

Ecological Impact Assessment

Revised Report

**Luckhoff Municipal Waste Facility
Development, Luckhoff, Free State**

Province

August 2018

Compiled for:



Compiled by:

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Executive Summary

The project applicant, Letsemeng Local Municipality proposes to construct a new/additional waste facility for disposal of domestic and general waste from the town of Luckhoff which forms part of the Xhariep District Municipality, Free State Province. NSVT Consultants was appointed by the applicant as the independent Environmental Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) process.

Due to the nature of the potential impacts of the proposed development on the local ecology, an Ecological study is required. This is required in order to determine the potential presence of ecologically significant species, habitats or wetland areas within the proposed project footprint which may be affected by the proposed development. Proposed mitigation and management measures 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 Impact Assessment. Two site visits/assessments for the proposed alternative development footprint areas were conducted on 19 December 2017 and 18 January 2018. Although these dates form part of the growing season, the area has not necessarily received adequate follow up rain yet after the initial rainfall events. It must therefore be noted that the time of the assessment was not necessarily favourable for successful identification of all plant species individuals. It is recommended that an additional ecological walkthrough be conducted prior to commencement of the project during the flowering period of underground bulbous plant species. This will ensure that no provincially protected or significant species have potentially been omitted.

Methodology

The proposed assessment area was assessed on foot and visual observations/identifications were made of habitat conditions, ecologically sensitive areas and relevant species present. Species were listed and categorised as per the Red Data Species List; Protected Species List of the National Forests Act (Act 84 of 1998), Invasive Species List of the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species Regulations, 2014 and the Provincially Protected species of the 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

Three alternative potential locations have been identified for the proposed waste facility development around the outskirts of the town of Luckhoff. Alternative 1 (preferred) is approximately 17.7 ha in size while Alternatives 2 and 3 are approximately 11.4 ha and 15.6 ha in size respectively. All three the assessment areas are situated on the Remaining Extent of the Farm De Dorpsgronden van Luckhoff no 577 (SG 21 Digit Code: F0110000000057700000). The town of Luckhoff forms part of the Letsemeng Local Municipality which, in turn forms part of the Xhariep District Municipality, Free State Province.

The assessment areas fall inside the municipal urban edge. Access to Alternative 1 (preferred) is obtained via Rabie Street and a subsequent dirt road to the east while access to Alternatives 2 and 3 is also obtained via Rabie Street and a subsequent dirt road to the west.

According to SANBI (2006-), Alternatives 1 and 2 form part of the Northern Upper Karoo vegetation type (NKu 3) which mainly consists of a flat to slightly sloping shrubland, dominated by dwarf karoo shrubs and sparse grasses. This vegetation type is classified as least threatened because of its broad distribution and it being mostly excluded from being utilised for intensive agricultural activities (SANBI, 2006-).

The majority of Alternative 3 however falls within the Xhariep Karroid Grassland vegetation type (Gh 3) while only the most northerly portion forms part of the Northern Upper Karoo vegetation type (NKu 3) (SANBI, 2006-). The former vegetation type is mostly characterised by extensive flat to slightly undulating bottomland landscapes consisting of low- to medium-height open grassland mingled with small patches of dwarf karroid shrubland. It is also classified as least threatened (SANBI, 2006-).

'Ground truthing' conducted during the site visit however suggests that the broader area rather forms a transitional zone between the two vegetation types and that all three alternatives are more representative of the Northern Upper Karoo vegetation type (NKu 3).

The entire Alternative 1 as well as the southern portion of Alternative 3 fall within an Ecological Support Area one (ESA 1), while the northern portion of Alternative 3 as well as the entire Alternative 2 is classified as an Ecological Support Area two (ESA 2) in accordance with the Free State Provincial Spatial Biodiversity Plan 2017, which sets out biodiversity priority areas in the province. ESA's are areas that must be maintained in at least fair ecological condition (semi-natural/moderately modified state) in order to support the ecological functioning of a CBA or protected area or that play an important role in delivering ecosystem services (Collins, 2017).

Results and Conclusion

The proposed waste facility development and infrastructure will in all probability completely transform the majority of the existing surface vegetation on the final footprint alternative which is eventually decided upon. Although all three alternatives scored high PES values due to their relatively natural states, the Northern Upper Karoo vegetation type (NKu 3), within which they are situated, is classified as least threatened and the surrounding natural landscape associated with the vegetation type is vast and relatively homogenous.

Alternative 1 is however situated within an area classified as an Ecological Support Area one (ESA 1) in accordance with the Free State Provincial Spatial Biodiversity Plan, 2014. With the exception of a locally unique rocky ridge which traverses the eastern and southern portion of Alternative 1 (preferred), the area merely constitutes the upper commencement portion of a small, localised water catchment area which drains towards a seasonal watercourse and artificially built earth dam situated to the south-west. The proposed footprint is however small relative to the broader catchment and drainage area and the transformation of the proposed development footprint area should therefore not make a significant difference in the surface water drainage. Alternative 1 (preferred) therefore merely scored a moderate EIS value and is not necessarily viewed as being of high conservational significance for habitat preservation or ecological functionality persistence in support of the surrounding ecosystem, local water catchment or ESA. The identified rocky ridge however possesses locally unique habitat attributes and it is reasonably expected that it is utilised by various reptile species (snakes and lizards) as refuge and for breeding/persistence purposes. It is therefore recommended that a representative portion of the rocky ridge should be adequately

buffered out of the proposed development footprint area if practicably possible. This has been achieved with the final design layout as per heading 8.3.

Both Alternatives 2 and 3 are mainly situated within an area classified as an Ecological Support Area two (ESA 2) while the southern portion of Alternative 3 falls within an Ecological Support Area one (ESA 1). Numerous individual small seasonal drainage lines traverse Alternatives 2 and 3, which are associated with the localised drainage and catchment area of a significant seasonal watercourse located directly adjacent east of the two assessment areas. This seasonal watercourse plays an important role in the local and regional water catchment towards the Orange River. Locally distinct dense woody portions closer to the riparian zone of the seasonal watercourse also provide significant refuge and habitat for bird species, smaller antelope and other mammal species. Alternatives 2 and 3 therefore scored a high EIS value and are viewed as being of relatively high conservational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, local and regional water catchment and the ESA.

Individuals of the provincially protected species *Aloe broomii* were found to be present within the southern portion of Alternative 1 (preferred) while only a single individual of the provincially protected small shrub species *Euphorbia burmannii* was found on the rocky ridge. Further individuals of the species *Aloe broomii* as well as a single clump of the provincially protected species *Aloe claviflora* were also found to be present outside the south-eastern boundary of the assessment area. The original layout of Alternative 1 (preferred) was revised during August 2018. No site visit was conducted for the revised layout but it forms part of the broader homogenous landscape. Assumptions for the revised Alternative 1 (preferred) are therefore based on the results of the original layout. It is therefore recommended that a final ecological walkthrough be conducted to confirm the locations of all individuals of the provincially protected *Aloe* species on site and that they subsequently be removed prior to the commencement of the construction phase and adequately relocated to a suitable, similar open area.

The three provincially protected species *Aloe broomii* and, to a lesser extent, *Aloe claviflora* and *Euphorbia burmannii* are also sparsely scattered throughout Alternatives 2 and 3 while only a single individual of the provincially protected tree species *Boscia foetida* was found within Alternative 2.

No Red Data Listed-, nationally protected- or any other species of conservational significance were found to be present within the three assessment areas.

It is in the opinion of the specialist that the identified significant potential ecological impacts for Alternatives 2 and 3 associated with the transformation of the Ecological Support Area (ESA) as well as the impediment and contamination of the significant seasonal watercourse will be too high and cannot be suitably reduced and mitigated to within acceptable levels. Alternatives 2 and 3 should therefore not be viewed as ecologically feasible locations and are not recommended for environmentally responsible development.

The only identified significant potential ecological impacts for Alternative 1 (preferred) associated with the contamination of the watercourse and groundwater can be suitably reduced and mitigated to within acceptable levels. Alternative 1 (preferred) should therefore be viewed as the least ecologically intrusive potential footprint area which can be authorised for development. The project should therefore be considered by the competent authority for environmental authorisation and approval but only the footprint area of Alternative 1 (preferred) should be applied for.

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

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Abbreviations

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|-------|--|
| 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 |
| IBA | Important Bird Area |
| MAP | Mean Annual Precipitation |
| MAT | Mean Annual Temperature |
| 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) |
| PES | Present Ecological State |
| SANBI | South African National Biodiversity Institute |
| SDF | Spatial Development Framework |
| 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, Letsemeng Local Municipality proposes to construct a new/additional waste facility for disposal of domestic and general waste from the town of Luckhoff which forms part of the Xhariep District Municipality, Free State Province. Three alternative potential locations have been identified for the proposed development around the outskirts of the town. Alternative 1 (preferred) is approximately 17.7 ha in size while Alternatives 2 and 3 are approximately 11.4 ha and 15.6 ha in size respectively.

NSVT Consultants was appointed by the applicant as the independent Environmental Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) process.

Due to the nature of the potential impacts of the proposed development on the local ecology, an Ecological study is required. This is required in order to determine the potential presence of ecologically significant species, habitats or wetland areas within the proposed project footprint which may be affected by the proposed development. Proposed mitigation and management measures 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 Impact 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 also conducted of the information available on the relevant vegetation types and national/provincial conservation significance status associated with the proposed footprint areas.

2. Date and Season of Ecological Walkthrough/Site Assessment

Two site visits/assessments for the proposed alternative development footprint areas were conducted on 19 December 2017 and 18 January 2018. Although these dates form part of the growing season, the area has not necessarily received adequate follow up rain yet after the initial rainfall events. It must therefore be noted that the time of the assessment was not necessarily favourable for successful identification of all plant species individuals. It is recommended that an additional ecological walkthrough be conducted prior to commencement of the project during the flowering period of underground bulbous plant species. This will ensure that no provincially protected or significant species have potentially been omitted.

The original layout of Alternative 1 (preferred) was revised during August 2018. No site visit was conducted for the revised layout but it forms part of the broader homogenous landscape. Assumptions for the revised Alternative 1 (preferred) are therefore based on the results of the original layout.

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 three alternative potential development areas.
- 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 proposed assessment area was assessed on foot and visual observations/identifications were made of habitat conditions, ecologically sensitive areas and relevant species present.
- Species were listed and categorised as per the Red Data Species List; Protected Species List of the National Forests Act (Act 84 of 1998), Invasive Species List of the National Environmental Management: Biodiversity Act (Act 10 of 2004), Alien and Invasive Species Regulations, 2014 and the Provincially Protected species of the 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 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. These guidelines state that a wetland delineation procedure must identify the outer edge of the temporary zone of the wetland, which marks the boundary between the wetland and adjacent terrestrial areas and is that part of the wetland that remains 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 locating 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 and a protective buffer zone, beginning from the outer edge of the wetland temporary zone, must be designated as sensitive in a sensitivity map. The guidelines stipulate buffers to be delineated around the boundary of a wetland. A protective 32 m buffer zone, beginning from the outer edge of the wetland temporary zone, must be implemented and designated as sensitive within which no development must be allowed to occur.

6. Study Area

Three alternative potential locations have been identified for the proposed waste facility development around the outskirts of the town of Luckhoff. The original layout of Alternative 1 (preferred) was revised during August 2018. The revised Alternative 1 (preferred) is approximately 17.7 ha in size while Alternatives 2 and 3 are approximately 11.4 ha and 15.6 ha in size respectively. All three the assessment areas are situated on the Remaining Extent of the Farm De Dorpsgronden van Luckhoff no 577 (SG 21 Digit Code: F0110000000057700000). The town of Luckhoff forms part of the Letsemeng Local Municipality which, in turn forms part of the Xhariep District Municipality, Free State Province.

The assessment areas fall inside the municipal urban edge. Access to Alternative 1 (preferred) is obtained via Rabie Street and a subsequent dirt road to the east while access to Alternatives 2 and 3 is also obtained via Rabie Street and a subsequent dirt road to the west.

See locality map below.

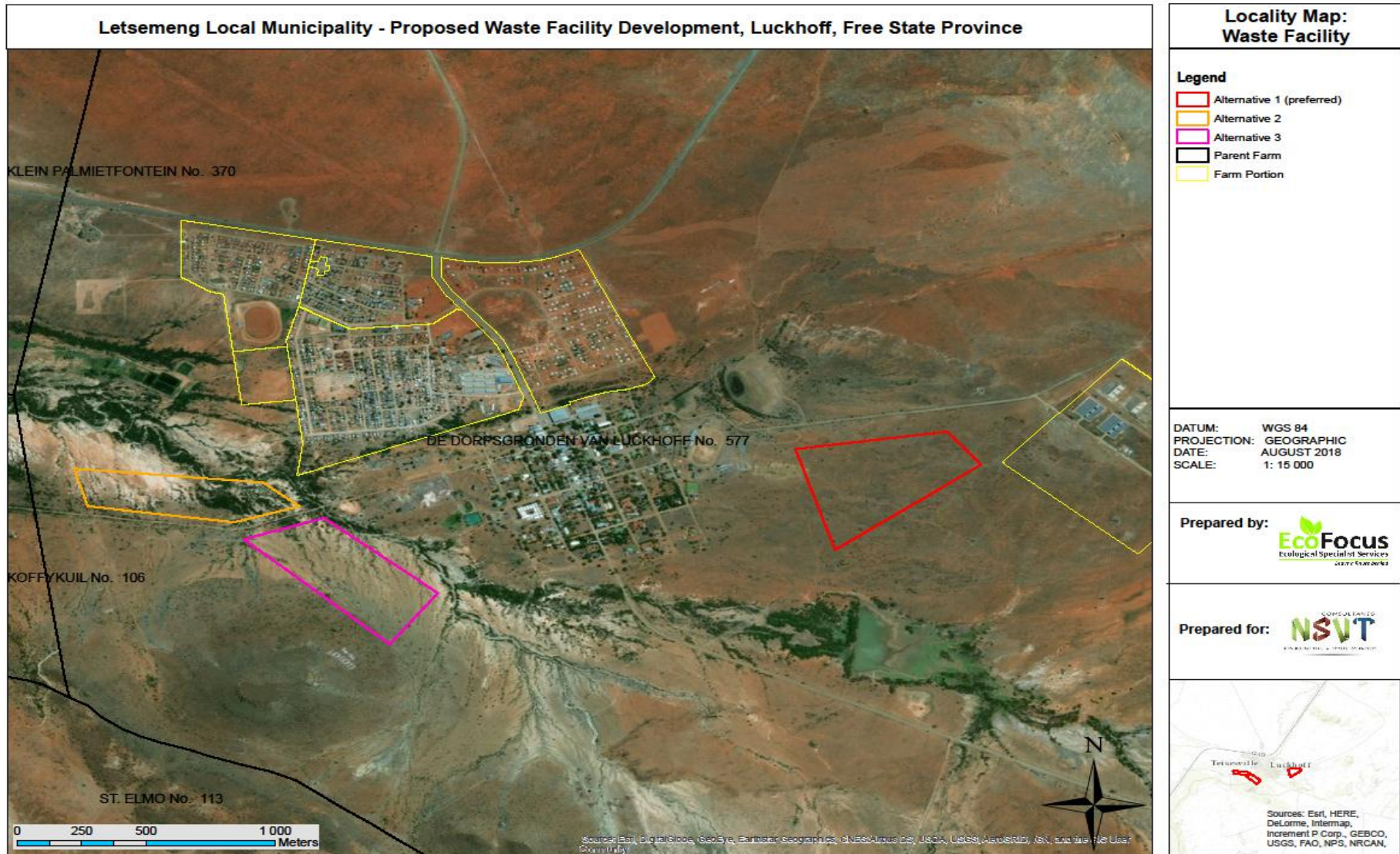


Figure 1: Locality map illustrating the three alternative assessment areas (see A3 sized map in the Appendices)

6.1. Climate

The rainfall of the region peaks during the summer months and the Mean Annual Precipitation (MAP) of the area is approximately 389 mm (www.climate-data.org). The maximum average monthly temperature is approximately 25°C in the summer months while the minimum average monthly temperature is approximately 9.3°C during the winter. Average maximum daily temperatures can reach up to 33.1°C in the summer months and dip to as low as 1°C during the winter. Frequent frost occurs during the winter months.

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 broader area forms part of a transitional zone between two different vegetation types. The first vegetation type is characterised by shales of the Volksrust formation and to a lesser extent the Prince Albert formation with Ae Ag and Fc land types while the second is characterised by alternating layers of sandstone and mudstone mostly of the Permian Adelaide Subgroup with Da or Db land types.

6.3. Vegetation and Conservation Status

According to SANBI (2006-), Alternatives 1 and 2 form part of the Northern Upper Karoo vegetation type (NKu 3) which mainly consists of a flat to slightly sloping shrubland, dominated by dwarf karoo shrubs and sparse grasses. This vegetation type is classified as least threatened because of its broad distribution and it being mostly excluded from being utilised for intensive agricultural activities (SANBI, 2006-).

The majority of Alternative 3 however falls within the Xhariep Karroid Grassland vegetation type (Gh 3) while only the most northerly portion forms part of the Northern Upper Karoo vegetation type (NKu 3) (SANBI, 2006-). The former vegetation type is mostly characterised by extensive flat to slightly undulating bottomland landscapes consisting of low- to medium-height open grassland mingled with small patches of dwarf karroid shrubland. It is also classified as least threatened (SANBI, 2006-).

'Ground truthing' conducted during the site visit however suggests that the broader area rather forms a transitional zone between the two vegetation types and that all three alternatives are more representative of the Northern Upper Karoo vegetation type (NKu 3).

The entire Alternative 1 as well as the southern portion of Alternative 3 fall within an Ecological Support Area one (ESA 1), while the northern portion of Alternative 3 as well as the entire Alternative 2 is classified as an Ecological Support Area two (ESA 2) in accordance with the Free State Provincial Spatial Biodiversity Plan 2017, which sets out biodiversity priority areas in the province. ESA's are areas that must be maintained in at least fair ecological condition (semi-natural/moderately modified state) in order to support the ecological functioning of a CBA or protected area or that play an important role in delivering ecosystem services (Collins, 2017).

The proposed waste facility development and infrastructure will in all probability completely transform the majority of the existing surface vegetation on the final footprint alternative which is eventually decided upon.

See vegetation and sensitivity maps below.

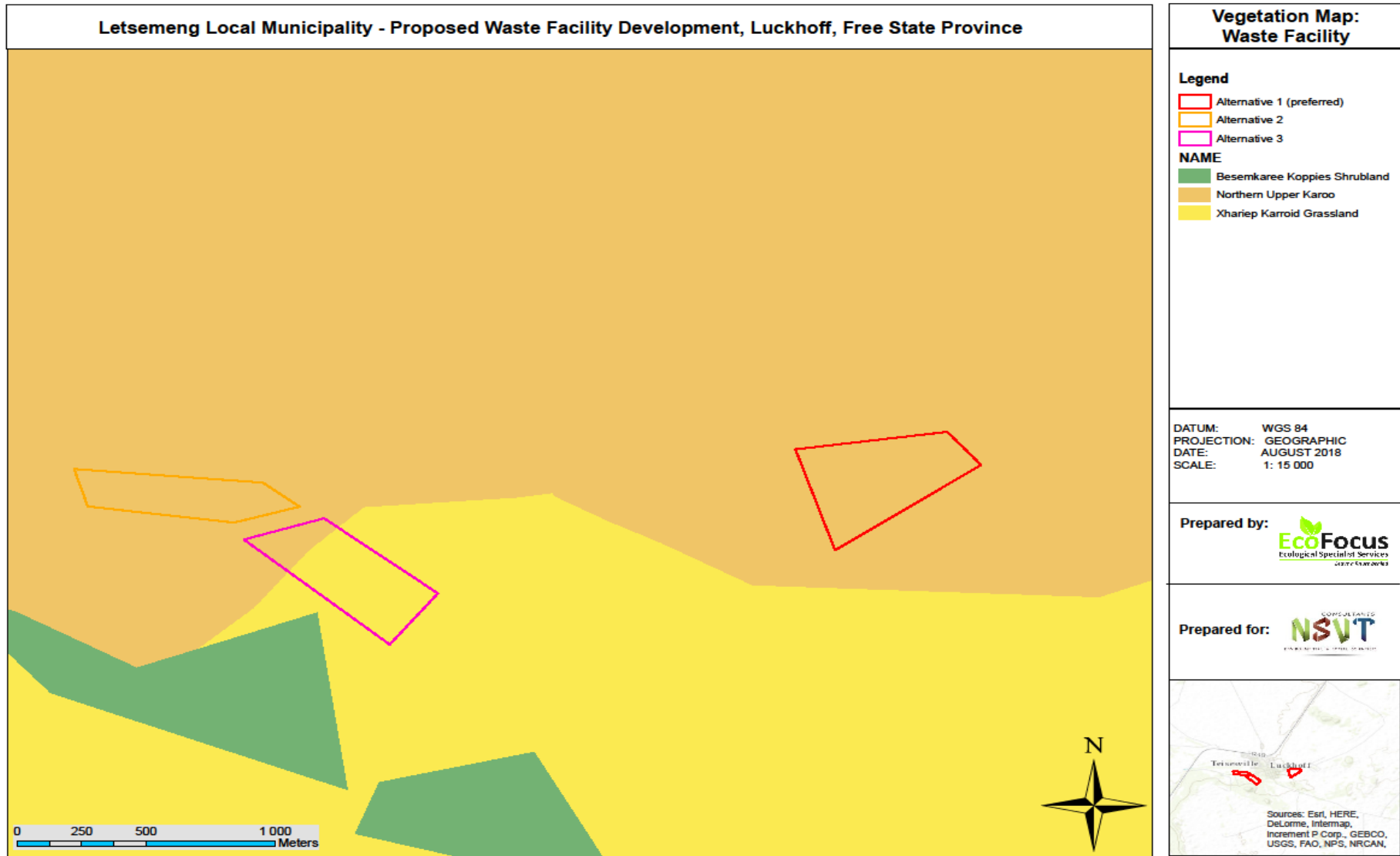


Figure 2: Vegetation map illustrating the vegetation types associated with the three alternative assessment areas (see A3 sized map in the Appendices)

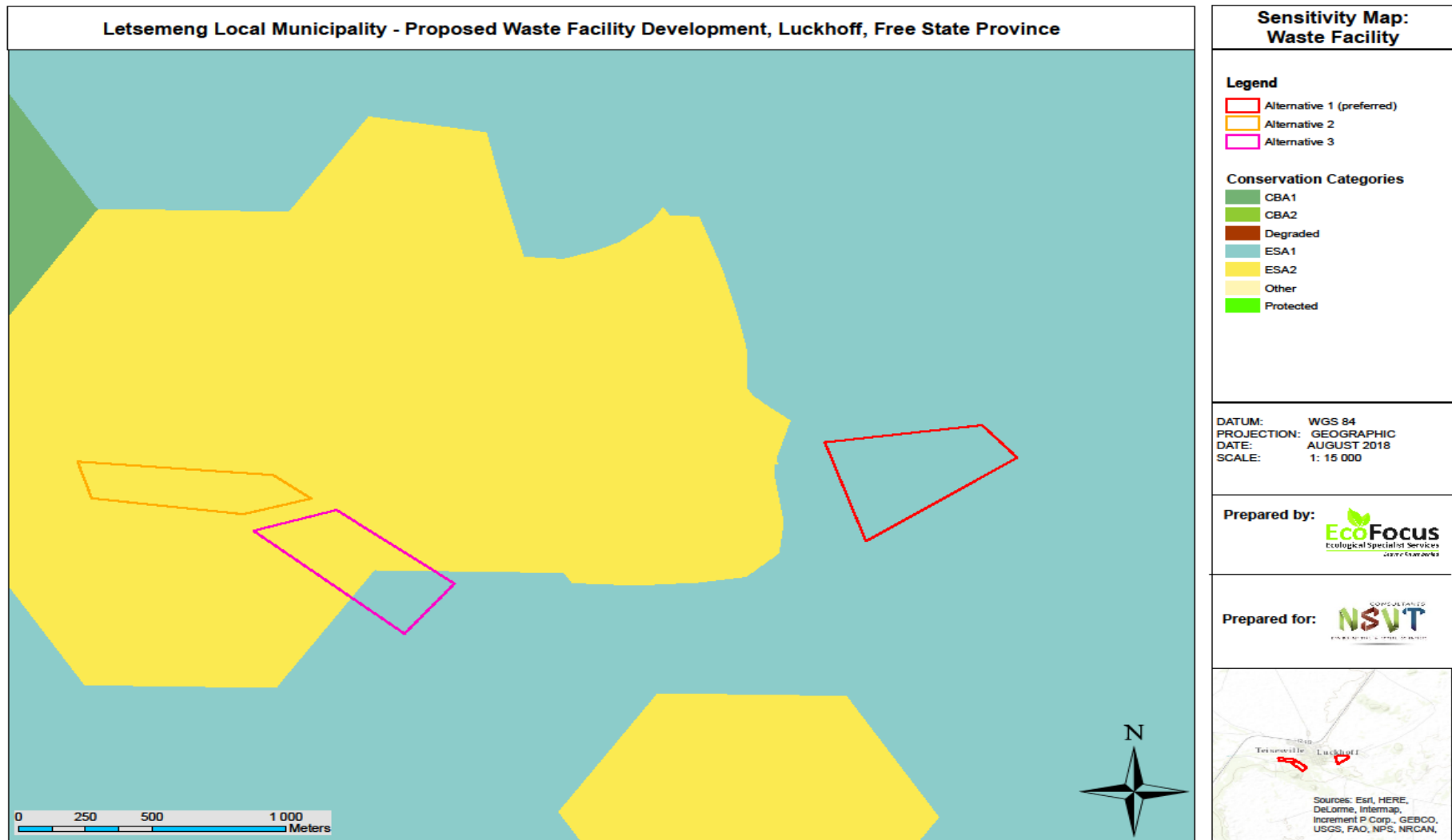


Figure 3: Sensitivity map illustrating the conservation statuses associated with the three alternative assessment areas (see A3 sized map in the Appendices)

7. Assumptions, Uncertainties and Gaps in Knowledge

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

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

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

- Uncertainty of prediction is critical at the data collection phase as observations and conclusions are made, only based on professional specialist opinion. Final certainty will only be obtained upon actual implementation of the proposed development. Adequate research, specialist experience and expertise should however minimise this uncertainty.
- Uncertainty of relevant decision making relates to the interpretation of provided information by relevant authorities during the EIA process. Continual two way communication and coordination between EAP's and relevant authorities should however decrease the

uncertainty of subjective interpretation. The importance of widespread/comprehensive consultation towards minimising the risk/possibility of omitting significant information and impacts is further stressed. The use of quantitative impact significance rating formulas (as utilised in this document) can further standardise the objective interpretation of results and limit the occurrence and scale of uncertainty and subjectivity.

- The principle of human nature provides for uncertainties and unpredictability with regards to the socio-economic impacts of the proposed development and the subsequent public reaction/opinion which will be received during the Public Participation Process (PPP).

Gaps in knowledge can be attributed to:

- Although the site visit date forms part of the growing season, the area has not necessarily received adequate follow up rain yet after the initial rainfall events. It must therefore be noted that the time of the assessment was not necessarily favourable for successful identification of all plant species individuals. It is recommended that an additional ecological walkthrough be conducted prior to commencement of the project during the flowering period of underground bulbous plant species. This will ensure that no provincially protected or significant species have potentially been omitted.
- The original layout of Alternative 1 (preferred) was revised during August 2018. No site visit was conducted for the revised layout but it forms part of the broader homogenous landscape. Assumptions for the revised Alternative 1 (preferred) are therefore based on the results of the original layout.
- 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

Alternative 1 (preferred) will be discussed separately of Alternatives 2 and 3 for reporting purposes.

8.1. Alternative 1 (preferred)

8.1.1. Current Existing Vegetation and Site Condition

The assessment area footprint is approximately 17.7 ha in size. A narrow, slightly elevated linear rocky ridge traverses the eastern and southern portion of the assessment area. This ridge constitutes a localised topographic highpoint which acts as a surface water drainage separation between the areas north and south the ridge. Surface water therefore respectively drains in a north-westerly and southerly direction away from the ridge. This has resulted in the assessment area constituting part of the upper commencement portion of a small, localised water catchment area which drains towards two watercourses and artificially built earth dams situated approximately 210 m to the south-west and 200 m to the north-west respectively. A number of small, first order ephemeral drainage lines also originate directly adjacent north of the assessment area which drain to the north of the ridge towards the artificially built earth dam and subsequent watercourse. These are however relatively small and would not necessarily contribute significant surface water runoff to the dam situated to the north-west. They also fall outside the development footprint and will therefore not be significantly impacted upon or their flow impeded.

The remainder of the assessment area, which constitutes the majority of the proposed development surface footprint, consists of a slightly to moderately sloping (towards the south) open shrubland, dominated by dwarf karoo shrubs with a sparse grass layer. A woody component is virtually completely absent with the exception of sporadic individuals of the small shrub species *Searsia ciliata*. The area is in a relatively natural ecological state associated with the Northern Upper Karoo vegetation type (NKu 3). The broader surrounding landscape is also relatively homogenous and in a natural state. Dominant shrubs are *Euryops subcarnosus*, *Wahlenbergia nodosus*, *Hertia pallens* & *Ruschia spinosa*. Other small shrubs species also found to be present include *Salsola aphylla*, *Pentzia spp.*, *Senecio hastatus* & *Lycium cinereum* while forbs include *Felicia muricata* & *Crotolaria orientalis* individuals. Individuals of the provincially protected species *Aloe broomii* & *A claviflora* were found to be sporadically present within the southern and western portion of the assessment area. It is recommended that a final ecological walkthrough be conducted to confirm the locations of all individuals of these species on site and that they subsequently be removed prior to the commencement of the construction phase and adequately relocated to a suitable, similar open area. The sparse grass layer is mainly dominated by the species *Aristida congesta* as well as other *Aristida*

spp. Eragrotis spp. and *Stpagrostis spp.* are also present but to a significantly lesser extent. No Red Data Listed-, nationally protected- or any other species of conservational significance were found to be present within the assessment area.

The open shrubland is utilised by various smaller antelope species such as Steenbok (*Raphicerus campestris*), burrowing mammals as well as numerous reptiles such as lizards, snakes & tortoises for foraging/persistence habitat but, their mobility along with the vast, continuous surrounding natural landscape allows for individuals to simply leave an area where disturbance is taking place and disperse to other similar, adequate areas. The assessment area does not fall within any Important Bird Areas (IBA) as per the latest IBA map obtained from the Birdlife SA website (www.birdlife.org.za/conservation/important_bird_areas/iba-map). No unique or specialised bird habitats were observed either.



Figure 4: Image illustrating the landscape of the open shrubland within Alternative 1 (preferred)

The shrub, forbs and grass species diversity of the rocky ridge is relatively similar to that of the open shrubland. The grass layer is however even sparser and the small shrub species *Searsia ciliata* is significantly more prominent on the ridge while a number of individuals of the woody shrub species *Diospyros lycioides* & *Euclea undulata* are also present throughout the ridge. Two individual shrubs of the woody species *Ziziphus mucronata* as well as a single individual of the provincially protected small shrub species *Euphorbia burmannii* were also found to be present on the ridge. The dwarf shrub species *Thesium hystrix* is also present on the ridge while being absent from the open shrubland.

Although not necessarily being conservationally significant, this rocky ridge possesses locally unique habitat attributes due its increased rockiness and it is reasonably expected that it is utilised by various specialised reptile species (snakes and lizards) as refuge and for breeding/persistence purposes. It is therefore recommended that a representative portion of the rocky ridge should be adequately buffered out of the proposed development footprint area if practicably possible.



Figure 5: Image illustrating the landscape of the rocky ridge which traverses the eastern and southern portion of Alternative 1 (preferred)

Table 5: Species list for Alternative 1 (preferred) of the proposed development (Provincially protected species highlighted in yellow)

| Species name | | |
|--------------------------|------------------------------|----------------------------|
| Graminoids | Forbs & small shrubs | Shrubs & trees |
| <i>Aristida congesta</i> | <i>Aloe broomii</i> | <i>Diospyros lycioides</i> |
| <i>Aristida spp.</i> | <i>Aloe claviflora</i> | <i>Euclea undulata</i> |
| <i>Eragrostis spp.</i> | <i>Crotolaria orientalis</i> | <i>Searsia ciliata</i> |
| <i>Stipagrostis spp.</i> | <i>Euphorbia burmannii</i> | <i>Ziziphus mucronata</i> |
| - | <i>Euryops subcarnosus</i> | - |
| - | <i>Felicia muricata</i> | - |
| - | <i>Hertia pallens</i> | - |
| - | <i>Lycium cinereum</i> | - |
| - | <i>Pentzia spp.</i> | - |

| | | |
|---|-----------------------------|---|
| - | <i>Ruschia spinosa</i> | - |
| - | <i>Salsola aphylla</i> | - |
| - | <i>Senecio hastatus</i> | - |
| - | <i>Thesium hystrix</i> | - |
| - | <i>Wahlenbergia nodosus</i> | - |

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

The Present Ecological State (PES) of Alternative 1 (preferred) is classified as Class A as it is unmodified, natural and pristine.

The relevant vegetation type is classified as least threatened and although the assessment area is situated within an area classified as an Ecological Support Area one (ESA 1), the surrounding natural landscape is vast and relatively homogenous. Although the assessment area constitutes part of the upper commencement portion of a small, localised water catchment area which drains towards a watercourse and artificially built earth dams situated to the south-west and north-west respectively, the proposed footprint is small relative to the broader catchment and drainage area of the relevant watercourse. A gravel berm around the eastern boundary of the assessment area and suitable stormwater channelling system around the other boundaries will also be implemented which will accumulate and channel/divert surface water runoff towards the south for dispersal. The transformation of the proposed development footprint area should therefore not make a significant difference in surface water drainage towards the relevant watercourses and artificially built earth dams. The Ecological Importance and Sensitivity (EIS) of Alternative 1 (preferred) is therefore classified as Class C (moderate) as it is ecologically important and sensitive on local scale mainly due to the presence of the locally unique rocky ridge and subsequent small, localised water catchment area as well as the presence of provincially protected species. Biodiversity is however still relatively ubiquitous within the broader area.

The assessment area is therefore not necessarily viewed as being of high conservational significance for habitat preservation or ecological functionality persistence in support of the surrounding ecosystem, broader vegetation type or local water catchment.

8.2. Alternatives 2 and 3

8.2.1. Current Existing Vegetation and Site Condition

Alternatives 2 and 3 are approximately 11.4 ha and 15.6 ha in size respectively. Both alternatives form part of a broad localised water catchment and drainage area consisting of numerous individual small seasonal water drainage lines which originate from the adjacently located hills and are scattered throughout the landscape. This catchment and drainage lines channel and drain surface water runoff into a significantly large second order ephemeral watercourse located directly adjacent east of the two assessment areas. This watercourse, in combination with other adjoining inflow watercourses, eventually drains into the Orange River situated approximately 24 km to the west and therefore plays an important role in the local and regional water catchment.

The two assessment areas mainly constitute undulating shrubland associated with the catchment and drainage area which is dominated by dwarf karoo shrubs with a very sparse grass layer. A well-developed open woody component is also present which significantly increases in density within the larger drainage lines and closer to the riparian zone of the seasonal watercourse. The woody component further away from the seasonal watercourse is mainly dominated by multi-stemmed shrubs and small trees of the species *Vachellia tortilis* & *Searsia burchellii*. The woody dominance of these two species is however replaced by a significant increase in density of taller shrubs and trees of the species *Vachellia karroo* within the larger drainage lines and closer to the riparian zone of the seasonal watercourse. Sporadic individuals of the tree species *Searsia leptodictya*, *Ziziphus mucronata* & *Schinus molle* (alien) were also found to be present closer to the riparian zone of the seasonal watercourse. A single individual of the provincially protected tree species *Boscia foetida* was found within Alternative 2.

The shrubland is mainly dominated by the shrub species *Salsola aphylla*, *Phaeoptilum spinosum*, *Lycium villosum*, *Phyllobolus sp.*, *Ruschia sp.* & *Pentzia spp.* Other small shrubs and forbs also found to be present include *Rhigozum trichotomum*, *Asparagus striatus*, *Cadaba aphylla*, *Ruschia hamata*, *Thesium hystrix*, *Crotolaria orientalis*, *Orbeopsis lutea*, *Euphorbia burmannii* (provincially protected), *Malephora sp.*, *Hertia pallens* & *Kalanchoe rotundifolia*. The two provincially protected species *Aloe broomii* and, to a lesser extent, *Aloe claviflora* as well as *Opuntia imbricata* (alien) are also sparsely scattered throughout the assessment areas. The very sparse grass layer mainly consists *Aristida spp* & *Stipagrostis spp* while the species *Digitaria argyrograpta* & *Heteropogon contortus* are also

present but to a significantly lesser extent. No Red Data Listed-, nationally protected- or any other species of conservational significance were found to be present within the two assessment areas.

The western portion of Alternative 3 houses a number of informal livestock holding camps while a single dirt road respectively forms the southern and northern boundaries of the two alternatives. Such anthropogenic activities tend to cause an ecological 'edge effect' which negatively impacts on the urban/rural interface area and both alternatives therefore are in a slightly disturbed state due to continued grazing of livestock.

Although the assessment areas do not fall within any Important Bird Areas (IBA) as per the latest IBA map obtained from the Birdlife SA website (www.birdlife.org.za/conservation/important_bird_areas/iba-map), the locally distinct dense woody portions closer to the riparian zone of the ephemeral watercourse provide significant refuge and habitat for bird species, smaller antelope and other mammal species.





Figure 6: Two images illustrating the undulating catchment and drainage area landscape within Alternatives 2 and 3





Figure 7: Two images illustrating the significant increase in woody density closer to the riparian zone of the seasonal watercourse within Alternatives 2 and 3

Table 6: Species list for Alternatives 2 and 3 of the proposed development (Provincially protected species highlighted in yellow)

| Species name | | |
|-------------------------------|-------------------------------|----------------------------|
| Graminoids | Forbs & small shrubs | Shrubs & trees |
| <i>Aristida spp.</i> | <i>Aloe broomii</i> | <i>Boscia foetida</i> |
| <i>Digitaria argyrograpta</i> | <i>Aloe claviflora</i> | <i>Schinus molle</i> |
| <i>Heteropogon contortus</i> | <i>Asparagus striatus</i> | <i>Searsia burchellii</i> |
| <i>Stipagrostis spp.</i> | <i>Cadaba aphylla</i> | <i>Searsia leptodictya</i> |
| - | <i>Crotolaria orientalis</i> | <i>Vachellia karroo</i> |
| - | <i>Euphorbia burmannii</i> | <i>Vachellia tortilis</i> |
| - | <i>Hertia pallens</i> | <i>Ziziphus mucronata</i> |
| - | <i>Kalanchoe rotundifolia</i> | - |
| - | <i>Lycium villosum</i> | - |
| - | <i>Malephora sp.</i> | - |
| - | <i>Opuntia imbricata</i> | - |
| - | <i>Orbeopsis lutea</i> | - |
| - | <i>Pentzia spp.</i> | - |
| - | <i>Phaeoptilum spinosum</i> | - |
| - | <i>Phyllobolus sp.</i> | - |

| | | |
|---|-----------------------------|---|
| - | <i>Rhigozum trichotomum</i> | - |
| - | <i>Ruschia hamata</i> | - |
| - | <i>Ruschia sp.</i> | - |
| - | <i>Salsola aphylla</i> | - |
| - | <i>Thesium hystrix</i> | - |

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

The Present Ecological State (PES) of Alternatives 2 and 3 is classified as Class B as they are largely natural. A small change in natural habitats and biota may have taken place due to grazing practices and the ecological 'edge effect' caused by anthropogenic activities but the ecosystem functionality has remained essentially unchanged.

The relevant vegetation types are classified as least threatened. Both of the assessment areas are mainly situated within an area classified as an Ecological Support Area two (ESA 2) while the southern portion of Alternative 3 falls within an Ecological Support Area one (ESA 1). The numerous drainage lines present within the two assessment areas, which are associated with the significant ephemeral watercourse located directly adjacent east, play an important role in the local and regional water catchment towards the Orange River. The locally distinct dense woody portions closer to the riparian zone of the seasonal watercourse also provide significant refuge and habitat for bird species, smaller antelope and other mammal species. The Ecological Importance and Sensitivity (EIS) of Alternatives 2 and 3 is therefore classified as Class B (high) as they are ecologically important and sensitive on provincial scale due to their important role in the local and regional water catchment. Biodiversity of the dense woody portions closer to the riparian zone of the seasonal watercourse is also locally distinct and may be sensitive to habitat modifications.

The two assessment areas are therefore viewed as being of relatively high conservational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem and local and regional water catchment. Alternatives 2 and 3 are therefore not recommended for development.

8.3. Ecological Sensitivity Map

The sensitivity map below illustrates the locally unique rocky ridge, the delineation of the small first order ephemeral water drainage lines as well as the provincially protected *Aloe* species locations within Alternative 1 (preferred).

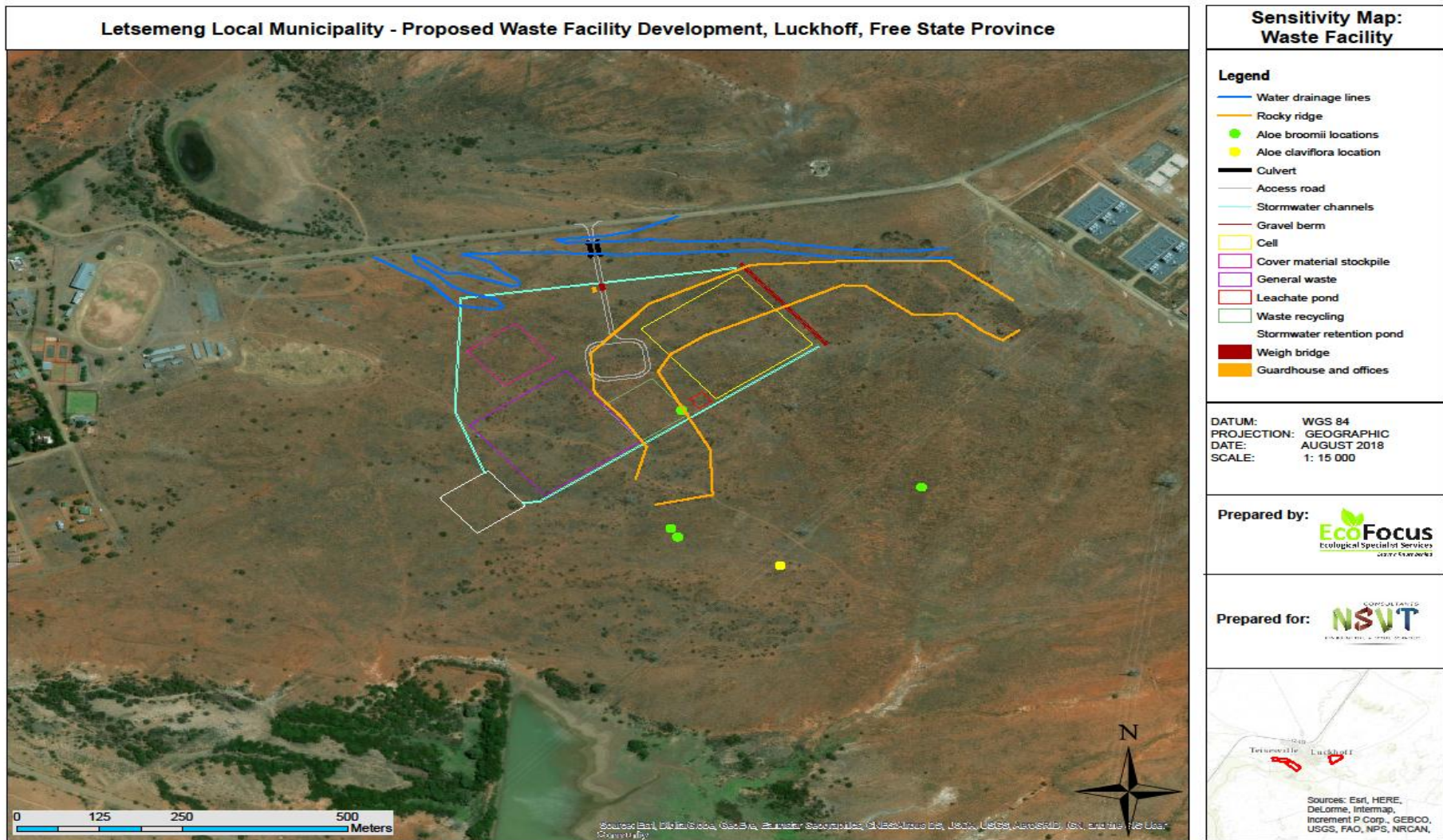


Figure 8: Sensitivity map illustrating the locally unique rocky ridge, the delineation of the small first order ephemeral water drainage lines as well as the provincially protected *Aloe* species locations within Alternative 1 (preferred) (see A3 sized map in the Appendices)

9. Ecological Impact Assessment

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

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

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

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

9.1. Construction Phase

Transformation of terrestrial vegetation on the assessment area associated with the Northern Upper Karoo vegetation type (NKu 3)

Alternative 1 (preferred) is approximately 17.7 ha in size while Alternatives 2 and 3 are approximately 11.4 ha and 15.6 ha in size respectively. The proposed waste facility development and infrastructure will in all probability completely transform the majority of the existing surface vegetation on the final footprint alternative which is eventually decided upon.

Although all three alternatives scored high PES values, the relevant vegetation type is classified as least threatened and the surrounding natural landscape associated with the vegetation type is vast and relatively homogenous. The proposed development footprints are therefore small relative to the larger landscape occupied by the relevant vegetation type and the significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Transformation of Ecological Support Areas (ESA's) associated with the three assessment areas

Alternative 1 (preferred) is approximately 17.7 ha in size while Alternatives 2 and 3 are approximately 11.4 ha and 15.6 ha in size respectively. The proposed waste facility development and infrastructure will in all probability completely transform the majority of the existing surface vegetation on the final footprint alternative which is eventually decided upon.

Although Alternative 1 is situated within an area classified as an Ecological Support Area one (ESA 1) in accordance with the Free State Provincial Spatial Biodiversity Plan, 2014, the surrounding natural landscape is vast and relatively homogenous and the area merely constitutes the upper commencement portion of a small, localised water catchment area which drains towards a watercourse and artificially built earth dam situated to the south-west. Alternative 1 (preferred) therefore merely scored a moderate EIS value and is therefore not necessarily viewed as being of high conservational significance for habitat preservation or ecological functionality persistence in support of the surrounding ecosystem, local water catchment or ESA.

Both Alternatives 2 and 3 are mainly situated within an area classified as an Ecological Support Area two (ESA 2) while the southern portion of Alternative 3 falls within an Ecological Support Area one (ESA 1). The numerous drainage lines present on Alternatives 2 and 3, which are associated with the significant seasonal watercourse located directly adjacent east, play an important role in the local and regional water catchment towards the Orange River. The locally distinct dense woody portions closer to the riparian zone of the seasonal watercourse associated with Alternatives 2 and 3 also provide significant refuge and habitat for bird species, smaller antelope and other mammal species. These two alternatives therefore scored a high EIS value and are viewed as being of relatively high conservational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, local and regional water catchment and the ESA. The significance of this potential impact will be medium for Alternative 1 (preferred) but medium-high for Alternatives 2 and 3.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Destruction/damage to Red Data Listed, nationally or provincially protected species individuals associated with the associated with the Northern Upper Karoo vegetation type (NKu 3)

Alternative 1 (preferred) is approximately 17.7 ha in size while Alternatives 2 and 3 are approximately 11.4 ha and 15.6 ha in size respectively. The proposed waste facility development and infrastructure will in all probability completely transform the majority of the existing surface vegetation on the final footprint alternative which is eventually decided upon.

Individuals of the provincially protected species *Aloe broomii* were found to be present within the southern portion of Alternative 1 (preferred) while only a single individual of the provincially protected small shrub species *Euphorbia burmannii* was found on the rocky ridge. Further individuals of the species *Aloe broomii* as well as a single clump of the provincially protected species *Aloe claviflora* were also found to be present outside the south-eastern boundary of the assessment area. The original layout of Alternative 1 (preferred) was revised during August 2018. No site visit was conducted for the revised layout but it forms part of the broader homogenous landscape. Assumptions for the revised Alternative 1 (preferred) are therefore based on the results of the original layout.

The three provincially protected species *Aloe broomii* and, to a lesser extent, *Aloe claviflora* and *Euphorbia burmannii* are sparsely scattered throughout Alternatives 2 and 3 while only a single individual of the provincially protected tree species *Boscia foetida* was found within Alternative 2.

No Red Data Listed-, nationally protected- or any other species of conservational significance were found to be present within the three assessment areas and the significance of this potential impact will therefore be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Transformation of locally unique and distinct habitats for birds, reptiles and mammal species associated with the three assessment areas

Alternative 1 (preferred) is approximately 17.7 ha in size while Alternatives 2 and 3 are approximately 11.4 ha and 15.6 ha in size respectively. The proposed waste facility development and infrastructure will in all probability completely transform the majority of the existing surface vegetation on the final footprint alternative which is eventually decided upon.

The rocky ridge within Alternative 1 (preferred) possesses locally unique habitat attributes and it is reasonably expected that it is utilised by various reptile species (snakes and lizards) as refuge and for breeding/persistence purposes.

The locally distinct dense woody portions closer to the riparian zone of the seasonal watercourse associated with Alternatives 2 and 3 provide significant refuge and habitat for bird species, smaller antelope and other mammal species.

The significance of this potential impact will therefore medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Alien invasive species establishment

The three assessment areas and surrounding natural areas could potentially be prone to significant alien invasive species establishment due to disturbances caused by construction activities. The sizes of the assessment areas are however relatively small compared to the remaining surrounding natural areas.

Due to the presence of the seasonal watercourse directly adjacent east of Alternatives 2 and 3, the areas could be more susceptible to the spreading of alien invasive species than Alternative 1 (preferred). The significance of this potential impact will therefore merely be low for Alternative 1 (preferred) but medium for Alternatives 2 and 3.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Surface material erosion

The three assessment areas and surrounding natural areas could potentially be prone to surface soil erosion due to the loosening of materials and removal of vegetation during construction which usually binds surface material. Due to the moderately sloping topography of the water catchment and drainage area associated with Alternatives 2 and 3, the risk of erosion is relatively high and the significance of this potential impact will be medium while it will merely be low for Alternative 1 (preferred) because of its slightly to moderately sloping topography.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Dust generation and emissions

The activities associated with the proposed project construction phase could potentially result in significant fugitive dust emissions due to vegetation removal. This could spread into the surrounding natural areas but the significance of this potential impact will merely be low.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Impeding of the water catchment areas and identified watercourses' flow regimes

The proposed development could cause impediment of the catchment areas. Alternative 1 (preferred) merely constitutes the upper commencement portion of a small, localised water catchment area which drains towards a watercourse and artificially built earth dam situated to the south-west. The proposed footprint is small relative to the broader catchment and drainage area of the relevant watercourse and the transformation of the proposed development footprint area should therefore not make a significant difference in surface water drainage towards the relevant watercourse and artificially built earth dam.

The numerous drainage lines present on the Alternatives 2 and 3, which are associated with the significant seasonal watercourse located directly adjacent east, however play an important role in the local and regional water catchment towards the Orange River. The proposed development could therefore potentially significantly impede the catchment.

The significance of this potential impact will merely be low for Alternative 1 (preferred) but medium for Alternatives 2 and 3.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Contamination of the watercourses and subsequent reduction of surface water quality

Dirty water runoff from the assessment area during the construction phase could potentially move into the watercourses which could contaminate and negatively impact on the water quality and subsequent ecological functionality of the area. The watercourse associated with Alternative 1 (preferred) is situated approximately 250 m to the south of the assessment area and should therefore not be adversely affected. The watercourse associated with Alternatives 2 and 3 is located directly adjacent east of the two assessment areas and could therefore be significantly impacted

upon by the development. The significance of this potential impact will merely be low for Alternative 1 (preferred) but medium for Alternatives 2 and 3.

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 or new ecological impacts associated with the operational phase over and above the already discussed significant long term impacts of the operational phase. The transformation of the ESA's was discussed under the construction phase impact section as a long term impact which will continue throughout the entire lifespan and operational phase of the proposed project.

A number of identified potential ecological impacts could however change in nature and increase in significance from the construction phase into the operational phase and will continue throughout while a few additional potential ecological impact could additionally take place during the operational phase.

Ecological degradation and alien invasive species establishment due to the ecological 'edge effect' caused by the development

The natural areas surrounding the proposed development footprint could potentially be prone to continued significant ecological degradation and alien invasive species establishment due to the ecological 'edge effect' caused by continuous disturbances from operational activities. Waste facilities tend to decrease the ecological integrity of the immediately surrounding landscape due to inadequate containment of light weighted plastics and other waste products which undesirably get dispersed into the surrounding environment and subsequently impact on the ecology. The significance of this potential impact will therefore be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Death of wild animals due to ingestion of light weighted plastics and other waste products

Wild animals could inadvertently ingest light weighted plastics and other waste products which have been undesirably dispersed into the surrounding natural area. Such ingestion could cause serious physiological harm or even death. The significance of this potential impact will be medium.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Continued impeding of the water catchment areas and identified watercourses' flow regimes

Once the construction of the development been completed, the proposed development could potentially result in continued impediment of the flow regime of the identified watercourse.

Alternative 1 (preferred) however merely constitutes the upper commencement portion of a small, localised water catchment area which drains towards a watercourse and artificially built earth dam situated to the south-west. The proposed footprint is small relative to the broader catchment and drainage area of the relevant watercourse and the transformation of the proposed development footprint area should therefore not make a significant difference in surface water drainage towards the relevant watercourse and artificially built earth dam.

The numerous drainage lines present on the Alternatives 2 and 3, which are associated with the significant seasonal watercourse located directly adjacent east, however play an important role in the local and regional water catchment towards the Orange River. The proposed development could therefore potentially significantly impede the catchment over an extended period of time. The significance of this potential impact will merely be medium for Alternative 1 (preferred) but medium-high for Alternatives 2 and 3.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Continued contamination of the watercourses and subsequent reduction of surface water quality

Dirty water runoff from the assessment area during the operational phase could potentially continue to move into the watercourses which could continuously contaminate and negatively impact on the water quality and subsequent ecological functionality of the area. The watercourse associated with Alternative 1 (preferred) is situated approximately 250 m to the south of the assessment area but could still be adversely affected over an extended period of time. The watercourse associated with Alternatives 2 and 3 is located directly adjacent east of the two assessment areas and could therefore be significantly and continuously impacted upon by the development. The significance of this potential impact will be medium for Alternative 1 (preferred) but medium-high for Alternatives 2 and 3.

Mitigation measures to reduce impacts are recommended under heading 9.4.

Contamination of groundwater and subsequent reduction of groundwater quality towards the watercourses to the south and north

Leakages or seepages of contaminated liquid waste materials disposed of at the site during the operational phase could potentially infiltrate into the groundwater system and result in significant continued chemical and biological contamination and reduction in groundwater quality. The area is

however located on underlying dolerite materials which will reduce the likelihood of significant seepage. The significance of potential contamination of groundwater will be medium-high to high.

Mitigation measures to reduce impacts are recommended under heading 9.4.

9.3. Cumulative Impacts

The majority of the potential cumulative impacts associated with the proposed development along with the existing waste facility should not be significantly high. The development of the proposed waste facility along with the existing facility could however potentially add significant cumulative impacts on groundwater contamination and quality as well as on contamination of local surface water catchment and drainage if not adequately managed. Adequate implementation and management of the recommended mitigation measures should however be able to reduce anticipated cumulative impacts.

The management and/or decommissioning of the existing waste facility situated west of the town should also be adequately managed and completed in order to reduce the current negative impacts being caused.

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 7: Environmental Risk and Significance Ratings

| | Alternative 1 (preferred) | Alternative 2 | Alternative 3 |
|--|---|---------------|---------------|
| Identified Environmental Impact | Transformation of terrestrial vegetation on the assessment area associated with the Northern Upper Karoo vegetation type (NKu 3) | | |
| Magnitude of Negative or Positive Impact | Low (4) | Low (4) | Low (4) |
| Duration of Negative or Positive Impact | Long term (4) | Long term (4) | Long term (4) |
| Extent of Positive or Negative Impact | Local (2) | Local (2) | Local (2) |
| Irreplaceability of Natural Resources being impacted upon | Low (2) | Low (2) | Low (2) |
| Reversibility of Impact | Moderate (3) | Moderate (3) | Moderate (3) |
| Probability of Impact Occurrence | High (4) | High (4) | High (4) |
| Cumulative Impact Rating prior to mitigation | Low | Low | Low |

| Environmental Significance Score and Rating prior to mitigation | Medium (60) | Medium (60) | Medium (60) |
|---|--|-------------|-------------|
| Mitigation Measures to be implemented | <p>It is recommended that Alternative 1 (preferred) be applied for, for development purposes.</p> <p>Alternatives 2 and 3 are therefore not recommended for development.</p> <p>It is recommended that a representative portion of the rocky ridge should be adequately buffered out of the proposed development footprint area. This has been achieved with the final design layout as per heading 8.3.</p> <p>The project construction footprint must be kept as small as practicably possible to reduce the actual surface impact on vegetation and no unnecessary/unauthorised footprint expansion into the surrounding areas may take place.</p> <p>No site construction camp to be established in any natural surrounding areas outside the proposed development area. Site camps only to be established within the proposed development footprint.</p> <p>Adequately fence off the construction area and ensure that no construction activities, machines or equipment operate or impact outside the fenced off area.</p> <p>Existing roads and farm tracks in close proximity to the proposed project area must be used during construction. No new roads or tracks to be constructed or implemented through any of the surrounding natural areas.</p> | | |

| | | | |
|--|--|----------------------|----------------------|
| Cumulative Impact Rating after mitigation implementation | Low | Low | Low |
| Environmental Significance Score and Rating after mitigation implementation | Low (48) | Low (48) | Low (48) |
| | | | |
| | Alternative 1 (preferred) | Alternative 2 | Alternative 3 |
| Identified Environmental Impact | Transformation of Ecological Support Areas (ESA's) associated with the three assessment areas | | |
| Magnitude of Negative or Positive Impact | Low (4) | High (8) | High (8) |
| Duration of Negative or Positive Impact | Long term (4) | Long term (4) | Long term (4) |
| Extent of Positive or Negative Impact | Local (2) | Regional (3) | Regional (3) |
| Irreplaceability of Natural Resources being impacted upon | Low (2) | Moderate (3) | Moderate (3) |
| Reversibility of Impact | Moderate (3) | Moderate (3) | Moderate (3) |

| | | | |
|--|--|------------------|------------------|
| Probability of Impact Occurrence | High (4) | High (4) | High (4) |
| Cumulative Impact Rating prior to mitigation | Low | Medium | Medium |
| Environmental Significance Score and Rating prior to mitigation | Medium (60) | Medium-High (84) | Medium-High (84) |
| Mitigation Measures to be implemented | <p>It is recommended that Alternative 1 (preferred) be applied for, for development purposes.</p> <p>Alternatives 2 and 3 are therefore not recommended for development.</p> <p>It is recommended that a representative portion of the rocky ridge should be adequately buffered out of the proposed development footprint area. This has been achieved with the final design layout as per heading 8.3.</p> <p>The project construction footprint must be kept as small as practicably possible to reduce the actual surface impact on vegetation and no unnecessary/unauthorised footprint expansion into the surrounding areas may take place.</p> <p>No site construction camp to be established in any natural surrounding areas outside the proposed development area. Site camps only to be established within the proposed development footprint.</p> <p>Adequately fence off the construction area and ensure that no construction activities, machines or equipment operate or</p> | | |

| | | | |
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| | <p>impact outside the fenced off area.</p> <p>Existing roads and farm tracks in close proximity to the proposed project area must be used during construction. No new roads or tracks to be constructed or implemented through any of the surrounding natural areas.</p> | | |
| Cumulative Impact Rating after mitigation implementation | Low | Medium | Medium |
| Environmental Significance Score and Rating after mitigation implementation | Low (48) | Medium-High (76) | Medium-High (76) |
| | | | |
| | Alternative 1 (preferred) | Alternative 2 | Alternative 3 |
| Identified Environmental Impact | Destruction/damage to Red Data Listed, nationally or provincially protected species individuals associated with the associated with the Northern Upper Karoo vegetation type (NKu 3) | | |
| Magnitude of Negative or Positive Impact | Very Low (2) | Low (4) | Low (4) |
| Duration of Negative or Positive Impact | Long term (4) | Long term (4) | Long term (4) |
| Extent of Positive or Negative Impact | Site specific (1) | Site specific (1) | Site specific (1) |

| | | | |
|--|---|--------------|--------------|
| Irreplaceability of Natural Resources being impacted upon | Moderate (3) | Moderate (3) | Moderate (3) |
| Reversibility of Impact | Low (4) | Low (4) | Low (4) |
| Probability of Impact Occurrence | High (4) | High (4) | High (4) |
| Cumulative Impact Rating prior to mitigation | Low | Low | Low |
| Environmental Significance Score and Rating prior to mitigation | Medium (56) | Medium (64) | Medium (64) |
| Mitigation Measures to be implemented | <p>It is recommended that Alternative 1 (preferred) be applied for, for development purposes.</p> <p>Alternatives 2 and 3 are therefore not recommended for development.</p> <p>A Provincial Flora Permit has to be obtained prior to the commencement of any construction activities.</p> <p>It is recommended that a final ecological walkthrough be conducted to confirm the locations of all individuals of the provincially protected <i>Aloe</i> species on site and that they subsequently be removed prior to the commencement of the construction phase and adequately relocated to a suitable, similar open area.</p> | | |

| | | | |
|--|---|----------------------|----------------------|
| | <p>It is recommended that a representative number of all the identified provincially protected species individuals within Alternatives 2 and 3 be removed prior to the commencement of the construction phase and adequately relocated to a suitable, similar open area.</p> <p>A Plant Relocation Management Plan must be compiled by a suitably qualified and experienced ecologist for the removal process</p> | | |
| Cumulative Impact Rating after mitigation implementation | Low | Low | Low |
| Environmental Significance Score and Rating after mitigation implementation | Low (14) | Low (28) | Low (28) |
| | | | |
| | Alternative 1 (preferred) | Alternative 2 | Alternative 3 |
| Identified Environmental Impact | Transformation of locally unique and distinct habitats for birds, reptiles and mammal species associated with the three assessment areas | | |
| Magnitude of Negative or Positive Impact | Low (4) | Medium (6) | Medium (6) |

| | | | |
|--|--|---------------|---------------|
| Duration of Negative or Positive Impact | Long term (4) | Long term (4) | Long term (4) |
| Extent of Positive or Negative Impact | Local (2) | Local (2) | Local (2) |
| Irreplaceability of Natural Resources being impacted upon | Moderate (3) | Moderate (3) | Moderate (3) |
| Reversibility of Impact | Moderate (3) | Moderate (3) | Moderate (3) |
| Probability of Impact Occurrence | High (4) | High (4) | High (4) |
| Cumulative Impact Rating prior to mitigation | Low | Low | Low |
| Environmental Significance Score and Rating prior to mitigation | Medium (64) | Medium (72) | Medium (72) |
| Mitigation Measures to be implemented | <p>It is recommended that Alternative 1 (preferred) be applied for, for development purposes.</p> <p>Alternatives 2 and 3 are therefore not recommended for development.</p> <p>It is recommended that a representative portion of the rocky ridge should be adequately buffered out of the proposed</p> | | |

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| | development footprint area. This has been achieved with the final design layout as per heading 8.3. | | |
| Cumulative Impact Rating after mitigation implementation | Low | Low | Low |
| Environmental Significance Score and Rating after mitigation implementation | Low (26) | Low (48) | Low (48) |
| | | | |
| | Alternative 1 (preferred) | Alternative 2 | Alternative 3 |
| Identified Environmental Impact | Alien invasive species establishment | | |
| Magnitude of Negative or Positive Impact | Very Low (2) | Medium (6) | Medium (6) |
| Duration of Negative or Positive Impact | Short term (2) | Short term (2) | Short term (2) |
| Extent of Positive or Negative Impact | Local (2) | Regional (3) | Regional (3) |
| Irreplaceability of Natural Resources being impacted upon | Low (2) | Low (2) | Low (2) |

| | | | |
|--|---|-------------|-------------|
| Reversibility of Impact | High (2) | High (2) | High (2) |
| Probability of Impact Occurrence | High (4) | High (4) | High (4) |
| Cumulative Impact Rating prior to mitigation | Low | Low | Low |
| Environmental Significance Score and Rating prior to mitigation | Low (40) | Medium (60) | Medium (60) |
| Mitigation Measures to be implemented | <p>It is recommended that Alternative 1 (preferred) be applied for, for development purposes.</p> <p>Alternatives 2 and 3 are therefore not recommended for development.</p> <p>Alien invasive species individuals currently on site must be actively eradicated from the assessment area and adequately disposed of in accordance with the National Environmental Management: Biodiversity Act (Act 10 of 2004); Alien and Invasive Species Regulations, 2014.</p> <p>Implement an adequate Alien Invasive Species Establishment Management and Prevention Plan during the construction phase. Such a management plan must be compiled by a suitably qualified and experienced ecologist.</p> <p>Areas within and immediately surrounding the proposed development footprint must be adequately rehabilitated to prevent significant alien invasive species establishment.</p> | | |

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| | <p>No site construction camp to be established in any natural surrounding areas outside the proposed development area. Site camps only to be established within the proposed development footprint.</p> <p>Adequately fence off the construction area and ensure that no construction activities, machines or equipment operate or impact outside the fenced off area.</p> <p>Existing roads and farm tracks in close proximity to the proposed project area must be used during construction. No new roads or tracks to be constructed or implemented through any of the surrounding natural areas.</p> | | |
| <p>Cumulative Impact Rating after mitigation implementation</p> | <p>Low</p> | <p>Low</p> | <p>Low</p> |
| <p>Environmental Significance Score and Rating after mitigation implementation</p> | <p>Low (9)</p> | <p>Low (20)</p> | <p>Low (20)</p> |
| | | | |
| | <p>Alternative 1 (preferred)</p> | <p>Alternative 2</p> | <p>Alternative 3</p> |
| <p>Identified Environmental Impact</p> | <p>Surface material erosion</p> | | |
| <p>Magnitude of Negative or Positive Impact</p> | <p>Very Low (2)</p> | <p>Medium (6)</p> | <p>Medium (6)</p> |

| | | | |
|--|--|----------------|----------------|
| Duration of Negative or Positive Impact | Short term (2) | Short term (2) | Short term (2) |
| Extent of Positive or Negative Impact | Site specific (1) | Local (2) | Local (2) |
| Irreplaceability of Natural Resources being impacted upon | Low (2) | Low (2) | Low (2) |
| Reversibility of Impact | High (2) | High (2) | High (2) |
| Probability of Impact Occurrence | Low (2) | High (4) | High (4) |
| Cumulative Impact Rating prior to mitigation | Low | Low | Low |
| Environmental Significance Score and Rating prior to mitigation | Low (18) | Medium (56) | Medium (56) |
| Mitigation Measures to be implemented | <p>It is recommended that Alternative 1 (preferred) be applied for, for development purposes.</p> <p>Alternatives 2 and 3 are therefore not recommended for development.</p> <p>An adequate Storm water and Erosion Management Plan must be implemented for the entire assessment area during the construction phase. This must be done in order to sufficiently manage storm water runoff and clean/dirty water separation in</p> | | |

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| | <p>order to prevent any significant erosion from occurring.</p> <p>Areas within and immediately surrounding the assessment area must be adequately rehabilitated to prevent significant erosion.</p> | | |
| Cumulative Impact Rating after mitigation implementation | Low | Low | Low |
| Environmental Significance Score and Rating after mitigation implementation | Low (9) | Low (9) | Low (9) |
| | | | |
| | Alternative 1 (preferred) | Alternative 2 | Alternative 3 |
| Identified Environmental Impact | Dust generation and emissions | | |
| Magnitude of Negative or Positive Impact | Low (4) | Low (4) | Low (4) |
| Duration of Negative or Positive Impact | Short term (2) | Short term (2) | Short term (2) |
| Extent of Positive or Negative Impact | Local (2) | Local (2) | Local (2) |

| | | | |
|--|--|------------|------------|
| Irreplaceability of Natural Resources being impacted upon | Low (2) | Low (2) | Low (2) |
| Reversibility of Impact | High (2) | High (2) | High (2) |
| Probability of Impact Occurrence | Medium (3) | Medium (3) | Medium (3) |
| Cumulative Impact Rating prior to mitigation | Low | Low | Low |
| Environmental Significance Score and Rating prior to mitigation | Low (36) | Low (36) | Low (36) |
| Mitigation Measures to be implemented | <p>Implement suitable dust management and prevention measures during the construction phase.</p> <p>Areas within and immediately surrounding the proposed project footprints must be adequately rehabilitated to prevent significant dust emissions.</p> | | |
| Cumulative Impact Rating after mitigation implementation | Low | Low | Low |
| Environmental Significance Score and Rating after mitigation implementation | Low (12) | Low (12) | Low (12) |

| | Alternative 1 (preferred) | Alternative 2 | Alternative 3 |
|--|--|----------------|----------------|
| Identified Environmental Impact | Impeding of the water catchment areas and identified watercourses' flow regimes | | |
| Magnitude of Negative or Positive Impact | Low (4) | High (8) | High (8) |
| Duration of Negative or Positive Impact | Short term (2) | Short term (2) | Short term (2) |
| Extent of Positive or Negative Impact | Regional (3) | Regional (3) | Regional (3) |
| Irreplaceability of Natural Resources being impacted upon | Moderate (3) | Moderate (3) | Moderate (3) |
| Reversibility of Impact | High (2) | High (2) | High (2) |
| Probability of Impact Occurrence | Medium (3) | High (4) | High (4) |
| Cumulative Impact Rating prior to mitigation | Low | Low | Low |
| Environmental Significance Score and Rating prior to mitigation | Low (42) | Medium (72) | Medium (72) |

| | | | |
|---|---|-----------------|-----------------|
| <p>Mitigation Measures to be implemented</p> | <p>It is recommended that Alternative 1 (preferred) be applied for, for development purposes.</p> <p>Alternatives 2 and 3 are therefore not recommended for development.</p> <p>An adequate Storm water Management Plan must be implemented within the assessment area during the construction phase. This must be done in order to sufficiently manage storm water runoff and clean/dirty water separation during the construction phase. This must be done to ensure continued ecological functionality of the local catchment.</p> <p>Storm water collected from the footprint surface area must be managed and channelled through an integrated storm water system.</p> <p>Adequate management of storm water runoff quality, quantities and flow speed from the proposed development area during the construction phase will play an integral role in the preservation of the catchment area’s integrity.</p> <p>Surface water runoff approaching the proposed project footprint area from topographically higher areas must be diverted around the footprint.</p> <p>A Water Use License Application (WULA) must be submitted to the Department of Water and Sanitation if required in accordance with the National Water Act (Act 36 of 1998).</p> | | |
| <p>Cumulative Impact Rating after mitigation implementation</p> | <p>Low</p> | <p>Low</p> | <p>Low</p> |
| <p>Environmental Significance Score and Rating after mitigation implementation</p> | <p>Low (11)</p> | <p>Low (32)</p> | <p>Low (32)</p> |

| | Alternative 1 (preferred) | Alternative 2 | Alternative 3 |
|--|--|----------------|----------------|
| Identified Environmental Impact | Contamination of the watercourses and subsequent reduction of surface water quality | | |
| Magnitude of Negative or Positive Impact | Low (4) | High (8) | High (8) |
| Duration of Negative or Positive Impact | Short term (2) | Short term (2) | Short term (2) |
| Extent of Positive or Negative Impact | Regional (3) | Regional (3) | Regional (3) |
| Irreplaceability of Natural Resources being impacted upon | Moderate (3) | Moderate (3) | Moderate (3) |
| Reversibility of Impact | High (2) | High (2) | High (2) |
| Probability of Impact Occurrence | Medium (3) | High (4) | High (4) |
| Cumulative Impact Rating prior to mitigation | Low | Low | Low |
| Environmental Significance Score and Rating prior to mitigation | Low (42) | Medium (72) | Medium (72) |

| | |
|--|---|
| Mitigation Measures to be implemented | <p>It is recommended that Alternative 1 (preferred) be applied for, for development purposes.</p> <p>Alternatives 2 and 3 are therefore not recommended for development.</p> <p>An adequate Storm water and Erosion Management Plan must be implemented for the entire assessment area during the construction phase. This must be done in order to sufficiently manage storm water runoff and clean/dirty water separation in order to prevent any significant contamination of the water quality and subsequent ecological functionality of the surrounding area through erosion from occurring.</p> <p>Storm water collected from the footprint surface area must be managed and channelled through an integrated storm water system.</p> <p>Adequate management of storm water runoff quality, quantities and flow speed from the proposed development area during the construction phase will play an integral role in the preservation of the catchment area's integrity.</p> <p>Surface water runoff approaching the proposed project footprint area from topographically higher areas must be diverted around the footprint.</p> <p>Areas within and immediately surrounding the assessment area must be adequately rehabilitated to prevent significant contamination through erosion.</p> <p>A South African Scoring System 5 (SASS 5) aquatic bio-monitoring assessment needs to be done of the relevant watercourses. This data must then be used as baseline data after which another SASS 5 analyses must be done halfway through- and at the end of the construction phase.</p> <p>If any contamination or reduction in water quality and the SASS 5 scores is determined due to the project, the competent authority must immediately be notified and the necessary steps must be followed by the project owner to locate and</p> |
|--|---|

| | | | |
|--|--|----------|----------|
| | remediate the source of contamination as soon as practicably possible. | | |
| Cumulative Impact Rating after mitigation implementation | Low | Low | Low |
| Environmental Significance Score and Rating after mitigation implementation | Low (11) | Low (32) | Low (32) |

9.4.2. Operational Phase

Table 8: Environmental Risk and Significance Ratings

| | Alternative 1 (preferred) | Alternative 2 | Alternative 3 |
|--|--|----------------------|----------------------|
| Identified Environmental Impact | Ecological degradation and alien invasive species establishment due to the ecological 'edge effect' caused by the development | | |
| Magnitude of Negative or Positive Impact | Low (4) | Medium (6) | Medium (6) |
| Duration of Negative or Positive Impact | Medium term (3) | Medium term (3) | Medium term (3) |
| Extent of Positive or Negative Impact | Local (2) | Regional (3) | Regional (3) |
| Irreplaceability of Natural Resources being impacted upon | Low (2) | Low (2) | Low (2) |
| Reversibility of Impact | High (2) | High (2) | High (2) |
| Probability of Impact Occurrence | High (4) | High (4) | High (4) |
| Cumulative Impact Rating prior to mitigation | Low | Low | Low |

| | | | |
|--|--|-------------|-------------|
| Environmental Significance Score and Rating prior to mitigation | Medium (52) | Medium (64) | Medium (64) |
| Mitigation Measures to be implemented | <p>Ensure that sufficient waste storage and disposal measures are implemented in order to adequately manage and contain light weighted plastics and other waste products to prevent significant undesired dispersal into surrounding natural areas. This will subsequently prevent ecological degradation and alien invasive species establishment.</p> <p>Community or municipal initiatives should be implemented for the annual clean-up of natural areas surrounding the facility.</p> <p>Implement an adequate Alien Invasive Species Establishment Management and Prevention Plan during the operational phase. Such a management plan must be compiled by a suitably qualified and experienced ecologist.</p> | | |
| Cumulative Impact Rating after mitigation implementation | Low | Low | Low |
| Environmental Significance Score and Rating after mitigation implementation | Low (20) | Low (26) | Low (26) |

| | Alternative 1 (preferred) | Alternative 2 | Alternative 3 |
|--|---|-----------------|-----------------|
| Identified Environmental Impact | Death of wild animals due to ingestion of light weighted plastics and other waste products | | |
| Magnitude of Negative or Positive Impact | Medium (6) | Medium (6) | Medium (6) |
| Duration of Negative or Positive Impact | Medium term (3) | Medium term (3) | Medium term (3) |
| Extent of Positive or Negative Impact | Local (2) | Local (2) | Local (2) |
| Irreplaceability of Natural Resources being impacted upon | Moderate (3) | Moderate (3) | Moderate (3) |
| Reversibility of Impact | Moderate (3) | Moderate (3) | Moderate (3) |
| Probability of Impact Occurrence | Medium (3) | Medium (3) | Medium (3) |
| Cumulative Impact Rating prior to mitigation | Low | Low | Low |
| Environmental Significance Score and Rating prior to mitigation | Medium (51) | Medium (51) | Medium (51) |

| | | | |
|--|--|----------------------|----------------------|
| Mitigation Measures to be implemented | <p>Ensure that sufficient waste storage and disposal measures are implemented in order to adequately manage and contain light weighted plastics and other waste products to prevent significant undesired dispersal into surrounding natural areas.</p> <p>Community or municipal initiatives should be implemented for the annual clean-up of natural areas surrounding the facility.</p> | | |
| Cumulative Impact Rating after mitigation implementation | Low | Low | Low |
| Environmental Significance Score and Rating after mitigation implementation | Low (28) | Low (28) | Low (28) |
| | | | |
| | Alternative 1 (preferred) | Alternative 2 | Alternative 3 |
| Identified Environmental Impact | Continued impeding of the water catchment areas and identified watercourses' flow regimes | | |
| Magnitude of Negative or Positive Impact | Medium (6) | High (8) | High (8) |
| Duration of Negative or Positive Impact | Medium term (3) | Medium term (3) | Medium term (3) |
| Extent of Positive or Negative Impact | Regional (3) | Regional (3) | Regional (3) |

| | | | |
|--|--|------------------|------------------|
| Irreplaceability of Natural Resources being impacted upon | Moderate (3) | Moderate (3) | Moderate (3) |
| Reversibility of Impact | Moderate (3) | Moderate (3) | Moderate (3) |
| Probability of Impact Occurrence | Medium (3) | High (4) | High (4) |
| Cumulative Impact Rating prior to mitigation | Low | Medium | Medium |
| Environmental Significance Score and Rating prior to mitigation | Medium (54) | Medium-High (80) | Medium-High (80) |
| Mitigation Measures to be implemented | <p>It is recommended that Alternative 1 (preferred) be applied for, for development purposes.</p> <p>Alternatives 2 and 3 are therefore not recommended for development.</p> <p>An adequate Storm water Management Plan must be implemented within the assessment area during the operational phase. This must be done in order to sufficiently manage storm water runoff and clean/dirty water separation during the operational phase. This must be done to ensure continued ecological functionality of the local catchment.</p> <p>Storm water collected from the footprint surface area must be managed and channelled through an integrated storm water system.</p> <p>Adequate management of storm water runoff quality, quantities and flow speed from the proposed development area</p> | | |

| | | | |
|--|--|----------------------|----------------------|
| | <p>during the operational phase will play an integral role in the preservation of the catchment area's integrity.</p> <p>Surface water runoff approaching the proposed project footprint area from topographically higher areas must be diverted around the footprint.</p> | | |
| Cumulative Impact Rating after mitigation implementation | Low | Low | Low |
| Environmental Significance Score and Rating after mitigation implementation | Low (15) | Medium (51) | Medium (51) |
| | | | |
| | Alternative 1 (preferred) | Alternative 2 | Alternative 3 |
| Identified Environmental Impact | Continued contamination of the watercourses and subsequent reduction of surface water quality | | |
| Magnitude of Negative or Positive Impact | Low (4) | Very High (10) | Very High (10) |
| Duration of Negative or Positive Impact | Medium term (3) | Medium term (3) | Medium term (3) |
| Extent of Positive or Negative Impact | Regional (3) | Regional (3) | Regional (3) |

| | | | |
|--|--|------------------|------------------|
| Irreplaceability of Natural Resources being impacted upon | Moderate (3) | Moderate (3) | Moderate (3) |
| Reversibility of Impact | Moderate (3) | Low (4) | Low (4) |
| Probability of Impact Occurrence | High (4) | High (4) | High (4) |
| Cumulative Impact Rating prior to mitigation | Low | Medium | Medium |
| Environmental Significance Score and Rating prior to mitigation | Medium (64) | Medium-High (92) | Medium-High (92) |
| Mitigation Measures to be implemented | <p>It is recommended that Alternative 1 (preferred) be applied for, for development purposes.</p> <p>Alternatives 2 and 3 are therefore not recommended for development.</p> <p>An adequate Storm water and Erosion Management Plan must be implemented for the entire assessment area during the operational phase. This must be done in order to sufficiently manage storm water runoff and clean/dirty water separation in order to prevent any significant contamination of the water quality and subsequent ecological functionality of the surrounding area from occurring.</p> <p>Storm water collected from the footprint surface area must be managed and channelled through an integrated storm water system.</p> <p>Adequate management of storm water runoff quality, quantities and flow speed from the proposed development area</p> | | |

| | | | |
|--|--|----------------------|----------------------|
| | <p>during the operational phase will play an integral role in the preservation of the catchment area's integrity.</p> <p>Surface water runoff approaching the proposed project footprint area from topographically higher areas must be diverted around the footprint.</p> <p>A South African Scoring System 5 (SASS 5) aquatic bio-monitoring assessment needs to be done of the relevant watercourses on a six monthly basis. This data must then be compared to the initial pre-construction baseline data.</p> <p>If any contamination or reduction in water quality and the SASS 5 scores is determined due to the project, the competent authority must immediately be notified and the necessary steps must be followed by the project owner to locate and remediate the source of contamination as soon as practicably possible.</p> | | |
| Cumulative Impact Rating after mitigation implementation | Low | Medium | Medium |
| Environmental Significance Score and Rating after mitigation implementation | Low (26) | Medium-High (84) | Medium-High (84) |
| | | | |
| | Alternative 1 (preferred) | Alternative 2 | Alternative 3 |
| Identified Environmental Impact | Contamination of groundwater and subsequent reduction of groundwater quality towards the watercourses to the south and north | | |
| Magnitude of Negative or Positive Impact | High (8) | Very High (10) | Very High (10) |

| | | | |
|--|--|---------------|---------------|
| Duration of Negative or Positive Impact | Long term (4) | Long term (4) | Long term (4) |
| Extent of Positive or Negative Impact | Regional (3) | Regional (3) | Regional (3) |
| Irreplaceability of Natural Resources being impacted upon | High (4) | High (4) | High (4) |
| Reversibility of Impact | Low (4) | Low (4) | Low (4) |
| Probability of Impact Occurrence | High (4) | High (4) | High (4) |
| Cumulative Impact Rating prior to mitigation | Medium | Medium | Medium |
| Environmental Significance Score and Rating prior to mitigation | Medium-High (92) | High (100) | High (100) |
| Mitigation Measures to be implemented | <p>The waste facility must be sufficiently lined underground in order to prevent undesired seepages or leaks into the groundwater.</p> <p>The integrity of the lining must be maintained and re-evaluated annually in order to ensure its functionality.</p> | | |

| | | | |
|--|--|----------|----------|
| | <p>A leachate pond must be constructed in order to store and treat leachates for adequate disposal.</p> <p>Groundwater samples must be collected directly downstream of the proposed project area prior to the commencement of the operational phase and the quality must be chemically and biologically analysed by an accredited laboratory in order to serve as baseline values for the groundwater quality.</p> <p>Groundwater samples must then be collected and the quality must be chemically and biologically analysed by an accredited laboratory on a continual minimum 6 month basis and compared with the baseline data.</p> <p>If any contamination or reduction in groundwater quality is determined due to the project, the competent authority must immediately be notified and the necessary steps must be followed by the project owner to locate and remediate the source of contamination as soon as practicably possible.</p> | | |
| Cumulative Impact Rating after mitigation implementation | Low | Low | Low |
| Environmental Significance Score and Rating after mitigation implementation | Low (40) | Low (44) | Low (44) |

10. Conclusion

The proposed waste facility development and infrastructure will in all probability completely transform the majority of the existing surface vegetation on the final footprint alternative which is eventually decided upon. Although all three alternatives scored high PES values due to their relatively natural states, the Northern Upper Karoo vegetation type (NKu 3), within which they are situated, is classified as least threatened and the surrounding natural landscape associated with the vegetation type is vast and relatively homogenous.

Alternative 1 is however situated within an area classified as an Ecological Support Area one (ESA 1) in accordance with the Free State Provincial Spatial Biodiversity Plan, 2014. With the exception of a locally unique rocky ridge which traverses the eastern and southern portion of Alternative 1 (preferred), the area merely constitutes the upper commencement portion of a small, localised water catchment area which drains towards a seasonal watercourse and artificially built earth dam situated to the south-west. The proposed footprint is however small relative to the broader catchment and drainage area and the transformation of the proposed development footprint area should therefore not make a significant difference in the surface water drainage. Alternative 1 (preferred) therefore merely scored a moderate EIS value and is not necessarily viewed as being of high conservational significance for habitat preservation or ecological functionality persistence in support of the surrounding ecosystem, local water catchment or ESA. The identified rocky ridge however possesses locally unique habitat attributes and it is reasonably expected that it is utilised by various reptile species (snakes and lizards) as refuge and for breeding/persistence purposes. It is therefore recommended that a representative portion of the rocky ridge should be adequately buffered out of the proposed development footprint area if practicably possible. This has been achieved with the final design layout as per heading 8.3.

Both Alternatives 2 and 3 are mainly situated within an area classified as an Ecological Support Area two (ESA 2) while the southern portion of Alternative 3 falls within an Ecological Support Area one (ESA 1). Numerous individual small seasonal drainage lines traverse Alternatives 2 and 3, which are associated with the localised drainage and catchment area of a significant seasonal watercourse located directly adjacent east of the two assessment areas. This seasonal watercourse plays an important role in the local and regional water catchment towards the Orange River. Locally distinct dense woody portions closer to the riparian zone of the seasonal watercourse also provide significant refuge and habitat for bird species, smaller antelope and other mammal species. Alternatives 2 and 3 therefore scored a high EIS value and are viewed as being of relatively high

conservational significance for habitat preservation and ecological functionality persistence in support of the surrounding ecosystem, local and regional water catchment and the ESA.

Individuals of the provincially protected species *Aloe broomii* were found to be present within the southern portion of Alternative 1 (preferred) while only a single individual of the provincially protected small shrub species *Euphorbia burmannii* was found on the rocky ridge. Further individuals of the species *Aloe broomii* as well as a single clump of the provincially protected species *Aloe claviflora* were also found to be present outside the south-eastern boundary of the assessment area. The original layout of Alternative 1 (preferred) was revised during August 2018. No site visit was conducted for the revised layout but it forms part of the broader homogenous landscape. Assumptions for the revised Alternative 1 (preferred) are therefore based on the results of the original layout. It is therefore recommended that a final ecological walkthrough be conducted to confirm the locations of all individuals of the provincially protected *Aloe* species on site and that they subsequently be removed prior to the commencement of the construction phase and adequately relocated to a suitable, similar open area.

The three provincially protected species *Aloe broomii* and, to a lesser extent, *Aloe claviflora* and *Euphorbia burmannii* are also sparsely scattered throughout Alternatives 2 and 3 while only a single individual of the provincially protected tree species *Boscia foetida* was found within Alternative 2.

No Red Data Listed-, nationally protected- or any other species of conservational significance were found to be present within the three assessment areas.

It is in the opinion of the specialist that the identified significant potential ecological impacts for Alternatives 2 and 3 associated with the transformation of the Ecological Support Area (ESA) as well as the impediment and contamination of the significant seasonal watercourse will be too high and cannot be suitably reduced and mitigated to within acceptable levels. Alternatives 2 and 3 should therefore not be viewed as ecologically feasible locations and are not recommended for environmentally responsible development.

The only identified significant potential ecological impacts for Alternative 1 (preferred) associated with the contamination of the watercourse and groundwater can be suitably reduced and mitigated to within acceptable levels. Alternative 1 (preferred) should therefore be viewed as the least ecologically intrusive potential footprint area which can be authorised for development. The project

should therefore be considered by the competent authority for environmental authorisation and approval but only the footprint area of Alternative 1 (preferred) should be applied for.

The proposed project 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

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12. Details of the Specialist

Adriaan Johannes Hendrikus Lamprecht (Pr.Sci.Nat)

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

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

Qualifications

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

Accredited courses completed

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

Professional registrations

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

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

Employment and Experience Background

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

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

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

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

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

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

Ecological Specialist Report Completion

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.

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.