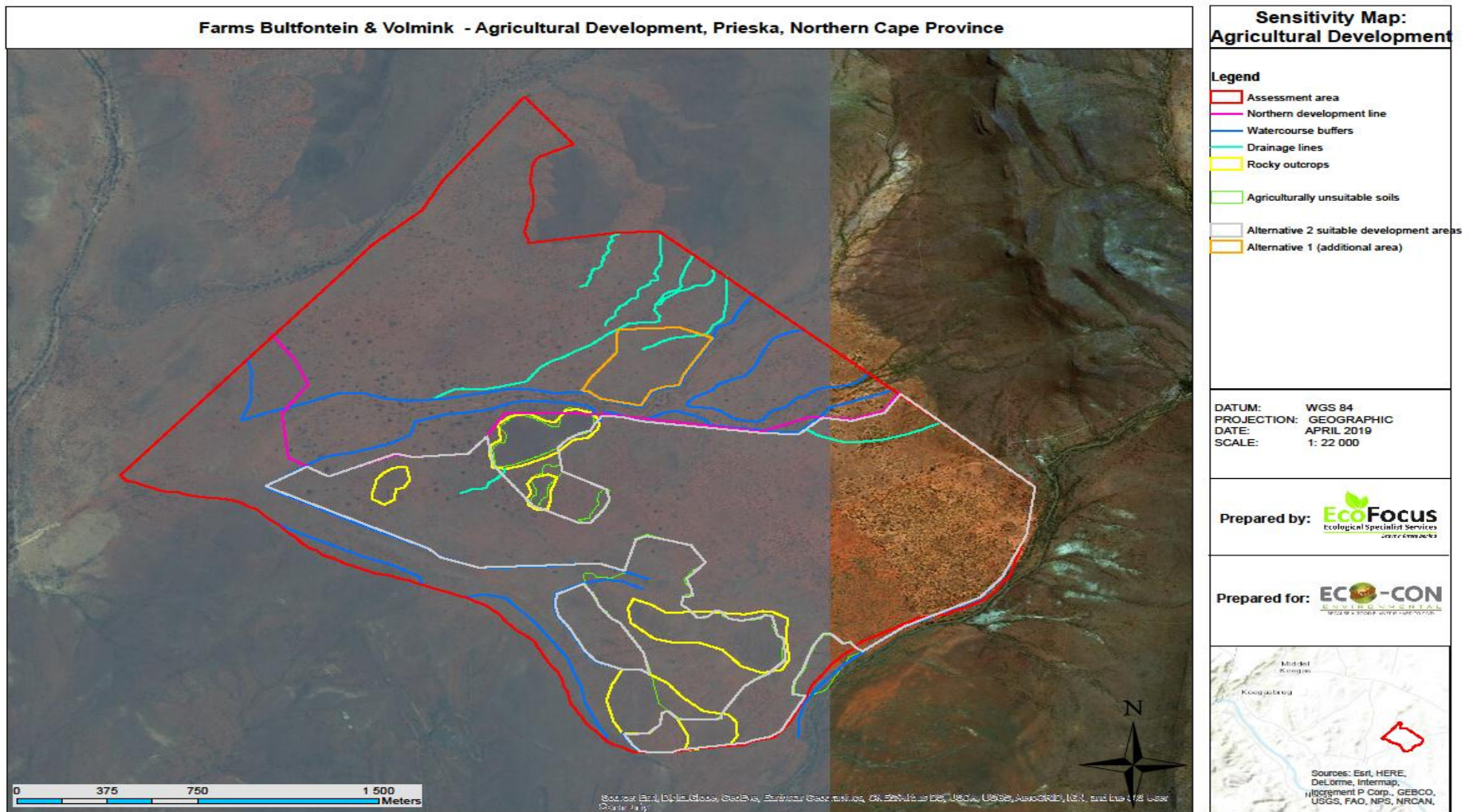


Figure 12: Sensitivity map illustrating the theoretical development line north of which no development should be allowed to take place. It also illustrates the buffer zones to be implemented around the significant ephemeral watercourses as well as the locations of the drainage lines and rocky ridge outcrops. It finally illustrates the agriculturally unsuitable soils and the recommended suitable development areas (see A3 sized map in the Appendices)

9. Ecological Impact Assessment

The following section identifies the potential ecological impacts (both positive and negative) which the proposed project will have on the surrounding environment.

Once the potential ecological impacts are identified, they are assessed by rating their Environmental Risk after which the final Environmental Significance is calculated and rated for each identified ecological impact.

The same Environmental Risk rating process is then followed for each ecological impact to determine the Environmental Significance if the recommended mitigation measures were to be implemented.

The objective of this section is therefore firstly to identify all the potential ecological impacts of the proposed project and secondly to determine the significance of the impacts and how effective the recommended mitigation measures will be able to reduce their significance. The potential ecological impacts which are still rated as highly significant, even after implementation of mitigations, can then be identified in order to specifically focus on implement of effective management strategies for them.

9.1. Construction Phase

Transformation of terrestrial vegetation on the assessment area associated with the Northern Upper Karoo (NKu 3) and Lower Gariep Broken Veld (NKb 1) vegetation types

The mechanical clearance and soil preparation associated with the proposed agricultural development will in all probability completely transform the majority of the existing surface vegetation on the assessment area.

Both of these vegetation types associated with the assessment area, are classified as least threatened as very little has been transformed thus far (SANBI, 2006-). The broader surrounding natural areas associated with the relevant vegetation types, are also extremely vast and largely undeveloped. The size of the proposed development is therefore small relative to the surrounding natural land. The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Transformation of a Critical Biodiversity Area one (CBA 1) and Ecological Support Area (ESA) associated with the assessment area

The mechanical clearance and soil preparation associated with the proposed agricultural development will in all probability completely transform the majority of the existing surface vegetation on the assessment area.

The majority of the assessment area as well as virtually the entire pipeline route is categorised as 'Other Natural Area' (ONA) while only a very small portion in the south-eastern corner of the assessment area falls within an Ecological Support Area (ESA) in accordance with the NCPSBP.

The location of the pump station on the banks of the Orange River falls within a Critical Biodiversity Area one (CBA 1) in accordance with the NCPSBP. The footprint of the pump station will however be very small and confined. Minimal clearance of vegetation for the associated pipeline up the river banks to the terrestrial plateau will therefore be required. The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Destruction of-/damage to Red Data Listed, nationally or provincially protected species individuals/habitats associated with the assessment area

The mechanical clearance and soil preparation associated with the proposed agricultural development will in all probability completely transform the majority of the existing surface vegetation on the assessment area.

Although no Red Data Listed species of conservational significance were found to be present within the assessment area, the provincially protected species *Euphorbia burmannii* & *Aloe claviflora* were encountered within the rocky ridge outcrops. It is also expected that the assessment area will house a number of provincially protected bulb species. Furthermore, tree and shrub individuals of the nationally protected species *Boscia albitrunca* & *Vachellia erioloba* are sparsely scattered throughout the southern and central portions of the assessment area. Approximately ≤ 85 *Boscia albitrunca* individuals and ≤ 180 *Vachellia erioloba* individuals are present within these southern and central portions. The majority of individuals of the latter species are however still relatively small (≤ 3.5 m in height) within the southern and central portions.

The densities of these two nationally protected species however increase significantly within the northern portion of the assessment area and a high number of large mature individuals (≥ 7 m in height) of the species *Vachellia erioloba* are present there. Approximately ≤ 200 *Boscia albitrunca* individuals and ≤ 450 *Vachellia erioloba* individuals are present within the northern portion. Due to the presence of this well-established woody component within the northern portion, the area subsequently also houses numerous large congregated nests of sociable weavers (*Philetairus socius*) which is a provincially protected species. The area is also utilised by various raptor- and other predatory bird species for breeding, foraging and persistence purposes. Individuals of the two nationally protected tree species are also sparsely scattered along the pipeline route.

Due to the natural pristine state of the assessment area, the area is utilised by a wide variety of common and specialised small antelope as well as burrowing and predatory mammals for breeding, foraging and persistence purposes. The mobility of such faunal species along with the broad, continuous surrounding natural landscape however allows for individuals to simply leave an area where disturbance is taking place and disperse to other similar, adequate areas. The significance of this potential impact will be high.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Terrestrial alien invasive species establishment

The assessment area is in a natural pristine condition and no significant establishments of any alien invasive species were found to be present. The assessment area and surrounding areas could however potentially be prone to significant alien invasive species establishment due to surface disturbances and vegetation clearance caused by cultivation and construction activities. The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Surface material erosion

The assessment area has a flat to slightly sloping topography but is mainly situated on deep loose red sandy Hutton soils. The assessment area and surrounding areas could therefore potentially be prone to surface soil erosion due to the loosening of materials and clearance of vegetation caused by construction activities which usually binds surface material. The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Dust generation and emissions

The initial soil preparation and cultivation activities associated with the proposed project construction phase could potentially result in significant fugitive dust emissions due to vegetation clearance and movement of machinery and equipment. Generated dust could spread into- and contaminate the surrounding natural areas as well as the ephemeral watercourses and the Orange River situated approximately 3.2 km south of the assessment area. The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Impeding and contamination of the flow regimes of the significant ephemeral watercourses

The activities associated with the construction phase could potentially result in contamination and impeding of natural surface water flow towards the ephemeral watercourses due to artificial obstruction of flow during rainfall events and hydrocarbon or other chemical spills by machinery and equipment. The ephemeral watercourses form an important part of the quaternary surface water catchment and drainage area which regionally drains towards the south and eventually discharges into the Orange River situated approximately 3.2 km south of the assessment area. The ephemeral watercourses are therefore viewed as being of relatively high conservational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type and surface water catchment and drainage area.

A significant number of small drainage lines feed into the directly adjacent ephemeral watercourse all along the length of the proposed pipeline route. The local catchment and drainage all along the length of the pipeline route towards the ephemeral watercourse, could therefore be significantly impeded by the construction of the aboveground pipeline.

The significance of this potential impact will be medium-high.

Mitigation measures to reduce impacts are recommended under heading 9.4.

9.2. Operational Phase

Once the construction phase has been completed, there should be no significant additional potential ecological impacts associated with the operational phase over and above the already discussed long term impacts of the construction phase. The transformation of the relevant vegetation types and CBA 1 as well as the destruction of provincially protected species individuals/habitats, alien invasive species establishment and surface material erosion were discussed and addressed during the construction phase as potential long term impacts.

A number of identified potential ecological impacts could however change in nature and increase in significance from the construction phase into the operational phase and will continue throughout the entire lifespan and operational phase of the proposed project. The following additional potential ecological impacts could therefore take place during the operational phase:

Continued dust generation and emissions

Continued soil preparation and cultivation activities associated with the proposed project operational phase could potentially result in significant continual fugitive dust emissions during the cultivation season. Generated dust could spread into- and contaminate the surrounding natural areas as well as the ephemeral watercourses and the Orange River situated approximately 3.2 km south of the assessment area. The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Continued impeding and contamination of the flow regimes of the significant ephemeral watercourses

The established cultivated lands of the proposed development could potentially continuously impede on the flow regime of the significant ephemeral watercourses due to continued artificial obstruction of natural surface water flow during rainfall events. Operational phase activities could potentially also result in significant continued pollution of the surface water catchment and drainage towards the ephemeral watercourses due to contamination of natural surface water flow by erosion and hydrocarbon or other chemical spills.

The significant number of small drainage lines which feed into the directly adjacent ephemeral watercourse all along the length of the pipeline route could also be significantly impeded by the established pipeline. The significance of this potential impact will be medium-high.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Alteration/contamination of soil and groundwater characteristics/quality

Operation of the cultivated lands could include significant continual irrigation, chemical and organic fertilisation as well as herbicide/pesticide treatment. This continued irrigation, fertilisation and herbicide/pesticide treatment over time, will result in significant long term leaching of salts, chemicals and other inorganic elements into the soil and groundwater. This will potentially alter and negatively affect the soil characteristics as well as quality/characteristics of groundwater over time. This will constitute a long term effect which will gradually commence during the operational phase and will continue for the entire duration of the proposed project lifespan and significantly beyond. The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Over extraction of irrigation water from the Orange River

Significant quantities of water will be extracted from the Orange River for irrigation purposes. In accordance with the information received from the EAP, the proposed development will require approximately 10 756 m³ of irrigation water per hectare per annum in order to irrigate adequately. This equates to a total of approximately 2 339 860 m³ irrigation water required per annum for Alternative 1 or 2 219 393 m³ for Alternative 2. This could potentially lead to over extraction from the Orange River if not adequately managed. The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Impeding of the ecological connectivity of the broader habitat and ecosystem

Once the construction phase has been completed and the cultivated lands are in place, it could impede and fragment the ecological connectivity and functionality of the broader habitat and ecosystem. No other significant existing agricultural developments are however present within the broader area and the connectivity of the broader habitat and ecosystem should therefore not be significantly impacted upon by the proposed development. The mobility of faunal species which utilise the area for breeding, foraging and persistence purposes along with the broad, continuous surrounding natural landscape, allows for individuals to simply leave an area where disturbance is taking place and disperse to other similar, adequate areas. The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

9.3. Cumulative Impacts

The mechanical clearance and soil preparation associated with the proposed agricultural development will in all probability completely transform the majority of the existing surface vegetation on the assessment area.

No other significant existing agricultural developments are however present within the broader area and the proposed development should therefore not pose any significant cumulative impacts to the ecological connectivity and functionality of the broader habitat and ecosystem. The continued contamination and impeding of the flow regimes of the significant ephemeral watercourses as well as the destruction of-/damage to Red Data Listed, nationally or provincially protected species individuals/habitats associated with the assessment area, are therefore not viewed as potentially significant long term cumulative residual impacts associated with the proposed development. These impacts can be suitably reduced and mitigated to within acceptable levels by implementation of the recommended mitigation measures.

It is therefore not anticipated that the proposed development would pose any significant potential cumulative residual ecological impacts within the broader region.

9.4. Risk Ratings of Potential Impacts

The following section provides the Environmental Risk as well as the Environmental Significance Ratings for the potential ecological impacts for the proposed project both before and after implementation of the recommended mitigation measures.

9.4.1. Construction Phase

Table 6: Environmental Risk and Significance Ratings

	Alternative 1	Alternative 2	Pump station and pipeline route
Identified Environmental Impact	Transformation of terrestrial vegetation on the assessment area associated with the Northern Upper Karoo (NKu 3) and Lower Gariep Broken Veld (NKb 1) vegetation types		
Magnitude of Negative or Positive Impact	Medium (6)	Medium (6)	Very low (2)
Duration of Negative or Positive Impact	Long term (4)	Long term (4)	Long term (4)
Extent of Positive or Negative Impact	Local (2)	Local (2)	Local (2)
Irreplaceability of Natural Resources being impacted upon	Low (2)	Low (2)	Low (2)
Reversibility of Impact	Low (4)	Low (4)	Moderate (3)
Probability of Impact Occurrence	High (4)	High (4)	Medium (3)
Cumulative Impact Rating prior to mitigation	Low	Low	Low

Environmental Significance Score and Rating prior to mitigation	Medium (72)	Medium (72)	Low (39)
Mitigation Measures to be implemented	<p>The new project construction footprint must be kept as small as practicably possible to reduce the actual surface impact on vegetation and no unnecessary/unauthorised footprint expansion into the surrounding areas may take place.</p> <p>Natural veld situated in-between the proposed cultivated lands must not be impacted upon and must be left undeveloped.</p> <p>No site construction camps to be established within the surrounding natural areas outside the project footprint areas.</p> <p>Adequately cordon off the construction area and ensure that no construction activities, machinery or equipment operate or impact within the natural surrounding areas outside the cordoned off area.</p> <p>Existing roads and farm tracks in close proximity to the proposed project area must be used during construction. No new roads or tracks to be constructed or implemented outside the footprint areas of the proposed cultivated lands.</p> <p>It is recommended that a theoretical development line must be drawn through the assessment area and no development should be allowed to take place north of this line.</p> <p>If development north of the line is still considered by the applicant, it would highly likely require the investigation and implementation of a suitable Biodiversity Offset as part of the NEMA mitigation hierarchy. A comprehensive Biodiversity Offset Feasibility Assessment and Report would therefore need to be conducted and compiled in order to identify and inform</p>		

	<p>on potential areas of suitable size and similar ecological value which could meaningfully contribute to the provincial and national biodiversity targets and conservation strategies. The proposed Biodiversity Offset Feasibility Assessment and Report will have to be evaluated by the relevant competent authorities in order to inform on their approval/rejection process. It is recommended that the Department of Agriculture, Forestry and Fisheries be informed of the application as an Interested & Affected Party during the Public Participation Process in order for them to provide comment and recommendations in this regard.</p> <p>Although the additional approximately 11.2 ha portion associated with Alternative 1 is situated north of the recommended development line, the location of this additional portion has specifically been chosen in an area with a lower tree density and few large mature individuals of the species <i>Vachellia erioloba</i> (≤ 15) relative to the rest of the area north of the development line. The development within this additional portion will therefore not result in the removal of a significant number of nationally protected tree individuals and should not necessarily impact significantly on the continued ecological functionality and connectivity of the broader ecosystem north of the development line.</p> <p>It is recommended that a representative portion of the rocky ridge outcrops should be adequately buffered out of the proposed development footprint area if practicably possible.</p> <p>The areas surrounding the pump station and pipeline route must be adequately rehabilitated as soon as practically possible after construction.</p> <p>A Rehabilitation Management Plan must be developed for this by a suitably qualified and experienced ecologist.</p>		
<p>Cumulative Impact Rating after mitigation implementation</p>	<p>Low</p>	<p>Low</p>	<p>Low</p>

Environmental Significance Score and Rating after mitigation implementation	Medium (60)	Medium (60)	Low (24)
	Alternative 1	Alternative 2	Pump station and pipeline route
Identified Environmental Impact	Transformation of a Critical Biodiversity Area one (CBA 1) and Ecological Support Area (ESA) associated with the assessment area		
Magnitude of Negative or Positive Impact	-	-	Low (4)
Duration of Negative or Positive Impact	-	-	Long term (4)
Extent of Positive or Negative Impact	-	-	Regional (3)
Irreplaceability of Natural Resources being impacted upon	-	-	High (4)
Reversibility of Impact	-	-	Moderate (3)
Probability of Impact Occurrence	-	-	Medium (3)

Cumulative Impact Rating prior to mitigation	-	-	Low
Environmental Significance Score and Rating prior to mitigation	-	-	Medium (54)
Mitigation Measures to be implemented	<p>The new project construction footprint must be kept as small as practicably possible to reduce the actual surface impact on vegetation and no unnecessary/unauthorised footprint expansion into the surrounding areas may take place.</p> <p>It is recommended that no large mature tree individuals be removed during construction of the pump station and associated pipeline up the river banks but that pipeline infrastructure be constructed underneath the dense tree canopy. This will also assist in protecting the pumping and pipeline infrastructure against potential flood events.</p> <p>The areas surrounding the pump station and pipeline route must be adequately rehabilitated as soon as practically possible after construction.</p> <p>A Rehabilitation Management Plan must be developed for this by a suitably qualified and experienced ecologist.</p>		
Cumulative Impact Rating after mitigation implementation	-	-	Low
Environmental Significance Score and Rating after mitigation implementation	-	-	Low (28)

	Alternative 1	Alternative 2	Pump station and pipeline route
Identified Environmental Impact	Destruction of-/damage to Red Data Listed, nationally or provincially protected species individuals/habitats associated with the assessment area		
Magnitude of Negative or Positive Impact	High (8)	High (8)	Low (4)
Duration of Negative or Positive Impact	Long term (4)	Long term (4)	Long term (4)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Local (2)
Irreplaceability of Natural Resources being impacted upon	Moderate (3)	Moderate (3)	Moderate (3)
Reversibility of Impact	Low (4)	Low (4)	Low (4)
Probability of Impact Occurrence	Definite (5)	Definite (5)	Medium (3)
Cumulative Impact Rating prior to mitigation	Medium-High	Medium-High	Medium
Environmental Significance Score and Rating prior to mitigation	High (110)	High (110)	Medium (51)

Mitigation Measures to be implemented	<p>A Provincial Flora Permit has to be obtained for the removal and relocation of all provincially protected species individuals prior to the commencement of any construction activities.</p> <p>A National Protected Tree License has to be obtained for the removal of all nationally protected tree species individuals prior to the commencement of any construction activities.</p> <p>The new project construction footprint must be kept as small as practicably possible to reduce the actual surface impact on vegetation and no unnecessary/unauthorised footprint expansion into the surrounding areas may take place.</p> <p>Natural veld situated in-between the proposed cultivated lands must not be impacted upon and must be left undeveloped.</p> <p>No site construction camps to be established within the surrounding natural areas outside the project footprint areas.</p> <p>Adequately cordon off the construction area and ensure that no construction activities, machinery or equipment operate or impact within the natural surrounding areas outside the cordoned off area.</p> <p>Existing roads and farm tracks in close proximity to the proposed project area must be used during construction. No new roads or tracks to be constructed or implemented outside the footprint areas of the proposed cultivated lands.</p> <p>It is recommended that a theoretical development line must be drawn through the assessment area and no development should be allowed to take place north of this line.</p>
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If development north of the line is still considered by the applicant, it would highly likely require the investigation and implementation of a suitable Biodiversity Offset as part of the NEMA mitigation hierarchy. A comprehensive Biodiversity Offset Feasibility Assessment and Report would therefore need to be conducted and compiled in order to identify and inform on potential areas of suitable size and similar ecological value which could meaningfully contribute to the provincial and national biodiversity targets and conservation strategies. The proposed Biodiversity Offset Feasibility Assessment and Report will have to be evaluated by the relevant competent authorities in order to inform on their approval/rejection process. It is recommended that the Department of Agriculture, Forestry and Fisheries be informed of the application as an Interested & Affected Party during the Public Participation Process in order for them to provide comment and recommendations in this regard.

Although the additional approximately 11.2 ha portion associated with Alternative 1 is situated north of the recommended development line, the location of this additional portion has specifically been chosen in an area with a lower tree density and few large mature individuals of the species *Vachellia erioloba* (≤ 15) relative to the rest of the area north of the development line. The development within this additional portion will therefore not result in the removal of a significant number of nationally protected tree individuals and should not necessarily impact significantly on the continued ecological functionality and connectivity of the broader ecosystem north of the development line.

It is recommended that a representative portion of the rocky ridge outcrops should be adequately buffered out of the proposed development footprint area if practicably possible.

No individuals of the two nationally protected tree species are to be removed during the pipeline construction phase and the pipeline route is to be diverted around any individuals of these two species if encountered.

It is recommended that an additional ecological walkthrough be conducted prior to commencement of the project during the flowering period of underground bulb plant species. This will ensure that no provincially protected or significant species have potentially been omitted.

Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Medium (51)	Medium (51)	Low (28)
	Alternative 1	Alternative 2	Pump station and pipeline route
Identified Environmental Impact	Terrestrial alien invasive species establishment		
Magnitude of Negative or Positive Impact	Medium (6)	Medium (6)	Low (4)
Duration of Negative or Positive Impact	Long term (4)	Long term (4)	Long term (4)
Extent of Positive or Negative Impact	Local (2)	Local (2)	Local (2)
Irreplaceability of Natural Resources being impacted upon	Low (2)	Low (2)	Low (2)
Reversibility of Impact	High (2)	High (2)	High (2)

Probability of Impact Occurrence	High (4)	High (4)	High (4)
Cumulative Impact Rating prior to mitigation	Low	Low	Low
Environmental Significance Score and Rating prior to mitigation	Medium (64)	Medium (64)	Medium (56)
Mitigation Measures to be implemented	<p>Implement an adequate Alien Invasive Species Establishment Management and Prevention Plan during the construction and operational phases. Such a management plan must be compiled by a suitably qualified and experienced ecologist.</p> <p>Areas within and immediately surrounding the proposed development footprint must be adequately rehabilitated as soon as practicably possible after construction in order to prevent significant alien invasive species establishment.</p> <p>The areas surrounding the pump station and pipeline route must be adequately rehabilitated as soon as practically possible after construction.</p> <p style="padding-left: 40px;">A Rehabilitation Management Plan must be developed for this by a suitably qualified and experienced ecologist.</p> <p>Natural veld situated in-between the proposed cultivated lands must not be impacted upon and must be left undeveloped.</p>		
Cumulative Impact Rating after mitigation implementation	Low	Low	Low

Environmental Significance Score and Rating after mitigation implementation	Low (26)	Low (26)	Low (22)
	Alternative 1	Alternative 2	Pump station and pipeline route
Identified Environmental Impact	Surface material erosion		
Magnitude of Negative or Positive Impact	Medium (6)	Medium (6)	Low (4)
Duration of Negative or Positive Impact	Long term (4)	Long term (4)	Long term (4)
Extent of Positive or Negative Impact	Local (2)	Local (2)	Local (2)
Irreplaceability of Natural Resources being impacted upon	Low (2)	Low (2)	Low (2)
Reversibility of Impact	High (2)	High (2)	High (2)
Probability of Impact Occurrence	Medium (3)	Medium (3)	Medium (3)

Cumulative Impact Rating prior to mitigation	Low	Low	Low
Environmental Significance Score and Rating prior to mitigation	Low (48)	Low (48)	Low (42)
Mitigation Measures to be implemented	<p>Adequate stormwater and erosion management measures must be implemented for the entire assessment area during the construction and operational phases. This must be done in order to sufficiently manage storm water runoff and clean/dirty water separation in order to prevent any significant erosion from occurring.</p> <p>Areas within and immediately surrounding the proposed development footprint must be adequately rehabilitated as soon as practicably possible after construction in order to prevent significant erosion.</p> <p>The areas surrounding the pump station and pipeline route must be adequately rehabilitated as soon as practicably possible after construction.</p> <p>A Rehabilitation Management Plan must be developed for this by a suitably qualified and experienced ecologist.</p>		
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (22)	Low (22)	Low (11)

	Alternative 1	Alternative 2	Pump station and pipeline route
Identified Environmental Impact	Dust generation and emissions		
Magnitude of Negative or Positive Impact	Medium (6)	Medium (6)	Low (4)
Duration of Negative or Positive Impact	Short term (2)	Short term (2)	Short term (2)
Extent of Positive or Negative Impact	Local (2)	Local (2)	Local (2)
Irreplaceability of Natural Resources being impacted upon	Low (2)	Low (2)	Low (2)
Reversibility of Impact	High (2)	High (2)	High (2)
Probability of Impact Occurrence	High (4)	High (4)	High (4)
Cumulative Impact Rating prior to mitigation	Low	Low	Low
Environmental Significance Score and Rating prior to mitigation	Medium (56)	Medium (56)	Low (48)

Mitigation Measures to be implemented	<p>Implement suitable dust management and prevention measures during the construction phase.</p> <p>Areas within and immediately surrounding the proposed development footprint must be adequately rehabilitated as soon as practicably possible after construction in order to prevent significant dust emissions.</p> <p>The areas surrounding the pump station and pipeline route must be adequately rehabilitated as soon as practically possible after construction.</p> <p style="padding-left: 40px;">A Rehabilitation Management Plan must be developed for this by a suitably qualified and experienced ecologist.</p>		
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (33)	Low (33)	Low (18)
	Alternative 1	Alternative 2	Pump station and pipeline route
Identified Environmental Impact	Impeding and contamination of the flow regimes of the significant ephemeral watercourses		
Magnitude of Negative or Positive Impact	High (8)	High (8)	Medium (6)

Duration of Negative or Positive Impact	Short term (2)	Short term (2)	Short term (2)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)
Irreplaceability of Natural Resources being impacted upon	High (4)	High (4)	High (4)
Reversibility of Impact	Low (4)	Low (4)	Low (4)
Probability of Impact Occurrence	High (4)	High (4)	High (4)
Cumulative Impact Rating prior to mitigation	Medium-high	Medium-high	Medium-high
Environmental Significance Score and Rating prior to mitigation	Medium-high (84)	Medium-high (84)	Medium-high (76)

Mitigation Measures to be implemented	<p>It is recommended that the ephemeral watercourses be adequately buffered out of the proposed development footprint and that no significant development is allowed to take place within the buffer zone.</p> <p>Adequate stormwater and erosion management measures must be implemented for the entire assessment area during the construction and operational phases. This must be done to ensure and sufficiently manage storm water runoff, clean/dirty water separation towards the ephemeral watercourses in order to maintain their ecological functionality and integrity.</p> <p>Areas within and immediately surrounding the proposed development footprint must be adequately rehabilitated as soon as practicably possible after construction in order to prevent significant dust emissions.</p> <p>The areas surrounding the pump station and pipeline route must be adequately rehabilitated as soon as practicably possible after construction.</p> <p style="padding-left: 40px;">A Rehabilitation Management Plan must be developed for this by a suitably qualified and experienced ecologist.</p> <p>Construction and design of the proposed pipeline should take into account the significant number of small drainage lines and the pipeline must be installed in a manner so as not to permanently impact or impede on the local surface water drainage towards the ephemeral watercourse.</p> <p>If hydrocarbons or other chemicals are to be stored on site during the construction phase, the storage areas must be situated as far away as practicably possible from the ephemeral watercourses.</p> <p>Hydrocarbon and other chemical storage areas must be adequately banded in order to be able to contain a minimum of 150</p>
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	<p>% of the capacity of storage tanks/units.</p> <p>Adequate hydrocarbon and other chemical storage, handling, usage and emergency spill procedures must be developed and all relevant construction personnel must be sufficient trained on- and apply these procedures during the entire construction phase.</p> <p>A Water Use License Application (WULA) must be submitted to the Department of Water and Sanitation if required in accordance with the National Water Act (Act 36 of 1998).</p>		
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (32)	Low (32)	Low (28)

9.4.2. Operational Phase

Table 7: Environmental Risk and Significance Ratings

	Alternative 1	Alternative 2	Pump station and pipeline route
Identified Environmental Impact	Continued dust generation and emissions		
Magnitude of Negative or Positive Impact	Medium (6)	Medium (6)	-
Duration of Negative or Positive Impact	Medium term (3)	Medium term (3)	-
Extent of Positive or Negative Impact	Local (2)	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Low (2)	Low (2)	-
Reversibility of Impact	High (2)	High (2)	-
Probability of Impact Occurrence	High (4)	High (4)	-
Cumulative Impact Rating prior to mitigation	Low	Low	-

Environmental Significance Score and Rating prior to mitigation	Medium (60)	Medium (60)	-
Mitigation Measures to be implemented	<p>Implement suitable dust management and prevention measures during the cultivation season.</p> <p>Lands to be sufficiently irrigated prior to commencement of cultivation and planting activities in order to prevent significant fugitive dust emissions.</p>		
Cumulative Impact Rating after mitigation implementation	Low	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (24)	Low (24)	-
	Alternative 1	Alternative 2	Pump station and pipeline route
Identified Environmental Impact	Continued impeding and contamination of the flow regimes of the significant ephemeral watercourses		
Magnitude of Negative or Positive Impact	High (8)	High (8)	Medium (6)
Duration of Negative or Positive Impact	Medium term (3)	Medium term (3)	Medium term (3)

Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)
Irreplaceability of Natural Resources being impacted upon	High (4)	High (4)	High (4)
Reversibility of Impact	Low (4)	Low (4)	Low (4)
Probability of Impact Occurrence	High (4)	High (4)	High (4)
Cumulative Impact Rating prior to mitigation	Medium-high	Medium-high	Medium-high
Environmental Significance Score and Rating prior to mitigation	Medium-high (88)	Medium-high (88)	Medium-high (80)
Mitigation Measures to be implemented	<p>The recommended buffer zone around the ephemeral watercourses must be adequately maintained and no development footprint is allowed to encroach into the buffer zone over time.</p> <p>Adequate stormwater and erosion management measures must be implemented for the entire assessment area during the construction and operational phases. This must be done to ensure and sufficiently manage storm water runoff, clean/dirty water separation towards the ephemeral watercourses in order to maintain their ecological functionality and integrity.</p> <p>The initial design of the installed pipeline which prevents impact or impediment of the significant number of small drainage lines and subsequent local surface water drainage towards the ephemeral watercourse, must be adequately maintained over</p>		

	<p>time.</p> <p>If hydrocarbons or other chemicals are to be stored on site during the operational phase, the storage areas must be situated as far away as practicably possible from the ephemeral watercourses.</p> <p>Hydrocarbon and other chemical storage areas must be adequately banded in order to be able to contain a minimum of 150 % of the capacity of storage tanks/units.</p> <p>Adequate hydrocarbon and other chemical storage, handling, usage emergency spill procedures must be developed and all relevant operational personnel must be sufficient trained on- and apply these procedures during the entire operational phase.</p>		
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (34)	Low (34)	Low (30)

	Alternative 1	Alternative 2	Pump station and pipeline route
Identified Environmental Impact	Alteration/contamination of soil and groundwater characteristics/quality		
Magnitude of Negative or Positive Impact	Medium (6)	Medium (6)	-
Duration of Negative or Positive Impact	Long term (4)	Long term (4)	-
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	High (4)	High (4)	-
Reversibility of Impact	Low (4)	Low (4)	-
Probability of Impact Occurrence	Medium (3)	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Medium	Medium	-
Environmental Significance Score and Rating prior to mitigation	Medium (63)	Medium (63)	-

Mitigation Measures to be implemented	Irrigation and fertilisation practices must be adequately managed in order to prevent over-fertilisation or over-irrigation which could lead to significant leaching and contamination of groundwater. A suitably qualified and experienced agricultural specialist must be consulted in order to advise on appropriate management practices.		
Cumulative Impact Rating after mitigation implementation	Low	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (36)	Low (36)	-
	Alternative 1	Alternative 2	Pump station and pipeline route
Identified Environmental Impact	Over extraction of irrigation water from the Orange River		
Magnitude of Negative or Positive Impact	Medium (6)	Medium (6)	Medium (6)
Duration of Negative or Positive Impact	Long term (4)	Long term (4)	Long term (4)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Regional (3)

Irreplaceability of Natural Resources being impacted upon	High (4)	High (4)	High (4)
Reversibility of Impact	Low (4)	Low (4)	Low (4)
Probability of Impact Occurrence	Medium (3)	Medium (3)	Medium (3)
Cumulative Impact Rating prior to mitigation	Medium	Medium	Medium
Environmental Significance Score and Rating prior to mitigation	Medium (63)	Medium (63)	Medium (63)
Mitigation Measures to be implemented	<p>Irrigation and fertilisation practices must be adequately managed in order to prevent over-fertilisation or over-irrigation which could lead to significant leaching and contamination of groundwater. A suitably qualified and experienced agricultural specialist must be consulted in order to advise on appropriate management practices.</p> <p>A Water Use License Application (WULA) must be submitted to the Department of Water and Sanitation in accordance with the National Water Act (Act 36 of 1998).</p> <p>Only the allotted water quantities as per the approved Water Use License are to be extracted.</p> <p>A flow meter is to be installed in order to enable monitoring and management water consumption.</p>		

	Water consumption figures must be submitted to the Department of Water and Sanitation (DWS) on a regular basis in order to ensure compliance with the allotted water quantities as per the approved Water Use License.		
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (36)	Low (36)	Low (36)
	Alternative 1	Alternative 2	Pump station and pipeline route
Identified Environmental Impact	Impeding of the ecological connectivity of the broader habitat and ecosystem		
Magnitude of Negative or Positive Impact	Low (4)	Low (4)	Very low (2)
Duration of Negative or Positive Impact	Medium term (3)	Medium term (3)	Medium term (3)
Extent of Positive or Negative Impact	Regional (3)	Regional (3)	Local (2)

Irreplaceability of Natural Resources being impacted upon	Low (2)	Low (2)	Low (2)
Reversibility of Impact	Moderate (3)	Moderate (3)	High (2)
Probability of Impact Occurrence	Medium (3)	Medium (3)	Low (2)
Cumulative Impact Rating prior to mitigation	Low	Low	Low
Environmental Significance Score and Rating prior to mitigation	Low (45)	Low (45)	Low (22)
Mitigation Measures to be implemented	<p>Natural veld situated in-between the proposed cultivated lands must not be impacted upon and must be left undeveloped.</p> <p>Existing roads and farm tracks in close proximity to the proposed project area must be used during construction. No new roads or tracks to be constructed or implemented outside the footprint areas of the proposed cultivated lands.</p> <p>The recommended theoretical development line must be adequately maintained and no development footprint is allowed to encroach into the northern portions of the assessment area over time.</p> <p>Although the additional approximately 11.2 ha portion associated with Alternative 1 is situated north of the recommended development line, the location of this additional portion has specifically been chosen in an area with a lower tree density and few large mature individuals of the species <i>Vachellia erioloba</i> (≤ 15) relative to the rest of the area north of the development</p>		

	<p>line. The development within this additional portion will therefore not result in the removal of a significant number of nationally protected tree individuals and should not necessarily impact significantly on the continued ecological functionality and connectivity of the broader ecosystem north of the development line.</p> <p>The recommended representative portion of the rocky ridge outcrops which is buffered out of the proposed development footprint area, must be adequately maintained and no development footprint is allowed to encroach into the buffer zone over time.</p>		
Cumulative Impact Rating after mitigation implementation	Low	Low	Low
Environmental Significance Score and Rating after mitigation implementation	Low (26)	Low (26)	Low (10)

10. Summary and Conclusion

The mechanical clearance and soil preparation associated with the proposed agricultural development will in all probability completely transform the majority of the existing surface vegetation on the assessment area.

Both the Northern Upper Karoo (NKu 3) and Lower Gariep Broken Veld (NKb 1) vegetation types associated with the assessment area, are classified as least threatened as very little has been transformed thus far (SANBI, 2006-). The majority of the assessment area as well as the entire pipeline route is further categorised as 'Other Natural Area' (ONA) while only a very small portion in the south-eastern corner of the assessment area falls within an Ecological Support Area (ESA) in accordance with the NCPSBP, which sets out biodiversity priority areas in the province. The location of the pump station on the banks of the Orange River falls within a Critical Biodiversity Area one (CBA 1) in accordance with the NCPSBP.

The assessment area is in a natural pristine condition and scored a very high PES value. The broader areas surrounding the assessment area, which are associated with the relevant vegetation types, are extremely vast and also largely natural and undeveloped. The size of the proposed development is therefore small relative to the surrounding natural region.

Although no Red Data Listed species of conservational significance were found to be present within the assessment area, the provincially protected species *Euphorbia burmannii* & *Aloe claviflora* were encountered within the rocky ridge outcrops. It is therefore recommended that a representative portion of the rocky ridge outcrops should be adequately buffered out of the proposed development footprint area if practicably possible. It is also expected that the assessment area will house a number of provincially protected bulb species. It is therefore further recommended that an additional ecological walkthrough be conducted prior to commencement of the project during the flowering period of underground bulb plant species. This will ensure that no provincially protected or significant species have potentially been omitted.

Furthermore, tree and shrub individuals of the nationally protected species *Boscia albitrunca* & *Vachellia erioloba* are sparsely scattered throughout the southern and central portions of the assessment area. Approximately ≤ 85 *Boscia albitrunca* individuals and ≤ 180 *Vachellia erioloba* individuals are present within these southern and central portions. The majority of individuals of the

latter species are however still relatively small (≤ 3.5 m in height) within the southern and central portions.

The densities of these two nationally protected species however increase significantly within the northern portion of the assessment area and a high number of large mature individuals (≥ 7 m in height) of the species *Vachellia erioloba* are present there. Approximately ≤ 200 *Boscia albitrunca* individuals and ≤ 450 *Vachellia erioloba* individuals are present within the northern portion. Due to the presence of this well-established woody component within the northern portion, the area subsequently also houses numerous large congregated nests of sociable weavers (*Philetairus socius*) which is a provincially protected species. The area is also utilised by various raptor- and other predatory bird species for breeding, foraging and persistence purposes. The northern portion of the assessment area is therefore viewed as being of relatively high conservational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type and nationally protected tree species.

Due to the significant presence of the two nationally protected tree species within the northern portion of the assessment area, together with the area's distinctly associated avifaunal ecology, it is recommended that a theoretical development line must be drawn through the assessment area and no development should be allowed to take place north of this line. If development north of the line is still considered by the applicant, it would highly likely require the investigation and implementation of a suitable Biodiversity Offset as part of the NEMA mitigation hierarchy. A comprehensive Biodiversity Offset Feasibility Assessment and Report would therefore need to be conducted and compiled in order to identify and inform on potential areas of suitable size and similar ecological value which could meaningfully contribute to the provincial and national biodiversity targets and conservation strategies. The proposed Biodiversity Offset Feasibility Assessment and Report will have to be evaluated by the relevant competent authorities in order to inform on their approval/rejection process. It is recommended that the Department of Agriculture, Forestry and Fisheries be informed of the application as an Interested & Affected Party during the Public Participation Process in order for them to provide comment and recommendations in this regard.

Although the additional approximately 11.2 ha portion associated with Alternative 1 is situated north of the recommended development line, the location of this additional portion has specifically been chosen in an area with a lower tree density and few large mature individuals of the species

Vachellia erioloba (≤ 15) relative to the rest of the area north of the development line. The development within this additional portion will therefore not result in the removal of a significant number of nationally protected tree individuals and should not necessarily impact significantly on the continued ecological functionality and connectivity of the broader ecosystem north of the development line.

Individuals of the two nationally protected tree species are also sparsely scattered along the pipeline route. No individuals of the two nationally protected tree species are to be removed during the pipeline construction phase and the pipeline route is to be diverted around any individuals of these two species if encountered.

The ephemeral watercourses which traverse the assessment area, form an important part of the mid to upper region of a quaternary surface water catchment and drainage area which regionally drains towards the south and eventually discharges into the Orange River situated approximately 3.2 km south of the assessment area. The ephemeral watercourses are therefore viewed as being of relatively high conservational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type and the surface water catchment and drainage area. It is therefore recommended that the ephemeral watercourses be adequately buffered out of the proposed development footprint and that no significant development is allowed to take place within the buffer zone.

A significant number of small drainage lines feed into the directly adjacent ephemeral watercourse all along the length of the proposed pipeline route. The local catchment and drainage all along the length of the pipeline route towards the ephemeral watercourse, could therefore be significantly impeded by the construction of the aboveground pipeline. Construction and design of the proposed pipeline should take into account the significant number of small drainage lines and the pipeline must be installed in a manner so as not to permanently impact or impede on the local surface water drainage towards the ephemeral watercourse.

It is the opinion of the specialist that the potentially significant ecological impacts associated with the contamination and impeding of the flow regimes of the significant ephemeral watercourses as well as destruction of-/damage to Red Data Listed, nationally or provincially protected species individuals/habitats associated with the assessment area, can be suitably reduced and mitigated to

within acceptable residual levels. The project should therefore be considered by the competent authority for environmental authorisation and approval.

Although Alternative 2 will result in the transformation of an approximately 11.2 ha smaller footprint area (total of 206.34 ha) relative to Alternative 1 (total of 217.54 ha), there is no significant difference in ecological impact ratings between the two alternatives. It is recommended that Alternative 2 rather be considered due to its slightly smaller impact footprint but either alternatives should prove to be acceptable for development.

The proposed development may however only continue if all recommended mitigations measures as per this ecological report are adequately implemented and managed for both the construction and operational phases of the proposed project. All necessary authorisations and permits must also be obtained prior to any commencement.

11. References

Collins, N.B. 2017. Free State Province Biodiversity Plan: Technical Report v1.0. Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs. Internal Report.

Conservation of Agricultural Resources Act (Act 43 of 1983)

Mucina, L. & Rutherford, M.C. (eds.) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

National Environmental Management Act (Act 107 of 1998)

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National Environmental Management: Biodiversity Act (Act 10 of 2004); Alien and Invasive Species Regulations, 2014

National Forests Act (Act 84 of 1998)

National Water Act (Act 36 of 1998)

Northern Cape Nature Conservation Act (Act 9 of 2009)

Northern Cape Provincial Spatial Biodiversity Plan 2016 (NCPSBP)
<http://bgis.sanbi.org/Projects/Detail/203>

South African National Biodiversity Institute (2006-). The Vegetation Map of South Africa, Lesotho and Swaziland, Mucina, L., Rutherford, M.C. and Powrie, L.W. (Editors), Online, <http://bgis.sanbi.org/SpatialDataset/Detail/18>, Version 2012.*

Van Oudtshoorn, F. 2004. Gids tot Grasse van SuidAfrika. 2nd Ed. Briza Publikasies.

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12. Details of the Specialist

Adriaan Johannes Hendrikus Lamprecht (Pr.Sci.Nat)

M.Env.Sci. Ecological remediation and sustainable utilisation (NWU: Potchefstroom)

South African Council for Natural Scientific Professions (SACNASP): Professional Ecological Scientist
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Abbreviated Curriculum Vitae

Qualifications

- M.Env.Sci Ecological Remediation and Sustainable Utilisation/Vegetation Ecology
 - 2010 - North West University Potchefstroom
- B.Sc Botany and Zoology (Cum Laude)
 - 2008 - North West University Potchefstroom

Accredited courses completed

- Implementing Environmental Management Systems ISO 14001
 - 2011 - North West University Potchefstroom
- Environmental Law for Environmental Managers
 - 2011 - North West University Potchefstroom
- SASS 5 Aquatic Biomonitoring Training Course
 - 2017 – GroundTruth Consulting

Professional registrations

- South African Council for Natural Scientific Professions (**SACNASP**)
 - Professional Ecological Scientist Registration number 115601

- International Association for Impact Assessment (**IAIA**)
 - Registration number 5232
- South African Green Industries Council (**SAGIC**) Invasive Species training
 - Registration number 2405/2459

Employment and Experience Background

Upon completion of his studies, Rikus started his career in 2011 as an **Environmental Professional in Training (PIT) at Anglo American Thermal Coal: Environmental Services**. He received environmental training and practical implementation experience in all environmental facets of the mining industry with the focus on: Environmental rehabilitation, land management (biodiversity and invasive species eradication), waste & water-, air quality-, game reserve-, environmental management and legislation, as well as corporate reporting. He was also appointed as the Biodiversity management custodian at Anglo American Thermal Coal collieries.

He was subsequently employed by **Fraser Alexander Tailings from October 2011 to the end of November 2015 as an Environmental Contracts Manager**, where he was responsible for the technical and operational management of all Fraser Alexander Tailings' mining environmental rehabilitation work. He was responsible for all facets of project management, as well as implementation of rehabilitation and environmental strategies, by planning activities, organising physical, financial and human resources, delegating task responsibilities, leading people, controlling risks and providing technical support.

He conducted a significant amount of quantitative and qualitative ecological vegetation monitoring during his employment period with the company. Such monitoring mainly included environmentally rehabilitated mining areas in the open-cast coal-, gold-, platinum- and chrome mining industries situated in the Free State, Gauteng, Mpumalanga, North-West and Limpopo Provinces. He was involved with analysis, processing and interpretation of environmental monitoring data and compilation of high quality technical/scientific environmental monitoring reports for clients. He was subsequently further involved with providing adequate ecological management and maintenance recommendations for rehabilitated areas. He also provided technical/scientific environmental rehabilitation support to mining clients, with regards to sufficient soil preparation and amelioration, grassing processes, as well as grass species mixtures and ratios.

He was then employed by **Enviroworks Consulting from January 2016 to the end of May 2017 as a Senior Ecological Specialist** where he was responsible for virtually all Ecological, Aquatic and Wetland specialist assessments and reporting related to Environmental Impact Assessment (EIA) and Basic Assessment (BA) projects. He also completed numerous EIA and BA projects as the main project Environmental Assessment Practitioner (EAP).

Rikus then subsequently established the company EcoFocus Consulting (Pty) Ltd, which provides high quality professional environmental and ecological specialist services and solutions to the industrial development-, construction-, mining-, agricultural and other sectors, at the end of May 2017.

He possesses significant qualifications, vast knowledge, skills and practical experience in the specialist field of ecological and environmental management. This, coupled with his disciplined, determined and goal-driven mind-set, as well as his high level of personal standards, ensure high quality, timely and outcomes based outputs and service delivery relating to any project.

Ecological Specialist Report Completion

2019

- Completion of a Water Use License Application (WULA) Risk Assessment for a proposed Kopanong Local Municipality Bridge Upgrading development project in Philippolis, Free State Province.
- Completion of a specialist ecological assessment and report for a proposed 4.9 ha Royal Vision Developments Gravel Quarry development project outside Kroonstad, Free State Province.
- Completion of a specialist ecological assessment and report for a proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.
- Completion of a specialist ecological assessment and report for a proposed 53 ha Arborlane Estates (Pty) Ltd agricultural development project outside Augrabies, Northern Cape Province.
- Completion of a specialist ecological assessment and report for a proposed 42.7 ha Arborlane Estates (Pty) Ltd NEMA Section 24G agricultural development project outside Augrabies, Northern Cape Province.
- Completion of a Water Use License Application (WULA) Risk Assessment for a proposed 53 ha Arborlane Estates (Pty) Ltd agricultural development project outside Augrabies, Northern Cape Province.

- Completion of a specialist ecological assessment and report for a proposed 20.2 km Water Pipeline Development from Lindley to Arlington, Free State Province.
- Completion of a specialist watercourse delineation and report for a proposed 5.36 ha Filling Station and Shopping Centre Development project in Thaba Nchu, Free State Province.
- Completion of a Water Use License Application (WULA) Risk Assessment for a proposed 20.2 km Water Pipeline Development from Lindley to Arlington, Free State Province.
- Completion of a specialist Grazing and Invasive Species Management Plan for the Farm Driefontein no 274, outside Ficksburg, Free State Province.
- Completion of a Water Use License Application (WULA) Risk Assessment for a proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.
- Completion of a Rehabilitation and Alien Invasive Species Management Plan for a proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.
- Completion of a Protected Species Relocation Management Plan for a proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.
- Completion of a GIS Master Layout Plan for a proposed 1262.7 ha Paul de Villiers NEMA Section 24G agricultural development project outside Douglas, Northern Cape Province.

2018

- Completion of a specialist ecological assessment and report for the proposed 30 ha Portion 30 of the Farm Lilyvale no 2313 Residential development project in Bloemfontein, Free State Province.
- Completion of a specialist ecological assessment and report for the proposed 20 ha Luckhoff Waste Facility development project in Luckhoff, Free State Province.
- Completion of a specialist ecological assessment and report for a proposed 19 ha agricultural development project outside Griekwastad, Northern Cape Province.
- Completion of a specialist ecological assessment and report for a proposed 135 ha agricultural development project outside Griekwastad, Northern Cape Province.
- Completion of five specialist ecological assessments and reports for the proposed Dawid Kruiper Local Municipality Residential Developments around Upington, Northern Cape Province.

- Completion of a specialist Grazing and Erosion Management Plan for the Farm Retiefs Nek no 123, outside Bethlehem, Free State Province.
- Completion of a specialist Grazing and Erosion Management Plan for the Farm Dekselfontein no 317, outside Bethlehem, Free State Province.
- Completion of a specialist ecological assessment and report for a proposed 12 ha agricultural development project in Petrusville, Northern Cape Province.
- Completion of a specialist ecological and wetland assessment and report for a proposed 270 ha industrial park development project in Secunda, Mpumalanga Province.
- Completion of a specialist ecological and wetland assessment and report for a proposed 233 ha industrial park development project in Sabie, Mpumalanga Province.
- Completion of a specialist ecological assessment and report for the proposed Dawid Kruiper Local Municipality Residential Development around Upington, Northern Cape Province.
- Completion of two specialist ecological assessments and reports for two proposed 15 ha agricultural development projects outside Hopetown, Northern Cape Province.
- Completion of two Alien Invasive Species Management Plans for two proposed 15 ha agricultural development projects outside Hopetown, Northern Cape Province.
- Completion of a Protected Species Relocation Management Plan for a proposed 15 ha agricultural development project outside Hopetown, Northern Cape Province.
- Completion of a specialist ecological and wetland assessment and report for a proposed 169 ha industrial park development project in Sabie, Mpumalanga Province.
- Completion of a specialist Grazing and Erosion Management Plan for the Farm Barnea no 231, outside Bethlehem, Free State Province.
- Compilation of a GIS locality, vegetation and sensitivity map for the proposed 7.13 ha Karoo Hoogland Local Municipality Residential Development project in Sutherland, Northern Cape Province.
- Completion of a specialist Erosion and Rehabilitation Monitoring Report for the Farms Die Kranse no 1174 and De Rotsen no 52 outside Vrede, Free State Province.
- Drafting of an official Environmental Policy for Teambo Facilitators (Pty) Ltd in Bloemfontein, Free State Province.
- Completion of a specialist ecological assessment and report for a proposed 11.6 ha COGHSTA NEMA Section 24G residential development project in Douglas, Northern Cape Province.
- Completion of a specialist ecological assessment and report for a proposed 3.26 ha COGHSTA NEMA Section 24G residential development project in Strydenburg, Northern Cape Province.

- Completion of a specialist ecological assessment and report for a proposed 25.6 ha COGHSTA NEMA Section 24G residential development project in Loxton, Northern Cape Province.
- Completion of a specialist biodiversity offset feasibility assessment and report for a proposed 805 ha agricultural development project outside Douglas, Northern Cape Province.
- Completion of a specialist ecological assessment and report for a proposed 2 ha Rouxville Waste Water Treatment Works expansion project in Rouxville, Free State Province.
- Completion of a specialist ecological exemption letter for the proposed Vanderkloof Tegnologie Chicken Abattoir development project in Petrusville, Northern Cape Province.
- Completion of a Protected Species Relocation Management Plan for a proposed 2 ha Rouxville Waste Water Treatment Works expansion project in Rouxville, Free State Province.
- Completion of a Rehabilitation and Alien Invasive Species Management Plan for a proposed 2 ha Rouxville Waste Water Treatment Works expansion project in Rouxville, Free State Province.
- Completion of a Stormwater and Erosion Management Plan for a proposed 2 ha Rouxville Waste Water Treatment Works expansion project in Rouxville, Free State Province.
- Completion of a Water Use License Application (WULA) Risk Assessment for a proposed 2 ha Rouxville Waste Water Treatment Works expansion project in Rouxville, Free State Province.
- Completion of a revised specialist ecological assessment and report for the proposed 17.7 ha Luckhoff Waste Facility development project in Luckhoff, Free State Province.
- Completion of a specialist ecological assessment and report for a proposed 113.3 ha Dawn Valley Estate development project in Bloemfontein, Free State Province.
- Completion of a specialist Grazing and Invasive Species Management Plan for the Farm Klipfontein no 71, outside Lindley, Free State Province.
- Completion of a specialist Grazing and Invasive Species Management Plan for the Farm Meyerskop no 1801, outside Bethlehem, Free State Province.
- Completion of a specialist ecological assessment and report for a proposed 2.24 ha Mullerstuine Cemetery development project in Vanderbijlpark, Gauteng Province.
- Completion of a specialist Species of Special Concern & Alien Invasive Species assessment and report for all the Transnet Engineering Group 5 Free State Province Sites.
- Completion of a specialist Species of Special Concern & Alien Invasive Species assessment and report for all the Transnet Engineering Group 6 Northern Cape Province Sites.
- Completion of a specialist ecological assessment and report for a proposed 80 ha agricultural development project outside Ritchie, Northern Cape Province.

- Completion of a specialist ecological and wetland assessment and report for a proposed 545 ha residential development project in Leandra, Mpumalanga Province.
- Completion of a specialist ecological assessment and report for a proposed 2 ha Chimoio Game Camp Lodging development project outside Kroonstad, Free State Province.
- Completion of a Water Use License Application (WULA) Risk Assessment for a proposed 2 ha Chimoio Game Camp Lodging development project outside Kroonstad, Free State Province.
- Completion of a Protected Species Relocation Management Plan for a proposed 80 ha agricultural development project outside Ritchie, Northern Cape Province.
- Completion of a Rehabilitation and Alien Invasive Species Management Plan for a proposed 80 ha agricultural development project outside Ritchie, Northern Cape Province.
- Completion of a Water Use License Application (WULA) Risk Assessment for a proposed 80 ha agricultural development project outside Ritchie, Northern Cape Province.
- Completion of a specialist Grazing Management Plan for the Farm Fairdale no 1048, outside Vrede, Free State Province.
- Completion of a specialist ecological assessment and report for the proposed 14.4 ha Frankfort Landfill Site expansion project in Frankfort, Free State Province.

2017

- Completion of a specialist ecological assessment and report for the proposed Phethogo Consulting filling station development project in Bloemfontein, Free State Province.
- Completion of a specialist ecological assessment and report for the proposed 132 kV CENTLEC Harvard transmission line development project in Bloemfontein, Free State Province.
- Completion of a specialist ecological assessment and report for the proposed Zevenfontein filling station development project in Johannesburg, Gauteng Province.
- Completion of a specialist ecological assessment and report for the proposed Olifantsvlei Curro School development project in Johannesburg, Gauteng Province.
- Completion of a specialist ecological assessment and report for the proposed 23 ha Babereki Agricultural development project in Hartswater, Northern Cape Province.
- Completion of a specialist ecological assessment and report for the proposed Eikenhof Curro School development project in Johannesburg, Gauteng Province.
- Completion of a specialist ecological assessment and report for the proposed 40 ha CoGHSTA residential development project in Norvalspont, Northern Cape Province.
- Completion of a specialist ecological assessment and report for the proposed 9 ha CoGHSTA residential development project in Williston, Northern Cape Province.

- Completion of a specialist ecological and wetland assessment and report for the proposed 100 ha Musgrave residential and commercial development in Bloemfontein, Free State Province.
- Completion of a specialist ecological assessment and report for the proposed 15 ha BVI Engineering Waste Water Treatment Works and associated pipeline development project in Britstown, Northern Cape Province.
- Completion of a specialist ecological walkthrough assessment and report and relocation of provincially protected species *Eucomis autumnalis* individuals for the Bloemwater 33.6 km Brandkop Bypass water supply pipeline in Bloemfontein, Free State Province.
- Completion and execution of a Species Relocation and Re-establishment Plan for 13 individuals of the provincially protected species, *Eucomis autumnalis*, for the Bloemwater 33.6 km Brandkop Bypass water supply pipeline in Bloemfontein, Free State Province.
- Completion of a specialist ecological exemption letter for the proposed Siloam Crematorium development in Welkom, Free State Province.
- Completion of a specialist ecological assessment and report for the proposed 0.5 ha Vuna Afrika Agricultural feedmill pelletizing plant development project outside Wepener, Free State Province.
- Completion of a specialist ecological assessment and report for the proposed 0.4 ha Olympic Flame filling station development project in Welkom, Free State Province.
- Completion of a specialist ecological assessment and report for a proposed 3000 ha agricultural development project outside Douglas, Northern Cape Province.
- Completion of a specialist ecological assessment and report for the proposed 46.04 ha University, Industrial and Residential development project in Orania, Northern Cape Province.
- Completion of a specialist ecological assessment and report for a proposed 482 ha Piet Louw NEMA Section 24G agricultural development project outside Hopetown, Northern Cape Province.
- Completion of a specialist ecological assessment for a proposed 500 ha Wolfkop Valley Estate development project outside Bloemfontein, Free State Cape Province.
- Completion of a specialist Erosion and Rehabilitation Management Plan for the Farms Die Kranse no 1174 and De Rotsen no 52 outside Vrede, Free State Province.
- Completion of a specialist ecological assessment and report for the proposed 4.1 ha Plot 31 Spitskop Residential development project in Bloemfontein, Free State Province.
- Completion of a specialist ecological assessment and report for the proposed 26.8 ha Oxidation Dam development project in Orania, Northern Cape Province.

2016

- Completion of a specialist ecological assessment and report for the proposed 3 km Olifantshoek Bulk Water Supply and reservoir development project in Olifantshoek, Northern Cape Province.
- Completion of two specialist ecological and wetland assessments and reports for the proposed respective 16 ha and 6 ha N8 highway gravel quarries development project near Ladybrand, Free State Province.
- Completion of a specialist ecological assessment and report for the proposed 100 ha De Eelt vineyard development project near Prieska, Northern Cape Province.
- Completion of two specialist ecological and wetland assessments and reports for the Lafarge cement production facility and quarry, respectively near Lichtenburg, North-West Province.
- Completion of a specialist ecological assessment and report for the proposed 12 ha Nooitgedacht Retirement Estate development project near Nelspruit, Mpumalanga Province.
- Completion of a specialist ecological assessment and report for the proposed 42 km Ventersburg Bulk Water Supply and reservoir development project between Ventersburg and Riebeeckstad, Free State Province.