

Ecological Assessment Report

**Water Pipeline Development from
Lindley to Arlington, Free State Province**

March 2019

Compiled for:



Compiled by:

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Table of Content

1.	Introduction.....	1
2.	Date and Season of Ecological Site Assessment.....	2
3.	Assessment Rational	3
4.	Objectives of the Assessment	4
5.	Methodology	5
6.	Study Area	11
6.1.	Climate.....	13
6.2.	Geology and Soils	13
6.3.	Vegetation and Conservation Status	13
7.	Assumptions, Uncertainties and Gaps in Knowledge	17
8.	Results and Discussion	19
8.1.	Completely Transformed Portions.....	20
8.2.	Cultivated Pasture Portions	21
8.3.	Moderately Disturbed and Degraded Portions.....	22
8.4.	Relatively Natural Portions	24
8.4.1.	Small ephemeral water drainage lines.....	24
8.4.2.	Significant ephemeral watercourses.....	25
8.4.3.	Extended terrestrial portions.....	27
8.5.	Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS).....	32
8.6.	Species List for the Proposed Pipeline Route	34
8.7.	Ecological Sensitivity Map.....	35
9.	Ecological Impact Assessment	37
9.1.	Construction Phase.....	37
9.2.	Operational Phase	41
9.3.	Cumulative Impacts.....	42
9.4.	Risk Ratings of Potential Impacts	43
9.4.1.	Construction Phase.....	44
9.4.2.	Operational Phase	55
10.	Summary and Conclusion.....	57
11.	References	59
12.	Details of the Specialist.....	60

Executive Summary

The project applicant, Nketoana Local Municipality proposes to develop a new raw water pipeline of approximately 20.2 km in length between the towns of Lindley and Arlington, Free State Province. The pipeline will traverse a number of farms along the proposed route and will tie into existing reservoirs within both towns. The entire pipeline route will merely constitute a narrow linear section of approximately ≤ 1.5 m wide.

NSVT Consultants was appointed by the applicant as the independent Environmental Practitioner (EAP) to conduct the Basic Assessment (BA) 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. A site visit/assessment for the proposed development footprint area was conducted on 19 March 2019. This date forms part of the end of the growing season and most plant species present could therefore be successfully identified.

Methodology

The proposed pipeline route was assessed with the use of a vehicle and potentially sensitive areas were further 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 Free State's Nature Conservation Ordinance (No 8 of 1969). 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 proposed pipeline route is approximately 20.2 km in length. It runs parallel and directly adjacent west of the R 707 provincial road and traverses a number of farms along the way. It must be a minimum of 29 m away from the road centre. The entire pipeline route will merely constitute a narrow linear section of approximately ≤ 1.5 m wide.

The starting point is on the Remaining Extent of the Farm Brandhoek no 20 (Lindley) and the finishing point on Portion 1 of the Farm Port Arlington no 114 (Arlington) (SG 21 Digit Codes: F0220000000002000000 and F0220000000011400001 respectively). The area forms part of the Nketoana Local Municipality which in turn, forms part of the Thabo Mufutsanyane District Municipality, Free State Province.

According to SANBI (2006-), the majority of the proposed pipeline route falls within the Eastern Free State Clay Grassland vegetation type (Gm 3) which is characterised by flat to slightly undulating and undulating/rolling closed grasslands with streams and rivers that drain the foothills of the Drakensberg. Only the most northerly portion of the proposed pipeline route falls within the Central Free State Grassland vegetation type (Gh 6) which mainly consists of undulating plains supporting short grassland dominated by *Themeda triandra* in natural conditions while *Eragrostis curvula* and *E chloromelas* become more dominant in degraded areas (SANBI, 2006-). Dwarf karoo bushes also establish in severely degraded clayey bottomlands.

The Eastern Free State Clay Grassland vegetation type (Gm 3) is classified as endangered because of significant transformation and degradation mostly caused by agricultural activities (SANBI, 2006-). The entire vegetation type was however subsequently officially classified as having a nationally vulnerable status in terms of the National Department of Environmental Affairs' (DEA) National Threatened Ecosystems System (Government Gazette No 34809, 9 December 2011). This in turn, also renders the entire vegetation type a priority ecosystem type for conservation on a national scale.

The Central Free State Grassland vegetation type (Gh 6) is classified as vulnerable as a significant portion has been transformed either by cultivation or for building of dams (SANBI, 2006-).

The majority of the proposed pipeline route is categorised as degraded land in accordance with the Free State Provincial Spatial Biodiversity Plan 2017, which sets out biodiversity priority areas in the province. Only small intermittent sections along the route are categorised as Other Natural Areas (ONA).

Results and Conclusion

The entire pipeline route will merely constitute a narrow linear section of approximately ≤ 1.5 m wide. The majority of the existing natural surface vegetation within the narrow linear section, will in all probability be completely transformed by the mechanical clearance and excavation activities associated with the proposed development. The proposed development should however not impact significantly wider than the narrow linear section.

The majority of the proposed pipeline route is categorised as degraded land in accordance with the Free State Provincial Spatial Biodiversity Plan 2017 and have mostly been transformed by informal residential settlements or cultivated agricultural lands along the route. These portions are therefore not reminiscent of the natural climactic state of the relevant vegetation types and are not considered to be of any conservational significance. These portions scored low EIS values.

Only the numerous remaining relatively natural small intermittent portions along the proposed pipeline route are categorised as Other Natural Areas (ONA) and are still relatively reminiscent of the natural climactic state of the relevant vegetation types. The Eastern Free State Clay Grassland (Gm 3) and Central Free State Grassland (Gh 6) vegetation types associated with these remaining relatively natural portions, are classified as nationally vulnerable (Government Gazette No 34809, 9 December 2011) and vulnerable (SANBI, 2006-) respectively. These portions are therefore viewed as being conservationally significant and the development footprint within these portions should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact.

Numerous small ephemeral water drainage lines and two significant ephemeral watercourses traverse the proposed pipeline route. They form part of the mid region of a quaternary surface water catchment and drainage area which drains towards the north-west. They are therefore viewed

as being conservationally significant and the development footprint through these portions should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact. The construction footprint through these portions must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued flow and ecological integrity of the watercourse and drainage lines.

Clumps of the provincially protected aquatic bulb species *Crinum bulbispermum* were found to be present within the two significant ephemeral watercourses. It is recommended that if any individuals of this species are encountered within the proposed pipeline route during the construction phase, they must be removed prior to the commencement of any vegetation clearance- or excavation activities and adequately relocated to a suitable and similar area as to where they were removed from.

Individuals of the provincially protected species *Erythrina zeyheri* & *Helichrysum nudifolium* were also found to be well represented within the extended terrestrial natural portions along the proposed pipeline route. With the exception of these species, no Red Data Listed, provincially- or nationally protected or any other species of conservational significance were found to be present within the proposed pipeline route.

The remaining relatively natural small intermittent portions along the proposed pipeline route scored moderate EIS values and are therefore viewed as being conservationally significant for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation types and quaternary surface water catchment and drainage area.

It is the opinion of the specialist that the only potentially significant ecological impact associated with the continued impeding of the flow regimes of the significant ephemeral watercourses and drainage lines, 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.

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.

List of Figures

Figure 1: Locality map illustrating the proposed pipeline route (see A3 sized map in the Appendices)	12
Figure 2: Vegetation map illustrating the vegetation types associated with the proposed pipeline route (see A3 sized map in the Appendices)	15
Figure 3: Sensitivity map illustrating the conservation statuses associated with the proposed pipeline route (see A3 sized map in the Appendices)	16
Figure 4: Two images illustrating examples of the completely transformed portions of the proposed pipeline route associated with the informal residential settlements and cultivated agricultural lands respectively	20
Figure 5: Two images illustrating examples of the cultivated pasture lands of the proposed pipeline route which virtually constitute a monoculture of the grass species <i>Eragrostis curvula</i>	21
Figure 6: Two images illustrating examples of the moderately disturbed and degraded portions of the proposed pipeline route. Footpaths and <i>Seriphium plumosum</i> (bankrupt bush) infestations are evident	23
Figure 7: Two images illustrating examples of the small ephemeral water drainage lines which traverse the proposed pipeline route	25
Figure 8: Two images illustrating the two significant ephemeral watercourses which traverse the proposed pipeline route	26
Figure 9: Two images illustrating the presence of clumps of the provincially protected aquatic bulb species <i>Crinum bulbispermum</i> within the significant ephemeral watercourses	27
Figure 10: Image illustrating the open relatively natural grassland portion situated between the two significant watercourses	28
Figure 11: Two images illustrating the locally unique/distinct rocky outcrop area present within the hill complex along the proposed pipeline route	29
Figure 12: Two images illustrating the open relatively natural grassland portion running past the Lindley informal residential settlement of Ntha	31
Figure 13: Sensitivity map illustrating the broad categories of the proposed pipeline route as well as the recommended buffer zone to be implemented around the locally unique/distinct rocky outcrop area (see A3 sized map in the Appendices).....	36

List of Tables

Table 1: Criteria for PES calculations	6
Table 2: Criteria for EIS calculations	7
Table 3: Scale utilised for the evaluation of the Environmental Risk Ratings.....	7
Table 4: Scale used for the evaluation of the Environmental Significance Ratings	9
Table 5: Species list for the proposed pipeline route (Provincially protected species highlighted in yellow; Legally declared invasive species highlighted in pink)	34
Table 6: Environmental Risk and Significance Ratings	44
Table 7: Environmental Risk and Significance Ratings.....	55

Abbreviations

BA	Basic Assessment
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
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 EAP, NSVT Consultants, 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, Nketoana Local Municipality proposes to develop a new raw water pipeline of approximately 20.2 km in length between the towns of Lindley and Arlington, Free State Province. The pipeline will traverse a number of farms along the proposed route and will tie into existing reservoirs within both towns. The entire pipeline route will merely constitute a narrow linear section of approximately ≤ 1.5 m wide.

NSVT Consultants was appointed by the applicant as the independent Environmental Practitioner (EAP) to conduct the Basic Assessment (BA) 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.

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

A site visit/assessment for the proposed development footprint area was conducted on 19 March 2019. This date forms part of the end of the growing season and most plant species present could therefore be successfully identified.

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

4. Objectives of the Assessment

Ecological and habitat survey:

- Identify and list significant faunal and floral species encountered on the proposed project area and list any protected and/or Red Data Listed species.
- Determine and discuss the present condition and extent of degradation and/or transformation of the vegetation on the proposed project area.
- Determine and discuss the ecological sensitivity and significance of the proposed project area.
- Identify and delineate all watercourses/wetland areas potentially present on the proposed project area.
- Identify, evaluate and rate the potential impacts of the proposed project on the natural environment.
- Provide recommendations on mitigation and management measures in order to attempt to reduce/alleviate these identified potential 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 sensitive areas will be provided to the applicant.

5. Methodology

- The pipeline route area was assessed with the use of a vehicle and potentially sensitive areas were further 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 Free State's Nature Conservation Ordinance (No 8 of 1969).
- 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.

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>

Extent of Positive or Negative Impact	<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>
Irreplaceability of Natural Resources being impacted upon	<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>
Reversibility of Impact	<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>
Probability of Impact Occurrence	<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>
Cumulative Impact	<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 proposed pipeline route is approximately 20.2 km in length. It runs parallel and directly adjacent west of the R 707 provincial road and traverses a number of farms along the way. It must be a minimum of 29 m away from the road centre. The entire pipeline route will merely constitute a narrow linear section of approximately ≤ 1.5 m wide.

The starting point is on the Remaining Extent of the Farm Brandhoek no 20 (Lindley) and the finishing point on Portion 1 of the Farm Port Arlington no 114 (Arlington) (SG 21 Digit Codes: F0220000000002000000 and F02200000000011400001 respectively). The area forms part of the Nketoana Local Municipality which in turn, forms part of the Thabo Mufutsanyane District Municipality, Free State Province.

See locality map below.

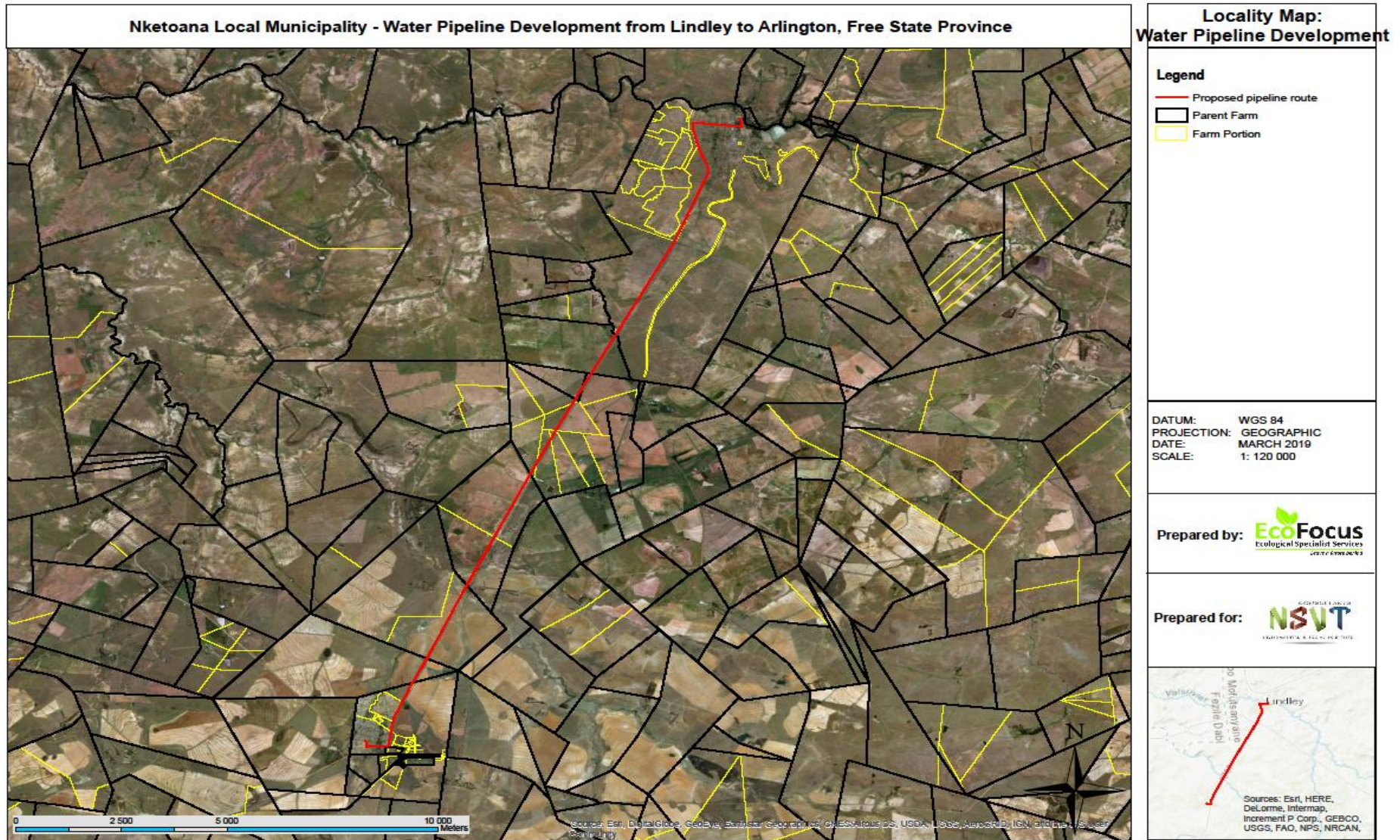


Figure 1: Locality map illustrating the proposed pipeline route (see A3 sized map in the Appendices)

6.1. Climate

The rainfall of the region peaks during the summer months and the Mean Annual Precipitation (MAP) of the area is approximately 640 mm (www.climate-data.org). The maximum average monthly temperature is approximately 21.3°C in the summer months while the minimum average monthly temperature is approximately 8°C during the winter. Maximum daily temperatures can reach up to 28.3°C in the summer months and dip to as low as -1.5°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 majority of the proposed pipeline route: Mudstones, sandstones and shale of the Beaufort Group. Glenrosa, Bonheim, Avalon and Mayo soils dominate outcrops and slightly elevated areas. Mayour landtypes are Bb, Bd and Ca.

The most northerly portion of the proposed pipeline route: Sedimentary mudstones and sandstone mainly of the Adelaide Subgroup as well as those of the Ecca Group giving rise to vertic, melanic and red soils. Typical soil forms are Arcadia, Bonheim, Kroonstad, Valsrivier and Rensburg. Dc landtype dominates the landscape.

6.3. Vegetation and Conservation Status

According to SANBI (2006-), the majority of the proposed pipeline route falls within the Eastern Free State Clay Grassland vegetation type (Gm 3) which is characterised by flat to slightly undulating and undulating/rolling closed grasslands with streams and rivers that drain the foothills of the Drakensberg. Only the most northerly portion of the proposed pipeline route falls within the Central Free State Grassland vegetation type (Gh 6) which mainly consists of undulating plains supporting short grassland dominated by *Themeda triandra* in natural conditions while *Eragrostis curvula* and *E chloromelas* become more dominant in degraded areas (SANBI, 2006-). Dwarf karoo bushes also establish in severely degraded clayey bottomlands.

The Eastern Free State Clay Grassland vegetation type (Gm 3) is classified as endangered because of significant transformation and degradation mostly caused by agricultural activities (SANBI, 2006-). The entire vegetation type was however subsequently officially classified as having a nationally vulnerable status in terms of the National Department of Environmental Affairs' (DEA) National

Threatened Ecosystems System (Government Gazette No 34809, 9 December 2011). This in turn, also renders the entire vegetation type a priority ecosystem type for conservation on a national scale.

The Central Free State Grassland vegetation type (Gh 6) is classified as vulnerable as a significant portion has been transformed either by cultivation or for building of dams (SANBI, 2006-).

The majority of the proposed pipeline route is categorised as degraded land in accordance with the Free State Provincial Spatial Biodiversity Plan 2017, which sets out biodiversity priority areas in the province. Only small intermittent sections along the route are categorised as Other Natural Areas (ONA).

The proposed development of the pipeline will only impact on and transform a narrow linear section along the route.

See vegetation and sensitivity maps below.

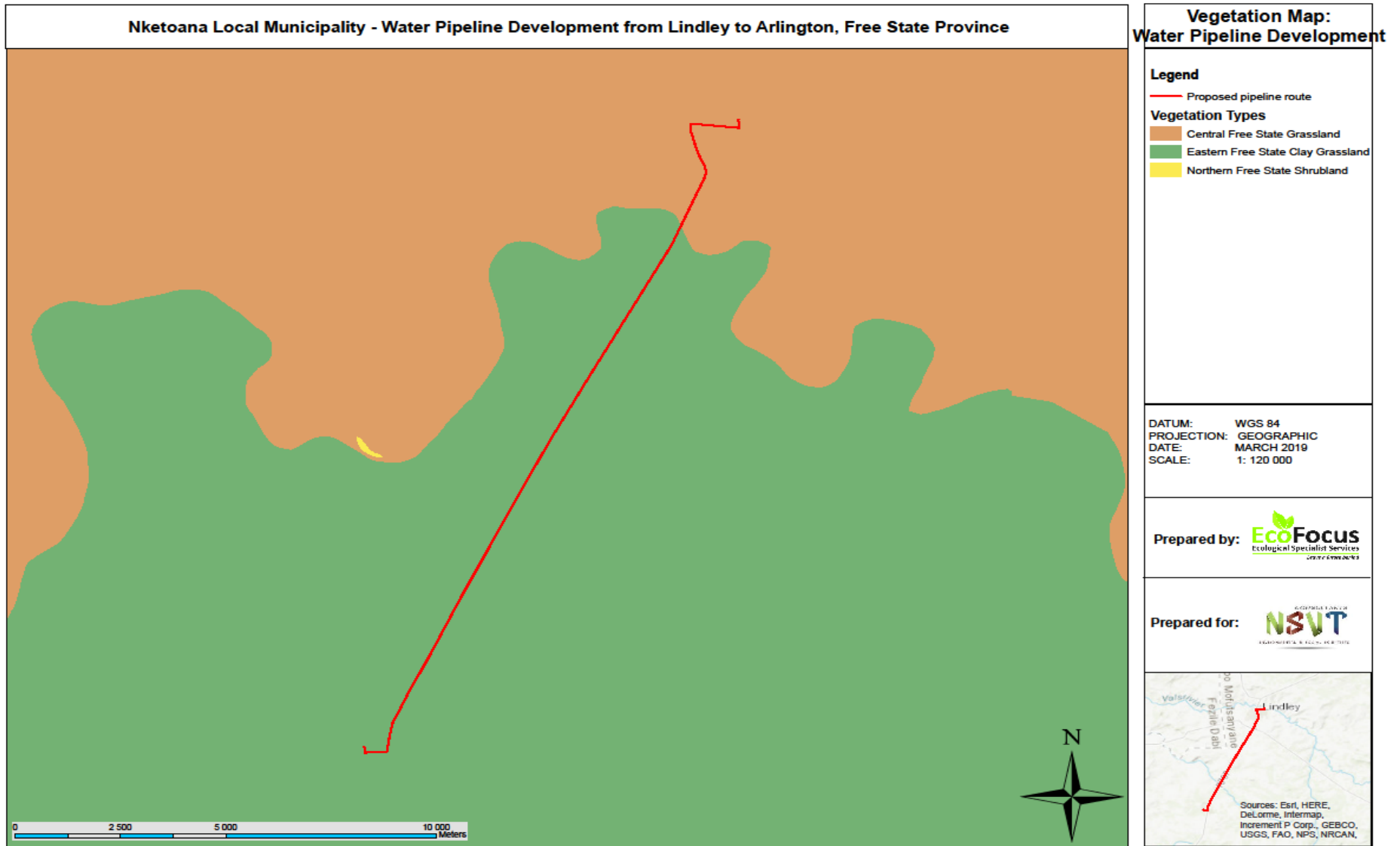


Figure 2: Vegetation map illustrating the vegetation types associated with the proposed pipeline route (see A3 sized map in the Appendices)

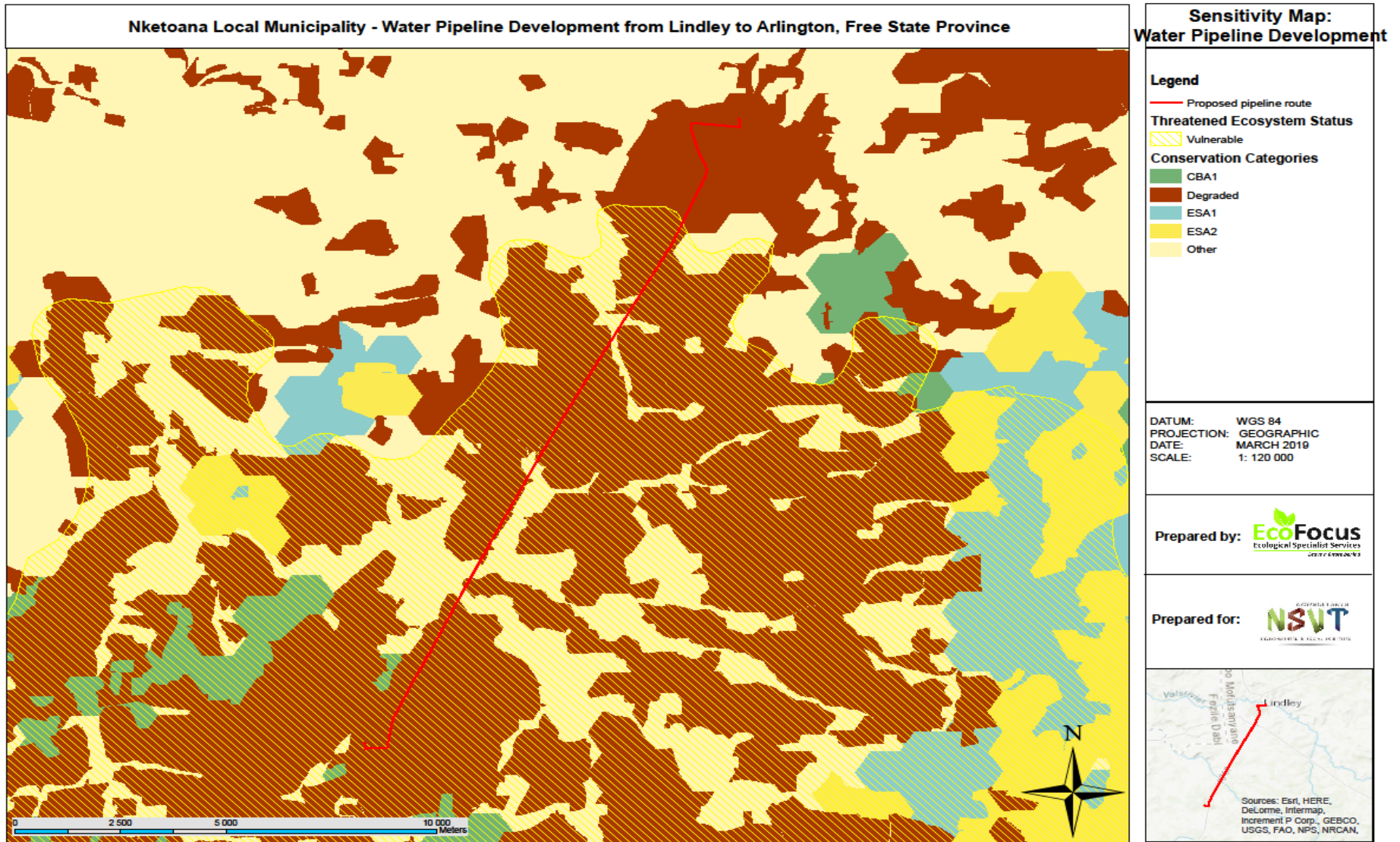


Figure 3: Sensitivity map illustrating the conservation statuses associated with the proposed pipeline route (see A3 sized map in the Appendices)

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 pipeline route 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 Basic 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 Basic 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 BA 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.

Given that a BA involves prediction, the uncertainty factor forms part of the assessment process. Two types of uncertainty are associated with the BA 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 BA 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).

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 proposed pipeline route is approximately 20.2 km in length. It runs parallel and directly adjacent west of the R 707 provincial road and traverses a number of farms along the way. It must be a minimum of 29 m away from the road centre. The entire pipeline route will merely constitute a narrow linear section of approximately ≤ 1.5 m wide. The majority of the existing natural surface vegetation within the narrow linear section, will in all probability be completely transformed by the mechanical clearance and excavation activities associated with the proposed development. The proposed development should however not impact significantly wider than the narrow linear section.

The proposed pipeline route has been divided into the following broad categories for reporting purposes:

- Completely transformed portions
- Cultivated pasture portions
- Moderately disturbed and degraded portions
- Relatively natural portions
 - Small ephemeral water drainage lines
 - Significant ephemeral watercourses

Each category will be discussed separately under headings 8.1 – 8.4 and will be visually illustrated in the sensitivity map under heading 8.7.

8.1. Completely Transformed Portions

The majority of the proposed pipeline route is completely transformed either due to it falling within the informal residential settlements of the two towns or due to it traversing cultivated agricultural lands along the route. Virtually no natural surface vegetation remains within these completely transformed portions.

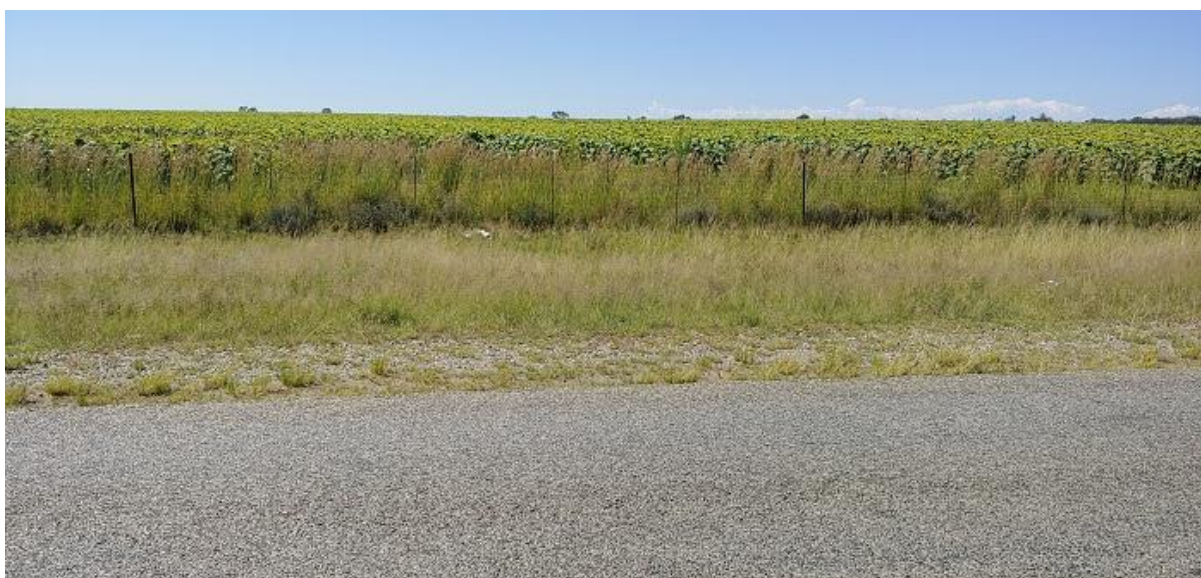


Figure 4: Two images illustrating examples of the completely transformed portions of the proposed pipeline route associated with the informal residential settlements and cultivated agricultural lands respectively

8.2. Cultivated Pasture Portions

Two significant intermittent portions along the proposed pipeline route traverse cultivated pasture lands. These lands virtually constitute a monoculture of the grass species *Eragrostis curvula* and very few, if any other grass- or forb species were found to be present. These cultivated pasture portions are therefore not reminiscent of the natural climactic state of the relevant vegetation type and are not considered to be of any conservational significance.



Figure 5: Two images illustrating examples of the cultivated pasture lands of the proposed pipeline route which virtually constitute a monoculture of the grass species *Eragrostis curvula*

8.3. Moderately Disturbed and Degraded Portions

Three intermittent portions along the proposed pipeline route are categorised as moderately disturbed and degraded. Although these portions still house virgin soil with a degree of natural vegetation remaining, they are situated directly between the informal residential settlements and the R 707 provincial road. These portions have therefore been significantly disturbed by continuous anthropogenic activities in the form of overgrazing by livestock from the local communities, numerous footpaths which traverse the areas and informal housing being sparsely built. Such anthropogenic activities tend to cause an ecological 'edge effect' which negatively impacts on the urban/rural interface area.

The grass species *Eragrostis curvula*, *E plana* & *E chloromelas* mainly dominate these portions while other grass species also found to be well represented include *Eragrostis gummiflua*, *Hyparrhenia hirta*, *Cynodon dactylon*, *Chloris virgata*, *Aristida spp.*, *Tragus berteronianus* & *Setaria sphacelata*. The majority of these well represented species are indicative of a disturbed and degraded state. The virtually complete absence of expected important climax grass species associated with the relevant vegetation type, such as *Themeda triandra*, *Cymbopogon pospischilii*, *Harpochloa falx* further reiterates the disturbed and degraded state of these portions.

The shrub species *Seriphium plumosum* (bankrupt bush) is also moderately to densely infested within these portions. This species is classified as an undesired indicator species of bush encroachment in accordance with the Conservation of Agricultural Resources Development Act (Act 43 of 1983) Regulations: Regulation 16. It is a significant problematic plant throughout the Eastern Free State which invades natural grassland by outcompeting and replacing the natural grass and forbs species present. The legally declared invasive species *Datura stramonium* & *Xanthium spinosum* (both Category 1b) were also found to be moderately present within these portions.

These moderately disturbed and degraded portions are therefore not reminiscent of the natural climactic state of the relevant vegetation type and are not considered to be of any conservational significance.



Figure 6: Two images illustrating examples of the moderately disturbed and degraded portions of the proposed pipeline route. Footpaths and *Seriphium plumosum* (bankrupt bush) infestations are evident

8.4. Relatively Natural Portions

Numerous small intermittent portions along the proposed pipeline route are categorised as relatively natural. They are not necessarily viewed as completely pristine mainly due to the ecological 'edge effect' caused by surrounding agricultural management practises such as grazing and cultivation.

Numerous small ephemeral water drainage lines and two significant ephemeral watercourses traverse the proposed pipeline route. All of the identified relatively natural portions as discussed above, are mainly associated with these ephemeral watercourses and drainage lines, with the exception of two extended terrestrial natural portions along the proposed pipeline route.

8.4.1. Small ephemeral water drainage lines

The in-stream beds and direct surroundings of the small ephemeral water drainage lines are mainly dominated by aquatic vegetation such as *Typha capensis*, *Paspalum dilatatum*, *Cyperus spp.*, *Cynodon dactylon* & *Eragrostis plana*. Forb species mainly found to be present include *Berkheya rigida*, *Cotula sp.*, *Verbena aristigera*, *Scabiosa columbaria* & the legally declared invasive species *Verbena bonariensis* (Category 1b). Due to the lack of continuous water flow through these drainage lines, they possess no distinct surrounding riparian zones with any significant woody representation.





Figure 7: Two images illustrating examples of the small ephemeral water drainage lines which traverse the proposed pipeline route

8.4.2. Significant ephemeral watercourses

The in-stream aquatic vegetation of the two significant ephemeral watercourses which traverse the proposed pipeline route, is relatively similar to that described for the small drainage lines. These two watercourses however possess distinct surrounding riparian zones with significant woody representation due to more constant water flows experienced.

The riparian zone of the first watercourse is mainly dominated by the species *Vachellia karroo* & *Asparagus spp.* while other woody species also found to be present include *Salix babylonica* and the legally declared invasive species *Pyracantha spp.* (Category 1b). The riparian zone of the second watercourse houses the same species but is rather dominated by a confined dense forest of the legally declared invasive species *Populus canescens* (Category 2).

Clumps of the provincially protected aquatic bulb species *Crinum bulbispermum* were also found to be present within the two significant ephemeral watercourses. It is recommended that if any individuals of this species are encountered within the proposed pipeline route during the construction phase, they must be removed prior to the commencement of any vegetation clearance- or excavation activities and adequately relocated to a suitable and similar area as to where they were removed from.

The numerous small ephemeral water drainage lines along with the two significant ephemeral watercourses form part of the mid region of a quaternary surface water catchment and drainage area which drains towards the north-west. They are therefore viewed as being conservationally significant and the development footprint through these portions should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact. The construction footprint through these portions must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued flow and ecological integrity of the watercourse and drainage lines.



Figure 8: Two images illustrating the two significant ephemeral watercourses which traverse the proposed pipeline route



Figure 9: Two images illustrating the presence of clumps of the provincially protected aquatic bulb species *Crinum bulbispermum* within the significant ephemeral watercourses

8.4.3. Extended terrestrial portions

There are two extended terrestrial natural portions along the proposed pipeline route. The first one constitutes the portion situated between the two significant watercourses and also continues for a distance past the crossing of the second significant watercourse.

The portion situated between the two significant watercourses constitutes open relatively natural grassland mainly dominated by the grass species *Themeda triandra*, *Cymbopogon pospischilii* & *Eragrostis chloromelas*. Forb species found to be well represented include *Bulbine abyssinica*, *Hermannia depressa* and the provincially protected species *Erythrina zeyheri* & *Helichrysum nudifolium*.

A slight degree of disturbance is evident within this portion mainly caused by grazing practices but the area is relatively reminiscent of the natural climactic state of the relevant nationally vulnerable vegetation type. The portion is therefore viewed as being conservationally significant and the development footprint within this portion should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact.



Figure 10: Image illustrating the open relatively natural grassland portion situated between the two significant watercourses

The first extended terrestrial natural portions continues for a distance past the crossing of the second significant watercourse. This portion however rather constitutes a rocky hill complex which also houses similar natural grassland. This hill complex portion is reminiscent of the natural climactic state of the relevant nationally vulnerable vegetation type and is therefore also viewed as being conservationally significant. The development footprint within this portion should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact.

A single isolated rocky outcrop area with increased surface rockiness, is present within the hill complex portion along the proposed pipeline route. The outcrop possesses locally unique/distinct habitat attributes and vegetation composition. Fern species such as *Pellaea calomelanos* & *Cheilanthes eckloniana* are present within the rocky crevasses while the woody species *Kiggelaria africana* is well represented and diagnostically confined only to this outcrop area.

It is further reasonably expected that this locally unique/distinct rocky outcrop area could be utilised by various specialised reptilian species (snakes and lizards) as refuge and for breeding/persistence purposes. Although not necessarily being conservationally significant, it is therefore recommended that this outcrop should be adequately buffered out of the proposed development footprint area if practicably possible. No development may take place within the buffered area.



Figure 11: Two images illustrating the locally unique/distinct rocky outcrop area present within the hill complex along the proposed pipeline route

The second extended terrestrial natural portion along the proposed pipeline route constitutes the portion running past the Lindley informal residential settlement of Ntha. Although this portion is in relatively close proximity to the informal residential settlement, it is still in a relatively natural state. Grazing by livestock from the local communities is evident but no significant overgrazing is apparent. Similar to the open grassland portion situated between the two significant watercourses, this portion is also mainly dominated by the grass species *Themeda triandra*, *Cymbopogon pospischilii* & *Eragrostis chloromelas*. The grass species *Eragrostis plana* is also well represented. Two rocky hills which house similar natural grassland are also present within this portion.

This portion falls within the vulnerable Central Free State Grassland vegetation type (Gh 6) in accordance with SANBI (2006-). A slight degree of disturbance is evident within this portion mainly caused by grazing practices but the area is relatively reminiscent of the natural climactic state of the relevant vulnerable vegetation type. The portion is therefore viewed as being conservationally significant and the development footprint within this portion should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact.





Figure 12: Two images illustrating the open relatively natural grassland portion running past the Lindley informal residential settlement of Ntha

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

The Present Ecological State (PES) of the majority of the proposed pipeline route is classified as Class D as it is largely modified. A significant loss of natural habitat, biota and subsequent basic ecosystem functionality has occurred mainly due to existing residential and agricultural transformation.

The Present Ecological State (PES) of the remaining relatively natural small intermittent portions along the proposed pipeline route is classified as Class B as they are largely natural. A small change in natural habitats and biota may have taken place mainly due to the ecological 'edge effect' caused by surrounding agricultural management practises such as grazing and cultivation but the ecosystem functionality has remained essentially unchanged.

The majority of the proposed pipeline route is categorised as degraded land in accordance with the Free State Provincial Spatial Biodiversity Plan 2017, which sets out biodiversity priority areas in the province. Only the remaining relatively natural small intermittent portions along the proposed pipeline route are categorised as Other Natural Areas (ONA). The Eastern Free State Clay Grassland (Gm 3) and Central Free State Grassland (Gh 6) vegetation types associated with these remaining relatively natural portions, are classified as nationally vulnerable (Government Gazette No 34809, 9 December 2011) and vulnerable (SANBI, 2006-) respectively. These portions are therefore viewed as being conservationally significant and the development footprint within these portions should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact.

Numerous small ephemeral water drainage lines and two significant ephemeral watercourses traverse the proposed pipeline route. They form part of the mid region of a quaternary surface water catchment and drainage area which drains towards the north-west. They are therefore viewed as being conservationally significant and the development footprint through these portions should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact. The construction footprint through these portions must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued flow and ecological integrity of the watercourse and drainage lines.

Clumps of the provincially protected aquatic bulb species *Crinum bulbispermum* were found to be present within the two significant ephemeral watercourses. It is recommended that if any individuals of this species are encountered within the proposed pipeline route during the construction phase,

they must be removed prior to the commencement of any vegetation clearance- or excavation activities and adequately relocated to a suitable and similar area as to where they were removed from.

Individuals of the provincially protected species *Erythrina zeyheri* & *Helichrysum nudifolium* were also found to be well represented within the extended terrestrial natural portions along the proposed pipeline route. With the exception of these species, no Red Data Listed, provincially- or nationally protected or any other species of conservational significance were found to be present within the proposed pipeline route.

The Ecological Importance and Sensitivity (EIS) of the majority of the proposed pipeline route is classified as Class D (low) as it is not ecologically important and/or sensitive on any scale due to existing residential and agricultural transformation. Biodiversity is ubiquitous and not unique or sensitive to further habitat modifications due to the already highly degraded and transformed state.

The Ecological Importance and Sensitivity (EIS) of the remaining relatively natural small intermittent portions along the proposed pipeline route is classified as Class C (moderate) as they are viewed as ecologically important and sensitive on local or possibly provincial scale mainly due to the presence of the nationally vulnerable vegetation type as well as the numerous small ephemeral water drainage lines and two significant ephemeral watercourses.

The remaining relatively natural small intermittent portions along the proposed pipeline route are therefore viewed as being conversationally significant for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation types and quaternary surface water catchment and drainage area.

8.6. Species List for the Proposed Pipeline Route

Table 5: Species list for the proposed pipeline route (Provincially protected species highlighted in yellow; Legally declared invasive species highlighted in pink)

Graminoids	Forbs	Shrubs & trees
<i>Aristida spp.</i>	<i>Berkheya rigida</i>	<i>Asparagus spp.</i>
<i>Chloris virgata</i>	<i>Bulbine abyssinica</i>	<i>Kiggelaria africana</i>
<i>Cymbopogon pospischilii</i>	<i>Cheilanthes eckloniana</i>	<i>Populus canescens</i>
<i>Cynodon dactylon</i>	<i>Cotula sp.</i>	<i>Pyracantha spp.</i>
<i>Cyperus spp.</i>	<i>Crinum bulbispermum</i>	<i>Salix babylonica</i>
<i>Eragrostis chloromelas</i>	<i>Datura stramonium</i>	<i>Vachellia karroo</i>
<i>Eragrostis curvula</i>	<i>Erythrina zeyheri</i>	-
<i>Eragrostis gummiflua</i>	<i>Helichrysum nudifolium</i>	-
<i>Eragrostis plana</i>	<i>Hermannia depressa</i>	-
<i>Hyparrhenia hirta</i>	<i>Pellaea calomelanos</i>	-
<i>Paspalum dilatatum</i>	<i>Scabiosa columbaria</i>	-
<i>Setaria sphacelata</i>	<i>Seriphium plumosum</i>	-
<i>Themeda triandra</i>	<i>Verbena aristigera</i>	-
<i>Tragus berteronianus</i>	<i>Xanthium spinosum</i>	-
<i>Typha capensis</i>	-	-

8.7. Ecological Sensitivity Map

The sensitivity map below illustrates the broad categories of the proposed pipeline route as well as the recommended buffer zone to be implemented around the locally unique/distinct rocky outcrop area.

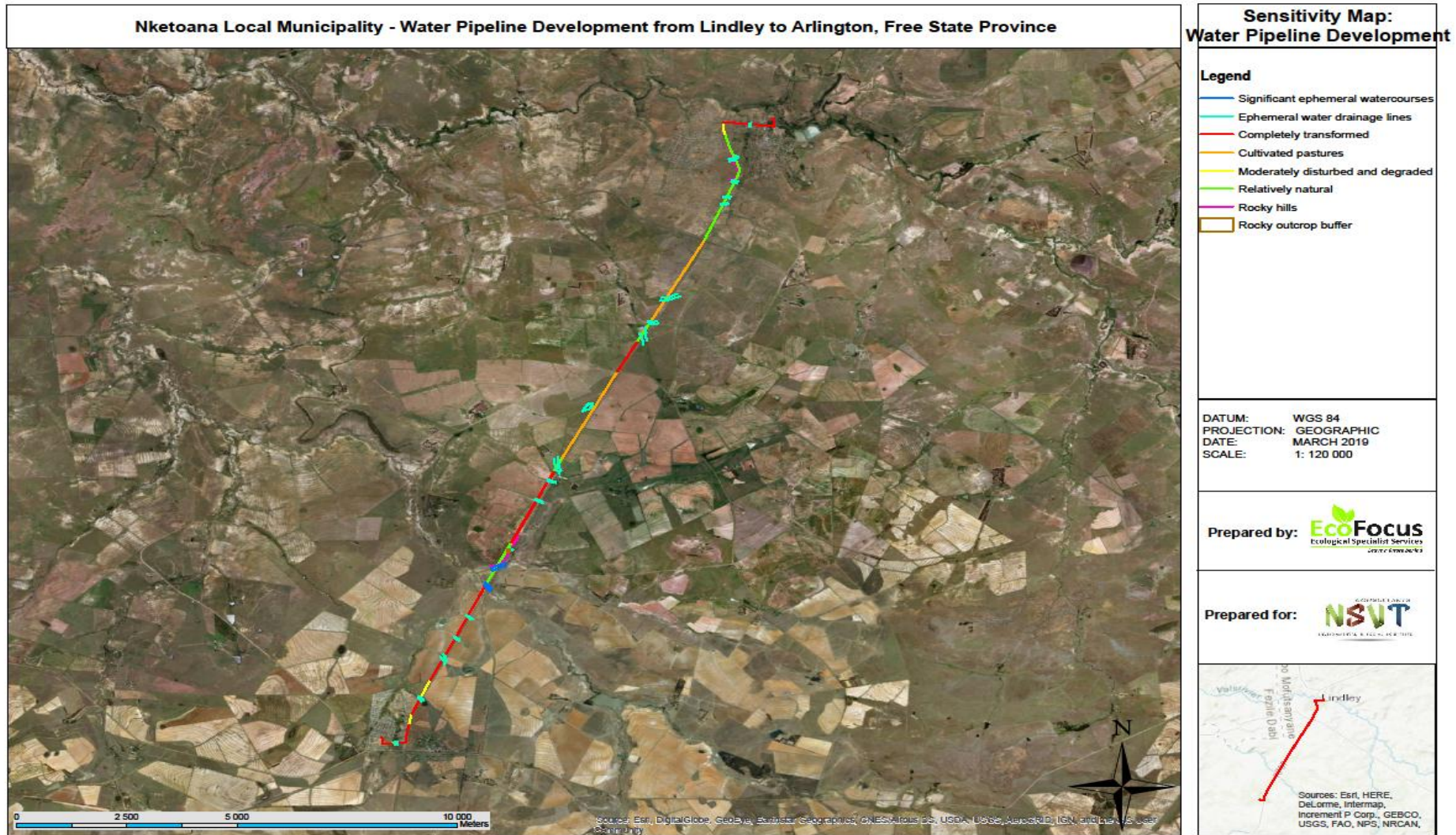


Figure 13: Sensitivity map illustrating the broad categories of the proposed pipeline route as well as the recommended buffer zone to be implemented around the locally unique/distinct rocky outcrop area (see A3 sized map in the Appendices)

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 implementation of effective management strategies for them.

9.1. Construction Phase

Transformation of terrestrial vegetation along the proposed pipeline route associated with the Eastern Free State Clay Grassland (Gm 3) and Central Free State Grassland (Gh 6) vegetation types

The majority of the proposed pipeline route is categorised as degraded land in accordance with the Free State Provincial Spatial Biodiversity Plan 2017, which sets out biodiversity priority areas in the province. These portions are therefore not reminiscent of the natural climactic state of the relevant vegetation types and are not considered to be of any conservational significance.

Only the remaining relatively natural small intermittent portions along the proposed pipeline route are categorised as Other Natural Areas (ONA). The Eastern Free State Clay Grassland (Gm 3) and Central Free State Grassland (Gh 6) vegetation types associated with these remaining relatively natural portions, are classified as nationally vulnerable (Government Gazette No 34809, 9 December 2011) and vulnerable (SANBI, 2006-) respectively.

The entire pipeline route will merely constitute a narrow linear section of approximately ≤ 1.5 m wide. The majority of the existing natural surface vegetation within the narrow linear section, will in

all probability be completely transformed by the mechanical clearance and excavation activities associated with the proposed development. The proposed development should however not impact significantly wider than the narrow linear section. The significance of this potential impact will be low.

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 proposed pipeline route

Clumps of the provincially protected aquatic bulb species *Crinum bulbispermum* were found to be present within the two significant ephemeral watercourses which traverse the proposed pipeline route.

Individuals of the provincially protected species *Erythrina zeyheri* & *Helichrysum nudifolium* were also found to be well represented within the extended terrestrial natural portions along the proposed pipeline route. With the exception of these species, no Red Data Listed, provincially- or nationally protected or any other species of conservational significance were found to be present within the proposed pipeline route.

The entire pipeline route will merely constitute a narrow linear section of approximately ≤ 1.5 m wide. The majority of the existing natural surface vegetation within the narrow linear section, will in all probability be completely transformed by the mechanical clearance and excavation activities associated with the proposed development. The proposed development should however not impact significantly wider than the narrow linear section. The significance of this potential impact will be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Terrestrial and aquatic alien invasive species establishment

No significant alien invasive species establishments were found to be present along the proposed pipeline route. The shrub species *Seriphium plumosum* (bankrupt bush) is however moderately to densely infested within the moderately disturbed and degraded portions along the proposed pipeline route. This species is classified as an undesired indicator species of bush encroachment in accordance with the Conservation of Agricultural Resources Development Act (Act 43 of 1983)

Regulations: Regulation 16. It is a significant problematic plant throughout the Eastern Free State which invades natural grassland by outcompeting and replacing the natural grass and forbs species present. The legally declared invasive species *Datura stramonium* & *Xanthium spinosum* (both Category 1b) were also found to be moderately present within these portions. These individuals will in fact be removed during the construction phase which will prove to be beneficial to the environment.

The proposed pipeline route and surrounding areas could potentially be prone to significant alien invasive species establishment due to surface disturbances caused by mechanical clearance and excavation activities during the construction phase. The presence of the significant ephemeral watercourses and drainage lines along the proposed pipeline route could further also potentially act as significant transport/distribution vectors for numerous terrestrial and aquatic invasive species into the broader region. The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Surface material erosion

Although the proposed pipeline route has varying degrees of slope and topography due to the undulating landscape, the narrow linear section of the route should not pose significant risk of potential 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.

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

The numerous small ephemeral water drainage lines and two significant ephemeral watercourses which traverse the proposed pipeline route form part of the mid region of a quaternary surface water catchment and drainage area which drains towards the north-west. They are therefore viewed as being conservationally significant.

The mechanical clearance and excavation activities during the construction phase could potentially result in contamination and impeding of natural surface water flow of the watercourses and drainage lines due to artificial obstruction of flow during rainfall events and hydrocarbon or other

chemical spills by machinery and equipment. 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, destruction of-/damage to Red Data Listed, nationally or 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.

The following additional potential ecological impact could however take place during the operational phase:

Continued impeding of the flow regimes of the significant ephemeral watercourses and drainage lines

The established pipeline of the proposed development could potentially continuously impede on the flow regimes of the significant ephemeral watercourses and drainage lines due to continued artificial obstruction of natural surface water flow during rainfall events. The significance of this potential impact will be medium-high.

Mitigation measures to reduce impacts are recommended under heading 9.4.

9.3. Cumulative Impacts

The entire pipeline route will merely constitute a narrow linear section of approximately ≤ 1.5 m wide. The majority of the existing natural surface vegetation within the narrow linear section, will in all probability be completely transformed by the mechanical clearance and excavation activities associated with the proposed development. The proposed development should however not impact significantly wider than the narrow linear section

Due to the majority of the proposed pipeline route being categorised as degraded land in accordance with the Free State Provincial Spatial Biodiversity Plan 2017, the proposed development should not pose any significant cumulative impacts to the relevant vegetation types or ecological connectivity and functionality of the broader habitat and ecosystem.

The only potential ecological impact which could possibly pose a significant cumulative negative impact within the broader region, is the continued impeding of the flow regimes of the significant ephemeral watercourses and drainage lines. Due to the extensive transformation of the broader landscape into agricultural cultivation developments, the quaternary surface water catchment and drainage area has been significantly impeded over time. The proposed pipeline development through the significant watercourses and drainage lines could therefore potentially add further to this impediment but this impact can be suitably reduced and mitigated to within acceptable levels by implementation of the recommended mitigation measures.

It is not anticipated that the proposed development would pose any significant potential long term cumulative ecological impacts within the broader region if all the recommended mitigation measures are adequately implemented.

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

	Proposed pipeline route	No go alternative
Identified Environmental Impact	Transformation of terrestrial vegetation along the proposed pipeline route associated with the Eastern Free State Clay Grassland (Gm 3) and Central Free State Grassland (Gh 6) vegetation types	
Magnitude of Negative or Positive Impact	Low (4)	-
Duration of Negative or Positive Impact	Long term (4)	-
Extent of Positive or Negative Impact	Site specific (1)	-
Irreplaceability of Natural Resources being impacted upon	Medium (3)	-
Reversibility of Impact	Low (4)	-
Probability of Impact Occurrence	Medium (3)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (48)	-

<p style="text-align: center;">Mitigation Measures to be implemented</p>	<p>The new project construction footprint within the remaining relatively natural small intermittent portions along the proposed pipeline route, should be restricted and kept as small as practicably possible in order to reduce the surface impact on surrounding vegetation and no unnecessary/unauthorised footprint expansion into the surrounding areas may take place.</p> <p>It is recommended that the identified locally unique/distinct rocky outcrop area should be adequately buffered out of the proposed development footprint area if practicably possible. No development may take place within the buffered area.</p> <p>No site construction camps to be established within the surrounding natural areas outside the project footprint.</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>Adequate operational procedures for machinery and equipment must be developed in order to strictly govern movement of machinery only within project footprint areas and ensure environmentally responsible construction practices and activities.</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 development.</p> <p>Areas surrounding construction footprints must be adequately rehabilitated as soon as practically possible after construction. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced</p>
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	ecologist.	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (28)	-
	Proposed pipeline route	No go alternative
Identified Environmental Impact	Destruction of-/damage to Red Data Listed, nationally or provincially protected species individuals/habitats	
Magnitude of Negative or Positive Impact	Low (4)	-
Duration of Negative or Positive Impact	Long term (4)	-
Extent of Positive or Negative Impact	Site specific (1)	-
Irreplaceability of Natural Resources being impacted upon	Medium (3)	-
Reversibility of Impact	Low (4)	-
Probability of Impact Occurrence	Medium (3)	-

Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (48)	-
Mitigation Measures to be implemented	<p>It is recommended that if any individuals of the provincially protected aquatic bulb species <i>Crinum bulbispermum</i> are encountered within the significant ephemeral watercourse portions of the proposed pipeline route during the construction phase, they must be removed prior to the commencement of any vegetation clearance- or excavation activities and adequately relocated to a suitable and similar area as to where they were removed from.</p> <p>An adequate Plant Relocation Management Plan must be compiled by a suitably qualified and experienced ecologist.</p> <p>A Provincial Flora Permit has to be obtained for the relocation of the abovementioned individuals as well as for the removal/destruction of all other provincially protected species individuals found to be present along the proposed pipeline route prior to the commencement of any relocation or removal/destruction activities.</p> <p>The new project construction footprint within the remaining relatively natural small intermittent portions along the proposed pipeline route, should be restricted and kept as small as practicably possible in order to reduce the surface impact on surrounding vegetation and no unnecessary/unauthorised footprint expansion into the surrounding areas may take place.</p> <p>It is recommended that the identified locally unique/distinct rocky outcrop area should be adequately buffered out of the proposed development footprint area if practicably possible. No development may take place within</p>	

	<p>the buffered area.</p> <p>No site construction camps to be established within the surrounding natural areas outside the project footprint.</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>Adequate operational procedures for machinery and equipment must be developed in order to strictly govern movement of machinery only within project footprint areas and ensure environmentally responsible construction practices and activities.</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 development.</p> <p>Areas surrounding construction footprints must be adequately rehabilitated as soon as practically possible after construction. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist.</p>	
<p>Cumulative Impact Rating after mitigation implementation</p>	<p>Low</p>	<p>-</p>

Environmental Significance Score and Rating after mitigation implementation	Low (14)	-
	Proposed pipeline route	No go alternative
Identified Environmental Impact	Terrestrial and aquatic alien invasive species establishment	
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	Medium (3)	-
Reversibility of Impact	High (2)	-
Probability of Impact Occurrence	High (4)	-
Cumulative Impact Rating prior to mitigation	Medium	-

Environmental Significance Score and Rating prior to mitigation	Medium (64)	-
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 surrounding construction footprints must be adequately rehabilitated as soon as practically possible after construction. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist.</p>	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (12)	-
	Proposed pipeline route	No go alternative
Identified Environmental Impact	Surface material erosion	
Magnitude of Negative or Positive Impact	Very low (2)	-

Duration of Negative or Positive Impact	Long term (4)	-
Extent of Positive or Negative Impact	Local (2)	-
Irreplaceability of Natural Resources being impacted upon	Medium (3)	-
Reversibility of Impact	High (2)	-
Probability of Impact Occurrence	Low (2)	-
Cumulative Impact Rating prior to mitigation	Low	-
Environmental Significance Score and Rating prior to mitigation	Low (26)	-
Mitigation Measures to be implemented	<p>Adequate stormwater and erosion management measures must be implemented for the proposed pipeline route during the construction and operational phases. This must be done to sufficiently manage storm water runoff in order to prevent any significant erosion from occurring.</p> <p>Areas surrounding construction footprints must be adequately rehabilitated as soon as practically possible after construction. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist.</p>	

Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (12)	-
	Proposed pipeline route	No go alternative
Identified Environmental Impact	Impeding and contamination of the flow regimes of the significant ephemeral watercourses and drainage lines	
Magnitude of Negative or Positive Impact	High (8)	-
Duration of Negative or Positive Impact	Short term (2)	-
Extent of Positive or Negative Impact	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	High (4)	-
Reversibility of Impact	Medium (3)	-
Probability of Impact Occurrence	High (4)	-

Cumulative Impact Rating prior to mitigation	Medium-High	-
Environmental Significance Score and Rating prior to mitigation	Medium-High (80)	-
Mitigation Measures to be implemented	<p>Adequate stormwater and erosion management measures must be implemented for the proposed pipeline route during the construction and operational phases. This must be done to sufficiently manage storm water runoff in order to prevent any significant erosion from occurring and maintain the ecological functionality and integrity of the watercourses and drainage lines.</p> <p>The construction footprint through the watercourses and drainage lines must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure their continued flow and ecological integrity. A Rehabilitation Management Plan must be compiled by a suitably qualified and experienced ecologist.</p> <p>Where the proposed pipeline route traverses the two significant ephemeral watercourses, it is recommended that the pipeline be placed over the watercourses on aboveground elevated concrete slabs in order to ensure the continued flow and ecological integrity of the watercourses.</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 watercourses and drainage lines.</p> <p>Hydrocarbon and other chemical storage areas must be adequately banded in order to be able to contain a</p>	

	<p>minimum of 150 % of the capacity of storage tanks/units.</p> <p>Adequate hydrocarbon and other chemical storage, handling, usage and spillage clean-up 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 for all the watercourse and drainage line crossings in accordance with the National Water Act (Act 36 of 1998).</p>	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (30)	-

9.4.2. Operational Phase

Table 7: Environmental Risk and Significance Ratings

	Proposed pipeline route	No go alternative
Identified Environmental Impact	Continued impeding of the flow regimes of the significant ephemeral watercourses and drainage lines	
Magnitude of Negative or Positive Impact	High (8)	-
Duration of Negative or Positive Impact	Medium term (3)	-
Extent of Positive or Negative Impact	Regional (3)	-
Irreplaceability of Natural Resources being impacted upon	High (4)	-
Reversibility of Impact	Medium (3)	-
Probability of Impact Occurrence	High (4)	-
Cumulative Impact Rating prior to mitigation	Medium-High	-
Environmental Significance Score and Rating prior to mitigation	Medium-High (84)	-

Mitigation Measures to be implemented	If all the recommended mitigations measures for the construction phase are adequately implemented and managed, it should prove sufficient in preventing any continued impeding of- or significant impact on the watercourses and drainage lines.	
Cumulative Impact Rating after mitigation implementation	Low	-
Environmental Significance Score and Rating after mitigation implementation	Low (16)	-

10. Summary and Conclusion

The entire pipeline route will merely constitute a narrow linear section of approximately ≤ 1.5 m wide. The majority of the existing natural surface vegetation within the narrow linear section, will in all probability be completely transformed by the mechanical clearance and excavation activities associated with the proposed development. The proposed development should however not impact significantly wider than the narrow linear section.

The majority of the proposed pipeline route is categorised as degraded land in accordance with the Free State Provincial Spatial Biodiversity Plan 2017 and have mostly been transformed by informal residential settlements or cultivated agricultural lands along the route. These portions are therefore not reminiscent of the natural climactic state of the relevant vegetation types and are not considered to be of any conservational significance. These portions scored low EIS values.

Only the numerous remaining relatively natural small intermittent portions along the proposed pipeline route are categorised as Other Natural Areas (ONA) and are still relatively reminiscent of the natural climactic state of the relevant vegetation types. The Eastern Free State Clay Grassland (Gm 3) and Central Free State Grassland (Gh 6) vegetation types associated with these remaining relatively natural portions, are classified as nationally vulnerable (Government Gazette No 34809, 9 December 2011) and vulnerable (SANBI, 2006-) respectively. These portions are therefore viewed as being conservationally significant and the development footprint within these portions should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact.

Numerous small ephemeral water drainage lines and two significant ephemeral watercourses traverse the proposed pipeline route. They form part of the mid region of a quaternary surface water catchment and drainage area which drains towards the north-west. They are therefore viewed as being conservationally significant and the development footprint through these portions should be restricted and kept as small as practicably possible in order to minimise the negative ecological impact. The construction footprint through these portions must also be adequately rehabilitated as soon as practicably possible after construction in order to ensure the continued flow and ecological integrity of the watercourse and drainage lines.

Clumps of the provincially protected aquatic bulb species *Crinum bulbispermum* were found to be present within the two significant ephemeral watercourses. It is recommended that if any individuals

of this species are encountered within the proposed pipeline route during the construction phase, they must be removed prior to the commencement of any vegetation clearance- or excavation activities and adequately relocated to a suitable and similar area as to where they were removed from.

Individuals of the provincially protected species *Erythrina zeyheri* & *Helichrysum nudifolium* were also found to be well represented within the extended terrestrial natural portions along the proposed pipeline route. With the exception of these species, no Red Data Listed, provincially- or nationally protected or any other species of conservational significance were found to be present within the proposed pipeline route.

The remaining relatively natural small intermittent portions along the proposed pipeline route scored moderate EIS values and are therefore viewed as being conversationally significant for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, broader vegetation types and quaternary surface water catchment and drainage area.

It is the opinion of the specialist that the only potentially significant ecological impact associated with the continued impeding of the flow regimes of the significant ephemeral watercourses and drainage lines, 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.

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: CBA map. Free State Department of Economic, Small Business Development, Tourism and Environmental Affairs. Internal Report.

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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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www.climate-data.org

12. Details of the Specialist

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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.

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 Retiefs Nek no 123, outside Bethlehem, Free State Province.
- Completion of a specialist Grazing and Erosion Management Plan for the 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.